



PUBLIC WORKS & WATER RESOURCES
CITY OF NEWARK

220 South Main Street · Newark, Delaware 19711
302.366.7000 · Fax 302.366.7160 · www.newarkde.gov

SOUTH WELLFIELD RESIN-GAC SYSTEM
CONTRACT NO. 23-08

ADDENDUM #2

June 15, 2023

1. PROJECT INFORMATION

Name:	South Wellfield Resin-GAC System
Owner:	City of Newark, Delaware
Contract Number:	23-08
Date of Addendum:	June 15, 2023
Questions Deadline:	5:00 p.m., Tuesday, June 13, 2023
Bid Submission Deadline:	2:00 p.m., Tuesday, June 20, 2023

2. NOTICE TO BIDDERS

- A. The Bidder shall acknowledge receipt of this addendum with their submitted proposal. Failure to do so may disqualify the Bidder.
- B. The date for questions and receipt of bids remains unchanged by this addendum.
- C. This addendum shall serve to answer questions submitted to date for this contract.

3. REVISIONS TO SPECIFICATIONS

- A. General Provisions
 - 1. Replace “ninety (90)” with “two-hundred forty (240)” under item 8 on page 23 to revise the duration of the contract.
 - 2. Delete the “PROPOSAL” form pages 47 and 48 and replace with the “PROPOSAL” form attached to this Addendum to correct the tree removal quantity. The attached PROPOSAL FORM should be used when submitting the bids.
- B. Section 31 23 33 – Trenching and Backfilling PART 2.1.B.
Replace “AASHTO #57 Stone” with “CR-6” to be used for aggregate backfill above the level of initial backfill to be consistent with that indicated in the Typical Cross Section detail on sheet 12 of 20.
- C. Section 31 23 33 – Trenching and Backfilling PART 2.1.C.
Pipe bedding and initial backfill shall be AASHTO #57 aggregate as specified in this section and revised on plan sheet 12 of 20 with this Addendum. See 4.D. of this Addendum.
- D. Section 46 33 10 – Chemical Feed System
Revise quantities within Part 2.2 based on the requirement of one new pump skid assembly to be provided.

4. REVISIONS TO PLAN SET

- A. Delete plan sheet 5 of 20 in its entirety and replace with the attached revised plan sheet 5 with redline revisions.
- B. Delete plan sheet 6 of 20 in its entirety and replace with the attached revised plan sheet 6 with redline revisions.
- C. Delete plan sheet 8 of 20 in its entirety and replace with the attached revised plan sheet 8 with redline revisions.
- D. Delete plan sheet 12 of 20 in its entirety and replace with the attached revised plan sheet 12 with redline revisions for backfill requirements.
- E. Delete plan sheet 17 of 20 in its entirety and replace with the attached revised plan sheet 17 with redline revisions "contraction joint".

5. RESPONSES TO QUESTIONS SUBMITTED VIA EMAIL

Question 1:	Should piping with the vaults be mechanical joint or flanged?
Response 1:	<i>Piping within the buried vault or above finished grade shall be flanged. Buried piping shall be mechanical joint. See revisions to sheet 6 of 20 as attached.</i>
Question 2:	Clarify the extent of driveway pavement to be replaced.
Response 2:	<i>See the outline area shown on sheet 5 of 20 as highlighted in the attached sheet 5 for clarification as to the bid quantity area identification.</i>
Question 3:	With respect to the project timeline, I requested a time extension for completion, within Add#1 - the total contract time is now 150 days. I was just informed by my suppliers that the valves and actuators will be 182 to delivery. We would still need to install, test, build the enclosure etc... Can this be addressed, or should the contractor bid the LD value in the quote?
Response 3:	<i>The duration of the contract is hereby extended to 240 calendar days in consideration for the potentially extended material lead times. All references within the contract documents are hereby revised as noted. The City will also consider time extensions during construction if necessitated by material lead times and justified with documentation provided by suppliers. The concrete slab foundation shall be constructed, cured, and ready within 90 days of the Notice to Proceed for unloading and setting of the units. Time extensions for the concrete slab foundation will not be considered.</i>
Question 4:	Please clarify if there will be one pump skid or two required.
Response 4:	<i>The Contractor shall furnish and install <u>one</u> chemical feed pump, skid, and one set of accessories.</i>
Question 5:	What is the breakdown of fabricated items for the Calgon Carbon units for coordination with limits of Contract work?
Response 5:	<i>See the attached sample Field Assembly Isometric provided by Calgon Carbon as an example of a guide for similar units provided by Calgon Carbon to others. Calgon Carbon is expecting to have a total of five delivery trucks for the delivery.</i>
Question 6:	Where does the 2" sump pump line get routed to it end point location and how will it be supported?
Response 6:	<i>The sump pump discharge shall be routed as shown to discharge to the ground level outside the vault.</i>
Question 7:	Is there a specific sump pump required type towards this project? Make/Model?

Response 7:	<i>See Section 22 14 29 "Sump Pumps" noting a basis of design model.</i>
Question 8:	Please clarify the piping tie in points from underground contractor supplied piping to the Calgon Carbon supplied piping/equipment.
Response 8:	<i>See page 30 of the attached Submittal Manual provided by Calgon Carbon, Spec No. 3.54 noting ANSI 125# and #150 flanges. The section view on plan sheet 14 shows the limits for the Calgon Carbon supplied materials. The Contractor shall make the connections to the Calgon Carbon equipment and piping at the limits of the depicted piping. Calgon Carbon is not providing underground piping. See drawing sections (pages 372-377 of the PDF) of Submittal Manual provided by Calgon Carbon.</i>
Question 9:	Are there spool pieces that need to be fabricated to tie in the underground lines and the equipment connections?
Response 9:	<i>PE x FL spool pieces will be required in the vertical sections of yard piping that connect the flanged piping from the manifold to the MJ pipe 90-degree fittings in the ground.</i>
Question 10:	Is the Calgon Carbon equipment arriving to site with the listed "Pipe Support Schedule" materials on page CS6002? Will they have to be field installed?
Response 10:	<i>See the attached sample Field Assembly Isometric (page 190 of the PDF) provided by Calgon Carbon as an example of that for similar units provided by Calgon Carbon to others.</i>
Question 11:	Are there piping ISO's to show all of the connections that are to be made?
Response 11:	<i>See the attached sample Field Assembly Isometric and Submittal Manual provided by Calgon Carbon as an example of that for similar units provided by Calgon Carbon to others.</i>
Question 12:	How is the Calgon Carbon equipment being shipped? Are they lifting details?
Response 12:	<i>Calgon Carbon is expecting to have a total of 5 delivery trucks and drop trailers for the delivery. There is a lifting lug on the lower side of the vessel (page 179 of the PDF) as well as 4 lugs on top of the vessel to assist going from horizontal to vertical. A crane will be needed.</i>
Question 13:	Can you provide the backwash procedures/requirements and information?
Response13:	<i>See the attached Backwash Procedure provided by Calgon Carbon (beginning on page 191 of the PDF).</i>
Question 14:	Does your shipments include all piping, valves, studs/nuts and gaskets on the Calgon Carbon equipment?
Response 14:	<i>The Calgon Carbon material shipment includes necessary materials and equipment for assembly as detailed. The Contractor shall be responsible for equipment and materials beyond the connection points. See the attached Submittal Manual provided by Calgon Carbon. Piping valves and nuts will be included as shown on the Bill of Materials (pages 372-377 of the PDF). Smaller items will be organized and shipped loose in crates. Anchor bolts are not included.</i>
Question 15:	How does the media get packed into the vessels typically? Special method/procedure?
Response 15:	<i>See the attached Carbon Transfer Procedure provided by Calgon Carbon (beginning on pages 196 and 204 of the PDF for carbon and resin respectively).</i>
Question 16:	Please reference Specification Section 40 05 13 – Piping, Fittings, and Accessories.....Paragraph 2.1F calls for non-buried flanged pipe and fittings to have "arc-applied or paint-applied, 99.99% pure zinc coating..." Is this necessary? It tends to add a significant cost to the materials and increased lead times.

Response 16:	<i>All aboveground piping and piping located within the valve vault shall be furnished with a shop applied red epoxy primer for ductile iron pipe and fittings. A zinc coating is not required.</i>
Question 17:	Detail #1 on Drawing S-1000 (17 of 20) calls for 1" diameter anchor bolts for the resin tanks to be drilled and epoxied into the concrete slab foundation. Are these anchor bolts to be supplied by the bidder or will they be supplied along with the resin tank materials being furnished by others.
Response 17:	<i>The Contractor shall be responsible for furnishing and installing 316 stainless steel anchor bolts.</i>
Question 18:	The attached Page 9 from Section 31 23 33 of the specifications for Trenching and Backfilling states that initial pipe trench backfill should consist of #57 stone placed to 6" above the top of the outside barrel of the pipe. Please confirm that this is not required and that after placing 6" of #57 stone bedding in the bottom of the trench beneath the invert of the new DI waterline the rest of the pipe trench can be backfilled with the on-site material from the trench excavation.
Response 18:	<i>See items 3.B., 3.C., and 4.D. above regarding the specification and detail. #57 stone bedding shall be installed for a depth of 6" under the pipe. Select borrow or approved native backfill shall be installed around the pipe and to a depth of 6" above the pipe. Aggregate backfill shall be used above that per the plan detail when piping is located under or within 6' of the equipment pad. Select borrow or approved on-site material may be used in other areas.</i>
Question 19:	<i>Please provide the specifications and/or a detailed sketch for the Valve Vault Access Ladder w/ Safety Post. Is this ladder galvanized steel, fiberglass, etc., and is there a preferred ladder manufacturer for supplying this item? The Safety Ladder Detail on Drawing CS-6001 (12 of 20) is a bit unclear.</i>
Response 19:	<i>Halliday Series L1E ladder extension in stainless steel or aluminum is acceptable. A Bilco LadderUP® safety post is also an acceptable alternative.</i>
Question 20:	Drawing S-1000 shows (4) Construction Joints running across the proposed concrete slab foundation for the resin tanks. Please provide a detail of what should be included at each of these Construction Joint locations. Do these Construction Joints also run down the vertical face of the below grade turn-down wall footings?
Response 20:	<i>See item 4.E above regarding "contraction" replacing "construction" style joint. The joints do not run through the depth of the slab.</i>
Question 21:	Will all geotechnical testing and soil compaction testing, and inspection be provided by others?
Response 21:	<i>Yes. The City will contract separately with the design engineer for geotechnical and soil compaction testing and inspections for the concrete slab foundation area.</i>

6. ATTACHMENTS TO THIS ADDENDUM

A. Revised plan sheets as noted.

END OF ADDENDUM #2

CITY OF NEWARK
Delaware

CONTRACT NO. 23-08

SOUTH WELLFIELD RESIN-GAC SYSTEM

PROPOSAL

To: The Mayor and City Council
Newark, Delaware

From: _____

The undersigned as a lawfully authorized agent for the below named bidder has carefully examined the Bid Documents to be known as Contract No. 23-08 and binds himself on award to him by the Mayor and City Council of Newark, Delaware to execute in accordance with such award, a contract of which this Proposal and said General Provisions and Specifications and any Addenda shall be a part, and to furnish the goods as specified F.O.B. Newark, Delaware in a manner that is in complete accordance with said General Provisions and Specifications at the following named unit price on or before the delivery period stated below:

BID ITEM	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	TOTAL
1	Mobilization/Demobilization	LS	1		
2	Remove Existing Tree	EA	2		
3	Modify Existing Monitoring Well	LS	1		
4	Miscellaneous Excavation and Backfill	CY	50		
5	Concrete Slab Foundation for Resin-GAC Tanks	LS	1		
6	Install Calgon Resin-GAC Tanks	LS	1		
7	Concrete Valve Vault	LS	1		
8	Construct Manifold Enclosure	EA	2		
9	Concrete Sidewalk	SY	69		
10	8" DI Water Main Pipe	LF	270		
11	4" DI Water Main Pipe	LF	20		
12	8" DI Class 150 Check Valve	EA	2		
13	8" DI Class 150 Gate Valve	EA	2		
14	4" DI Class 150 Gate Valve & Valve Box	EA	1		
15	8" Butterfly Valve w/ Valve Stem Extension & Beck Actuator	EA	3		
16	Connect to Existing 16" Water Main	LS	1		
17	4" Cam-Lock Connection Fitting	EA	2		
18	3/4" Sample Tap	EA	4		

19	Shallow Backwash Manhole	EA	1		
20	Plant Thuja Plicata "Green Giant" Tree	EA	16		
21	Install New NaOCl Feed Piping & Blue-White Pro-Series M3 NaOCl Pump w/ Tuffskid Skid Frame	LS	1		
22	Electrical Installation	LS	1		
23	Controls Installation	LS	1		\$85,750.00
24	2" Mill and Overlay Existing Asphalt Driveway	SY	295		
25	Site Restoration	LS	1		
<u>TOTAL BID</u>					\$



CHEM-PRIME H.S. SERIES 37H

PRODUCT PROFILE

GENERIC DESCRIPTION	Phenolic Alkyd
COMMON USAGE	Lead- and chromate-free, fast-drying, corrosion-resistant primer that accepts a variety of high-performance topcoats. Ideally suited for steel fabricators, OEM's and field applications. Note: Not recommended for immersion.
COLORS	77 Red, 78 Gray.

COATING SYSTEM

TOPCOATS	Series 2H, 2HS, 27, 37H, 43-36, 66, L69, L69F, N69, N69F, V69, V69F, 73, 113, 114, 115, V115, 161, 180, 181, 1026, 1028, 1029, 1074, 1074U, 1075, 1075U, 1094, 1095, 1096. Note: Allow Series 1026 to cure one week before topcoating. Note: Some systems are not recommended for frequently sweating or continually wet conditions. Reference the applicable topcoat data sheet for additional information. Also, an additional coat of 37H is suggested before applying Series 180 or 181. Contact Tnemec Technical Services for details.
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SURFACE PREPARATION

STEEL	Enclosed or Protected: SSPC-SP3 Power Tool Cleaning Weather-Exposed: SSPC-SP6/NACE 3 Commercial Blast Cleaning
CAST/DUCTILE IRON	Contact your Tnemec representative or Tnemec Technical Services.
ALL SURFACES	Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS	56.0 ± 2.0% †
RECOMMENDED DFT	2.0 to 3.5 mils (50 to 90 microns) per coat.
CURING TIME	Temperature: 75°F (24°C) To Handle: 30 minutes To Recoat With Series:

Series 2H, 2HS, 37H, 43-36	Series 113, 114, 115, V115, 180, 181, 1026, 1028, 1029	Series 27•, 66•, L69, L69F, N69, N69F, V69, V69F, 73, 161•, 1074, 1074U, 1075, 1075U, 1094, 1095, 1096
16 hours	24 hours	24 hours

Curing time varies with surface temperature, air movement, humidity and film thickness.

•Note: Allow 37H to cure 14 days if 27, 66 or 161 is to be used as an intermediate coat and topcoated with 73, 1074, 1074U, 1075 or 1075U. Then allow 27, 66 or 161 to cure an additional 24 hours before topcoating.

Water Tank Exteriors: Five days or more curing required before filling.

VOLATILE ORGANIC COMPOUNDS	Unthinned: 2.75 lbs/gallon (330 grams/litre) Thinned 4% (No. 2 Thinner): 2.94 lbs/gallon (352 grams/litre) Thinned 9% (No. 2 Thinner): 3.15 lbs/gallon (377 grams/litre)
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HAPS	Unthinned: 2.20 lbs/gal solids Thinned 4% (No. 2 Thinner): 2.72 lbs/gal solids Thinned 9% (No. 2 Thinner): 3.36 lbs/gal solids
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THEORETICAL COVERAGE	898 mil sq ft/gal (22.0 m ² /L at 25 microns). See APPLICATION for coverage rates. †
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NUMBER OF COMPONENTS	One
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PACKAGING	Five-gallon pail yielding 5 gallons (18.9 L) and 55 gallon drum yielding 50 gallons (189.2 L).
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NET WEIGHT PER GALLON	12.07 ± 0.25 lbs (5.47 ± 0.11 kg)
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STORAGE TEMPERATURE	Minimum 20°F (-7°C) Maximum 110°F (43°C)
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TEMPERATURE RESISTANCE	(Dry) Continuous 200°F (93°C) Intermittent 250°F (121°C)
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SHELF LIFE	12 months at recommended storage temperature.
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FLASH POINT - SETA	65°F (18°C)
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HEALTH & SAFETY	Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. Keep out of the reach of children.
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CHEM-PRIME H.S. | SERIES 37H

APPLICATION

COVERAGE RATES

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m ² /Gal)
Suggested	2.5 (65)	4.5 (115)	359 (33.4)
Minimum	2.0 (50)	4.0 (100)	449 (41.7)
Maximum	3.5 (90)	6.5 (165)	257 (23.9)

Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. †

MIXING

Power mix to a uniform consistency, making sure no pigment remains in the bottom of the container.

THINNING

Use No. 2 Thinner. For air spray, thin up to 9% per gallon. For airless spray, brush or roller, thin up to 4% per gallon.

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	75-90 psi (5.2-6.2 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher atomizing pressure and pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-485 microns)	3000-4000 psi (207-276 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions. Roller: Use high quality synthetic woven nap covers, 1/4" nap for smooth surfaces, 3/8" nap for rough surfaces. Brush: Recommended for small areas only. Use high quality nylon or synthetic bristle brushes.

SURFACE TEMPERATURE

Minimum 40°F (4°C) Maximum 120°F (49°C)
The surface should be dry and at least 5°F (3°C) above the dew point.

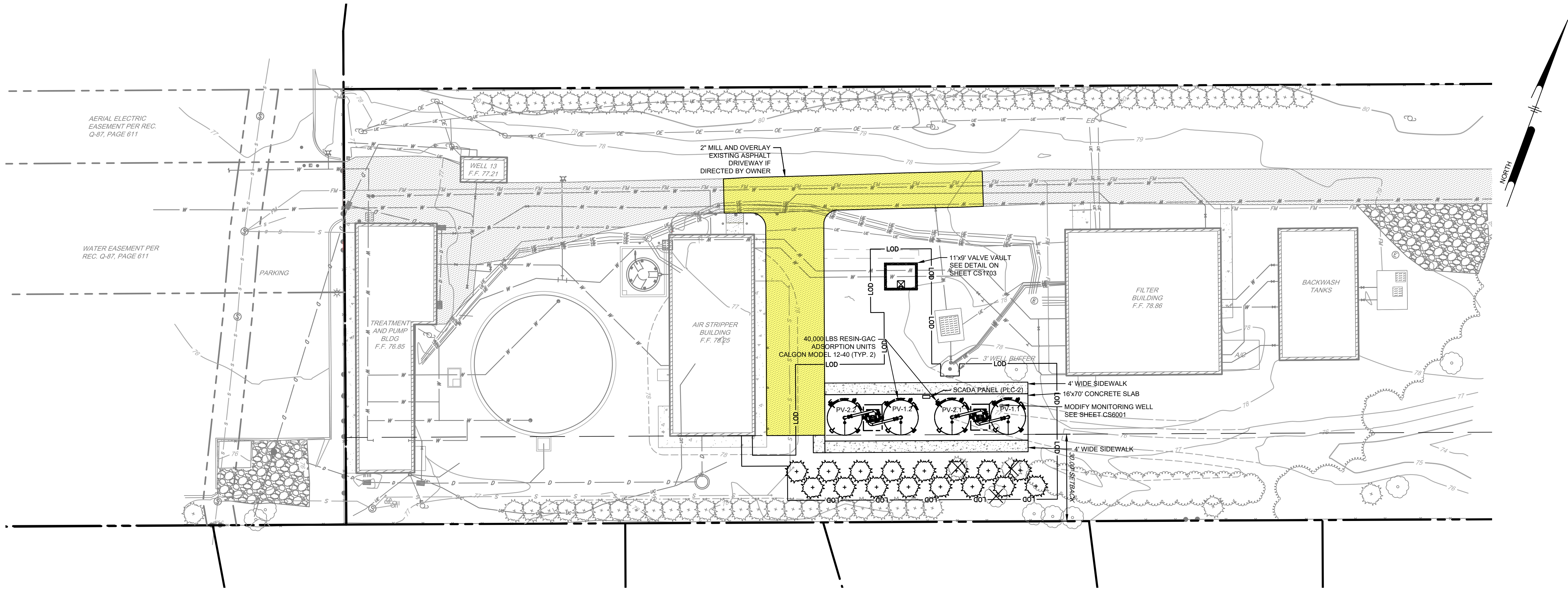
CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or xylol.

† Values may vary with color.

WARRANTY & LIMITATION OF SELLER'S LIABILITY: Tnemec Company, Inc. warrants only that its coatings represented herein meet the formulation standards of Tnemec Company, Inc. THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. The buyer's sole and exclusive remedy against Tnemec Company, Inc. shall be for replacement of the product in the event a defective condition of the product should be found to exist and the exclusive remedy shall not have failed its essential purpose as long as Tnemec is willing to provide comparable replacement product to the buyer. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, ENVIRONMENTAL INJURIES OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO THE BUYER. Technical and application information herein is provided for the purpose of establishing a general profile of the coating and proper coating application procedures. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests, accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating.

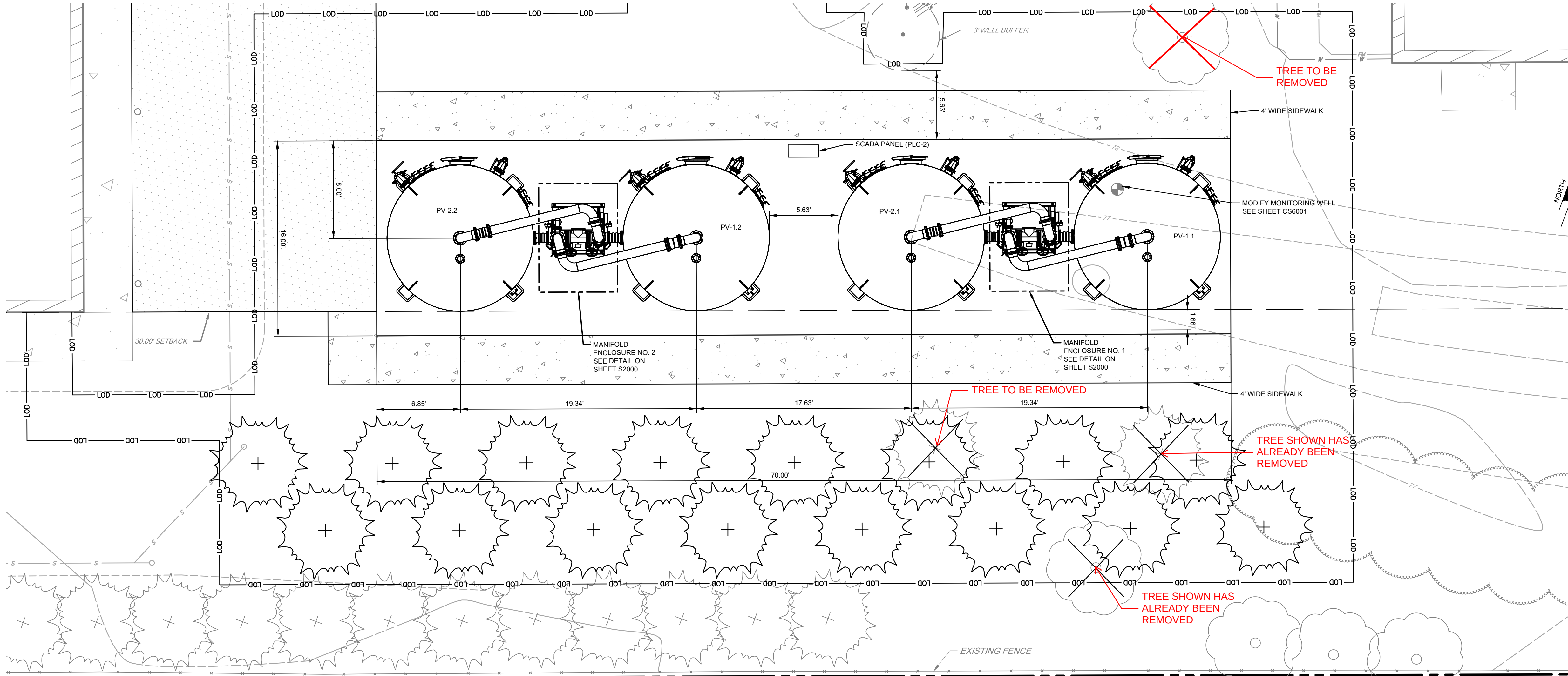
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SITE & SYSTEM LAYOUT

SCALE: 1" = 20'

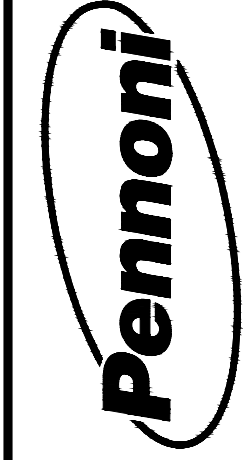
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ENLARGED SITE & SYSTEM LAYOUT

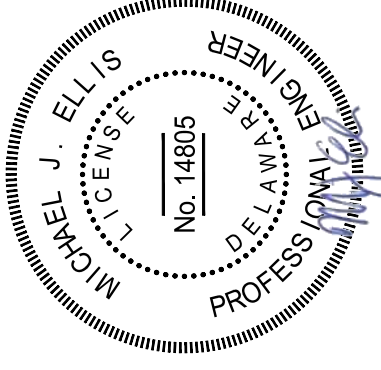
SCALE: 1" = 5'

0 5' 10'



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Newark, DE 19713-4310
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ALL DIMENSIONS MUST BE VERIFIED BY CONTRACTOR
AND OWNER MUST BE NOTIFIED OF ANY
DISCREPANCIES BEFORE PROCEEDING WITH WORK



SOUTH WELLFIELD RESIN-GAC SYSTEM

912 SOUTH CHAPEL STREET
NEWARK, DE 19713

SITE & SYSTEM LAYOUT PLAN

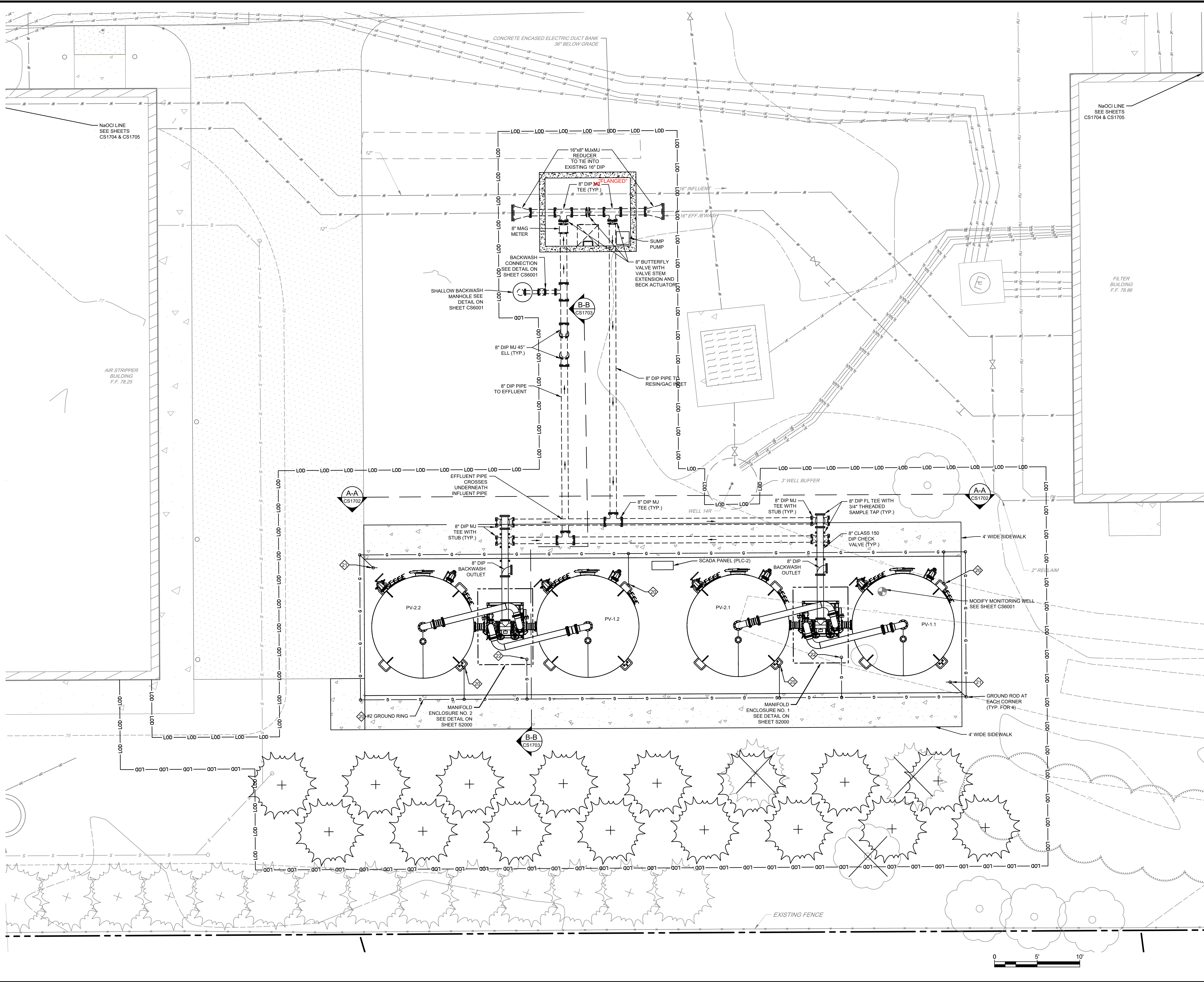
CITY OF NEWARK
220 SOUTH MAIN STREET
NEWARK, DE 19711

NO.	DATE	REVISIONS	BY
1	05/18/2023	BID PLAN SUBMISSION	ELA
2	06/02/2023	ADDENDUM 2	ELA

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PROJECT	CNEWK22008
DATE	2023-05-05
DRAWING SCALE	AS NOTED
DRAWN BY	ELA
APPROVED BY	MJE

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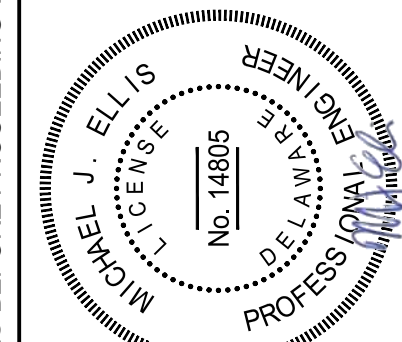
SOUTH WELLFIELD RESIN-GAC SYSTEM

912 SOUTH CHAPEL STREET
NEWARK, DE 19713

YARD PIPING PLAN

CITY OF NEWARK
220 SOUTH MAIN STREET
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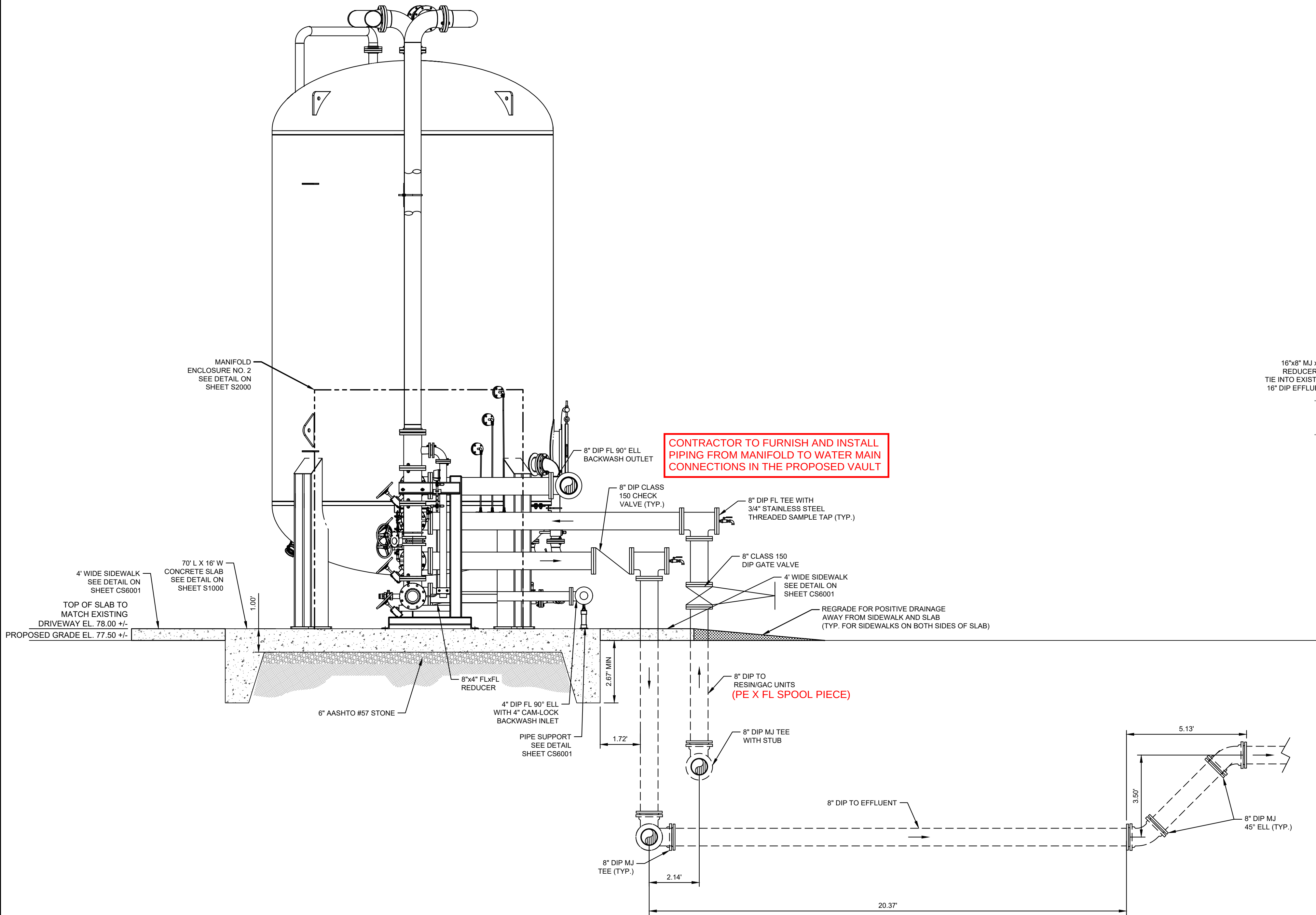
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EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

PROJECT CNEWK22008
DATE 2023-05-05
DRAWING SCALE 1"=5'
DRAWN BY ELA
APPROVED BY MJE

CS1701
SHEET 6 OF 20

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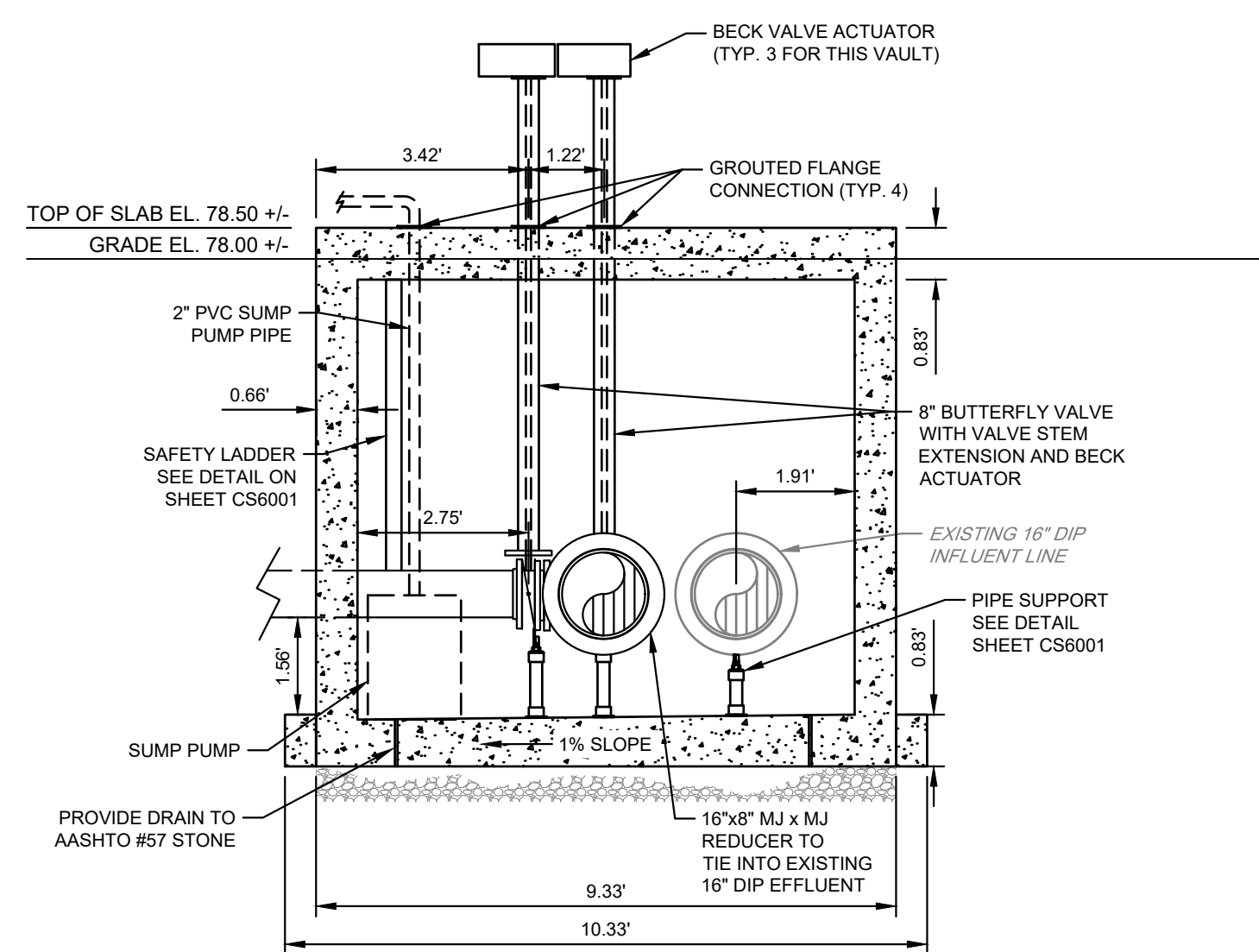
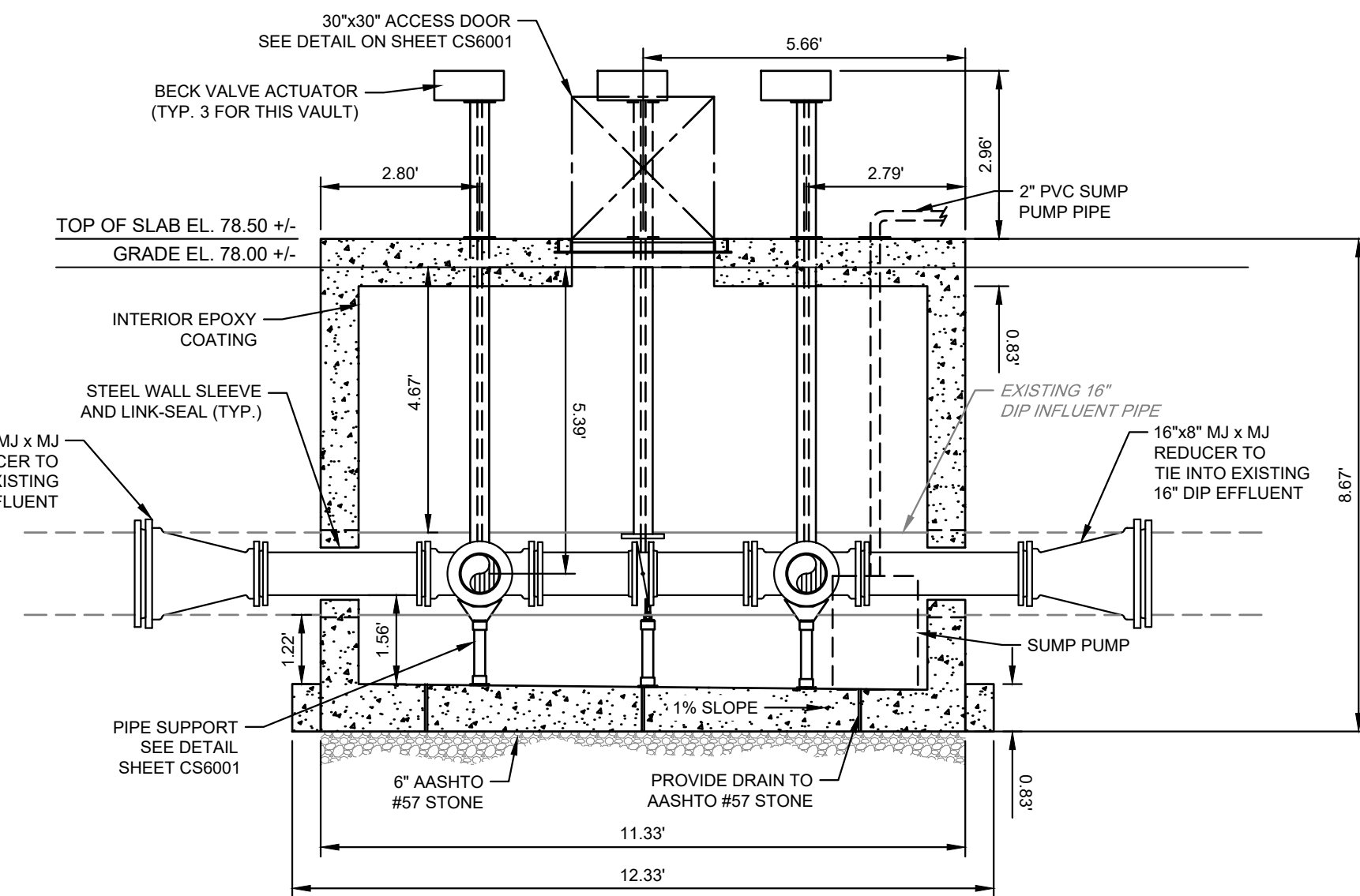
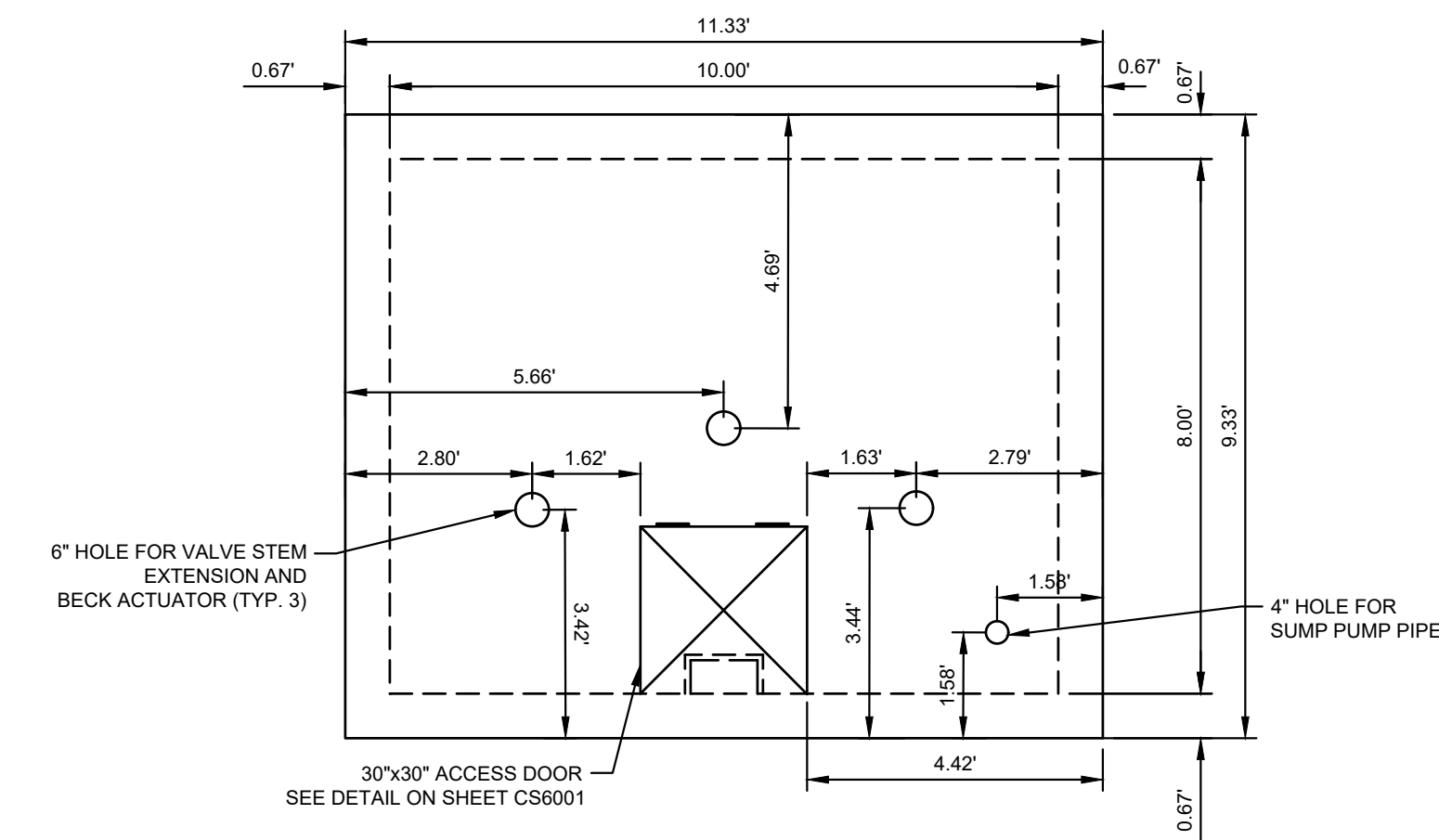
CONTRACTOR TO FURNISH AND INSTALL
PIPING FROM MANIFOLD TO WATER MAIN
CONNECTIONS IN THE PROPOSED VAULT

8" DIP TO RESIN/GAC UNITS
(PE X FL SPOOL PIECE)

B YARD PIPING SECTION
SCALE: 3/8" = 1'

NOTES:

- ALL DIMENSIONS ARE APPROXIMATE AND NEED TO BE FIELD VERIFIED AND ADJUSTED AS NECESSARY BY THE CONTRACTOR.
- ALL WATER PIPING MUST HAVE A MINIMUM OF 42" OF COVER.

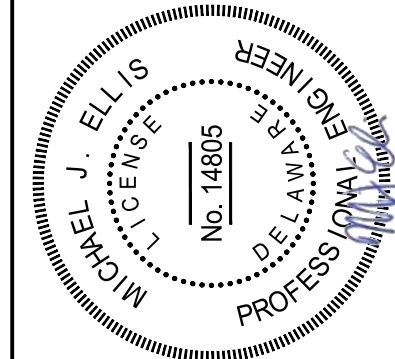


VALVE VAULT DETAIL
SCALE: 3/8" = 1'



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SOUTH WELLFIELD RESIN-GAC SYSTEM

912 SOUTH CHAPEL STREET
NEWARK, DE 19713

PIPING SECTIONS

CITY OF NEWARK
220 SOUTH MAIN STREET
NEWARK, DE 19711

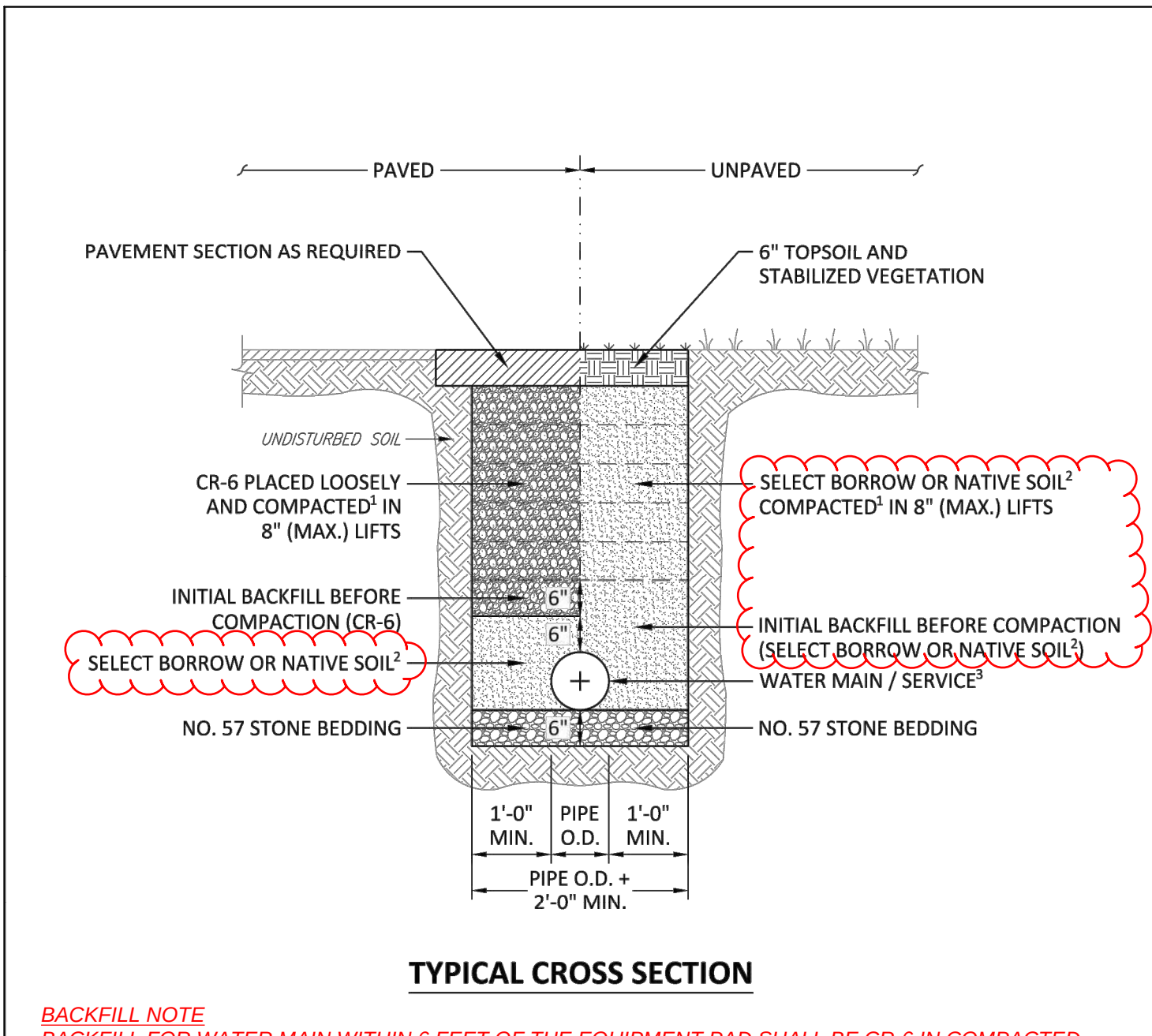
NO.	DATE	REVISIONS	BY
1	05/19/2023	BID PLAN SUBMISSION	ELA
2	06/14/2023	ADDENDUM 2	

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PROJECT	CNEWK22008
DATE	2023-05-05
DRAWING SCALE	3/8"=1'
DRAWN BY	ELA
APPROVED BY	MJE

CS1703

SHEET 8 OF 20



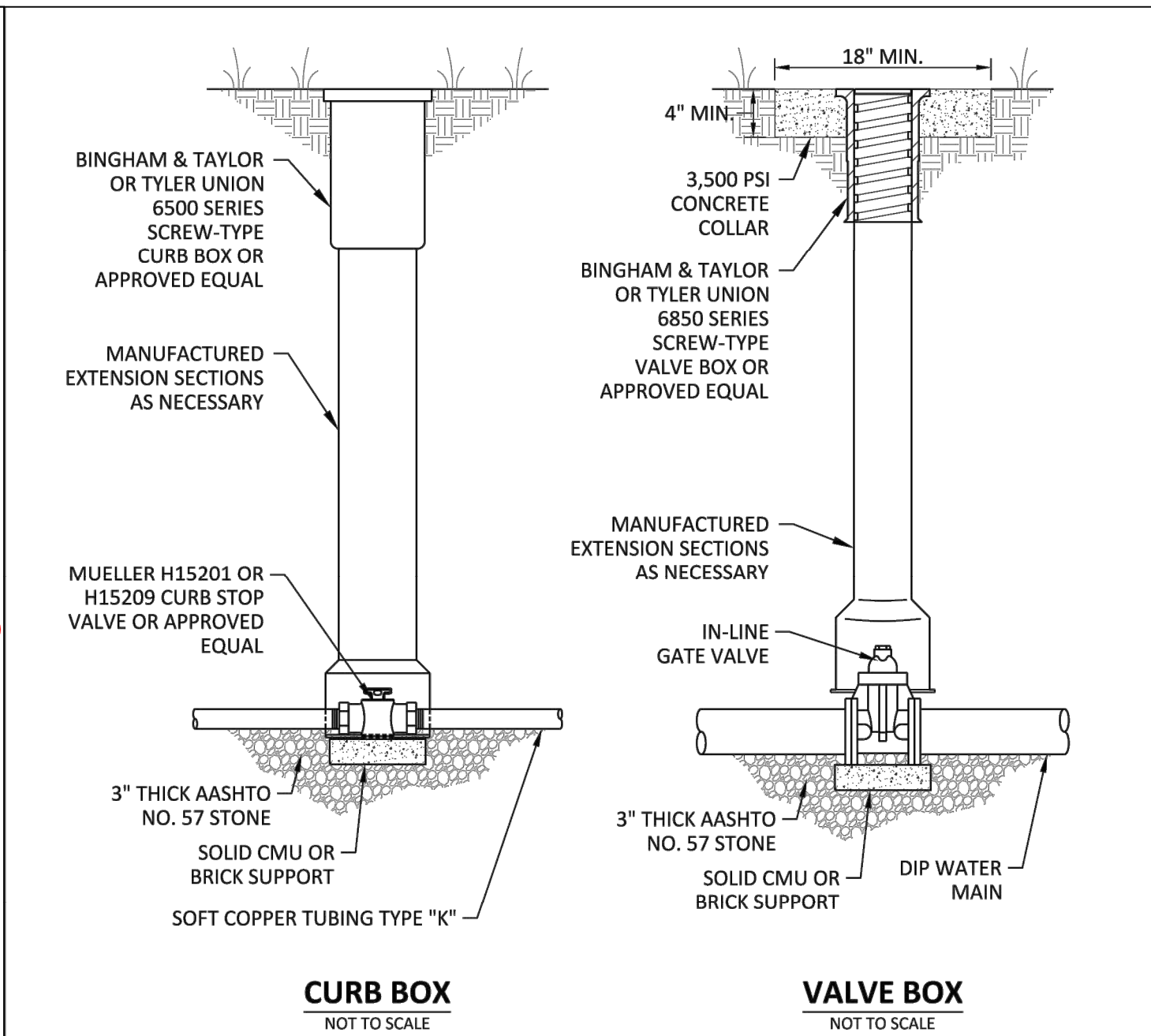
- NOTES:**
1. COMPACTION TO BE ACHIEVED USING MECHANICAL TAMPER OF VIBRATORY COMPACTOR.
 2. USE OF NATIVE SOIL SHALL BE AT THE SOLE DISCRETION OF THE PUBLIC WORKS AND WATER RESOURCES DEPARTMENT DIRECTOR OR THEIR DESIGNEE.
 3. WATER MAIN SHALL BE WRAPPED IN POLYETHYLENE ENCASEMENT AS REQUIRED BY THE CITY WATER AND WASTEWATER STANDARDS AND SPECIFICATIONS.
 4. FOR PAVED AREAS, THE PAVEMENT SECTION REQUIRED IS DETERMINED BY THE TYPE OF ROAD AND WHETHER THE TRENCH IS LONGITUDINAL OR PERPENDICULAR TO THE ROAD. CONTRACTOR TO VERIFY EXISTING PAVEMENT CROSS SECTION.
 5. FOR UNPAVED AREAS, VEGETATION SHALL BE RESTORED TO EXISTING CONDITIONS UNLESS OTHERWISE DIRECTED.

CITY OF NEWARK
PUBLIC WORKS AND WATER
RESOURCES DEPARTMENT

220 SOUTH MAIN STREET
NEWARK, DELAWARE 19711
(302) 366-7000
www.newarkde.gov
@CityofNewarkDE

WATER TRENCH DETAIL

DATE: JANUARY 2019
SCALE: NOT TO SCALE
DRAWN BY: MMW
APPROVED BY: EJA
SHEET: **W1**

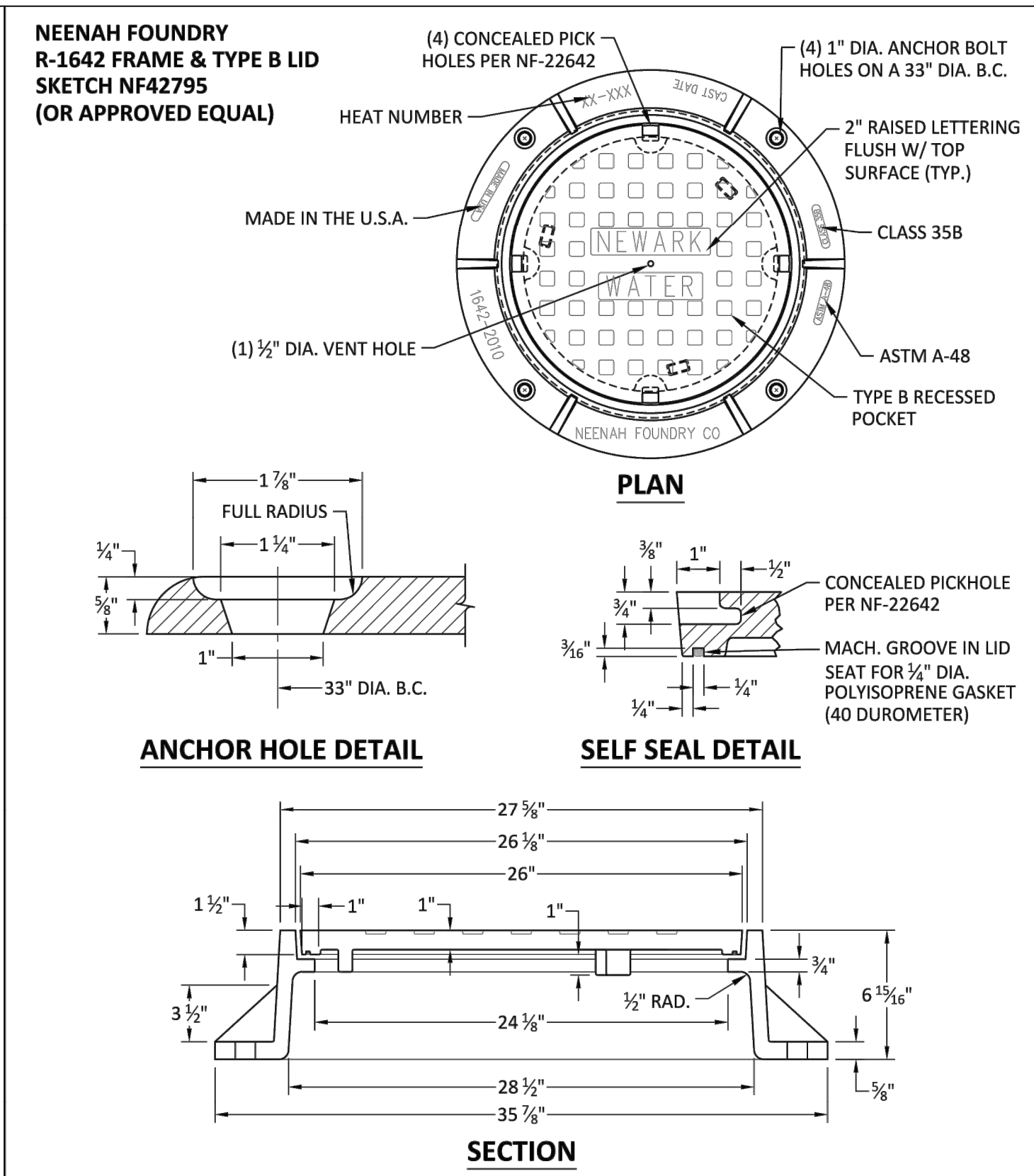


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RESOURCES DEPARTMENT

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**STANDARD INSTALLATION
CURB BOX AND VALVE BOX**

DATE: OCTOBER 2018
SCALE: NOT TO SCALE
DRAWN BY: MMW
APPROVED BY: EJA
SHEET: **W5**

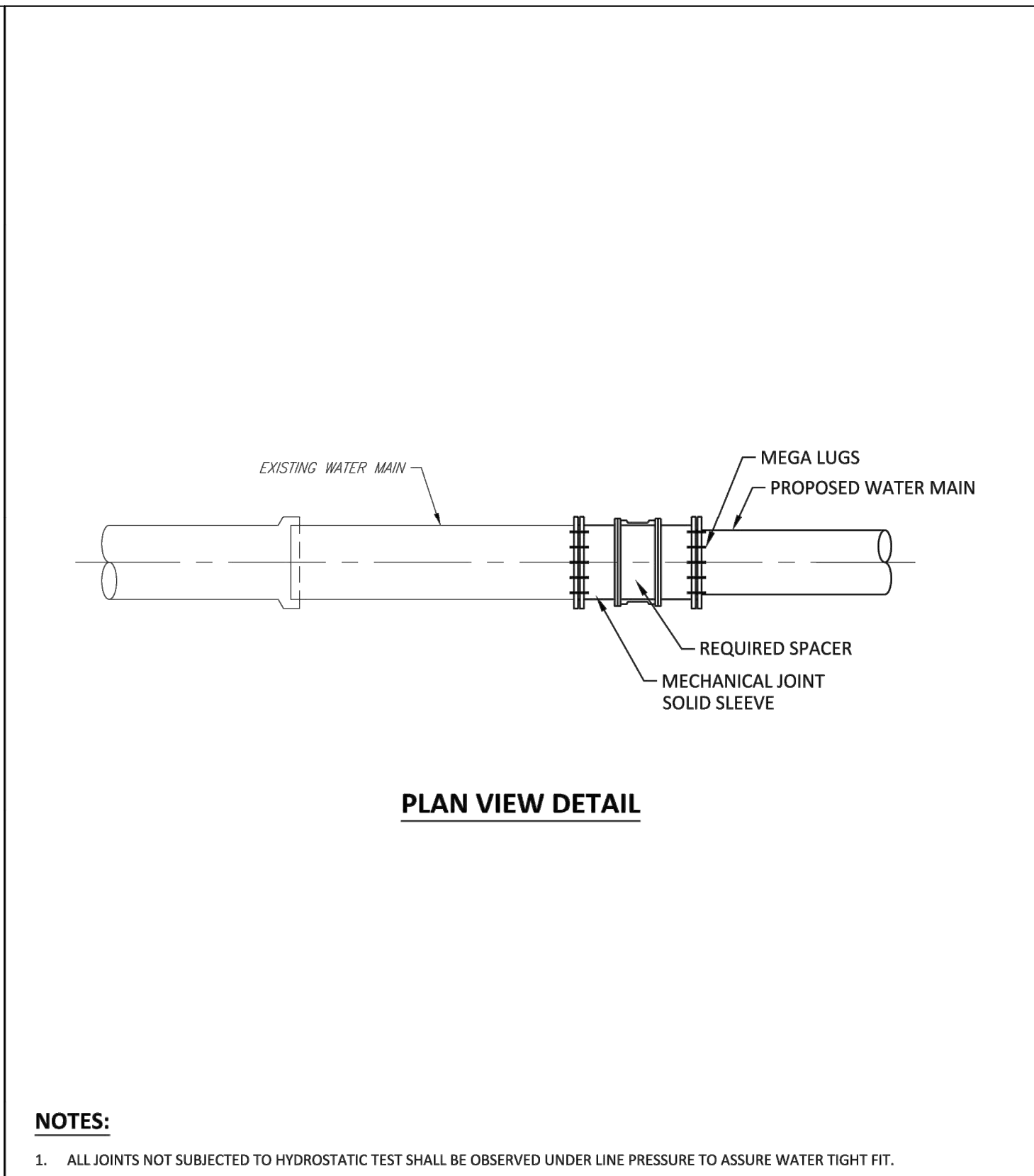


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**STANDARD MANHOLE FRAME
& COVER**

DATE: AUGUST 2018
SCALE: NOT TO SCALE
DRAWN BY: MMW
APPROVED BY: EJA
SHEET: **W7**

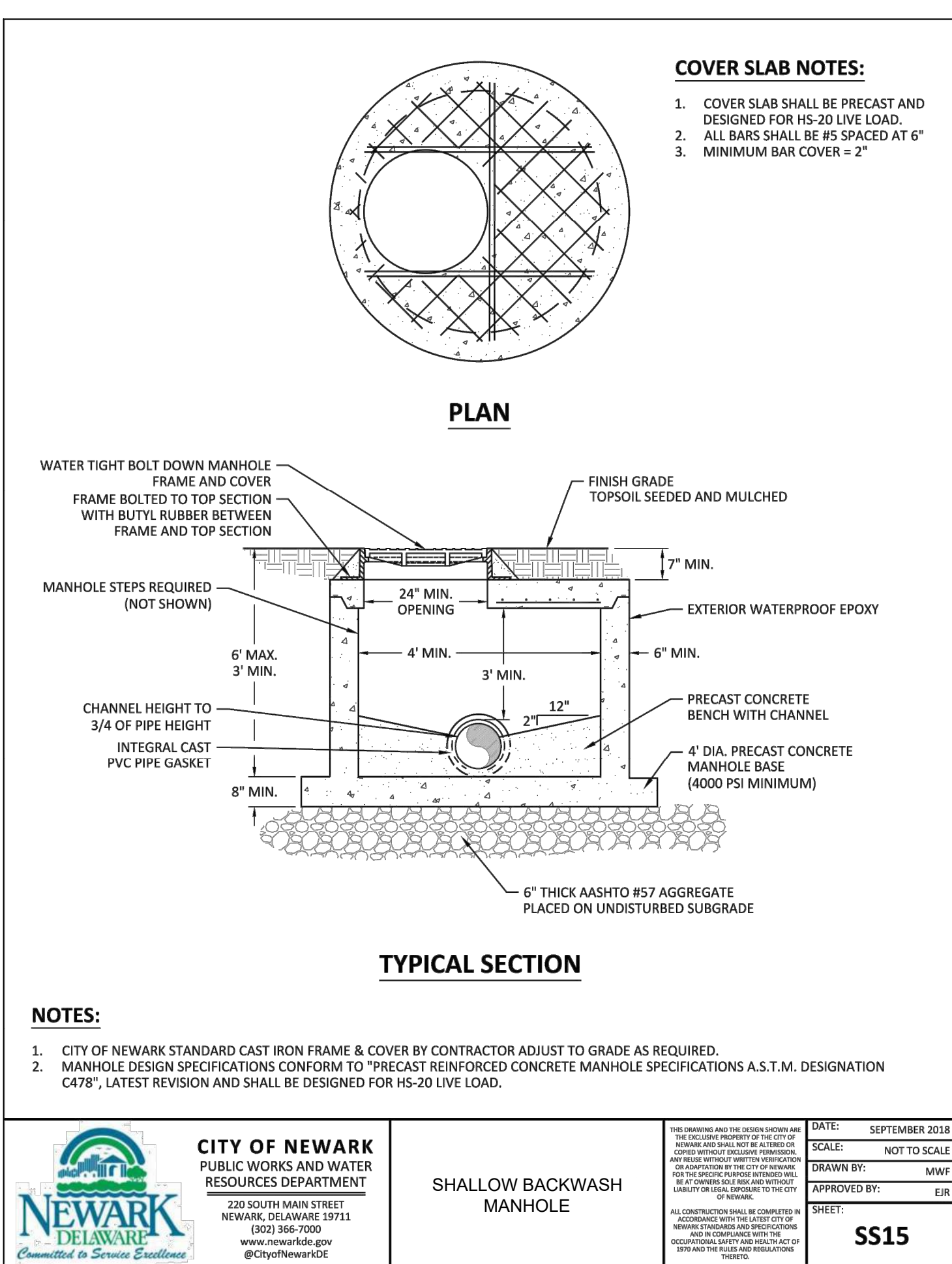


CITY OF NEWARK
PUBLIC WORKS AND WATER
RESOURCES DEPARTMENT

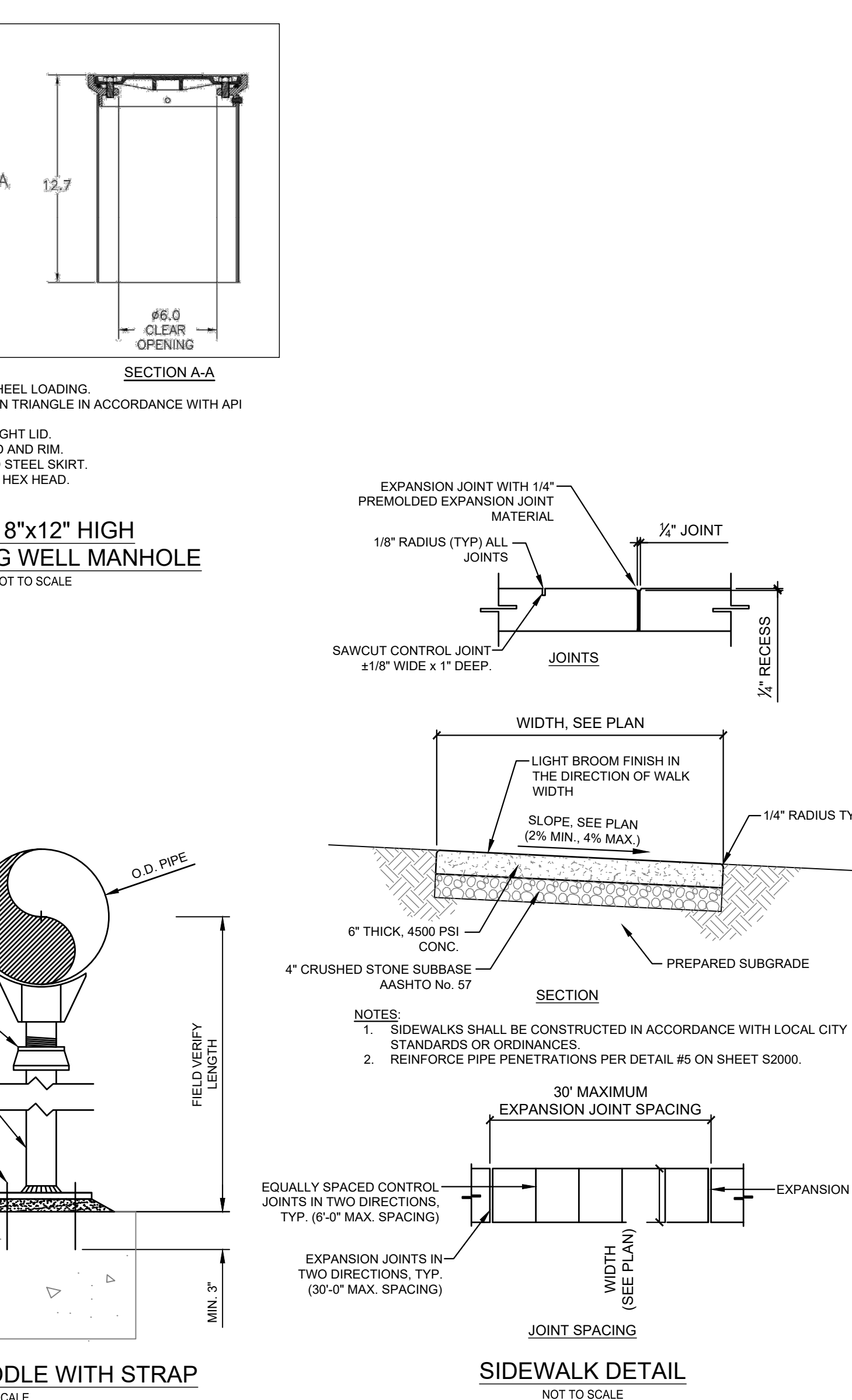
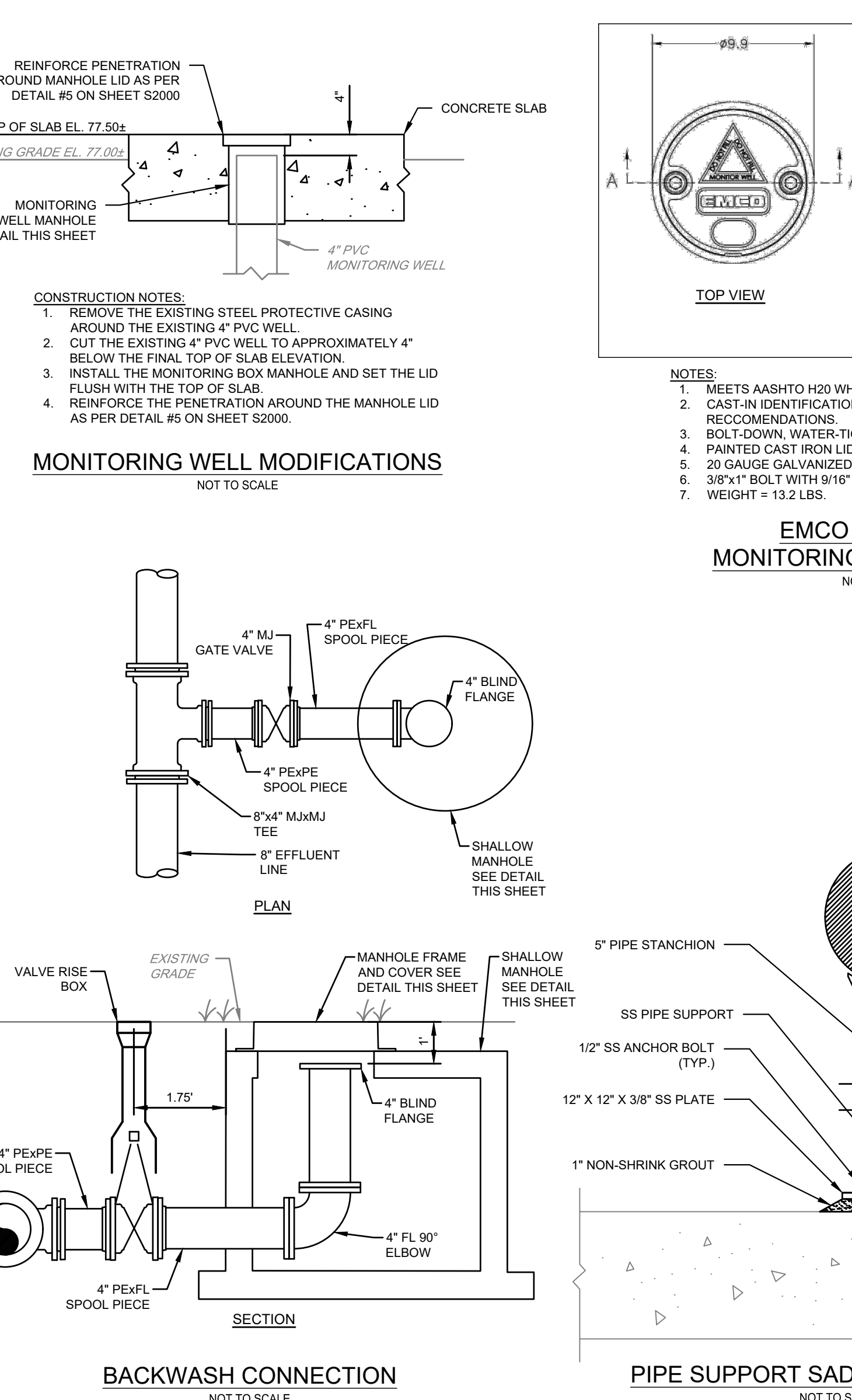
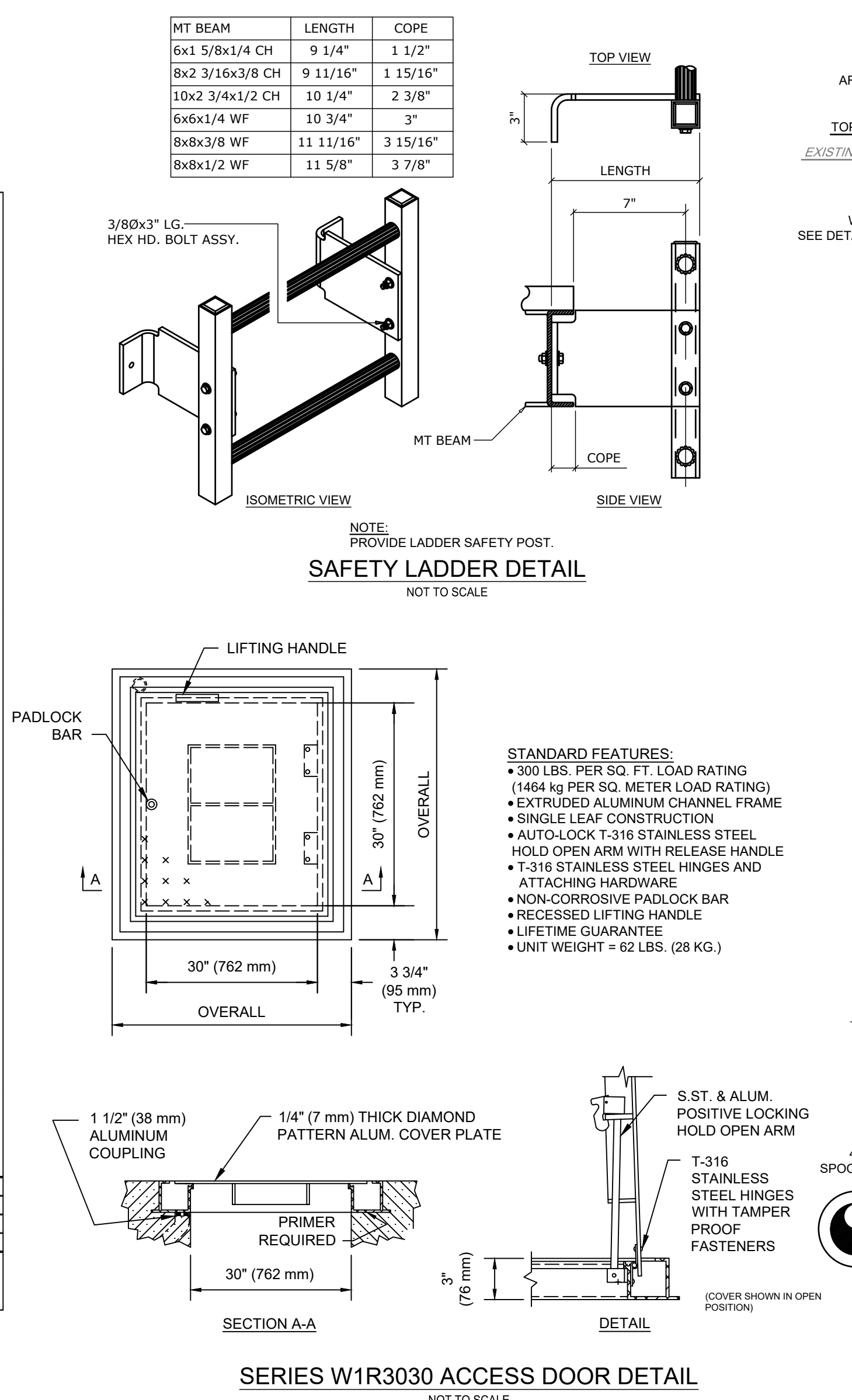
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@CityofNewarkDE

**CONNECTION TO EXISTING
WATER MAIN**

DATE: AUGUST 2018
SCALE: NOT TO SCALE
DRAWN BY: MMW
APPROVED BY: EJA
SHEET: **W10**



NOT FOR CONSTRUCTION



PENNONI ASSOCIATES INC.
Christiana Executive Campus
121 Continental Drive, Suite 207
Newark, DE 19713-4310
T 302.655.4451 F 302.654.2895

SOUTH WELLFIELD RESIN-GAC SYSTEM
912 SOUTH CHAPEL STREET
NEWARK, DE 19713

CONSTRUCTION DETAILS

CITY OF NEWARK
220 SOUTH MAIN STREET
NEWARK, DE 19711

NO.	DATE	REVISIONS	BY
1	05/10/2023	BID PLAN SUBMISSION	ELA
2	06/14/2023	ADDENDUM 2	ELA

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PROJECT: **CNEWK22008**

DATE: 2023-05-05

DRAWING SCALE: **AS NOTED**

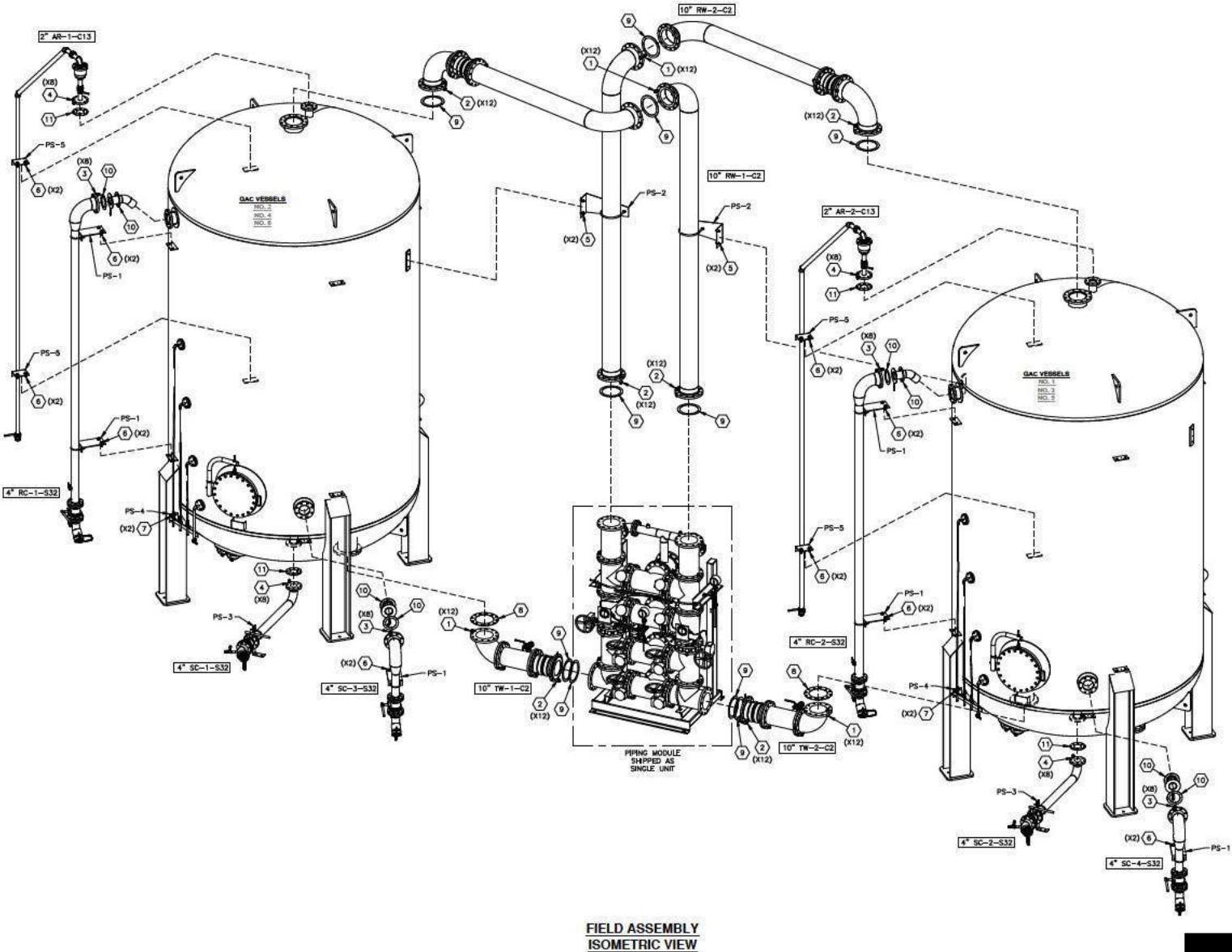
DRAWN BY: **ELA**

APPROVED BY: **MJE**

CS6001

SHEET 12 OF 20

INFORMATIONAL DRAWING ONLY - PROVIDED AS AN EXAMPLE REFERENCE



BOLT CHART		
ITEM	QTY	DESCRIPTION
1	48	BOLT SET, 3/8" x 4" LG. w/HVY. HEX NUT & (2) SAE F.W. (TYPE 18-8 SS) & BOLT INSULATOR KIT, 10"-150# FLANGE w/2# LG. SLEEVES (FOR DETAILS, SEE DWG. 90130122)
2	72	BOLT SET, 3/8" x 4" LG. w/HVY. HEX NUT & (2) SAE F.W. (TYPE 18-8 SS) & BOLT INSULATOR KIT, 10"-150# FLANGE w/2# LG. SLEEVES (FOR DETAILS, SEE DWG. 90130122)
3	32	BOLT SET, 3/8" x 4" LG. w/HVY. HEX NUT & (2) SAE F.W. (TYPE 18-8 SS) & BOLT INSULATOR KIT, 8"-150# FLANGE w/2# LG. SLEEVES (FOR DETAILS, SEE DWG. 90130122)
4	32	BOLT SET, 3/8" x 3/8" LG. w/HVY. HEX NUT & (2) SAE F.W. (TYPE 18-8 SS) & BOLT INSULATOR KIT, 4"-150# FLANGE w/2# LG. SLEEVES (FOR DETAILS, SEE DWG. 90130122)
5	4	STUD SET, 3/8" x 2# LG. w/HVY. HEX NUT & F.W. (ALL THREAD, 304SS)
6	20	BOLT SET, 3/8" x 2# LG. w/HVY. HEX NUT & (2) F.W. (304SS)
7	4	BOLT SET, 3/8" x 2" LG. w/HVY. HEX NUT & (2) F.W. (304SS)

GASKET CHART		
ITEM	QTY	DESCRIPTION
8	2	10" FULL FACE
9	10	10" RING TYPE
10	8	8" RING TYPE
11	4	4" FULL FACE

PIPE SUPPORT CHART		
ITEM	QTY	DESCRIPTION
PS-1	6	4" REACT. CARBON/4" SPENT CARBON (UPPER)
PS-2	2	6" INTLUENT
PS-3	2	4" SPENT CARBON (LOWER)
PS-4	2	3" LEVEL IND./W/ CONE VENT
PS-5	4	2" AIR RELIEF/VENT

NOTE:
1. (1) SYSTEM SHOWN, (3) SYSTEMS REQUIRED.

2			
1			
0	ISSUED FOR CONSTRUCTION	RES	5/23/2023
REV	DESCRIPTION	APP	DATE
REVISIONS			
TOLERANCES (unless otherwise specified)			
ANGULAR	30°/32'	DECIMAL (2 PLACES)	0.010
FRACTIONAL	1/8"	DECIMAL (3 PLACES)	0.008
DECIMAL (1 PLACES)	0.015	DECIMAL (4 PLACES)	0.0005

Calsonic Industries

3.3 WETTING (DEAERATING THE CARBON)

In a typical bed of virgin carbon, the pore volume is approximately 40% of the bed volume. Carbon which is shipped dry will contain air in these pores. Therefore, the carbon must be properly wetted prior to being placed on stream. If this is not done, the air within these pores will displace into the void spaces between the carbon particles during operation and cause high pressure drop and channeling in the adsorbers. These problems can cause premature breakthrough of contaminants. Air will not migrate out of the bed during normal downflow operation.

The time required for wetting is a function of liquid temperature and viscosity. Generally, a minimum wetting period of 24 hours is required using water at ambient temperatures, although a period of up to 72 hours is preferred for complete wetting. After wetting, backwashable adsorbers should be backwashed to remove air and segregate the carbon by size.

As an alternative, the Calgon Carbon Service trailer containing fresh carbon may be filled with water and allowed to stand for several hours. When the fresh carbon is transferred to the adsorber, the adsorber should be backwashed to eliminate any remaining air.

After the carbon has been wetted, the adsorber should be drained and then backfilled until water flows out the system vent line. The adsorber should be filled up-flow at 2 gpm/ft² maximum. For a Model 12-40 System this is 150 gpm, maximum.

If the unit must be placed on-stream before the carbon has been wetted, the adsorbers should be drained and backfilled when the pressure drop becomes prohibitive or after two days of operation, whichever occurs first.

For process applications, the same procedure is required. If the process liquid cannot be diluted with water and the carbon must be wetted with the process liquid there will be a significant heat of adsorption. In this case, Calgon Carbon should be contacted for specific instructions on the method to be used for wetting.

3.4 BACKWASHING AND BACKFLUSHING

3.4.1 BACKWASHING

Backwashing an adsorber results in expanding or fluidizing the carbon bed. This is accomplished by running contaminant-free water upflow through the carbon bed. The backwash flow rate depends upon the vessel diameter, carbon particle mesh size and the backwash water temperature (refer to the bed expansion curve in Section 8). Backwash flow rates may need to be adjusted due to seasonal temperature variations. Calgon Carbon vessels are designed with significant straight side height to permit 30% bed expansion. Before starting the backwash

operation, ensure that your vessel has appropriate straight side for the intended bed expansion; otherwise media may be lost during backwashing.

A 20% bed expansion will usually provide acceptable results, but a 30% bed expansion is optimal.

For your system, refer to Section 1.2 for the design backwash water flow rate. Note that this rate assumes a 55°F backwash water source. Use the bed expansion curve in Section 8 to determine a backwash rate if the water source is at a different temperature.

Backwashing of a carbon bed should be done after fresh carbon has been transferred into an adsorber and wetted (see Section 3.3). This is referred to as the Initial Backwash. Backwashing during operation to remove sediment from the top of the bed is referred to as an Operational Backwash.

Initial Backwash

The reasons for backwashing before placing fresh carbon on-line are to:

1. Size segregates the carbon (larger particles at bottom, smaller particles on top).
 - a. Therefore, subsequent backwashing will return the carbon particles to the same relative position in the bed.
 - b. Reduce pressure drop
2. Remove any remaining air from the bed.
3. Remove carbon fines which can lead to excessive pressure drop.

In addition, proper backwashing is a crucial step in collecting the most representative and meaningful post-start up data on compounds of interest such as metals and organic contaminants.

In municipal drinking water applications NSF/ANSI 61 establishes criteria for the release of metals (i.e. arsenic) from media used in drinking water treatment. The NSF/ANSI 61 testing protocol for GAC media is designed to mimic the critical procedural steps of a GAC adsorption filter start up and conditioning in the field. This test method consists of several steps:

1. Media conditioning: 16 hour soak
2. Backwash: 30 minutes @ 30% bed expansion
3. Media exposure I: 1 hour soak, discard water

4. Media exposure II: 1 hour soak, discard water
5. Media exposure III: 1 hour soak, analyze sample

In order for the data collected at adsorber start up and the data collected during NSF/ANSI 61 testing to be comparable, the field and lab procedures must be consistent with one another.

An analogous backwash is also recommended when an adsorber is to be restarted after an extended shutdown or when the bed has been drained.

After the wetting period, start backwashing slowly (< 5% bed expansion) to fill the vessel and submerge the bed. In incremental steps, increase the backwash water flow rate until a 20-30% bed volume expansion is obtained. Once the 20-30% carbon bed expansion is achieved, continue the backwash at this maximum rate for 20 to 30 minutes. The backwash water flow rate is then reduced by reversing the ramp up steps used to reach 20-30% expansion. Please see the below delineated steps outlining the recommended initial backwash ramp up/down procedure:

1. Flow @ 5% expansion for 2 minutes
2. Flow @ 10% expansion for 2 minutes
3. Flow @ 15% expansion for 2 minutes
4. Flow @ 20-30% expansion for 20-30 minutes
5. Flow @ 15% expansion for 2 minutes
6. Flow @ 10% expansion for 2 minutes
7. Flow @ 5% expansion for 2 minutes

Operational Backwash

Backwashing is done during operation to remove:

1. Sediment from the top of the bed.
2. Carbon fines that may be plugging the underdrain.
3. Air that is binding the bed.

Operational backwashes are normally required due to an increase in pressure drop across the carbon bed. The frequency of backwash will depend on the level of turbidity in the influent and throughput of the adsorber. The backwash time required to clean the GAC bed depends on the amount of deposited suspended solids, the nature of the suspended solids, and the depth of solids build-up.

The operational backwash procedure is essentially the same as the initial backwash procedure described above, but the time maintained at 20-30% expansion is reduced. Observation of the amount of time required to obtain visually clear effluent water at maximum backwash rate determines a sufficient backwash time. Please see the below delineated steps outlining the recommended operational backwash ramp up/down procedure:

1. Flow @ 5% expansion for 2 minutes
2. Flow @ 10% expansion for 2 minutes
3. Flow @ 15% expansion for 2 minutes
4. Flow @ 20-30% expansion for 10-20 minutes
5. Flow @ 15% expansion for 2 minutes
6. Flow @ 10% expansion for 2 minutes
7. Flow @ 5% expansion for 2 minutes

3.4.2 BACKFLUSHING

In a system that is not designed for backwashing, an operation termed backflushing can be used to remove fines from the upper portion of the bed. This operation will not remove fines from the lower portion of the bed because it does not expand the bed. Expansion of the bed allows the fines at the bottom of the bed to move to the top. However, fines do not always cause high pressure drop, and their removal is not always necessary.

The backflushing rate is 2 to 3 gpm/ft² and this is not significant enough to expand the carbon bed. For the Model 12-40 adsorber this is a flow rate from 150 gpm to 225 gpm. Flow rates of less than 225 gpm will not expand the bed; therefore, size segregation of the bed will not occur. The time required for backflushing is 30 to 45 minutes.

Normally when backwashing or backflushing, a clean external water source is used. The stream should be compatible with the system and free of suspended solids and organic contaminants which might affect adsorption. If necessary, effluent from the adsorber system may be used as the water source. In this case a tank with storage capacity for 15 minutes of backwash water (20,000 gallons) will be necessary.

When normal downflow operation is started after backwashing, the initial 5 to 15 minutes of effluent flow will be dark due to a small quantity of fines. Under normal operating conditions, this condition will clear up.

3.4.3 BACKWASHING AN ADSORBER (FIGURES 6 AND 7 IN SECTION 8)

In this mode, a clean external source is used as the source for the backwash water. Note that the lead adsorber is taken out of service while the backwashing procedure takes place. It is recommended that the entire system be taken off-line to retain all process conditions. However, for continuous flow, the lag adsorber can remain on-line while the lead bed is being backwashed.

For a system operating in parallel, only the vessel needing backwashed should be taken off-line when backwashing is required.

1. Isolate the adsorber to be backwashed. If adsorber PV1 is to be backwashed, refer to Section 3.6.4 for valve sequencing. If adsorber PV2 is to be backwashed, refer to Section 3.6.6 for sequencing. If entire system is taken off-line, make sure source is turned off (i.e., pump) and all valves at system are closed.
2. Open the vent valve (V5 for adsorber PV1, V6 for adsorber PV2).
3. Open the backwash water inlet valve (V8 for adsorber PV1, V7 for adsorber PV2) and start the backwash pump. Backwash flow should be increased to design flow gradually, avoiding water hammer.

The backwash water enters the vessel through the effluent line and flows up through the underdrain and the carbon bed. The backwash water discharge from the vent line should be observed for clarity to determine the duration of backwashing. Backwashing for high pressure drop should take approximately 10 minutes. If excessive sediment and turbidity exists in the untreated water, the backwashing times may have to be increased to 15 minutes. A fresh carbon fill should be backwashed to classify the carbon. The time required for this step is approximately 15 minutes or until the backwash discharge is free of fines.



SUBMITTAL MANUAL
(2) MODEL 12-40 DWC
GRANULAR ACTIVATED CARBON
ADSORPTION SYSTEMS

FOR

CITY OF NEWARK
NEWARK, DE

SOLD TO: CITY OF NEWARK

APRIL, 2023

CALGON CARBON PROJECT NUMBER:
CUSTOMER PURCHASE ORDER NUMBER:

IXO.220002.NEWARK
20221012
REV. 2

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OTHER THAN SPECIFICALLY PERMITTED IN WRITING BY CALGON CARBON CORPORATION.

SAFETY DEPENDS ON YOU

Calgon Carbon Corporation's equipment is designed and built with safety in mind. However, proper installation and operation can increase your overall safety.

DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

SAFETY HIGHLIGHTS

READ AND UNDERSTAND THE FOLLOWING SAFETY HIGHLIGHTS.



WARNING

This statement appears where the information must be followed exactly to avoid serious personal injury or loss of life



CAUTION

This statement appears where the information must be followed exactly to avoid minor personal injury or damage to equipment.

QUESTIONS, TROUBLESHOOTING, SPARE PARTS

Call Calgon Carbon Corporation at 1-800-422-7266

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PAINT SPECIFICATIONS	SECTION 4
DRAWINGS.....	SECTION 5



SECTION 1

CARBON / MEDIA

FILTRASORB® 400

Granular Activated Carbon

Applications



FILTRASORB 400 activated carbon can be used in a variety of liquid phase applications for the removal of dissolved organic compounds. FILTRASORB 400 has been successfully applied for over 40 years in applications such as drinking and process water purification, wastewater treatment, and food, pharmaceutical, and industrial purification.

Description

FILTRASORB 400 is a granular activated carbon for the removal of dissolved organic compounds from water and wastewater as well as industrial and food processing streams. These contaminants include taste and odor compounds, organic color, total organic carbon (TOC), industrial organic compounds such as TCE and PCE, and PFAS.

This activated carbon is made from select grades of bituminous coal through a process known as reagglomeration to produce a high activity, durable, granular product capable of withstanding the abrasion associated with repeated backwashing, hydraulic transport, and reactivation for reuse. Activation is carefully controlled to produce a significant volume of both low and high energy pores for effective adsorption of a broad range of high and low molecular weight organic contaminants.

FILTRASORB 400 is formulated to comply with all the applicable provisions of the AWWA Standard for Granular Activated Carbon (B604) and Food Chemicals Codex. This product may also be certified to the requirements of NSF/ANSI 61 for use in municipal water treatment facilities. Only products bearing the NSF Mark are certified to the NSF/ANSI 61 - Drinking Water System Components - Health Effects standard. Certified Products will bear the NSF Mark on packaging or documentation shipped with the product.

Features / Benefits

- Produced from a pulverized blend of high quality bituminous coals resulting in a consistent, high quality product.
- Carbon granules are uniformly activated through the whole granule, not just the outside, resulting in excellent adsorption properties and constant adsorption kinetics.
- The reagglomerated structure ensures proper wetting while also eliminating floating material.
- High mechanical strength relative to other raw materials, thereby reducing the generation of fines during backwashing and hydraulic transport.
- Carbon bed segregation is retained after repeated backwashing, ensuring the adsorption profile remains unchanged and therefore maximizing the bed life.
- Reagglomerated with a high abrasion resistance, which provides excellent reactivation performance.
- High density carbon resulting in a greater adsorption capacity per unit volume.

Specifications¹

FILTRASORB 400

Iodine Number, mg/g	1000 (min)
Moisture by Weight	2% (max)
Effective Size	0.55–0.75 mm
Uniformity Coefficient	1.9 (max)
Abrasion Number	75 (min)
Screen Size by Weight, US Sieve Series	
On 12 mesh	5% (max)
Through 40 mesh	4% (max)

¹Calgon Carbon test method

Typical Properties*

FILTRASORB 400

Apparent Density (tamped)	0.54 g/cc
Water Extractables	<1%
Non-Wettability	<1%

*For general information only, not to be used as purchase specifications.

Safety Message

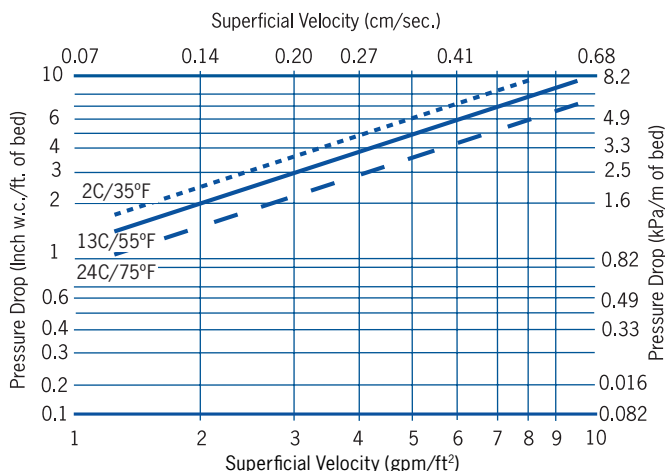
Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

1.800.4CARBON calgoncarbon.com

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 DS-FILTRA40018-EIN-E1

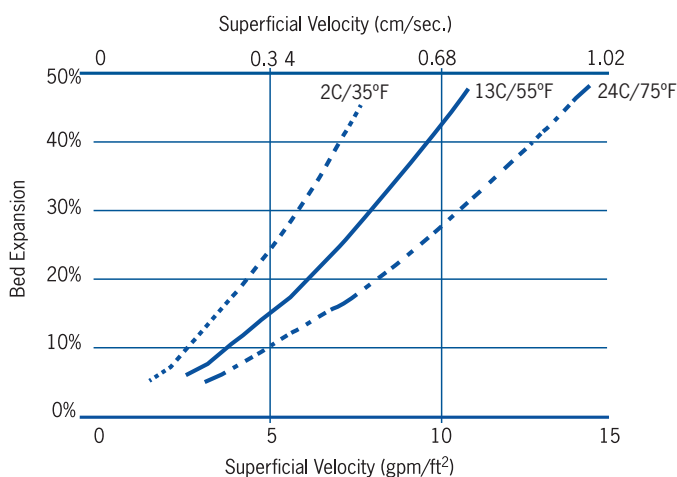
Typical Pressure Drop

Based on a backwashed and segregated bed



Typical Bed Expansion During Backwash

Based on a backwashed and segregated bed



Conditioning and Backwashing

Backwashing and conditioning fresh GAC before placing into operation is critical to GAC performance. The reasons for backwashing before placing fresh media online are to: (1) size segregate the media so subsequent backwashing will return the media to the same relative position in the bed, (2) remove any remaining air from the bed, and (3) remove media fines which can lead to excessive pressure drop and flow restriction. In addition, proper backwashing is a crucial step to collecting the most representative and meaningful post-start up data on compounds of interest, such as metals listed in the NSF/ANSI 61 standard.

Below are the recommended steps for proper conditioning and backwashing of GAC based on Filtrasorb 400 GAC being backwashed at 55°F:

1. Fully submerge GAC bed in clean, contaminant free water for at least 16 hours (overnight)
2. Open backwash inlet and begin up-flow at 3 gpm/ft² for 2 minutes
3. Increase flow to 5 gpm/ft² and maintain for 2 minutes
4. Increase flow to 7 gpm/ft² and maintain for 2 minutes
5. Increase flow to 8.5 gpm/ft² and maintain for 30 minutes*
6. Decrease flow to 7 gpm/ft² and maintain for 2 minutes
7. Decrease flow to 5 gpm/ft² and maintain for 2 minutes
8. Decrease flow to 3 gpm/ft² and maintain for 2 minutes
9. Close backwash inlet and stop flow

*Duration representative of initial backwash conditions. Required duration during operational backwashes can be shorter but will vary by utility, solids load, and GAC throughput. Contact Calgon Carbon for more information"

Design Considerations

FILTRASORB 400 activated carbon is typically applied in down-flow packed-bed operations using either pressure or gravity systems. Design considerations for a treatment system is based on the user's operating conditions, the treatment objectives desired, and the chemical nature of the compound(s) being adsorbed.

Safety Message

Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

1.800.4CARBON calgoncarbon.com

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DS-FILTRA40018-EIN-E1

SECTION 1: Identification of the Substance/Mixture and of the Company/Undertaking

1.1. Product identifier

Product name : FILTRASORB 400
Product form : Substance
CAS No : 7440-44-0
Product code : 12030
Synonyms : Activated carbon; Steam activated carbon

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Adsorbent

1.3. Details of the supplier of the safety data sheet

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA 15230
412-787-6700

1.4. Emergency telephone number

Emergency number : CHEMTREC (24 HRS): 1-800-424-9300

SECTION 2: Hazards Identification

2.1. Classification of the substance or mixture

GHS-US classification

Combustible Dust

Not classified as a simple asphyxiant. Product does not displace oxygen in the ambient atmosphere, but slowly adsorbs oxygen from a confined space when wet. Under conditions of anticipated and recommended use, product does not pose an asphyxiation hazard.

2.2. Label elements

GHS-US labeling

Signal word (GHS-US) : **Warning**
Hazard statements (GHS-US) : May form combustible dust concentrations in air.

2.3. Other hazards

Other hazards not contributing to the classification : Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/Information on Ingredients

3.1. Substance

Name	Product identifier	%
Activated carbon	(CAS No) 7440-44-0	< 100

3.2. Mixture

Not applicable

SECTION 4: First Aid Measures

4.1. Description of first aid measures

First-aid measures general : If exposed or concerned, get medical attention/advice. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before re-use. Never give anything to an unconscious person.

First-aid measures after inhalation : IF INHALED: Remove to fresh air and keep at rest in a comfortable position for breathing.

First-aid measures after skin contact : IF ON SKIN (or clothing): Remove affected clothing and wash all exposed skin with water for at least 15 minutes.

First-aid measures after eye contact : IF IN EYES: Immediately flush with plenty of water for at least 15 minutes. Remove contact lenses if present and easy to do so. Continue rinsing.

FILTRASORB 400

Product Code: 12030

Safety Data Sheet

First-aid measures after ingestion : IF SWALLOWED: Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center or medical professional. Get medical attention if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : Not expected to present a significant hazard under anticipated conditions of normal use. Dust may cause irritation to the respiratory system.

Symptoms/injuries after skin contact : Dust may cause irritation.

Symptoms/injuries after eye contact : Dust may cause irritation and redness.

Symptoms/injuries after ingestion : Not expected to present a significant hazard under anticipated conditions of normal use.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available.

SECTION 5: Firefighting Measures

5.1. Extinguishing media

Suitable extinguishing media : Water spray. Carbon dioxide. Dry chemical. Foam. Sand.

Unsuitable extinguishing media : None known.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Dust may be combustible under specific conditions. May be ignited by heat, sparks or flames.

Explosion hazard : Dust may form explosive mixture in air.

Reactivity : No dangerous reactions known under normal conditions of use. Carbon oxides may be emitted upon combustion of material.

5.3. Advice for firefighters

Firefighting instructions : Wear NIOSH-approved self-contained breathing apparatus suitable for the surrounding fire. Use water spray or fog for cooling exposed containers. Evacuate area.

SECTION 6: Accidental Release Measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Evacuate area. Keep upwind. Ventilate area. Spill should be handled by trained clean-up crews properly equipped with respiratory equipment and full chemical protective gear (see Section 8).

6.1.1. For non-emergency personnel

No additional information available.

6.1.2. For emergency responders

No additional information available.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Avoid release to the environment. Product is not soluble, but can cause particulate emission if discharged into waterways. Dike all entrances to sewers and drains to avoid introducing material to waterways. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment : Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust.

Methods for cleaning up : Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust. Dispose of material in compliance with local, state, and federal regulations.

6.4. Reference to other sections

No additional information available.

SECTION 7: Handling and Storage

7.1. Precautions for safe handling

Precautions for safe handling : Avoid dust formation. Avoid contact with skin, eyes and clothing. Do not handle until all safety precautions have been read and understood. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Keep away from sources of ignition - No smoking.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container tightly closed in a cool, dry, and well-ventilated place. Keep away from ignition sources.

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Safety Data Sheet

SECTION 8: Exposure Controls/Personal Protection

8.1. Control parameters

Activated carbon (7440-44-0)*

OSHA PEL (TWA) (mg/m³)

≤ 5 (Respirable Fraction)

≤ 15 (Total Dust)

*Exposure limits are for inert or nuisance dust. No specific exposure limits have been established for this activated carbon product by OSHA or ACGIH.

8.2. Exposure controls

Appropriate engineering controls

: Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof equipment with flammable materials. Ensure adequate ventilation, especially in confined areas. Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

Personal protective equipment

: Gloves. Safety glasses. Protective clothing. Under insufficient ventilation conditions wear respiratory protection.



Hand protection

: Gloves should be classified under Standard EN 374 or ASTM F1296. Suggested glove materials are: Neoprene, Nitrile/butadiene rubber, Polyethylene, Ethyl vinyl alcohol laminate, PVC or vinyl. Suitable gloves for this specific application can be recommended by the glove supplier.

Eye protection

: Use eye protection suitable to the environment. Avoid direct contact with eyes.

Skin and body protection

: Wear long sleeves, and chemically impervious PPE/coveralls to minimize bodily exposure.

Respiratory protection

: Use NIOSH-approved dust/particulate respirator. Where vapor, mist, or dust exceed PELs or other applicable OELs, use NIOSH-approved respiratory protective equipment.

SECTION 9: Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical state

: Solid

Appearance

: Granular, powder, or pelletized substance

Color

: Black

Odor

: Odorless

Odor threshold

: No data available

pH

: No data available

Relative evaporation rate (butylacetate=1)

: Not applicable

Melting point

: Not applicable

Freezing point

: Not applicable

Boiling point

: Not applicable

Flash point

: No data available

Auto-ignition temperature

: > 325 °C

Decomposition temperature

: No data available

Flammability (solid, gas)

: > 325 °C

Vapor pressure

: Not applicable

Relative vapor density at 20 °C

: Not applicable

Apparent density

: 0.3 - 0.75 g/cc

Solubility

: Insoluble

Log Pow

: Not applicable

Log Kow

: Not applicable

Viscosity, kinematic

: Not applicable

Viscosity, dynamic

: Not applicable

Explosive properties

: No data available

Oxidising properties

: No data available

Explosive limits

: No data available

9.2. Other information

No additional information available.

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SECTION 10: Stability and Reactivity

10.1. Reactivity

No dangerous reactions known under normal conditions of use.

10.2. Chemical stability

Stable under use and storage conditions as recommended in section 7.

10.3. Possibility of hazardous reactions

None known.

10.4. Conditions to avoid

Avoid dust formation. Heat. Ignition sources. Exposure to high concentrations of organic compounds may cause bed temperature to rise.

10.5. Incompatible materials

Alkali metals. Strong oxidizing agents.

10.6. Hazardous decomposition products

Carbon monoxide (CO), carbon dioxide (CO₂).

SECTION 11: Toxicological Information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Activated carbon (7440-44-0)	
LD ₅₀ oral rat	> 2000 mg/kg

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Not classified

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Silica: crystalline, quartz (14808-60-7)	
IARC group	1 - Carcinogenic to humans
The International Agency for Research on Cancer (IARC) has classified "silica dust, crystalline, in the form of quartz or cristobalite" as carcinogenic to humans (group 1). However these warnings refer to crystalline silica dusts and do not apply to solid activated carbon containing crystalline silica as a naturally occurring, bound impurity. As such, we have not classified this product as a carcinogen in accordance with the US OSHA Hazard Communication Standard (29 CFR §1910.1200) but recommend that users avoid inhalation of product in a dust form.	

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Symptoms/injuries after inhalation : Not expected to present a significant hazard under anticipated conditions of normal use.

Symptoms/injuries after skin contact : Dust may cause irritation of the skin.

Symptoms/injuries after eye contact : Dust may cause irritation and redness.

Symptoms/injuries after ingestion : Not expected to present a significant hazard under anticipated conditions of normal use.

SECTION 12: Ecological Information

12.1. Toxicity

No additional information available.

12.2. Persistence and degradability

No additional information available.

12.3. Bioaccumulative potential

No additional information available.

12.4. Mobility in soil

No additional information available.

FILTRASORB 400

Product Code: 12030

Safety Data Sheet

12.5. Other adverse effects

No additional information available.

SECTION 13: Disposal Considerations

13.1. Waste treatment methods

- Waste treatment and disposal methods : Vacuum or shovel material into a closed container. Dispose in a safe manner in accordance with local/national regulations. Do not allow the product to be released into the environment.
- Additional information : Activated carbon is an adsorbent media; hazard classification is generally determined by the adsorbate. Consult U.S. EPA guidelines listed in 40 CFR 261.3 for more information on hazardous waste disposal.

SECTION 14: Transport Information

14.1. In accordance with DOT

Not classified as hazardous for domestic land transport.

- UN-No.(DOT) : None on finished product
- DOT NA no. : None on finished product
- Proper Shipping Name (DOT) : Not regulated
- Department of Transportation (DOT) Hazard Classes : None on finished product
- Hazard labels (DOT) : None on finished product
- Packing group (DOT) : None on finished product
- DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : None on finished product

14.2. Transport by sea

Not classified as hazardous for water transport.

- IMO / IMDG
- UN/NA Identification Number : None on finished product
- UN- Proper Shipping Name : Not regulated
- Transport Hazard Class : None on finished product

14.3. Air transport

Not classified as hazardous for air transport.

- ICAO / IATA
- UN/NA No : None on finished product
- UN- Proper Shipping Name : Not regulated
- Transport Hazard Class : None on finished product
- Packing Group : None on finished product
- Marine Pollutant : None on finished product

14.4. Additional information

- Other information : Under the UN classification for activated carbon, all activated carbons have been identified as a class 4.2 product. However, this product type or an equivalent has been tested according to the United Nations Transport of Dangerous Goods, Manual of Tests and Criteria, Part III, Test N.4 - Test Method for Self Heating Substances) and it has been specifically determined that this product type or an equivalent does not meet the definition of a self-heating substance (class 4.2). This information is applicable to the steam activated carbon product described in this document.

SECTION 15: Regulatory Information

15.1. US Federal regulations

FILTRASORB 400

All chemical substances in this product are listed as "Active" in the EPA (Environmental Protection Agency) "TSCA Inventory Notification (Active-Inactive) Requirements Rule" ("the Final Rule"). as of February 2019 or are otherwise exempt.

SARA Section 311/312 Hazard Classes	Physical hazard - Combustible dust
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FILTRASORB 400

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Cobalt (7440-48-4)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on United States SARA Section 313

SARA Section 313 - Emission Reporting 0.1 %

15.2. International regulations

No additional information available.

15.3. US State regulations

California Proposition 65

WARNING: This product can expose you to chemicals including Silica: crystalline, quartz, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

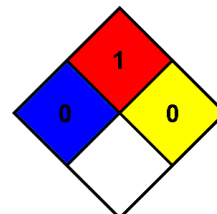
Component	Carcinogenicity	Developmental toxicity	Reproductive toxicity male	Reproductive toxicity female	No significant risk level (NSRL)	Maximum allowable dose level (MADL)
Silica: crystalline, quartz (14808-60-7)	X					
Titanium dioxide (13463-67-7)	X				Not available	
Cobalt (7440-48-4)	X					

Component	State or local regulations
Aluminum oxide (1344-28-1)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Massachusetts - Right To Know List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List
Calcium sulfate (7778-18-9)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Massachusetts - Right To Know List
Silica: crystalline, quartz (14808-60-7)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Massachusetts - Right To Know List
Titanium dioxide (13463-67-7)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Massachusetts - Right To Know List
Cobalt (7440-48-4)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Massachusetts - Right To Know List

SECTION 16: Other Information

Indication of changes : Revision 4.0
Revision Date : 10/20/2020
Other information : Author: ADK
For internal use only : PR #1
Prepared according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.
NFPA fire hazard : 1 - Must be preheated before ignition can occur.
NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 0
Flammability : 1
Physical : 0

FILTRASORB 400

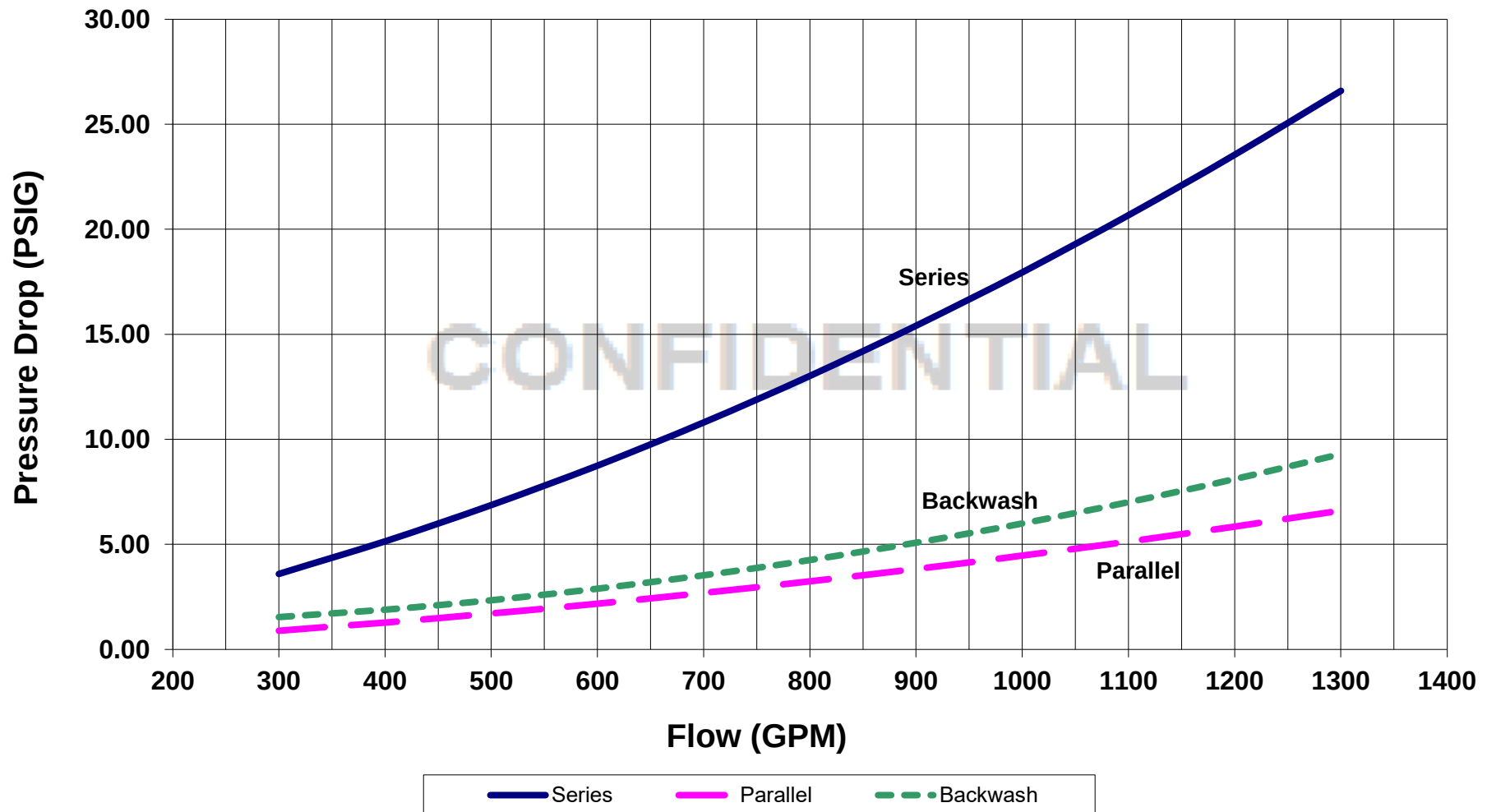
Product Code: 12030

Safety Data Sheet

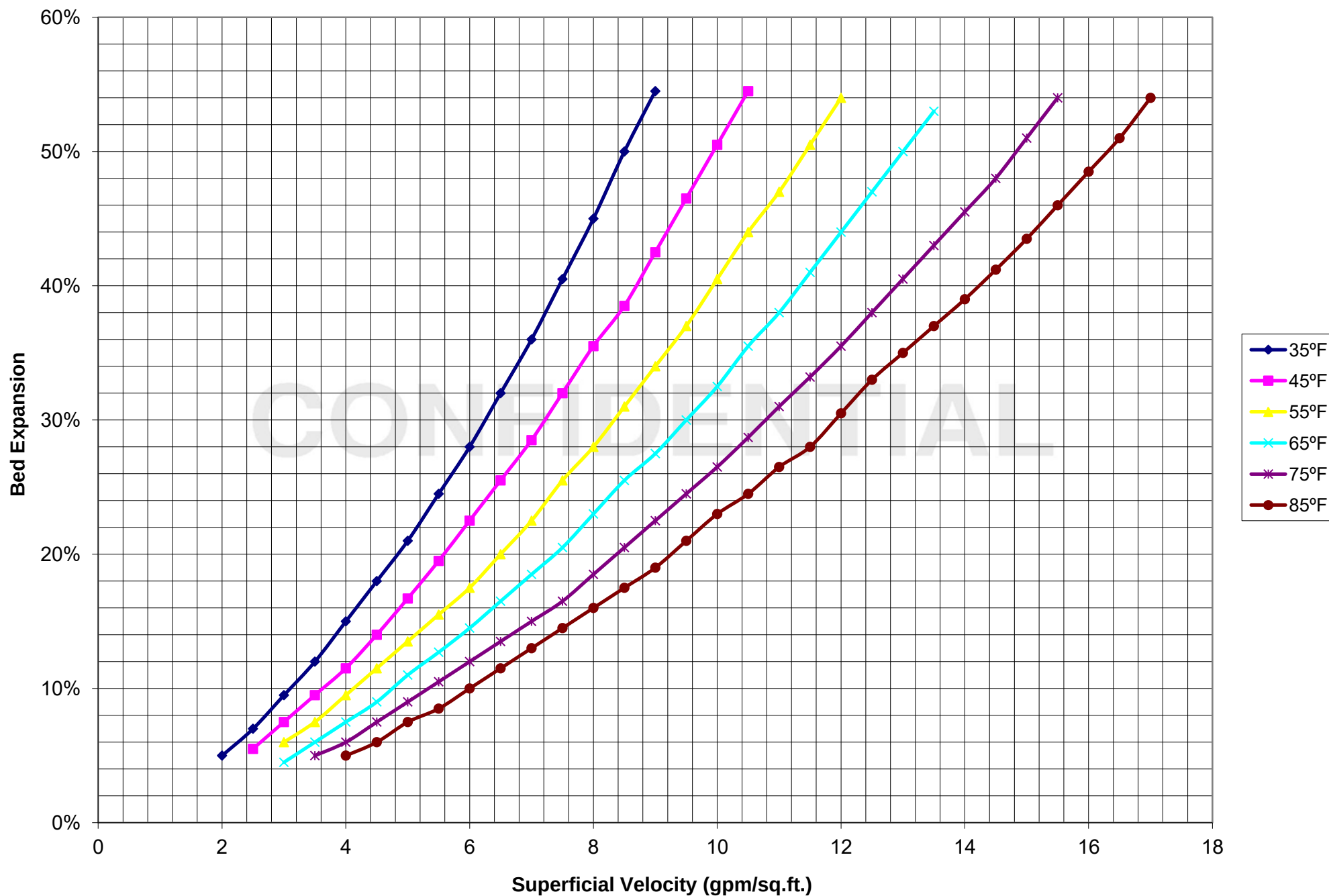
Personal Protection :

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product. The information in this document applies to this specific material as supplied. It may not be valid if product is used in combination with other materials. It is the user's responsibility to determine the suitability and completeness of this information for their particular use. While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Calgon Carbon Corporation makes no warranty with respect to the same, and disclaims all liability for reliance thereon.

Pressure Drop Curve
Model 12-40, 40,000 # F-400 Carbon, 8in piping,
60 deg. F., 120 spec. 22.113 septas



F400 Bed Expansion Curve Backwashed & Segregated



SALES SPECIFICATION SHEET

CALRES 2301

Strong Base Anion Exchange Resin

Test	Specification		Calgon Carbon Test Method
	Min	Max	
TOTAL CAPACITY (ANION), eq/l	0.51	-	GB/T 5760-2000
WATER RETENTION CAPACITY, wt%	48	60	GB/T 5757-86
WHOLE BEAD COUNT, %	95	-	ASTM D2862
16 US MESH [1.18 mm], wt%	-	3	
< 45 US MESH [0.355 mm], wt%	-	5	

Structure: Macroporous

Functional Group: N-Tri-Butyl Amine

Ionic Form: Chloride

This product complies with NSF 61 (WQA Gold Seal)

Calgon Carbon Corporation's products are continuously being improved and changes may have taken place since this publication went to press. -10/30/2019



+1 800 422 7266 calgoncarbon.com

CalgonCarbon
A Kuraray Company

SECTION 1: Identification of the Substance/Mixture and of the Company/Undertaking

1.1. Product identifier

Product name : CALRES 2301
Product form : Mixture
Product code : 1077516

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Ion exchange and/or adsorption processes

1.3. Details of the supplier of the safety data sheet

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA 15230
412-787-6700

1.4. Emergency telephone number

Emergency number : CHEMTREC (24 HRS): 1-800-424-9300; INTERNATIONAL: 1-703-527-3887

SECTION 2: Hazards Identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

GHS-US labeling

No labelling applicable.

2.3. Other hazards

No additional information available.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/Information on Ingredients

3.1. Substance

Not applicable

3.2. Mixture

Name	Product identifier	%
Styrene, divinylbenzene polymer, chloromethylated, tributylamine-functionalized	116565-72-1	43-53
Dimethylamine functionalize chloromethylated copolymer of styrene and divinylbenzene	69011-17-2	38-50

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : If exposed or concerned, get medical attention/advice. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before re-use. Never give anything to an unconscious person.

First-aid measures after inhalation : IF INHALED: Remove to fresh air and keep at rest in a comfortable position for breathing.

First-aid measures after skin contact : IF ON SKIN (or clothing): Remove affected clothing and wash all exposed skin with water for at least 15 minutes.

First-aid measures after eye contact : IF IN EYES: Immediately flush with plenty of water for at least 15 minutes. Remove contact lenses if present and easy to do so. Continue rinsing.

First-aid measures after ingestion : IF SWALLOWED: Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center or medical professional. Get medical attention if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

Symptoms/injuries after inhalation : May cause respiratory irritation.

Symptoms/injuries after skin contact : May cause skin irritation.

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Symptoms/injuries after eye contact : Direct contact with the eyes is likely to be irritating.
Symptoms/injuries after ingestion : May cause gastrointestinal irritation.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available.

SECTION 5: Firefighting Measures

5.1. Extinguishing media

Suitable extinguishing media : Water spray. Carbon dioxide. Dry chemical.

5.2. Special hazards arising from the substance or mixture

Fire hazard : This material will not burn until the water has evaporated. Residue can burn.
Explosion hazard : Product is not explosive.
Reactivity : No dangerous reactions known under normal conditions of use. Carbon oxides, nitrogen oxides, organic amines, ammonia, hydrogen chloride, methyl chloride, phenol, hydrocarbons, and benzenes may be emitted upon combustion of material.

5.3. Advice for firefighters

Firefighting instructions : Wear NIOSH-approved self-contained breathing apparatus suitable for the surrounding fire. Use water spray or fog for cooling exposed containers. Evacuate area.

SECTION 6: Accidental Release Measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Evacuate area. Ventilate area. Keep upwind. Spill should be handled by trained clean-up crews properly equipped with respiratory equipment and full chemical protective gear (see Section 8). Beads can cause serious slipping hazard on hard smooth surface.

6.1.1. For non-emergency personnel

No additional information available.

6.1.2. For emergency responders

No additional information available.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Avoid release to the environment. Product is not soluble, but can cause particulate emission if discharged into waterways. Dike all entrances to sewers and drains to avoid introducing material to waterways. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment : Sweep or shovel spills into appropriate container for disposal.
Methods for cleaning up : Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust. Dispose of material in compliance with local, state, and federal regulations.

6.4. Reference to other sections

No additional information available.

SECTION 7: Handling and Storage

7.1. Precautions for safe handling

Precautions for safe handling : Avoid contact with skin, eyes and clothing. Do not handle until all safety precautions have been read and understood. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Keep away from sources of ignition - No smoking. Handling this product may result in electrostatic accumulation. Leave room for expansion as dry resin swells upon wetting and/or changing ionic form. Equipment construction material should be compatible with feed, regenerant, ionic form and effluent of the ion exchange process.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store in a dry, cool and well-ventilated place. Keep container closed when not in use.
Maximum storage period : 36 months
Storage temperature : 0 - 50 °C (preferred temperature is in lower half of range)

SECTION 8: Exposure Controls/Personal Protection

8.1. Control parameters

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8.2. Exposure controls

Appropriate engineering controls

: Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof equipment with flammable materials. Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

: Gloves. Protective goggles.



Hand protection

: Use gloves chemically resistant to this material when prolonged or repeated contact could occur. Suggested glove materials are: Neoprene, Nitrile/butadiene rubber, Polyethylene, Ethyl vinyl alcohol laminate, PVC or vinyl.

Eye protection

: Use eye protection suitable to the environment. Avoid direct contact with eyes.

Skin and body protection

: Wear long sleeves, and chemically impervious PPE/coveralls to minimize bodily exposure.

Respiratory protection

: Use NIOSH-approved dust/particulate respirator. Where vapor, mist, or dust exceed PELs or other applicable OELs, use NIOSH-approved respiratory protective equipment.

SECTION 9: Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical state	: Solid
Appearance	: Beads
Molecular mass	: 99,999 kg/mol (calculated)
Color	: White, yellow or tan
Odor	: No data available
Odor Threshold	: No data available
pH	: Neutral
Relative evaporation rate (water=1)	: 1
Melting point	: Decomposes at elevated temperature
Freezing point	: Not applicable
Boiling point	: Not applicable
Flash point	: Not applicable
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: Not applicable
Relative vapour density at 20 °C	: Not applicable
Relative density	: 1.1 (calculated)
Density	: 0.7 g/cm ³ (calculated)
Solubility	: Insoluble in water Water: 0 %
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: Not applicable
Viscosity, dynamic	: Not applicable
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: Not applicable

9.2. Other information

No additional information available.

SECTION 10: Stability and Reactivity

10.1. Reactivity

No dangerous reactions known under normal conditions of use.

10.2. Chemical stability

Stable under use and storage conditions as recommended in section 7.

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Product Code: 1077516

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10.3. Possibility of hazardous reactions

None known.

10.4. Conditions to avoid

Elevated temperature (> 400 °F) .

10.5. Incompatible materials

Avoid contact with oxidizing materials. Oxidizing agents such as nitric acid attack organic exchange resins under certain conditions. Before using strong oxidizing agents, consult sources knowledgeable in handling such materials. The severity of the reaction with oxidizing materials can vary from slight degradation to an explosive reaction.

10.6. Hazardous decomposition products

Carbon monoxide (CO), carbon dioxide (CO₂). Nitrogen oxides. Organic amines. Ammonia. Hydrogen chloride. Methyl chloride. Phenol. Hydrocarbons. Benzenes.

SECTION 11: Toxicological Information

11.1. Information on toxicological effects

Acute toxicity	: Oral: Very low. Typical LD ₅₀ (rat) >5,000 mg/kg
Skin corrosion/irritation	: Not classified
Serious eye damage/irritation	: Not classified
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: Not classified
Specific target organ toxicity (repeated exposure)	: Not classified
Aspiration hazard	: Not classified
Symptoms/injuries after inhalation	: May cause respiratory irritation.
Symptoms/injuries after skin contact	: May cause skin irritation.
Symptoms/injuries after eye contact	: Direct contact with the eyes is likely to be irritating.
Symptoms/injuries after ingestion	: May cause gastrointestinal irritation.

SECTION 12: Ecological Information

12.1. Toxicity

Ecology - general : No information available. Not expected to be acutely toxic, but material in pellet or bead form may mechanically cause adverse effects if ingested by waterfowl or aquatic life.

12.2. Persistence and degradability

No additional information available.

12.3. Bioaccumulative potential

Profile 80	
Bioaccumulative potential	Based on its structural properties, the polymer is not biologically available. Accumulation in organisms is not to be expected.

12.4. Mobility in soil

No additional information available.

12.5. Other adverse effects

Other adverse effects : No data available.

SECTION 13: Disposal Considerations

13.1. Waste treatment methods

Waste treatment and disposal methods : Vacuum or shovel material into a closed container. Dispose in a safe manner in accordance with local/national regulations. Do not allow the product to be released into the environment.

SECTION 14: Transport Information

14.1. In accordance with DOT

Not classified as hazardous for domestic land transport

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UN-No.(DOT)	: None on finished product
DOT NA no.	: None on finished product
Proper Shipping Name (DOT)	: Not regulated
Department of Transportation (DOT) Hazard Classes	: None on finished product
Hazard labels (DOT)	: None on finished product
Packing group (DOT)	: None on finished product
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	: None on finished product

14.2. Transport by sea

Not classified as hazardous for water transport

IMO / IMDG

UN/NA Identification Number	: None on finished product
UN- Proper Shipping Name	: Not regulated
Transport Hazard Class	: None on finished product

14.3. Air transport

Not classified as hazardous for air transport

ICAO / IATA

UN/NA No	: None on finished product
UN- Proper Shipping Name	: Not regulated
Transport Hazard Class	: None on finished product
Packing Group	: None on finished product
Marine Pollutant	: None on finished product

SECTION 15: Regulatory Information

15.1. US Federal regulations

CALRES 2301

All chemical substances in this product are listed as "Active" in the EPA (Environmental Protection Agency) "TSCA Inventory Notification (Active-Inactive) Requirements Rule" ("the Final Rule"). as of February 2019 or are otherwise exempt.

SARA Section 311/312 Hazard Classes	None
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15.2. International regulations

No additional information available.

15.3. US State regulations

California Proposition 65

This product does not contain any substances known to the state of California to cause cancer and/or reproductive harm.

Component	State or Local Regulations
Styrene, divinylbenzene polymer, chloromethylated, tributylamine-functionalized	U.S. - Massachusetts - Right To Know List U.S. - Massachusetts - Right To Know List - Extraordinary Hazardous Substances U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances U.S. - Pennsylvania - RTK (Right to Know) List
Dimethylamine functionalized chloromethylated copolymer of styrene and divinylbenzene	U.S. - Massachusetts - Right To Know List U.S. - Massachusetts - Right To Know List - Extraordinary Hazardous Substances U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other Information

Indication of changes	: Revision 2.0: Minor updates needed.
Revision Date	: 06/22/2020
Other information	: Author: ADK/RAK
For internal use only	: PR #80

CALRES 2301

Product Code: 1077516

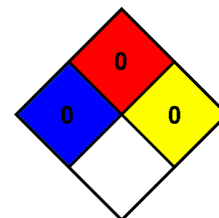
Safety Data Sheet

Prepared according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 0

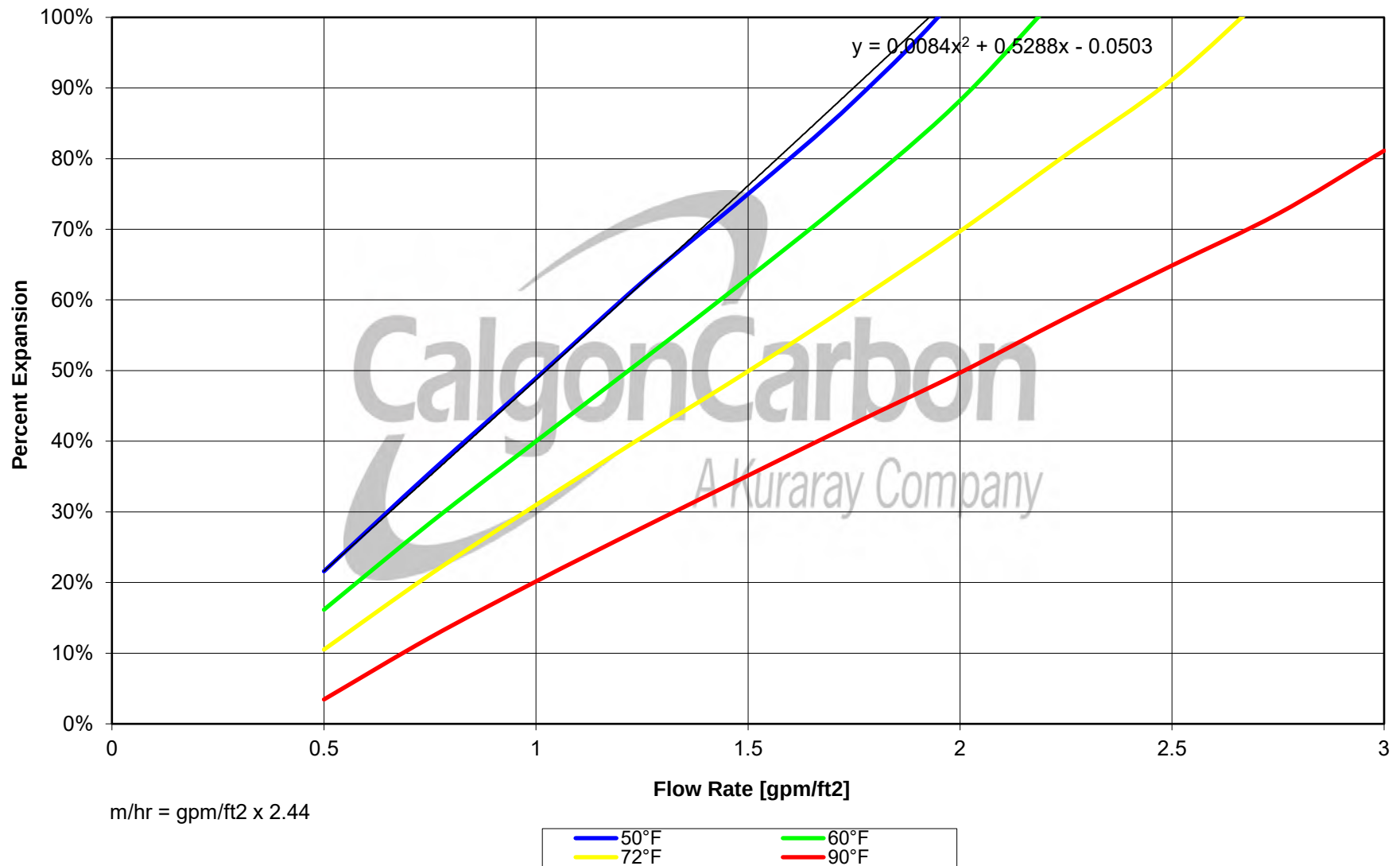
Flammability : 0

Physical : 0

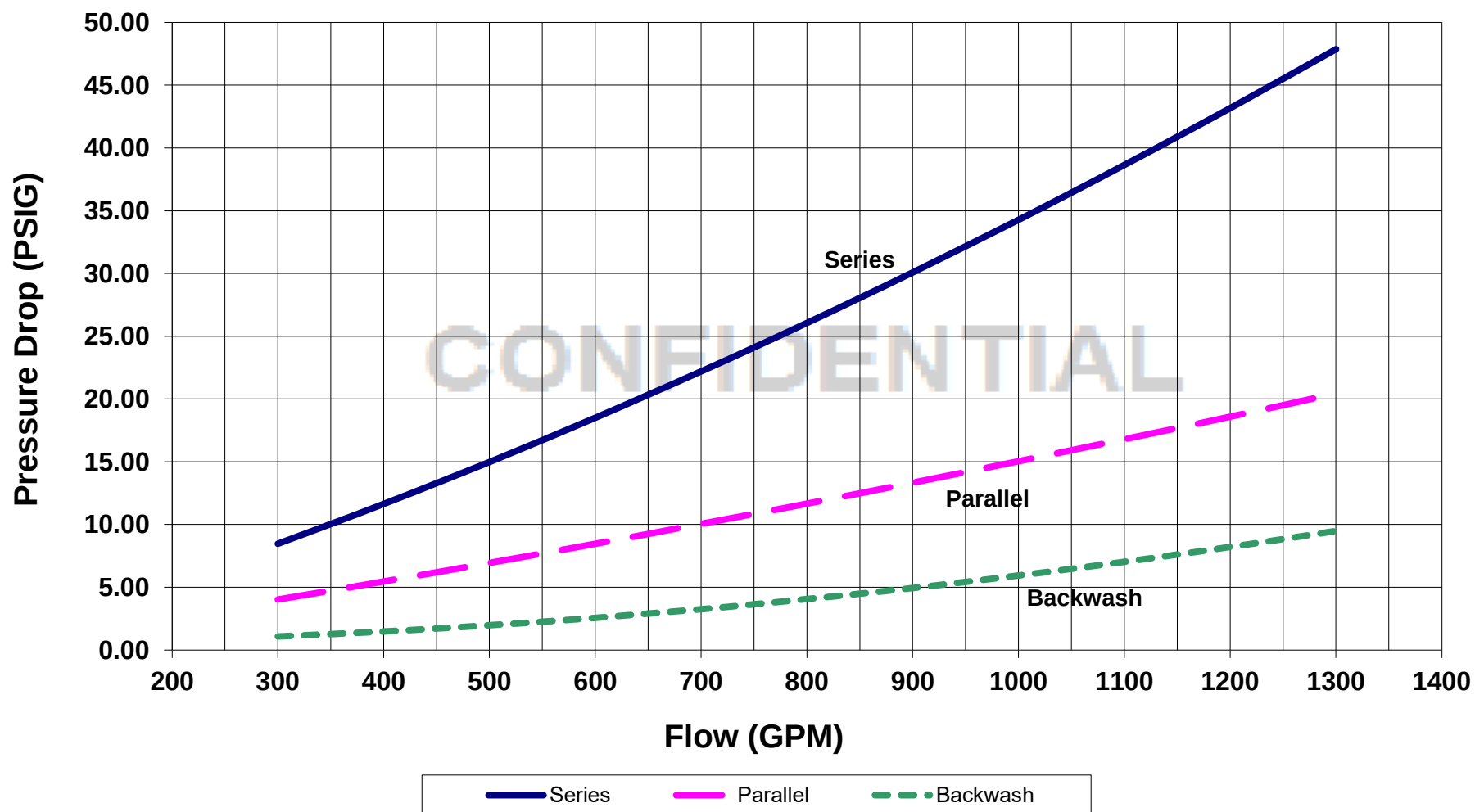
Personal Protection :

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product. The information in this document applies to this specific material as supplied. It may not be valid if product is used in combination with other materials. It is the user's responsibility to determine the suitability and completeness of this information for their particular use. While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Calgon Carbon Corporation makes no warranty with respect to the same, and disclaims all liability for reliance thereon.

Resin Bed Expansion Curves



Pressure Drop Curve
Model 12-40, 535 Cu. Ft. Cal Res 2301 Resin,
8in Piping, 60 deg. F., 120 spec. 22.110 septas





Carbon Enterprises, Inc.

"ONE COMPANY FOR ALL YOUR FILTER MEDIA"**Anthracite 0.60 - 0.80**

Typical Lab Analysis

SIEVE	Particle Size	% Passing
#6	3.35mm	100
#8	2.36mm	99.7
#10	2.00mm	99.3
#12	1.70mm	98.4
#14	1.40mm	96.8
#16	1.18mm	94.1
#18	1.00mm	78.6
#20	0.85mm	23.8
#25		5.5

Test	Result	Specification
Effective Size (mm)	0.78	0.60-0.80
Uniformity Coefficient	1.2	1.6
MOH Hardness	2.85	2.7 min.
Specific Gravity	1.6	1.6 min.
Acid Solubility	0.87%	5.00%
Caustic Solubility	1.46	2.00

Safety Data Sheet

Product Identity: Anthracite

1/1/2016

Section I - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Trade name Anthracite filter media
Company CEI Anthracite (manufacturer)
603 S Church Street
Hazleton, PA 18201
570-459-7005

Section II - COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Anthracite Carbon
CAS Number 8029-10-5 100%
OHSA PEL 2mb/M3

Section III - HAZARD(S) IDENTIFICATION

Prolonged inhalation of substantial quantities of dust may cause irritation
Prolonged ingestion of substantial quantities of dust may cause irritation
Contact with eyes/mucous membranes may cause temporary irritation
Contact with the skin may cause temporary irritation.

Section IV - FIRST AID MEASURES

Skin contact Remove particles and flush with water
Eye contact Flush eye with water and remove all particles. Consult a physician if the problem persists.
Ingestion Give water and seek medical advise if the problem persists.
Inhalation Remove subject into fresh air and seek medical advise.

Section V - FIRE FIGHTING MEASURES

Suitable extinguishing media Use water spray or foam extinguishers.
Fire fighting procedure Wear self contained breathing apparatus and full protection.

Section VI - ACCIDENTAL RELEASE MEASURES

Personal Precaution Non-hazardous
Environmental Precaution Non-hazardous
Clean up Method Take up mechanically

Section VII - HANDLING AND STORAGE

Precautions for Handling No special instructions
Measures to protect against Do not store near a heat source
Fire/Explosion Non explosive
Storage Store in a dry place

Section VIII - EXPOSURE CONTROLS AND PERSONAL PROTECTION

Respiratory Protection Not required for normal operations. Recommended for high volume applications if dust is present.
Hand Protection Protective gloves are recommended.
Body Protection Wearing of overalls is recommended.
Eye Protection Eye protection is recommended.

Hygiene Measures High standard of personal hygiene must be encouraged.

Section IX - PHYSICAL AND CHEMICAL PROPERTIES

Appearance Granular/Solid
Color Black
Odor None
Specific Gravity 1.6 $\pm$ 0.05
Bulk Density 50 pounds per cubic foot

Section X - STABILITY AND REACTIVITY

The material is stable under normal conditions.

Materials to Avoid None

Section XI - TOXICOLOGICAL INFORMATION

The material is stable under normal conditions.

Toxicological Tests Acute Toxicity N/A
Additional Information N/A

Experiences Relevant Observations None

Section XII - ECOLOGICAL INFORMATION

Information on Elimination None
Behavior in the Environment Material is resistant to bio-degradation
Mobility and Bio-accumulative potential None
Aquatic Toxicity N/A

Section XIII - DISPOSAL CONSIDERATIONS

Dispose to an authorized landfill site.

Dispose in accordance with all Federal and Local regulations.

Section XIV - TRANSPORT INFORMATION

Road / Rail ARD / RID Not dangerous
Inland Sea AND/ADNR Not dangerous
Air Transport ICAO / IATA Not dangerous

Section XV - REGULATORY INFORMATION

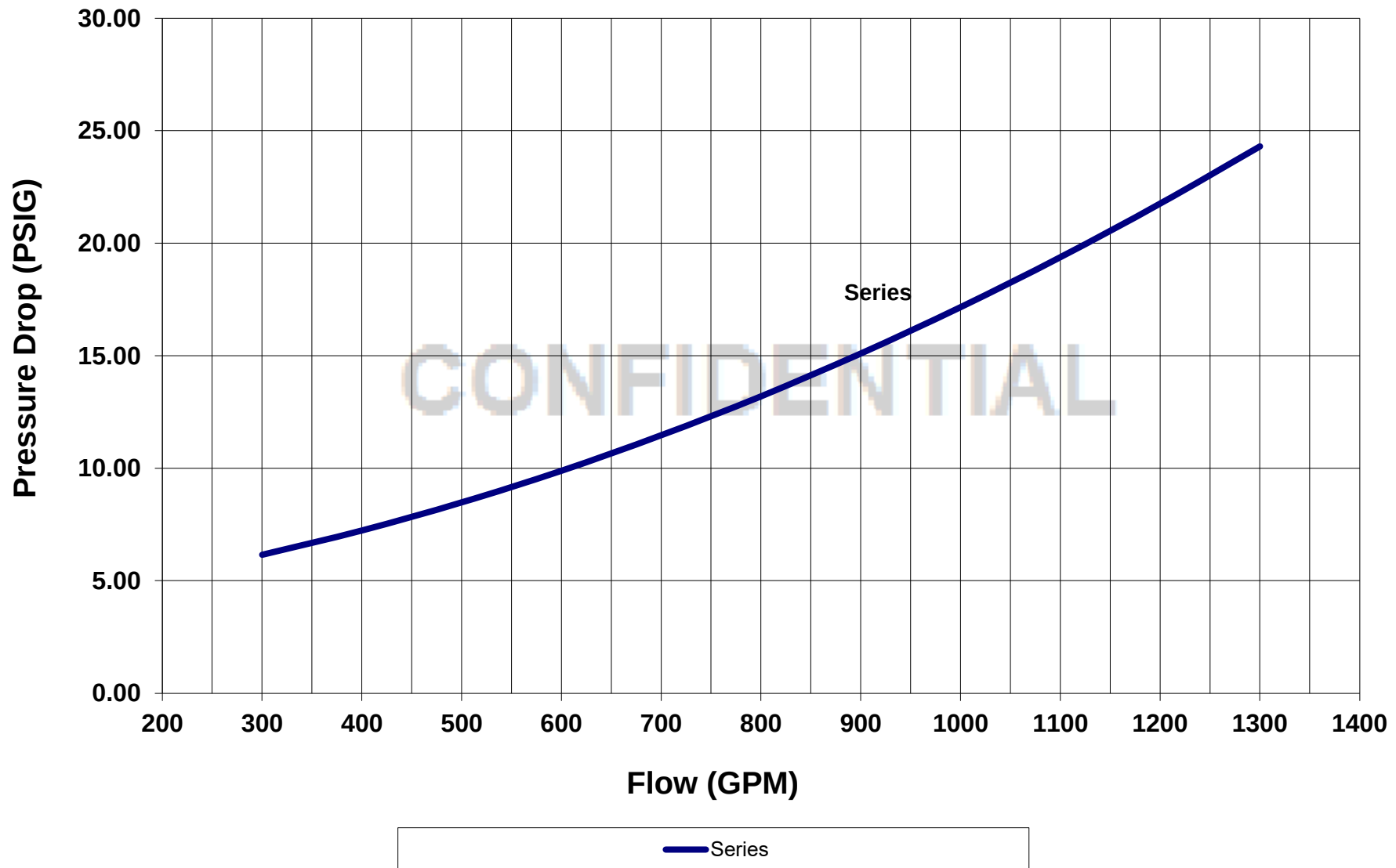
Labeling Not classified as hazardous

Section XVI - OTHER INFORMATION

All the information provided herein is based upon our present knowledge and experience and describes our product with regard to its safety requirements. Users should satisfy themselves that the information provided complies with their National Regulations. This is not to be considered as an assurance of the properties or a description of the quality of the product. CEI assumes no liability arising out of the use of this product by others.

END OF MATERIAL SAFETY DATA SHEET

Pressure Drop Curve
Model 12-40 Hybrid System, 40,000 # F-400 Carbon,
& 535 Cu. Ft. Cal Res 2301 Resin, 8in Process Piping
60 deg. F., 120 spec. 22.110 septas





SECTION 2

SPECIFICATIONS & CATALOG CUTSHEETS

	MATERIAL SPECIFICATION BUTTERFLY VALVES	SPEC NO: 3.54
	DWC WAFER STYLE CAST IRON BUTTERFLY VALVE	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	One-piece ductile iron wafer style body, EPDM food grade seat material, One piece 416 stainless steel stem, Stainless steel or aluminum bronze disc material.
ACTUTATOR:	Lever operator for valve sizes 2" through 6", weatherproof worm gear wheel operator for sizes 8" through 12".
TESTING:	Valves shall comply with Section 5: Inspection Testing and Rejection of AWWA specification C-504-87.
RATING:	200 psig @ 180 Deg. F. for Apollo, Centerline & Flow Line 175 psig @ 180 Deg. F. for Bray
CONSTRUCTION:	Shaft: 1 piece, through shaft construction.
CONNECTION:	Compatible with ANSI 125# and 150# flanges. Gasket not required.
MANUFACTURER:	Apollo, Bray, Centerline, Flow Line
SIZES:	2" through 12"
MODELS:	Apollo Series 141, Bray Series 30, Centerline Series 200, Flow Line Series 70
SERVICE CONDITIONS:	Potable water at ambient temperature
NOTES:	Centering lugs preferred to facilitate installation

Issue Date	Revision Date	Approved By	Approval Date
July 18, 2022		Robert Sprowls	July 18, 2022

PROPRIETARY AND CONFIDENTIAL

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brands you trust.

TECHNICAL DATASHEET
CENTER LINE® - Resilient Seated Butterfly Valves
Now All Ductile Iron Body Standard on Series 200



Series 200 Overview

- Available in sizes 2" to 72".
- Available in Wafer and Lug style bodies (2" to 30").
- Double flange bodies available in sizes 28" to 72".
- Wafer bodies feature four (4) alignment holes.
- Pressure ratings for tight shutoff at temperatures up to the maximum limit of the seat material:
 - 2" to 12" - 200 psi.
 - 14" to 72" - 150 psi.
- Ideal for on-off or throttling services.
- Available with handles (2" to 12"), manual gear actuators (2" to 72"), and electric or pneumatic actuators (2" to 72").
- Refer to Crane automation bulletin for details for pneumatic and electric actuators.
- Designed to comply with MSS SP-67 and MSS SP-25.
- Compatible with ASME B16.1 and ASME B16.5 flanges (2" to 24") and ASME B16.47 Series A (MSS SP-44) flanges (28" to 72").
- Valves 2" to 20" meet the intent and have passed the AWWA C504-87, Section 5 proof of design tests.
- Type approval certification from ABS & USCG Category A for marine applications (2" to 24").
- Bi-directional dead-end service capability to 200 psi (2" to 12") and 150 psi (14" - 24") is standard on lug style valves.
- Operators mounted perpendicular to the pipeline.
- For bolting information, consult the Center Line Installation and Maintenance Manual.
- Vacuum Service Rating: zero leakage at 24" of mercury.
- Commercial cleaning available for Oxygen level 2 applications.
- CE/PED Certification available for sizes 2" to 24".

Valve Seating Torques (In-Lbs.) 2" to 30"

Valve Size	Standard Disc Differential Pressure								Undercut Differential Pressure	
	50 PSI ΔP Bushing		100 PSI ΔP Bushing		150 PSI ΔP Bushing		200 PSI ΔP Bushing		75 PSI ΔP Bushing	
	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE
2"	106	100	117	106	129	111	140	117	-	-
2 ½"	152	150	166	163	181	176	195	189	-	-
3"	213	207	230	220	248	232	265	244	-	-
4"	321	290	386	323	450	357	515	390	-	-
5"	481	423	598	481	715	540	832	598	-	-
6"	692	599	878	691	1,063	783	1,248	875	-	-
8"	1,326	1,060	1,716	1,183	2,106	1,307	2,496	1,430	1,124	819
10"	2,239	1,671	3,010	1,872	3,780	2,074	4,550	2,275	1,363	909
12"	3,959	2,568	4,953	2,795	5,948	3,023	6,942	3,250	2,457	1,445
14"	4,881	2,640	6,226	3,070	7,570	3,500	-	-	4,400	2,300
16"	7,020	4,260	8,580	4,880	10,140	5,500	-	-	5,900	3,600
18"	10,105	6,287	12,202	7,243	14,300	8,200	-	-	8,300	5,500
20"	13,923	8,360	16,582	9,180	19,240	10,000	-	-	11,100	6,700
24"	23,617	15,427	26,953	16,813	30,290	18,200	-	-	17,300	12,100
30"	39,721	27,313	43,391	29,407	47,060	31,500	-	-	27,300	21,100

Valve Seating Torques (in-lbs), 28" to 72" Double Flanged

Valve Size	Standard Disc Differential Pressure		
	50 psi ΔP Wet	100 psi ΔP Wet	150 psi ΔP Wet
28"	34,030	38,180	41,502
30"	39,110	43,880	47,698
32"	50,040	56,145	61,028
36"	61,660	69,175	75,190
40"	81,720	91,690	99,660
42"	124,360	139,530	151,660
48"	171,320	192,210	208,925
42"	184,270	206,740	224,720
54"	204,672	229,630	249,600
60"	308,460	346,080	376,170
64"	377,400	423,430	460,250
66"	420,950	472,290	513,360
72"	505,150	566,750	616,030

All torques shown in these charts were derived from test data using water at 60°F. For torques using dry gases, multiply these numbers by 2.0. For torques involving other media, please consult the factory.

There is no safety factor included in the numbers shown on these charts. For actuator sizing, Crane recommends that these values be multiplied by 1.2 for single valve applications, or 2.0 for 3-way ("tee") applications.

Under certain conditions, hydrodynamic torque can meet or exceed seating and unseating torques. When designing valve systems, hydrodynamic torque must be considered to help assure correct selection for the application.

Series 200 Temperature Ratings and C_v Values

Seat Temperature Ratings

Seat Material	Temperature Ratings, °F
Buna-N	+10 to 180
EPDM (2" to 16")	-30 to 275
EPDM (18" & Above)	-30 to 225
Viton®	10 to 400

Although elastomers have an effective operating temperature range, when used in valves, these ranges may have to be modified. The temperature ranges shown in the table have been adjusted accordingly.

For Low Temperature: While the seat materials selected for use in Center Line butterfly valves are capable of withstanding lower temperatures without damage, the durometer of the elastomer is changed. This "hardening" of the seat may increase the operating torque beyond the structural limits of the stem and/or the disc to stem configuration.

For High Temperature: When using Viton®, the operating pressure of the valve is reduced above 275°F.

Field Replacement: Replacing seats in sizes 14" and above requires factory service.

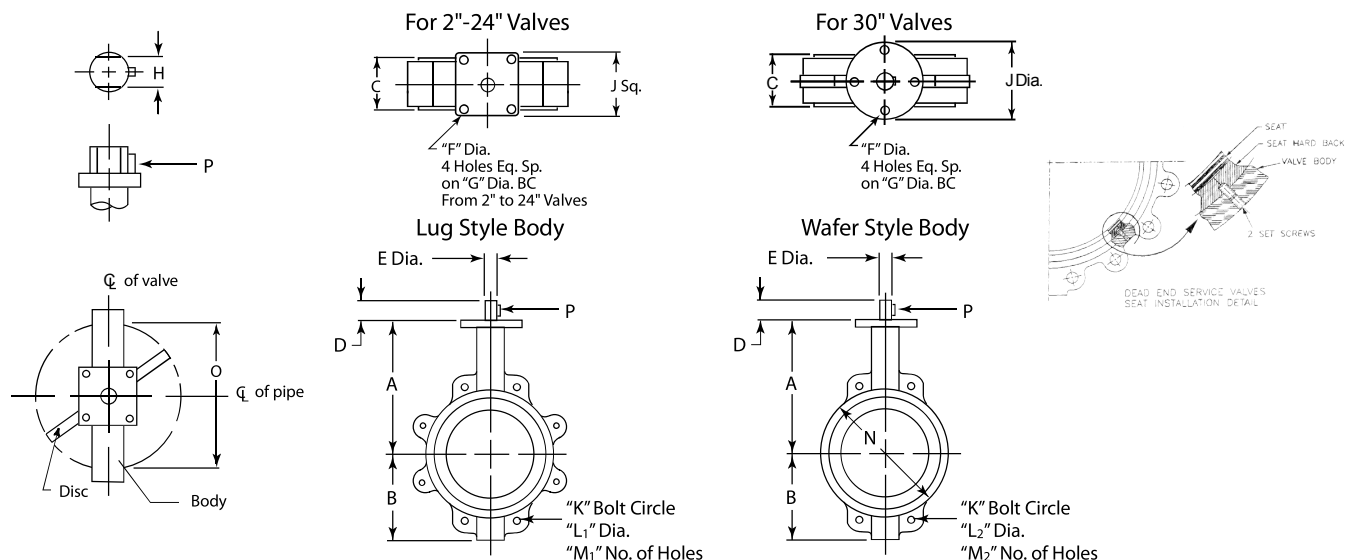
C_v Values – Valve Sizing Coefficients (US-GPM @ 1 psi ΔP), 2" to 30" Wafer and Lug Style Valves

Size	Degrees Open								
	10°	20°	30°	40°	50°	60°	70°	80°	90°
2"	0.06	3	7	15	27	44	70	105	115
2-1/2"	0.10	6	12	25	45	75	119	178	196
3"	0.20	9	18	39	70	116	183	275	302
4"	0.30	17	36	78	139	230	364	546	600
5"	0.50	29	61	133	237	392	620	930	1,022
6"	0.80	45	95	205	366	605	958	1,437	1,579
8"	2	89	188	408	727	1,202	1,903	2,854	3,136
10"	3	151	320	694	1,237	2,047	3,240	4,859	5,340
12"	4	234	495	1,072	1,911	3,162	5,005	7,507	8,250
14"	6	338	715	1,549	2,761	4,568	7,230	10,844	11,917
16"	8	464	983	2,130	3,797	6,282	9,942	14,913	16,388
18"	11	615	1,302	2,822	5,028	8,320	13,168	19,752	21,705
20"	14	791	1,647	3,628	6,465	10,598	16,931	25,396	27,908
24"	22	1,222	2,587	5,605	9,989	16,528	26,157	39,236	43,116
30"	37	2,080	4,406	9,546	17,010	28,147	44,545	66,818	73,426

C_v Values – Valve Sizing Coefficients (US-GPM @ 1 psi ΔP), 28" to 72" Double-Flanged Valves

Size	Degrees Open								
	10°	20°	30°	40°	50°	60°	70°	80°	90°
28"	35	1,743	3,479	6,349	12,385	23,176	35,987	52,685	57,456
30"	36	1,982	4,253	9,069	16,165	26,964	42,832	63,482	70,356
32"	44	2,295	4,637	10,763	18,073	30,120	48,394	69,115	81,245
36"	255	2,919	6,456	12,150	19,242	31,880	50,030	76,383	84,153
40"	283	3,984	7,959	14,895	23,059	34,636	52,806	81,490	116,275
42"	350	4,589	8,629	16,397	26,137	41,952	68,584	101,800	132,859
48"	449	5,210	11,420	21,383	29,143	49,380	88,505	134,833	146,688
52"	900	4,100	9,210	15,110	24,200	38,960	62,580	96,833	118,090
54"	1,299	5,904	13,158	21,594	34,583	55,671	89,411	138,334	168,700
60"	1,480	6,400	14,500	24,500	39,400	63,200	102,000	154,000	190,000
64"	1,518	6,938	15,979	27,797	40,399	64,573	104,725	162,868	203,290
66"	1,650	7,110	16,100	27,300	43,800	70,200	113,000	171,000	211,000
72"	1,900	8,220	13,600	31,500	50,700	81,200	131,000	198,000	244,000

Series 200 Dimensions



Dimensions 2" - 30" Wafer and Lug

For installation and maintenance instructions, please refer to the IOM manual available at www.cranecpe.com

Valve Size	A	B	C	D	E	F	G	H	J	K	L ₁	L ₂	M ₁	M ₂	N	O	P
2" in	6.38	3.19	1.88	1.25	0.50	0.38	2.76	0.39	2.75	4.75	5/8-11UNC	0.69	4	4	4.00	1.26	Woodruff #3
50 mm	161.93	80.96	47.63	31.75	12.70	9.53	70	10	69.85	120.65		17.46			101.60	32.00	
2-1/2" in	6.88	3.50	2.00	1.25	0.50	0.38	2.76	0.39	2.75	5.50	5/8-11UNC	0.69	4	4	4.75	1.83	Woodruff #3
65 mm	174.63	88.90	50.80	31.75	12.70	9.53	70	10	69.85	139.70		17.46			120.65	46.50	
3" in	7.12	3.75	2.00	1.25	0.50	0.38	2.76	0.39	2.75	6.00	5/8-11UNC	0.69	4	4	5.00	2.54	Woodruff #3
80 mm	180.98	95.25	50.80	31.75	12.70	9.53	70	10	69.85	152.40		17.46			127.00	64.50	
4" in	7.88	4.50	2.12	1.25	0.62	0.38	2.76	0.47	2.75	7.50	5/8-11UNC	0.69	8	4	6.25	3.54	Woodruff #9
100 mm	200.03	114.30	53.98	31.75	15.88	9.53	70	12	69.85	190.50		17.46			158.75	89.90	
5" in	8.38	5.00	2.38	1.25	0.75	0.38	2.76	0.55	2.75	8.50	3/4-10UNC	0.81	8	4	7.50	4.36	Woodruff #9
125 mm	212.73	127.00	60.33	31.75	19.05	9.53	70	14	69.85	215.90		20.64			190.50	110.70	
6" in	8.88	5.50	2.38	1.25	0.75	0.38	2.76	0.55	2.75	9.50	3/4-10UNC	0.81	8	4	8.38	5.72	Woodruff #9
150 mm	225.43	139.70	60.33	31.75	19.05	9.53	70	14	69.85	241.30		20.64			212.73	145.30	
8" in	10.25	6.88	2.50	1.75	0.88	0.44	4.02	0.67	3.75	11.75	3/4-10UNC	0.81	8	4	10.62	7.60	Woodruff #9
200 mm	260.35	174.63	63.50	44.45	22.23	11.11	102	17	95.33	298.45		20.64			269.88	193.00	
10" in	11.50	8.00	2.75	1.75	1.12	0.44	4.02	0.87	3.75	14.25	7/8-9UNC	0.94	12	4	12.88	9.50	Woodruff #15
250 mm	292.10	203.20	69.85	44.45	28.58	11.11	102	22	95.33	361.95		23.81			327.03	241.30	
12" in	13.25	9.62	3.12	1.75	1.25	0.44	4.02	0.95	3.75	17.00	7/8-9UNC	0.94	12	4	15.88	11.45	Woodruff #15
300 mm	336.55	244.48	79.38	44.45	31.75	11.11	102	24	95.33	431.80		23.81			403.23	290.80	
14" in	14.50	10.50	3.12	1.75	1.25	0.44	4.02	0.95	3.75	18.75	1-8UNC	1.06	12	4	17.12	12.78	Woodruff #15
350 mm	368.30	266.70	79.38	44.45	31.75	11.11	102	24	95.33	476.25		26.99			434.98	324.60	
16" in	15.75	12.88	3.50	2.00	1.31	0.88	6.50	1.06	6.50	21.25	1-8UNC	1.06	16	4	19.25	14.97	0.31" Sq x 1.75"
400 mm	400.05	327.02	88.90	50.80	33.34	22.23	165	27	165.10	539.75		26.99			488.95	380.20	
18" in	16.62	13.62	4.25	2.00	1.50	0.88	6.50	1.06	6.50	22.75	1-1/8-7UNC	1.25	16	4	21.25	16.83	0.38" Sq x 1.50"
450 mm	422.28	346.08	107.95	50.80	38.10	22.23	165	27	165.10	577.85		31.75			539.75	427.50	
20" in	18.88	15.12	5.38	2.75	1.62	0.88	6.50	1.26	6.50	25.00	1-1/8-7UNC	1.25	20	4	23.62	18.67	0.38" Sq x 1.75"
500 mm	479.43	384.18	136.53	63.50	41.28	22.23	165	32	165.10	635.00		31.75			650.88	474.20	
24" in	22.12	18.38	6.12	2.75	2.00	0.88	6.50	1.42	6.50	29.50	1-1/4-7UNC	1.38	20	4	27.88	22.62	0.50" Sq x 2.25"
600 mm	561.98	466.73	155.58	69.85	50.80	22.23	165	36	165.10	749.30		34.93			708.03	574.50	
30" in	25.50	24.75	6.75	3.25	2.50	0.88	8.50	N/A	11.25	36.00	1-1/4-7UNC	1.25	28	4	34.38	28.60	0.62" Sq x 2.62"
750 mm	647.70	628.65	171.45	82.55	63.50	22.23	215.9		285.75	914.40		31.75			873.13	726.40	

L1 and M1 refer to Lug style valves, L2 and M2 refer to Wafer Style. "C" dimension is listed with elastomer in the relaxed condition. Approximately 1/8" total compression is required for proper sealing with pipe flanges. Valves are designed for installation between ASME B16.1 Class 125 (Iron) and B16.5 Class 150 (Steel) flanges. Gaskets are not needed, and should not be used since the seat face seals against the mating flange. If the valve is to be installed in between any other flanges, consult your Center Line agent or the factory for additional information. Center Line recommends that a blind flange be used on end of line applications.

"O" dimension is the valve clearance dimension.

Series 200 Dimensions

Weights: 2" to 72" (Bare Stem)

		2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	30"	32"	36"	40"	42"
Wafer	lbs	6	7	10	13	18	20	32	42	70	95	117	165	275	440	-	740	-	-	-	-
	kg	2.7	3.2	4.5	5.9	8.2	9.1	14.5	19.1	31.7	43.1	53.1	74.8	124.7	199.6	-	335.7	-	-	-	-
Lug	lbs	7	8	14	26	28	31	49	72	105	155	195	230	396	610	-	1,050	-	-	-	-
	kg	3.2	3.6	6.4	11.8	12.7	14.1	22.2	32.7	47.6	70.3	88.5	104.3	179.6	276.7	-	476.3	-	-	-	-
Flanged	lbs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,175	1,219	1,528	1,954	2,145	2,500
	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	533	553	693	886	973	1,134

		48"	54"	60"	66"	72"
Wafer	lbs	-	-	-	-	-
	kg	-	-	-	-	-
Lug	lbs	-	-	-	-	-
	kg	-	-	-	-	-
Flanged	lbs	3,720	5,446	5,868	7,850	10,584
	kg	1,687	2,470	2,661	3,560	4,800

Weights: 28" - 48" Double Flanged (Gear Actuated)

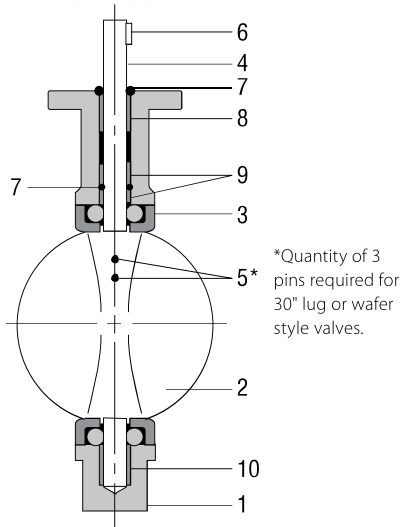
	28"	30"	32"	36"	40"	42"	48"
lbs	1327	1372	1680	2130	2509	2864	4084
kg	602	622	762	966	1138	1299	1852

Weights: 54" - 72" Double Flanged (Gear Actuated)

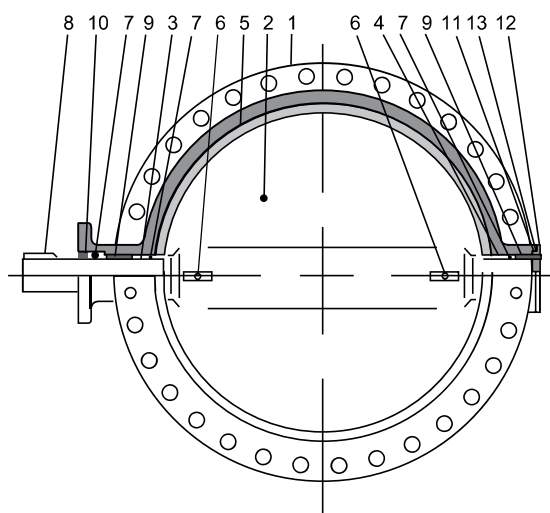
	54"	60"	66"	72"
lbs	5810	6617	8600	11797
kg	2635	3001	3900	5350

Series 200 Materials of Construction

Sizes 2"-30"



Sizes 28"-48"



Bill of Materials 2" - 30"

Item	Description	Materials	Optional Materials
1	Body	Ductile Iron, A536 Grade 65-45-12 *	Ductile Iron, A395 Gr. 60-40-18
2	Disc	Ductile Iron, A536 Grade 65-45-12 **	Aluminum-Bronze, B148 Grade C954; 316 Stainless Steel, A351 Grade CF8M; Monel®, A494 Grade M30C
3	Seat	Buna-N or EPDM	Viton®
4	Shaft	416 Stainless Steel, A582 Type 416	316 Stainless Steel, A276/A479 Type 316; Monel®, B164 Type 400, Class B; 17-4PH Stainless Steel, A564 Type 630, Condition H1150
5	Taper Pins	416 Stainless Steel, A582 Type 416	316 Stainless Steel, A276/A479 Type 316; Monel®, B164 Type 400, Class B; 17-4PH Stainless Steel, A564 Type 630, Condition H1150
6	Key	Carbon Steel, AISI C1018	No Option Available
7	O-Ring	Buna-N	Viton®
8	Bushing	PTFE	Luberized Bronze
9	Bushing	PTFE	Luberized Bronze
10	Bushing	PTFE	Luberized Bronze

Monel® is a registered trademark of Special Metals Corporation™

Viton® is a registered trademark of DuPont™

Bill of Materials, 28" to 72"

Item	Description	Materials	Optional Materials
1	Body	Ductile Iron, A536 Grade 65-45-12 *	Ductile Iron, A395 Gr. 60-40-18
2	Disc	Ductile Iron, A536 Grade 65-45-12 **	Aluminum-Bronze, B148 Grade C954; 316 Stainless Steel, A351 Grade CF8M
3	Upper Shaft	416 Stainless Steel, A582 Type 416	316 Stainless Steel (standard with 316 Stainless Steel disc), A276/A479 Type 316
4	Lower Shaft	416 Stainless Steel, A582 Type 416	316 Stainless Steel (standard with 316 Stainless Steel disc), A276/A479 Type 316
5	Seat	Buna-N or EPDM	Viton®
6	Taper Pin	416 Stainless Steel, A582 Type 416	316 Stainless Steel, A276/A479 Type 316
7	O-Ring	Buna-N	No Option Available
8	Key	Carbon Steel, AISI C1018	No Option Available
9	Bushing	PTFE	Luberized Bronze
10	Bushing	PTFE	Luberized Bronze
11	Thrust Washer	PTFE	Luberized Bronze
12	End Plate	Ductile Iron, A536 Grade 65-45-12 *	No Option Available
13	O-Ring	Buna-N	No Option Available

* Ductile iron bodies are available with an optional epoxy coating.

** Ductile iron discs are standard with an epoxy coating.

Series 200 Figure Number System

Series 200 1
0 1
8 2
A 3
G 4
0 5
6 6
1 7
0 8
5 9
5 — 10

1. Size	Code	5. Disc	Code	9. Actuator	Code
2"	02	316 SS (CF8M)	4	Handle (10 positions)	2
2½"	25	Ductile Iron (2" - 72")	5	Infinite/Lockable (2"-6")	3
3"	03	Aluminum-Bronze (2" - 72")	6	Infinite (8")	4
to	- - -	Monel® 400 (M30-C) (2" - 30")	7	Gear Operator	5
72"	72			Pneumatic Double Acting	6
				Pneumatic SR Fail Close (FCW)	7
				Pneumatic SR Fail Open (FCCW)	8
				Electric	9
				Gear Operator with Memory Stop	G
				Buried Gear / 2" Square Drive Nut	C
				Gear Operator with Chain Wheel	U
				None	X
2. Series/Style	Code	6. Shaft	Code	10. Special Features	Code
Wafer (2"-30")	A	416 SS	1		
Lug/Deadend (2"-30")	C	316 SS ¹	4	CE Marked - Non-Impact Tested	P
Flange (28"-72")	D	Monel® 400 (2" - 30")	7		
		17-4PH Cond. H1150 SS (2" - 30")	9		
		¹ Standard with 316 SS disc only.			
3. Body	Code	7. Bushing	Code		
Epoxy Coated DI (A536) (2" - 12")	V	Bronze ²	0		
Ductile Iron (A536) (14" - 72")	2	PTFE	3		
Ductile Iron (A395) (2" - 30")	G				
		² Standard on 52" - 72" valve sizes			
4. Pressure	Code	8. Seat / Liner	Code		
200 PSI (2"-12")	0	Buna-N	1		
75 PSI Undercut (8" - 30")	3	EPDM	5		
150 PSI (14" - 72")	6	Viton® (400°F)	6		

Note: For ASTM material designations, see Bill-of-Materials on page 7

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION BALL VALVES	SPEC NO: 4.96
	DWC FULL PORT BRASS OR BRONZE THREADED BALL VALVE	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Brass full bore ball valve with blow-out proof stem and seat retainer designed to permit valve to be dead ended in either flow direction. Brass body and stem, chrome plated brass ball, PTFE seat and seals.
ACTUATOR:	Lever operated. Valve has lockable feature to lock the valve in either the open or shut position.
RATING:	600 PSIG @ 100 DEG. F.
CONNECTION:	Threaded ends. Screwed body inserts or tail pieced are not acceptable.
MANUFACTURER:	Hammond / Milwaukee Valve Company
SIZES:	1/4" through 2"
MODELS:	Hammond Model UP8901 / Milwaukee UPBA-475B
SERVICE CONDITIONS:	Potable water at ambient temperature

Issue Date	Revision Date	Approved By	Approval Date
July 19, 2022		Robert Sprowls	July 19, 2022

PROPRIETARY AND CONFIDENTIAL

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Brass Ball Valve For Potable Water

Two-Piece • Full-Port

600 PSIG WOG

Threaded Ends

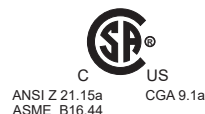
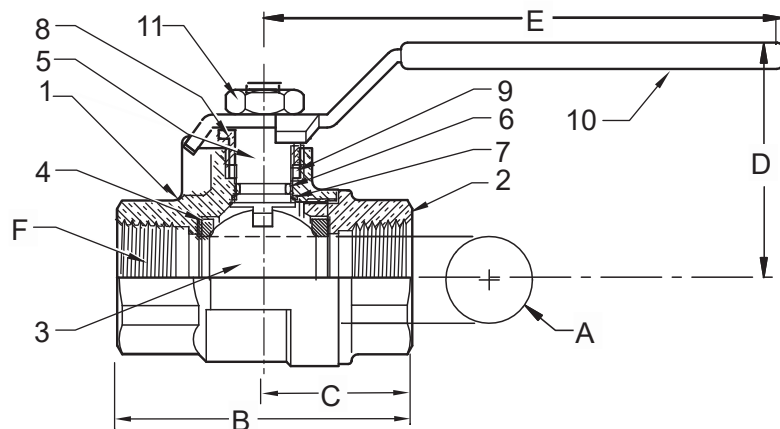
UP8901* 1/4"-3"

Dimensions and workmanship conform to MSS SP-110

ASME A112.4.14

*Also Available UP8901-07

Designed in accordance with the
requirements of California AB 1953,
Vermont S 152 and Senate Bill S3874



MATERIAL LIST

ITEM	PART	MATERIALS	ASTM SPEC.
1	Body	Brass, Forged	B283 C27450
2	Tailpiece	Brass, Forged	B283 C27450
3	Ball	Brass w/Chrome	C27450
4	Ball Seal	PTFE	Commercial
5	Stem	Brass	C27450
6	O-Ring	Buna-N	D2006
7	Thrust Washer	PTFE	Commercial
8	Gland Nut	Brass	B16
9	Packing	PTFE	Commercial
10	Handle	Zinc Plated Steel	Commercial
11	Handle Nut	Zinc Plated Steel	Commercial

DIMENSIONS

Valve Size	UNITS	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"
A	INCHES	0.39	0.39	0.51	0.76	1.00	1.26	1.50	2.00	2.48	2.95
	mm	9.9	9.9	12.7	19.3	25	32.0	38.1	51.0	63	74.9
B	INCHES	1.87	1.87	2.25	2.62	3.06	3.5	3.75	4.38	5.16	6
	mm	47	47	57	67	78	89	95	111	131.1	152.4
C	INCHES	0.95	0.95	1.12	1.31	1.91	2.21	1.87	2.19	2.58	3
	mm	24	24	61	33	49	56	47	56	65.5	76.2
D	INCHES	1.42	1.42	1.46	1.93	2.1	2.33	2.52	2.96	3.94	4.37
	mm	36	36	37	49	53	59	64	75	100.1	111
E	INCHES	3.14	3.14	3.14	4.35	4.35	5.00	5.00	6.90	7.87	7.87
	mm	80	80	80	110	110	127	127	175	199.9	199.9
F	THREAD SIZE	1/4" NPT	3/8" NPT	1/2" NPT	3/4" NPT	1" NPT	1-1/4" NPT	1-1/2" NPT	2" NPT	2-1/2" NPT	3" NPT
Cv		12	12	18	40	72	112	161	287	307	323
TORQUE	in-lb	16	16	19	58	69	89	124	210	445	563
	N.m	1.8	1.8	2.1	6.5	7.8	10	14	24	50	64
WEIGHT	lbs	0.33	0.34	0.47	0.89	1.24	1.66	2.34	4.94	7.4	10.47
	Kg	0.149	0.155	0.213	0.403	0.565	0.755	1.064	2.245	3.35	4.75

Hammond Valve
16550 W. Stratton Drive
New Berlin, WI 53151
Phone: 262-432-2702
Fax: 262-432-2703

Rev 11

*Same design as Milwaukee UPBA-475B.

Note: Lead free refers to the wetted surface of the pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$. Source: California Health and Safety Code (116875).

The information presented on this sheet is correct at the time of publication. Hammond Valve reserves the right to change design, and/or material specifications without notice. For the Installation, Operation and Maintenance Manual (IOM) see the engineering section on our website. For the most current information access www.hammondvalve.com
Hammond Valve is a registered trade mark of Milwaukee Valve Company.





INSTALLATION -BALL VALVE ,THREADED END

- 1) Thoroughly clean and prepare the piping system before valve installation.
- 2) Remove the valve end caps if present, and inspect the valve ports and seating surfaces for cleanliness just prior to installation.
- 3) Support the valve to prevent unnecessary stresses induced by connecting pipe.
- 4) Be sure the rating of the valve is compatible with the intended service conditions.
- 5) Operate the valve from the full open to closed position.
- 6) PTFE thread sealant is recommended when making up connections. Consult the sealant manufacturer's instructions for proper use. Install on pipe and not on the valve.
- 7) Care should be used to not over tighten the valve onto the pipe, as it is possible to distort the internal parts of the valve.
- 8) Because bronze is a softer metal than steel, always put the pipe in a vise and turn the valve onto the pipe end. Always use a smooth-jawed wrench on the valve end on the same side of the valve to which the pipe or fitting is being installed to prevent distortion of the internal parts of the valve or transmission of torque and stress into the body joint. Pipe Wrenches should be used on a pipe and fittings only.
- 9) Take precaution also to prevent loosening body to tailpiece connection by reverse rotation during installment/alignment. Such loosening could comprise body to tailpiece sealing.
- 10) Verify the tightness of the packing nut after installation.

OPERATION

- 1) Ball valves are designed to be opened by rotating the lever handle in a counterclockwise direction, and closing in a clockwise direction. The handle indicates the ball port direction.
- 2) Under certain conditions, throttling flow in the near-closed position can destroy the valve seats. Consult factory for throttling service.

INSPECTION & MAINTENANCE

- 1) Periodic inspection and preventative maintenance is not required other than adjustment of stem packing, and cycling of the valve from open to closed position.
- 2) If a valve develops a packing leak, adjust the packing nut to increase the pressure on the stem packing. The packing nut should be turned in a clockwise direction approximately $\frac{1}{4}$ turn, or until the leakage stops. **Do not repack valves under pressure.**
- 3) Repair or replacement of two piece ball valves internal parts is not recommended. Damage can occur to the body and tailpiece during disassembly that would make the valve inoperable.

REPAIR PARTS Not available for ULTRA-PURE valves.

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION BALL VALVES	SPEC NO: 4.94
	DWC FULL PORT STAINLESS STEEL FLANGED BALL VALVE	

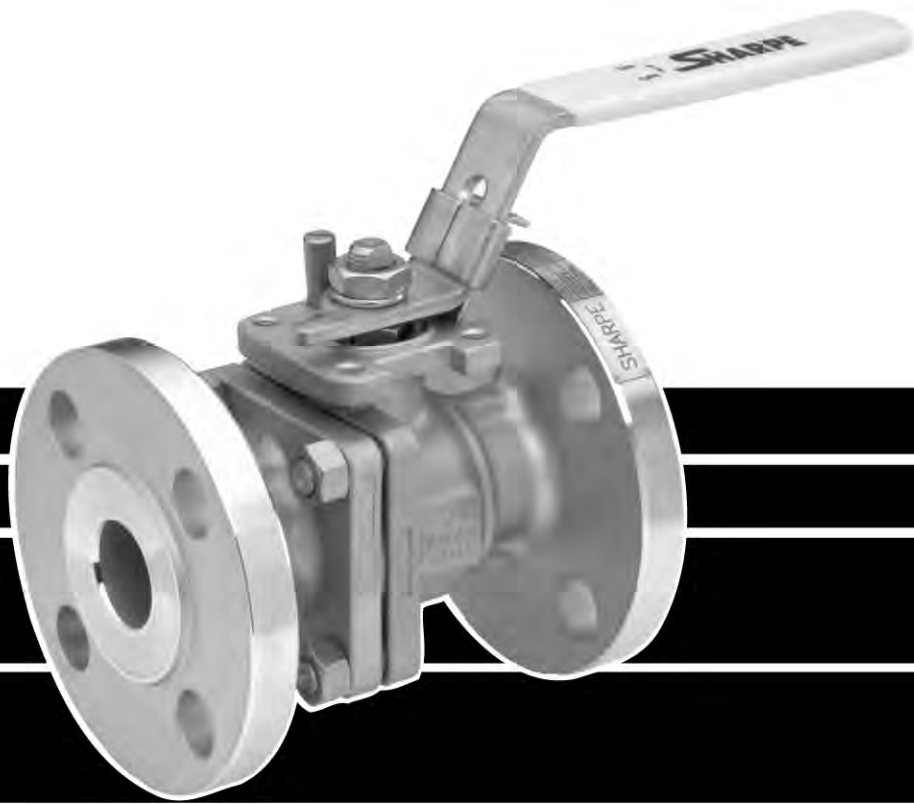
SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Stainless steel full bore ball valve 1/2" thru 4" size (reduced port for 6" & 8" acceptable) with blow-out proof stem and seat retainer designed to permit valve to be dead ended in either flow direction. Type 316 stainless steel body, ball and stem, TFE seats and seals. No asbestos allowed.
ACTUATOR:	Gear Operator for 6" and 8" size valves. Lever operated 4" and smaller. Valve has lockable feature to lock the valve in either the open or shut position.
RATING:	275 PSIG @ 100 DEG. F. or 110 PSIG @ 353 DEG. F.
CONNECTION:	150# ANSI B16.5 flanged ends, raised face, 1/2" thru 4" size Face-to-face dimensions to conform to ANSI B16.10 for steel gate valves. Screwed body inserts not acceptable.
MANUFACTURER:	Sharpe
SIZES:	1/2" through 8"
MODELS:	Sharpe Series 50
SERVICE CONDITIONS:	Carbon/water slurry at ambient temperature

Issue Date	Revision Date	Approved By	Approval Date
July 18, 2022		Robert Sprowls	July 18, 2022

PROPRIETARY AND CONFIDENTIAL

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SHARPE[®] VALVES



**FLANGED FULL PORT
BALL VALVE
SERIES 50 / CLASS 150**

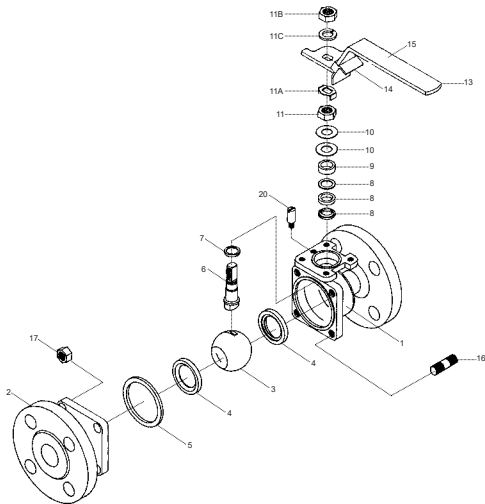
SERIES 50

VALVE PARTS AND IDENTIFICATION

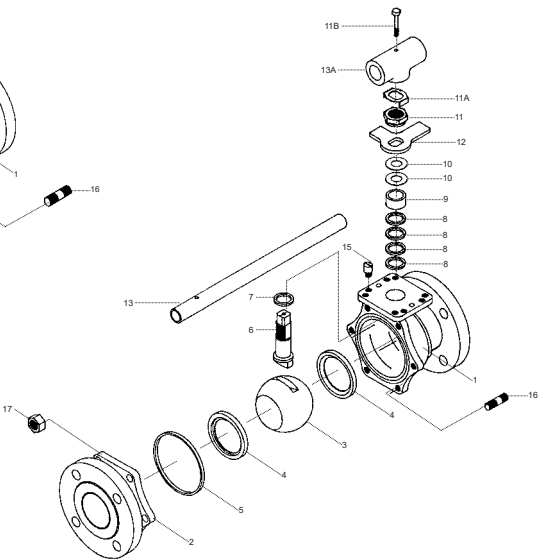
CLASS 150

BLOW OUT PROOF STEM

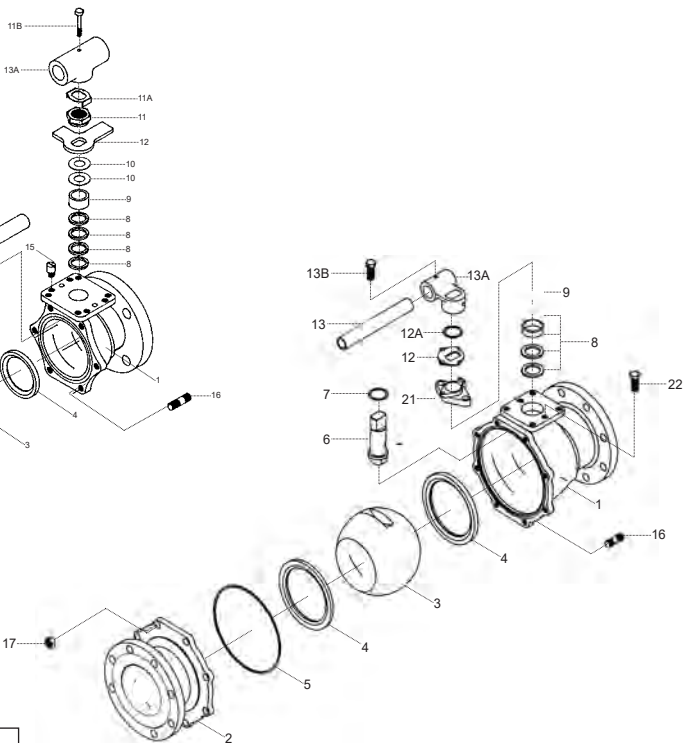
LOCKING DEVICE



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

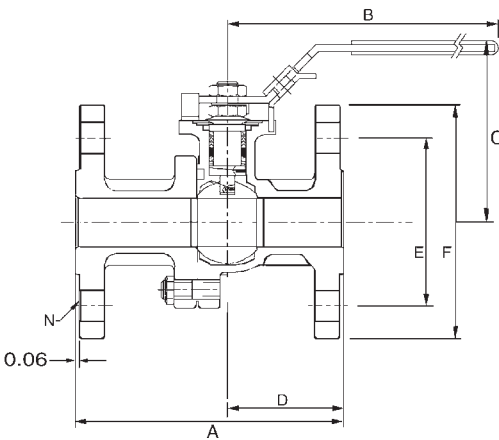
APPLICABLE STANDARDS	
Wall Thickness	ASME B 16.34
Face to Face Dimensions	ASME B 16.10
Flange Dimensions	ASME B 16.5
Pressure Tests	ASME B 16.34 API 598 (Optional)
Basic Design	ASME B16.34

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

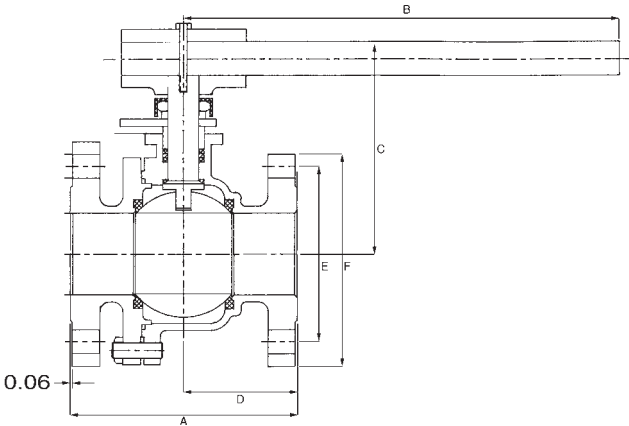
SERIES 50

DIMENSIONS

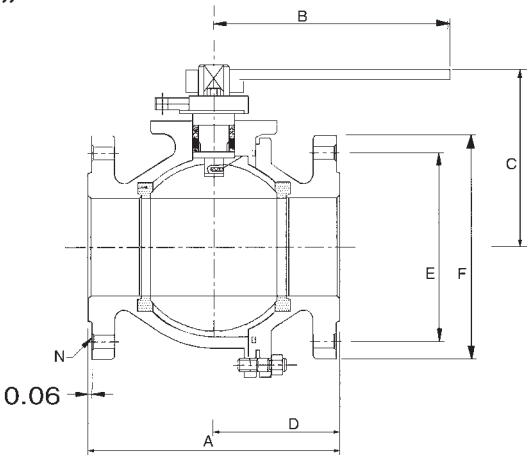
1/2" - 2"



→ 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

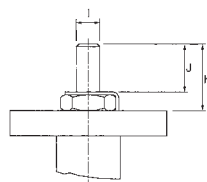
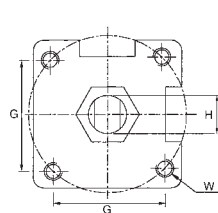
WEIGHT (lbs.)

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

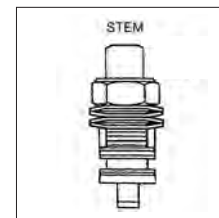
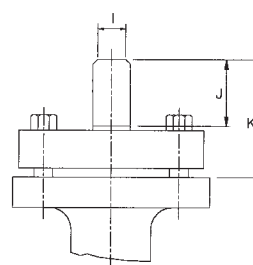
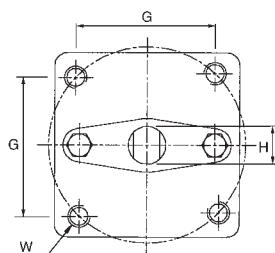
SIZE	A	B	C	D	E	F	N	G	H	I	J	K	W
1/2"	4.25	4.75	3.60	1.80	2.38	3.50	4	1.39	3/8-24 UNF	.22	.28	.63	M5
3/4"	4.62	4.75	3.75	2.00	2.75	3.85	4	1.39	3/8-24 UNF	.22	.28	.63	M5
1"	5.00	6.22	3.75	2.12	3.13	4.25	4	1.39	7/16-20 UNF	.30	.30	.90	M6
1-1/2"	6.50	9.00	4.50	2.76	3.56	5.00	4	1.94	9/16-18 UNF	.35	.42	1.18	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.

1/2" - 4"

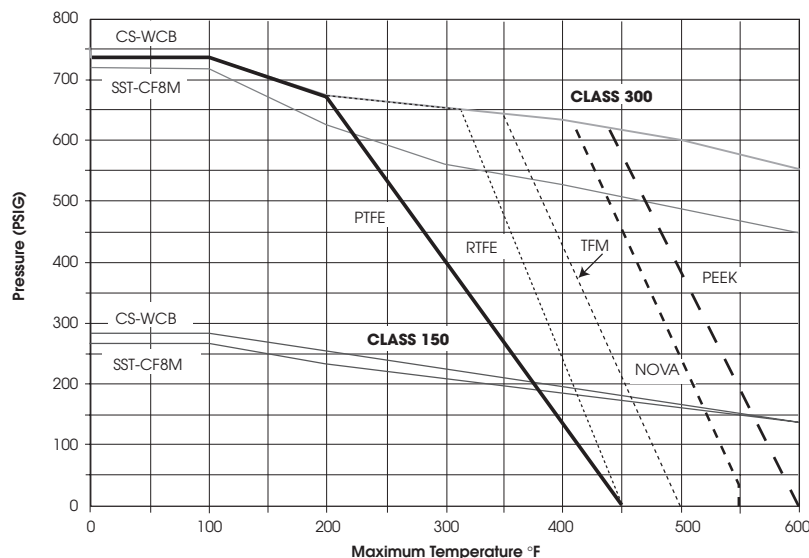


6" - 8"



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

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.

	MATERIAL SPECIFICATION BALL VALVES	SPEC NO: 4.95
	DWC REGULAR PORT STAINLESS STEEL THREADED BALL VALVE	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Stainless steel regular bore ball valve with blow-out proof stem and seat retainer designed to permit valve to be dead ended in either flow direction. Type 316 stainless steel body, ball and stem, TFE seats and seals.
ACTUATOR:	Lever operated. Valve has lockable feature to lock the valve in either the open or shut position.
RATING:	1,000 PSIG @ 250 DEG. F. or 250 PSIG @ 400 DEG. F.
CONNECTION:	Threaded ends. Screwed body inserts or tail pieced are not acceptable.
MANUFACTURER:	Sharpe
SIZES:	1/4" through 2"
MODELS:	Sharpe Series 50M76
SERVICE CONDITIONS:	Potable water at ambient temperature

Issue Date	Revision Date	Approved By	Approval Date
July 18, 2022		Robert Sprowls	July 18, 2022

PROPRIETARY AND CONFIDENTIAL

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Series 50M76

2-Piece Ball Valve

SHARPE®

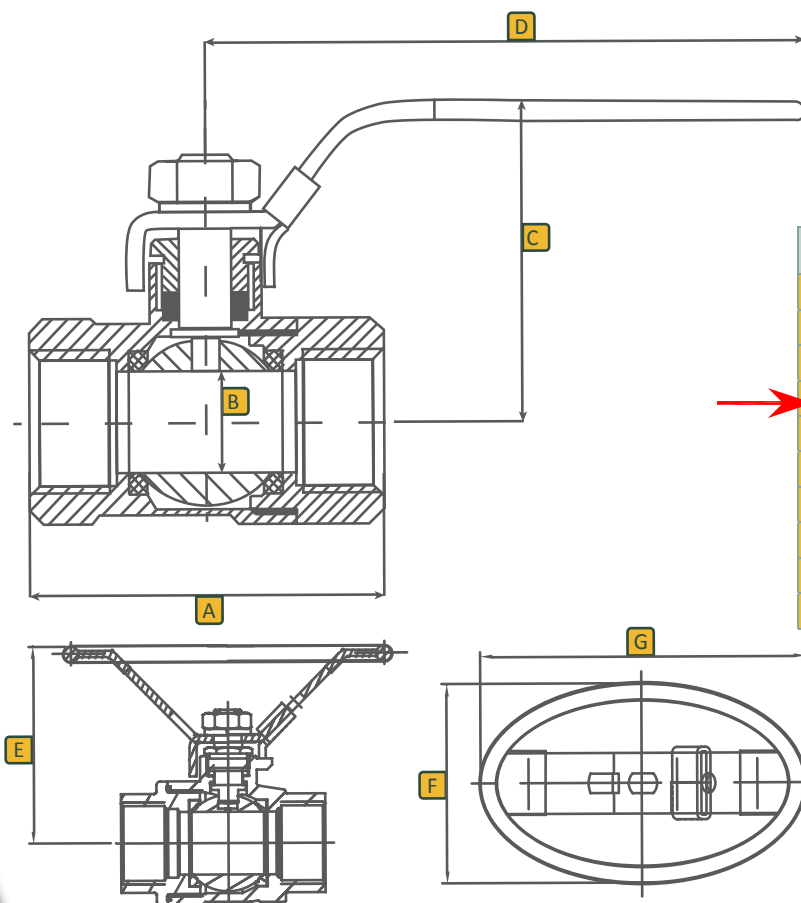
Valves, Automation & Controls

Features

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



Dimensions

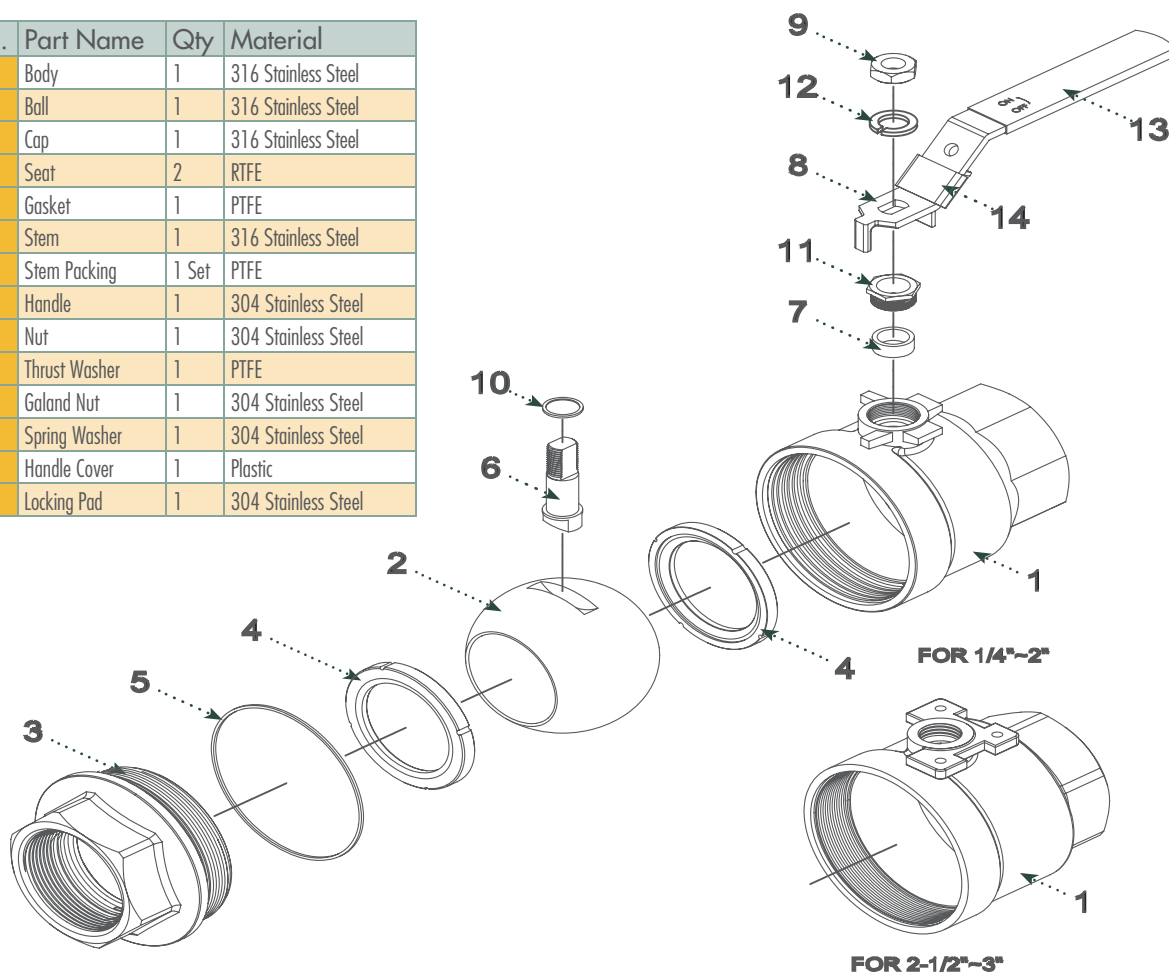


Dimensions (Inches)

Size	A	B	C	D	E	F	G
1/4	2.00	0.43	1.81	4.00	1.06	2.16	3.39
3/8	2.00	0.43	1.81	4.00	1.06	2.16	3.39
1/2	2.36	0.50	1.89	4.00	1.06	2.16	3.39
3/4	2.75	0.80	2.04	5.00	1.34	2.76	4.33
1	3.25	1.00	2.44	5.75	1.53	3.18	5.26
1-1/4	3.80	1.25	2.56	5.75	1.53	3.18	5.26
1-1/2	4.33	1.50	2.96	7.50	1.97	4.13	6.30
2	5.27	2.00	3.25	7.50	1.97	4.13	6.30
2-1/2	6.58	2.50	5.00	9.73	-	-	-
3	7.55	3.00	5.40	9.73	-	-	-

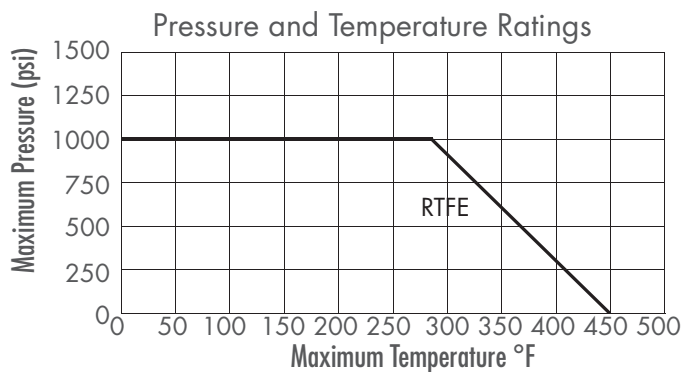
Parts & Materials

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	Gland 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-Lbs
1/4	6	0.5
3/8	6	0.5
1/2	24	0.7
3/4	35	1.1
1	47	2.0
1-1/4	81	3.0
1-1/2	105	4.8
2	241	8.0
2-1/2	319	14.0
3	580	20.0



Ordering

Fig: 1/2 - 50M76

Description: 1/2" - Series 50M76

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

	MATERIAL SPECIFICATION STRAINERS	SPEC NO: 22.29
	SAMPLE PORT SEPTUM, TYPE 316 STAINLESS STEEL	

SAP PART NUMBER:	1058440
CCC DRAWING NUMBER:	90100025
MATERIAL:	Sample port septum, Type 316 stainless steel, 0.060" wedge wire with 0.008" slot opening, Septum to be 1" O.D. x 1 1/2" long with 1/2" threaded half-coupling one end and 1/8" thk. cap other end, Overall Length= 2 9/16"
MANUFACTURER:	Orthos or equal

Issue Date:

Revision Date: 10/22/2010

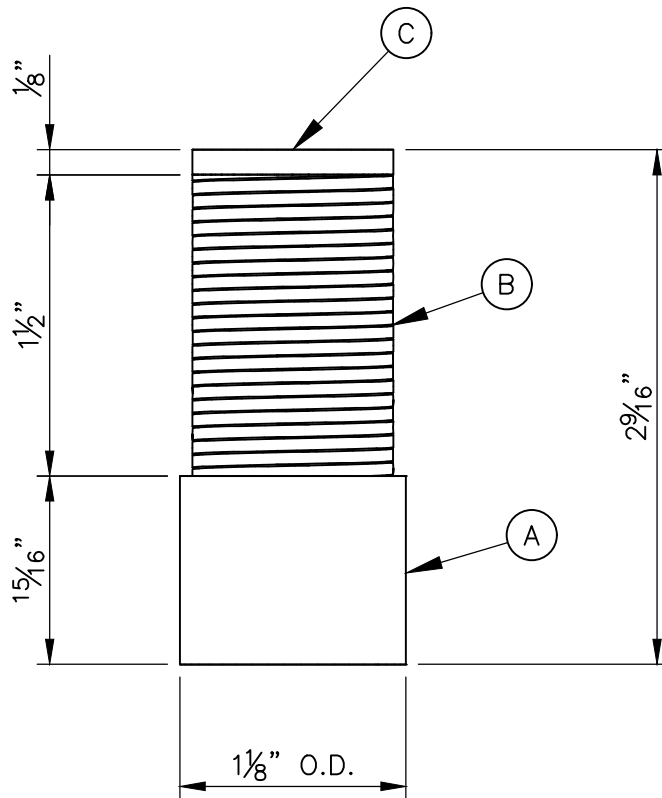
Approved by Joseph P. McMahon on 10/22/2010

PROPRIETARY AND CONFIDENTIAL

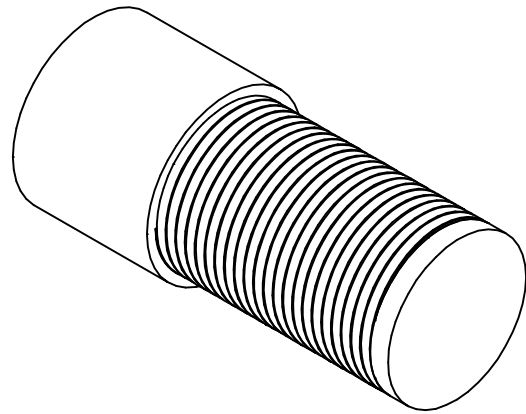
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BILL OF MATERIAL

ITEM	QUANTITY	SAP#	DESCRIPTION	MATERIAL
A	1		1/2" HALF COUPLING, 3000#, THREADED	316L SS
B	1		WEDGE WIRE, 1" O.D. X 1 1/2" LG., 0.060" WIRE W/0.008" SLOT	316L SS
C	1		CAP, 1" O.D. X 1/8" THK.	316L SS



PLAN



ISO

SAP NUMBER: 1058440

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	NAME	DATE
DRAFTER	RES	10-21-2010
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	STANDARD	



CLIENT			
TITLE 1/2" SAMPLE PORT SEPTA DETAIL CCC SPEC. 22.29			
DWG. Size	A	SHEET No.	1 OF 1
		SCALE	NONE
DWG. No.	90100025		REV. 0

2			
1			
0	ISSUED FOR FABRICATION	RES	10/21/10
REV	DESCRIPTION	APP	DATE
REVISIONS			

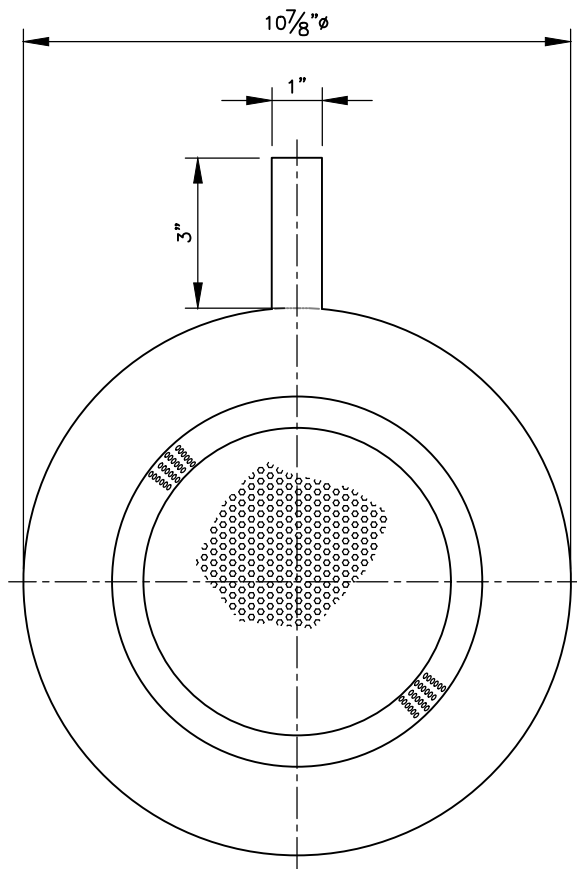
 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION STRAINERS	SPEC NO: 22.54
	BASKET STRAINER, TYPE 316 STAINLESS STEEL	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Perforated basket strainer (Media Retention) for 150 lb. Raised Face Flanges, type 316 stainless steel construction. Basket is to be Fabricated from 14 Gage 316 stainless steel with 1/8" holes drilled on 3/16" centers and covered with 40 mesh 316 stainless steel screen, this will then be covered by a 4 mesh 316 stainless steel support screen (0.063" wire diameter).
RATING:	Support Screen is to be designed for 125 PSIG if plugged in forward or reverse flow.
MANUFACTURER:	Mack Iron Works Company, Filter Solutions Inc.
SIZES:	2" thru 12"
MODELS:	Mack Iron Works Company Style PBL, Filter Solutions Inc. Style PBL

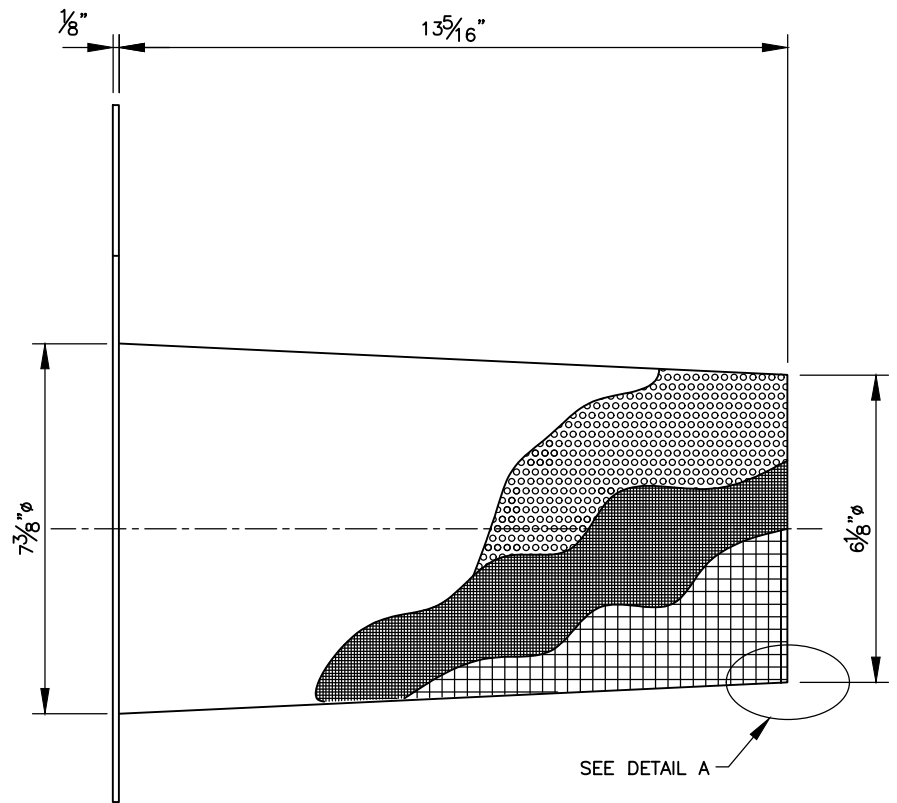
Issue Date	Revision Date	Approved By	Approval Date
September 29, 2022		Robert Sprowls	September 29, 2022

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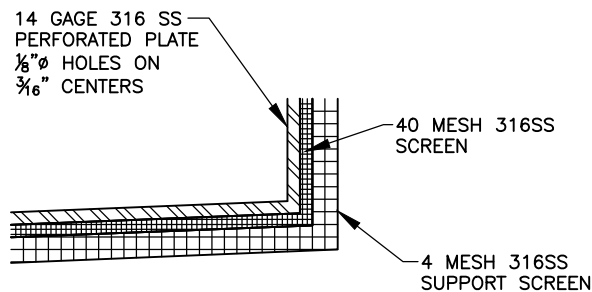
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FRONT



SIDE



DETAIL A

SAP NUMBER: 1043510

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	NAME	DATE
DRAFTER	BKM	8/29/06
DESIGNER		
CHECKER	RES	4/3/07
APPROVAL		
PROJECT No.	STANDARD	



CLIENT		STANDARD	
TITLE		8" STRAINER, 316L SS CCC SPEC 22.53 DETAILS	
DWG. Size	A	SHEET No.	1 OF 1
SCALE		NONE	
DWG. No.	90060220		REV. 1

REV	DESCRIPTION	APP	DATE
2			
1	ADD SAP NUMBER	RES	2/22/2018
0	ISSUED FOR FABRICATION	RES	4/3/07
REVISIONS			

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION STRAINERS	SPEC NO: 22.113
	FILTER NOZZLE, 316 STAINLESS STEEL, ANSI/NSF-61	

SAP PART NUMBER:	1081827
CCC DRAWING NUMBER:	90190642
MATERIAL:	Filter nozzle, 316 stainless steel construction. 2.0" O.D. x 2-1/4" long wedge-wire basket with 0.008" slot spacing, No.60 profile wire with a minimum of twenty-four (24) No.60 support rods with 22 gauge formed cap top & bottom; 1"-8 UNC thread on 3/4" Sch. 80 pipe X 2" long. Comes with 316 S.S. nut, flat and lock washer and two ANSI/NSF-61 gaskets 2" O.D. X 1 1/4" I.D. X 1/8" thick. Total overall length 4 1/2"
MANUFACTURER:	Federal Screen Products, or equal.
SEPTA SLOT SIZE:	0.008
SEPTA LENGTH:	4 1/2"
SEPTA DIAMETER:	2"
SEPTA CONNECTION TYPE:	1" Male UNC Thread

Issue Date: 12/13/2016

Revision Date: 07/01/2019

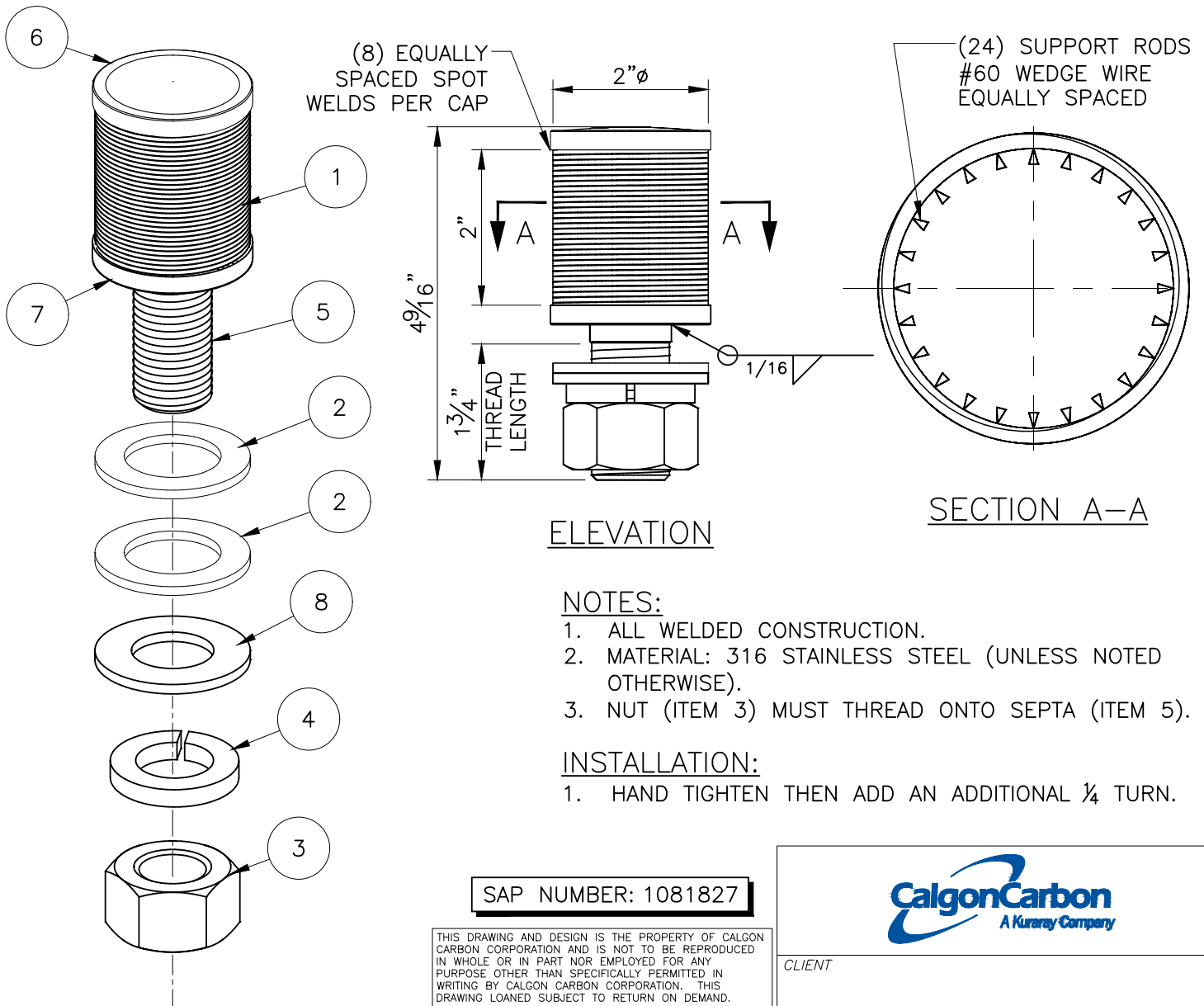
Approved by Joseph P. McMahon on 03/30/2017

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BILL OF MATERIAL

ITEM	QTY	DESCRIPTION
1	1	2" O.D. x 2 1/4" LONG WEDGE-WIRE BASKET WITH 0.008" SLOT SPACING, No. 60 PROFILE WIRE WITH (24) No. 60 SUPPORT RODS, 316 STAINLESS STEEL
2	2	GASKET, 2" O.D. x 1-1/8" I.D. x 1/8" THK., ANSI/NSF-61
3	1	HEX NUT, 1-8UNC, 316 STAINLESS STEEL
4	1	LOCK WASHER, 1"Ø, STANDARD HELICAL SPRING, 316 STAINLESS STEEL
5	1	PIPE, 3/4"Ø x 2" LG, SCH 80S W/1"-8UNC x 1-3/4" LONG THREAD, 316 STAINLESS STEEL
6	1	FORMED CAP, 20 GA., 2" I.D., 316 STAINLESS STEEL
7	1	FORMED CAP, 20 GA., 2" I.D., W/ 3/4" HOLE, 316 STAINLESS STEEL
8	1	WASHER, 1"Ø, PLAIN, TYPE A, SERIES N, 316 STAINLESS STEEL.



ELEVATION

SECTION A-A

NOTES:

1. ALL WELDED CONSTRUCTION.
2. MATERIAL: 316 STAINLESS STEEL (UNLESS NOTED OTHERWISE).
3. NUT (ITEM 3) MUST THREAD ONTO SEPTA (ITEM 5).

INSTALLATION:

1. HAND TIGHTEN THEN ADD AN ADDITIONAL 1/4 TURN.

SAP NUMBER: 1081827

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	NAME	DATE
DRAFTER	SPROWLS	07-01-2019
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	STANDARD	



CLIENT	
TITLE	SEPTA (SPEC 22.113) 316 STAINLESS STEEL, ANSI/NSF-61 DETAILS
DWG. Size	A
SHEET No.	1 OF 1
SCALE	NONE
DWG. No.	90190642
REV.	0

REV	DESCRIPTION	APP	DATE
0	ISSUED FOR FABRICATION	RES	7/1/19
REVISIONS			

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION EXPANSION JOINTS	SPEC NO: 24.25
	DWC RUBBER EXPANSION JOINT, DOUBLE ARCH TYPE	

SAP PART NUMBER:		
CCC DRAWING NUMBER:		
MATERIAL:	Rubber expansion joint, double arch type, EPDM cover and tube. Joint allows axial compression and extension, lateral deflection and minimum 13 degrees angular misalignment. Steel backing flanges to be galvanized or zinc plated, 150 # drilling. No gaskets required. Control rod assemblies are required when surge or test pressure exceed 163 psi.	
DIMENSIONS	Size	Face to Face
	1" thru 6"	10"
	8"	13"
	10" thru 12"	14"
RATING:	190 psi @ 170 DEG. F.	
MANUFACTURER:	Proco Products, Inc., General Rubber, Unisource Mfg.	
SIZES:	1" thru 12"	
MODELS:	Proco Products, Inc., Model 242/EE, General Rubber Style 1102, Unisource Style 302	

Issue Date	Revision Date	Approved By	Approval Date
September 28, 2022		Robert Sprows	September 28, 2022

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The image features a stack of several industrial expansion joints, each with a different colored elastomer (white, black, blue, orange, green, dark blue) and a metal flange. At the bottom, there is a detailed view of a spherical joint assembly, which includes a large metal pipe, a spherical body, and a flange with multiple bolts. The background is a gradient of yellow and orange.

PROCO

The Expansion Joint and Check Valve People

MOLDED SPHERICAL JOINTS STYLE 240/242

Proco Style 240/242 Molded Spherical Joints

Proco Style 240/242 Spherical Molded Expansion Joints are designed for piping systems to absorb pipe movements, relieve stress, reduce system noise/vibration, compensate for misalignment/offset and to protect rotating mechanical equipment against start-up surge forces.

The molded style 240 single sphere and 242 twin sphere designed bellows are inherently stronger than the conventional hand-built style spool arch type. Internal pressure within a "sphere" is exerted in all directions, distributing forces evenly over a larger area. The spherical design "flowing arch" reduces turbulence and sediment buildup.

Features and Benefits:

Absorbs Directional Movement

Thermal movements appear in any rigid pipe system due to temperature changes. The Style 240 and Style 242 spherical arch expansion joints allow for axial compression or axial extension, lateral deflection as well as angular movement. (Note: Rated movements in this publication are based on one plane movements. Multiple movement conditions are based on a multiple movement calculation. Contact Proco for information when designing multiple pipe movements.)

Easy Installation with Rotating Metallic Flanges

The floating metallic flanges freely rotate on the bellows, compensating for mating flange misalignment, thus speeding up installation time. Gaskets are not required with the Style 240 or Style 242, provided the expansion joints are mated against a flat face flange as required in the installation instructions.

Flange Materials/Drilling

The Proco Style 240 and Style 242 molded expansion joints are furnished complete with plated carbon steel flanges for corrosion protection. 304 or 316 stainless steel flanges are available upon request as well as ANSI 250/300 lb., BS-10, DIN PN10 & PN16 and JIS-10K drilling.

Absorbs Vibration, Noise and Shock

The Proco Style 240 and Style 242 molded expansion joints effectively dampen and insulate downstream piping against the transmission of noise and vibration generated by mechanical equipment. Noise and vibration caused by equipment can cause stress in pipe, pipe guides, anchors and other equipment downstream. Water hammer and pumping impulses can also cause strain, stress or shock to a piping system. Install the Style 240 or Style 242 molded expansion joints to help compensate for these system pressure spikes.

Wide Service Range with Low Cost

Engineered to operate up to 300 PSIG or 265°F, the Proco Style 240 and Style 242 can be specified for a wide range of piping requirements. Compared to conventional hand-built spool type joints, you will invest less money when specifying the mass-produced, consistent high quality, molded single or twin sphere expansion joints.

Material Identification

All Style 240 or Style 242 molded expansion joints have branded elastomer designations. Neoprene Tube/Neoprene Cover (NN) and Nitrile Tube/Neoprene Cover (NP) elastomer designated joints meet the Coast Guard Requirements and conform to ASTM F1123-87. 240C/NP-9 joints have ABS certification.

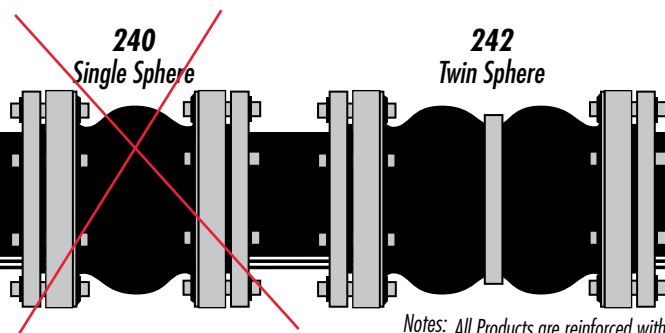
Large Inventory

Proco Products, Inc. maintains one of the largest inventories of rubber expansion joints in the world. Please contact us for price and availability.

Table 1: Available Styles • Materials

For Specific Elastomer Recommendations, See: PROCO "Chemical To Elastomer Guide"								
240-A	240-C	240-AV,D,E,M	242-A,B,C	PROCO Material Code	Cover Elastomer ¹	Tube Elastomer ²	Maximum Operating Temp. °F	Identifying Color Band/Label
		X	X	/BB ³	Chlorobutyl	Chlorobutyl	250°	Black
		X	X	/EE ³	EPDM	EPDM	250°	Red
X	X			/EE ^{3,4}	EPDM	FDA-EPDM	250°	Red
		X		/EQ ³	EPDM	FDA-EPDM	250°	Red
X	X			/EE-9 ^{3,5}	EPDM	EPDM	265°	DBL Red
	X			/ET-9 ^{3,6}	EPDM	PTFE	265°	Red
	X			/HH	CSM	CSM	212°	Green
		X	X	/NH	Neoprene	CSM	212°	Green
	X			/NJ	Neoprene	FDA-Nitrile	212°	White
	X	X	X	/NN	Neoprene	Neoprene	225°	Blue
	X			/NT ⁶	Neoprene	PTFE	225°	Blue
X	X	X	X	/NP	Neoprene	Nitrile	212°	Yellow
X	X			/NP-9 ⁷	Neoprene	Nitrile-ABS	212°	DBL Yellow

Protecting Piping and Equipment Systems from Stress/Motion



Notes: All Products are reinforced with Nylon Tire Cord, except 240-A and 240-C which are reinforced with Polyester.

1. All NN & NP elastomer designated joints meet the Coast Guard Requirements and conform to ASTM F 1123-87 and are marked accordingly.
2. Branding Label will be marked as "Food Grade".
3. BB, EE or EE-9 are good for 300°F blower service at 20 PSI or less.

4. 240-A & 240-C expansion joints have black EPDM tube, but are FDA compliant.

5. EE-9 joints are peroxide cured.
6. Products with PTFE loose liner are not intended for vacuum service.
7. NP-9 joints have ABS certification.
8. All elastomers above are not intended for steam service.

Information subject to change without notice.

Style 242 Twin Sphere Performance Data

Table 3: Sizes • Movements • Pressures • Flange Standards • Weights

NOMINAL Pipe Size I.D.	Neutral Length	PROCO Style Number ¹	242 Movement Capability: From Neutral Position ²					Pressure ⁴		Standard Flange Drilling Dimensions ⁸					Weight in lbs	
			Axial Compression Inches	Axial Extension Inches	Lateral Deflection Inches	Angular Deflection Degrees	Thrust Factor ³	Positive PSIG ⁵	Vacuum ⁶ Inches of Hg	Flange O.D. Inches	Bolt Circle Inches	Number of Holes	Size of Holes Inches	Bolt Hole ⁷ Thread	Exp. Joint & Flanges	Control Unit Set (2 Rod)
1 (25)	10.00	242-C	2.000	1.188	1.750	45	4.43	225	26	4.25	3.13	4	0.625	—	5.2	3.6
1.25 (32)	7.0	242-A						225					0.625	1/2-13 UNC	5.3	3.5
	7.0	242-HA	2.000	1.188	1.750	45	6.34	300	26	4.63	3.5	4	0.625	—	6.5	3.5
	10.00	242-C						225					0.625	—	6.2	3.6
1.5 (40)	6.00	242-B						225					0.625	—	6.1	4.6
	6.00	242-HB						300					0.625	—	7.6	4.6
	7.00	242-A	2.000	1.188	1.750	45	6.49	225	26	5.0	3.88	4	0.625	1/2-13 UNC	6.8	4.8
	7.00	242-HA						300					0.625	—	8.3	4.8
	10.00	242-C						225					0.625	—	7.7	5.1
2 (50)	6.00	242-B						225		6.0	4.75	4	0.750	—	9.0	6.6
	7.00	242-A						225		6.0	4.75	4	0.750	—	9.0	7.0
	10.00	242-C	2.000	1.188	1.750	45	7.07	235	26	6.0	4.75	4	0.750	5/8-11 UNC	10.2	7.3
	6.00	Q-242-HB						300		6.0	4.75	4	0.750	—	10.5	6.6
	7.00	Q-242-HA						300		6.5	5.00	8	0.750	—	10.5	7.0
2.5 (65)	6.00	242-B						225					0.750	—	12.9	7.6
	7.00	242-A						225					0.750	—	13.3	8.0
	10.00	242-C	2.000	1.188	1.750	43	11.05	225	26	7.0	5.5	4	0.750	5/8-11 UNC	14.5	8.4
	6.00	Q-242-HB						300					0.750	—	15.3	7.6
	7.00	Q-242-HA						300					0.750	—	15.8	8.0
3 (80)	7.00	242-A						225		7.5	6.0	4	0.750	5/8-11 UNC	14.3	8.6
	9.00	242-B						225		7.5	6.0	4	0.750	—	15.2	9.0
	10.00	242-C	2.000	1.188	1.750	38	13.36	225	26	7.5	6.0	4	0.750	—	15.8	9.1
	12.00	242-C						300		7.5	6.0	4	0.750	—	16.0	9.9
	7.00	Q-242-HA						300		8.25	6.62	8	0.875	—	18.2	8.6
3.5 (90)	10.00	242-C	2.000	1.188	1.750	34	18.67	225	26	8.5	7.0	8	0.750	—	20.6	8.1
4 (100)	9.00	242-A						225		9.0	7.5	8	0.750	5/8-11 UNC	20.3	8.0
	10.00	242-C	2.000	1.375	1.562	34	22.69	225	26	9.0	7.5	8	0.750	—	21.3	8.2
	12.00	242-C						225		9.0	7.5	8	0.750	—	22.0	8.2
	9.00	Q-242-HA						300		10.0	7.88	8	0.750	3/4-10 UNC	26.4	8.0
5 (125)	9.00	242-A						225		10.0	8.5	8	0.875	—	24.5	8.3
	10.00	242-C	2.000	1.375	1.562	29	30.02	225	26	10.0	8.5	8	0.875	—	25.5	9.1
	12.00	242-C						225		10.0	8.5	8	0.875	—	26.0	9.1
	9.00	Q-242-HA						300		11.0	9.25	8	0.875	—	31.4	8.3
6 (150)	9.00	242-A						225		11.0	9.5	8	0.875	3/4-10 UNC	29.5	11.7
	10.00	242-C	2.000	1.375	1.562	25	41.28	225	26	11.0	9.5	8	0.875	—	30.5	11.9
	12.00	242-C						225		11.0	9.5	8	0.875	—	31.0	12.0
	14.00	242-C						225		11.0	9.5	8	0.875	—	32.0	12.0
	9.00	Q-242-HA						300		12.5	10.62	12	0.875	—	38.6	11.7
8 (200)	9.00	242-B						225		13.5	11.75	8	0.875	—	42.3	14.5
	10.00	242-C						225		13.5	11.75	8	0.875	—	43.4	15.0
	12.00	242-C						225		13.5	11.75	8	0.875	—	44.0	15.2
	13.00	242-A	2.375	1.375	1.375	19	63.62	225	26	13.5	11.75	8	0.875	—	43.8	15.4
	14.00	242-C						225		13.5	11.75	8	0.875	3/4-10 UNC	46.0	16.0
	9.00	Q-242-HB						300		15.0	13.0	12	1.000	—	55.4	14.5
	13.00	Q-242-HA						300		15.0	13.0	12	1.000	—	57.5	15.4

See Notes Page 6

Style 242 Twin Sphere Performance Data

Table 3: Sizes • Movements • Pressures • Flange Standards • Weights

NOMINAL Pipe Size I.D.	Neutral Length	PROCO Style Number ¹	242 Movement Capability: From Neutral Position ²					Pressure ⁴		Standard Flange Drilling Dimensions ⁸					Weights in lbs	
			Axial Compression Inches	Axial Extension Inches	Lateral Deflection Inches	Angular Deflection Degrees	Thrust Factor ³	Positive PSIG ⁵	Vacuum ⁶ Inches of Hg	Flange O.D. Inches	Bolt Circle Inches	Number of Holes	Size of Holes Inches	Bolt Hole ⁷ Thread	Exp. Joint & Flanges	Control Unit Set (2 Rod)
10 (250)	12.00	242-B						225		16.0	14.25	12	1.000	—	64.1	23.5
	13.00	242-A						225		16.0	14.25	12	1.000	—	65.5	24.5
	14.00	242-C	2.375	1.375	1.375	15	103.87	225	26	16.0	14.25	12	1.000	7/8-9 UNC	66.7	24.5
	12.00	Q-242-HB						275		17.5	15.25	16	1.125	—	86.5	23.5
	13.00	Q-242-HA						275		17.5	15.25	16	1.125	—	88.4	24.5
12 (300)	12.00	242-B						225		19.0	17.00	12	1.000	—	94.0	30.0
	13.00	242-A						225		19.0	17.00	12	1.000	—	95.0	31.0
	14.00	242-C	2.375	1.375	1.375	13	137.89	225	26	19.0	17.00	12	1.000	7/8-9 UNC	99.1	31.0
	12.00	Q-242-HB						275		20.5	17.75	16	1.250	—	110.0	30.0
	13.00	Q-242-HA						275		20.5	17.75	16	1.250	—	110.0	31.0
14 (350)	13.75	242-A	1.750	1.118	1.118	9	182.65	150	26	19.0	18.75	12	1.125	—	112.0	32.0
16 (400)	12.00	242-C						125					1.125	—	124.0	28.8
	12.00	242-HC	1.750	1.118	1.118	8	240.53	175	26	23.5	21.25	16	1.125	—	160.0	28.8
	13.75	242-A						125					1.125	—	132.0	30.8
	13.75	242-HA						175					1.125	—	170.2	30.8
18 (450)	12.00	242-C						125					1.250	—	138.0	35.1
	13.75	242-A	1.750	1.118	1.118	7	298.65	125	26	25.0	22.75	16	1.250	—	146.0	36.1
	13.75	242-HA						175					1.250	—	181.2	36.1
20 (500)	12.00	242-C						125					1.250	—	172.0	35.0
	13.75	242-A	1.750	1.118	1.118	7	363.05	125	26	27.5	25.0	20	1.250	—	182.0	35.5
	13.75	242-HA						175					1.250	—	182.0	35.5
24 (600)	12.00	242-C						110					1.375	—	190.0	47.0
	13.75	242-A	1.750	1.118	1.118	5	510.70	110	26	32.5	29.5	20	1.375	—	220.0	48.0
	13.75	242-HA						160					1.375	—	266.2	48.0
30 (750)	12.00	242-C	1.750	1.118	1.118	4	779.31	110	26	38.75	36.0	28	1.375	—	270.0	82.0

NOTES:

Standard Proco Style 242-A Expansion Joints shown in Bold Type are considered Standards and are inventoried in large quantities.

1. "HW" denotes Heavy Weight Construction. For sizes 2" I.D. thru 12" I.D., Proco will only offer these items with 300 lb. drilling and are denoted by Q-242-HW. All Q-240-HW units will only be sold with control units.

2. Movements shown in the above tables are non-concurrent.

3. Calculation of Thrust (Thrust Factor). When expansion joints are installed in the pipeline, the static portion of the thrust is calculated as a product of the area of the I.D. of the arch of the expansion joint times the maximum pressure (design, test or surge) that will occur in the line. The result is a force expressed in pounds.

Take design, surge or test pressure X thrust factor to calculate end thrust.

"Effective Area"

Thrust Factor=

$$T = \frac{\pi}{4} (D)^2 (P)$$

T= Thrust

P= PSI (Design, Test or Surge)

D= Arch I.D.

4. Pressure rating is based on 170°F operating temperature. The pressure rating is reduced at higher temperatures.

5. Pressures shown at maximum "operating pressure". Test pressure is 1.5 times "operating pressure". Burst pressure is 4 times "operating pressure". If factory hydro-test is required, an additional joint per size must be purchased and tested. Once hydro-tested this joint may not be sent to field for installation as the beaded end will have taken a (compressed) set and can not be reused.

6. Vacuum rating is based on neutral installed length, without external load. Products should not be installed in extension for vacuum applications. Flattening of the arch in extended mode will cause the arch to collapse.

7. Style 242A/NN (neoprene elastomer only) expansion joints 1.0" I.D. thru 12" I.D. are available with tapped (threaded) holes and must be specified at time of order.

8. In addition to standard 150 lb. drilled flanges, Proco can provide expansion joints listed above in 300 lb. drilling, BS-10 (British) drilling, Metric PN10 and PN16 drilling and JIS 10kg/cm drilling.

Style 240/242 Drilling Chart

Table 4: Flange Drilling

 NOMINAL Pipe Size Inch (mm)	American 125/150# Conforms to ANSI B16.1 and B16.5						American 250/300# Conforms to ANSI B16.1 and B16.5					British Standard 10:1962 Conforms to BS 10 Table E				
	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Drilled Hole Size	Threaded Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size
1 (25)	0.55 (14.0)	4.25 108.0	3.13 79.4	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	4.88 124.0	3.5 88.9	4 4	0.75 19.1	0.59 15.0	4.5 114.0	3.25 82.6	4 4	0.62 15.9
1.25 (32)	0.55 (14.0)	4.63 118.0	3.5 88.9	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	5.25 133.0	3.88 98.4	4 4	0.75 19.1	0.59 15.0	4.75 121.0	3.44 87.3	4 4	0.62 15.9
1.5 (40)	0.55 (14.0)	5.0 127.0	3.88 98.4	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	6.12 156.0	4.50 114.3	4 4	0.88 22.2	0.59 15.0	5.25 133.0	3.88 98.4	4 4	0.62 15.9
2 (50)	0.63 (16.0)	6.0 152.0	4.75 120.7	4 4	0.75 19.1	5/8 - 11 UNC	0.71 18.0	6.50 165.0	5.00 127.0	8 8	0.75 19.1	0.63 16.0	6.0 152.0	4.5 114.3	4 4	0.75 19.1
2.5 (65)	0.71 18.0	7.0 178.0	5.5 139.7	4 4	0.75 19.1	5/8 - 11 UNC	0.71 18.0	7.5 191.0	5.88 149.2	8 8	0.88 22.2	0.71 18.0	6.5 165.0	5.0 127.0	4 4	0.75 19.1
3 (80)	0.71 18.0	7.5 191.0	6.0 152.4	4 4	0.75 19.1	5/8 - 11 UNC	0.79 20.0	8.25 210.0	6.62 168.2	8 8	0.88 22.2	0.71 18.0	7.25 184.0	5.75 146.1	4 4	0.75 19.1
3.5 (90)	0.71 18.0	8.5 216.0	7.0 177.8	8 8	0.75 19.1	5/8 - 11 UNC	0.79 20.0	9.0 229.0	7.25 184.2	8 8	0.88 22.2	0.71 18.0	8.0 203.0	6.5 165.1	8 8	0.75 19.1
4 (100)	0.71 18.0	9.0 229.0	7.5 190.5	8 8	0.75 19.1	5/8 - 11 UNC	0.79 20.0	10.0 254.0	7.88 200.0	8 8	0.88 22.2	0.71 18.0	8.5 216.0	7.0 177.8	8 8	0.75 19.1
5 (125)	0.79 20.0	10.0 254.0	8.5 215.9	8 8	0.88 22.2	3/4 - 10 UNC	0.87 22.0	11.0 279.0	9.25 235.0	8 8	0.88 22.2	0.79 20.0	10.0 254.0	8.25 209.6	8 8	0.75 19.1
6 (150)	0.87 22.0	11.0 279.0	9.5 241.3	8 8	0.88 22.2	3/4 - 10 UNC	0.87 22.2	12.5 318.0	10.62 269.9	12 12	0.88 22.2	0.87 22.2	11.0 279.0	9.25 235.0	8 8	0.88 22.2
8 (200)	0.87 22.0	13.5 343.0	11.75 298.5	8 8	0.88 22.2	3/4 - 10 UNC	0.95 24.0	15.0 381.0	13.0 330.2	12 12	1.00 25.4	0.87 22.2	13.5 343.0	11.5 292.1	8 8	0.88 22.2
10 (250)	0.95 24.0	16.0 406.0	14.25 362.0	12 12	1.00 25.4	7/8 - 9 UNC	1.02 26.0	17.5 445.0	15.25 387.4	16 16	1.13 28.6	0.95 24.0	16.0 406.0	14.0 355.6	12 12	0.88 22.2
12 (300)	0.95 24.0	19.0 483.0	17.0 431.8	12 12	1.00 25.4	7/8 - 9 UNC	1.02 26.0	20.5 521.0	17.75 450.9	16 16	1.25 31.8	0.95 24.0	18.0 457.0	16.0 406.4	12 12	1.00 25.4
14 (350)	1.02 26.0	21.0 533.0	18.75 476.3	12 12	1.13 28.6	1 - 8 UNC	1.10 28.0	23.0 584.0	20.25 514.4	20 20	1.25 31.8	1.02 26.0	20.75 527.0	18.5 469.9	12 12	1.00 25.4
16 (400)	1.10 28.0	23.5 597.0	21.25 539.8	16 16	1.13 28.6	1 - 8 UNC	1.18 30.0	25.5 648.0	22.5 571.5	20 20	1.38 34.9	1.10 28.0	22.75 578.0	20.5 520.7	12 12	1.00 25.4
18 (450)	1.18 30.0	25.0 635.0	22.75 577.9	16 16	1.25 31.8	1 1/8 - 7 UNC	1.18 30.0	28.0 711.0	24.75 628.7	24 24	1.38 34.9	1.18 30.0	25.25 641.0	23.0 584.2	16 16	1.00 25.4
20 (500)	1.18 30.0	27.5 699.0	25.0 635.0	20 20	1.25 31.8	1 1/8 - 7 UNC	1.18 30.0	30.5 775.0	27.0 685.8	24 24	1.38 34.9	1.18 30.0	27.75 705.0	25.25 641.4	16 16	1.00 25.4
24 (600)	1.18 30.0	32.0 813.0	29.5 749.3	20 20	1.38 34.9	1 1/4 - 7 UNC	1.18 30.0	36.0 914.0	32.0 812.8	24 24	1.62 41.3	1.18 30.0	32.5 826.0	29.75 755.7	16 16	1.25 31.8
30 (750)	1.26 32.0	38.75 984.0	36.0 914.4	28 28	1.38 34.9	1 1/4 - 7 UNC	1.26 32.0	43.0 1092.0	39.25 997.0	28 28	2.00 50.8	1.26 32.0	39.25 997.0	36.5 927.1	20 20	1.38 34.9

Installation Instructions for Non-Metallic Expansion Joints with Beaded End Flanges

1. Service Conditions:

Make sure the expansion joint rating for temperature, pressure, vacuum*, movements and selection of elastomeric materials match the system requirements. Contact the manufacturer if the system requirements exceed those of the expansion joint selected.

(*Vacuum service for spherical rubber connectors: Vacuum rating is based on neutral installed length. These products should not be installed “extended” on vacuum applications.)

2. Alignment:

Expansion joints are not designed to make up for piping misalignment errors. Piping misalignment should be no more than 1/8” in any direction. Misalignment of an expansion joint will reduce the rated movements and can induce severe stress of the material properties, thus causing reduced service life.

3. Anchoring:

Anchors are required wherever the piping system changes direction. Expansion joints should be located as close as possible to anchor points. If an anchoring system is not used, it is recommended that control rods be installed on the expansion joint to prevent excessive movements from occurring due to pressure thrust of the line.

4. Pipe Support:

Piping must be supported so expansion joints do not carry any pipe weight.

5. Mating Flanges:

Install the expansion joint against the mating pipe flanges and install bolts so that the bolt head is against the expansion joint flange. Flange-to-flange dimension of the expansion joint must match the breech opening*. (*A spherical rubber connector must be compressed 1/8” to 3/16” during installation in order to obtain a correct installed face-to-face dimension.)

Make sure the mating flanges are clean and are a flat-faced type. When attaching beaded end flange expansion joints to raised face flanges, the use of metal gaskets are required to prevent metal flange faces from cutting rubber bead during installation.

Never install expansion joints next to wafer type check or butterfly valves. Serious damage to the rubber flange bead can result due to lack of flange mating surface and/or bolt connection.

6. Bolting Torque:

Table 8 shows the recommended torque values for non-metallic expansion joints with beaded end type-flanges: Tighten bolts in stages by alternating around the flange. Use the recommended torque values in Table 8 to achieve a good seal. Never tighten an expansion joint to the point that there is metal-to-metal contact between the expansion joint flanges and the mating flanges. A slight bulge in the rubber beaded end should create a flush tight seal.

Note: Torque values are approximate due to mating flange surfaces, installation offsets, operating pressures and environmental conditions.

7. Storage:

Ideal storage is in a warehouse with a relatively dry, cool location. Store flanges face down on a pallet or wooden platform. Do not store other heavy items on top of the expansion joints. Ten year shelf life can be expected with ideal conditions. If storage must be outdoors, place on a wooden platform and joints should not be in contact with the ground. Cover with a tarpaulin.

8. Large Joint Handling:

Do not lift with ropes or bars through the bolt holes. If lifting through the bore, use padding or a saddle to distribute the weight. Make sure cables or forklift tines do not contact the rubber. Do not let expansion joints sit vertically on the edges of the flanges for any period of time.

9. Additional Tips:

- A. Do not insulate over a non-metallic expansion joint. This facilitates inspection of the tightness of the joint bolting.
- B. It is acceptable (but not necessary) to lubricate the expansion joint flanges with a thin film of graphite dispersed in glycerin or water to ease disassembly at a later time.
- C. Do not weld in the near vicinity of a non-metallic joint.
- D. If expansion joints are to be installed underground, or will be submerged in water, contact manufacturer for specific recommendations.
- E. If the expansion joint will be installed outdoors, make sure the cover material will withstand ozone, sunlight, etc.
- F. Check the tightness of lead-free flanges two or three weeks after installation and retighten if necessary.

Warning: Expansion joints may operate in pipelines or equipment carrying fluids and/or gasses at elevated temperature and pressures and may transport hazardous materials. Precautions should be taken to protect personnel in the event of leakage or splash. Rubber joints should not be installed in areas where inspection is impossible. Make sure proper drainage is available in the event of leakage when operating personnel are not available.

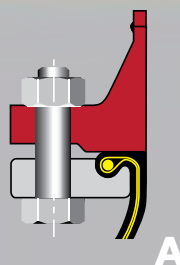
Installation Instructions for Non-Metallic Expansion Joints with Beaded End Flanges

Table 8: Bolt-Torque					
Nominal Pipe Size Expansion Joint I.D. Inch /(mm)	Step 1 FT-LBS (Nm)	Rest	Step 2 FT-LBS (Nm)	Rest	Step 3 FT-LBS (Nm)
1 (25)	18 (25)	30 Min	30 (40)	60 Min	45-60 (60-80)
1.25 (32)	18 (25)	30 Min	30 (40)	60 Min	45-60 (60-80)
1.5 (40)	18 (25)	30 Min	30 (40)	60 Min	45-60 (60-80)
2 (50)	18 (25)	30 Min	30 (40)	60 Min	45-60 (60-80)
2.5 (65)	18 (25)	30 Min	35 (50)	60 Min	50-60 (70-80)
3 (80)	25 (35)	30 Min	45 (60)	60 Min	60-75 (80-100)
3.5 (90)	25 (35)	30 Min	45 (60)	60 Min	60-75 (80-100)
4 (100)	25 (35)	30 Min	45 (60)	60 Min	60-75 (80-100)
5 (125)	25 (35)	30 Min	45 (60)	60 Min	60-75 (80-100)
6 (150)	30 (40)	30 Min	50 (70)	60 Min	60-75 (80-100)
8 (200)	30 (40)	30 Min	50 (70)	60 Min	60-75 (80-100)
10 (250)	30 (40)	30 Min	50 (70)	60 Min	75-85 (100-115)
12 (300)	30 (40)	30 Min	50 (70)	60 Min	75-85 (100-115)
14 (350)	30 (40)	30 Min	60 (80)	60 Min	75-95 (110-130)
16 (400)	30 (40)	30 Min	60 (80)	60 Min	75-95 (110-130)
18 (450)	30 (40)	30 Min	60 (80)	60 Min	90-95 (120-130)
20 (500)	30 (40)	30 Min	65 (90)	60 Min	95-185 (130-250)
24 (600)	30 (40)	30 Min	65 (90)	60 Min	95-185 (130-250)
30 (750)	30 (40)	30 Min	65 (90)	60 Min	95-220 (130-300)

Note: Bolt torque based on new bolts and nuts

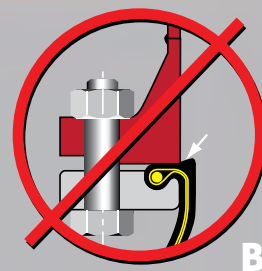
Right:

Flanges with correct ID help prevent damage to rubber.



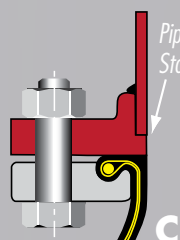
Wrong:

Insure matting flanges I.D. is flush with rubber.



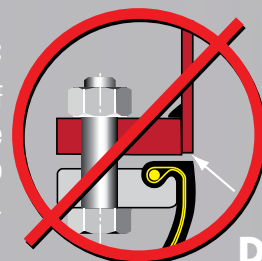
Right:

Weld neck flanges with correct ID prevent damage to rubber.



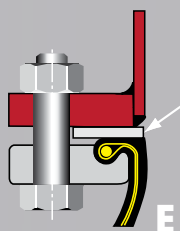
Wrong:

Uneven end of pipe can cause damage to rubber.



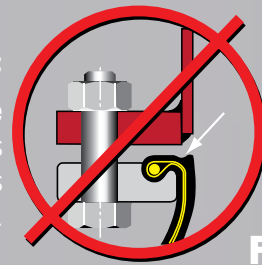
Right:

In case of B, D, F an additional metal gasket can be used to prevent damage to rubber.



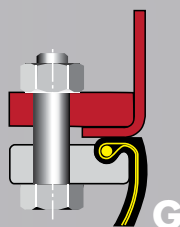
Wrong:

Inner edge of flanges damages rubber.

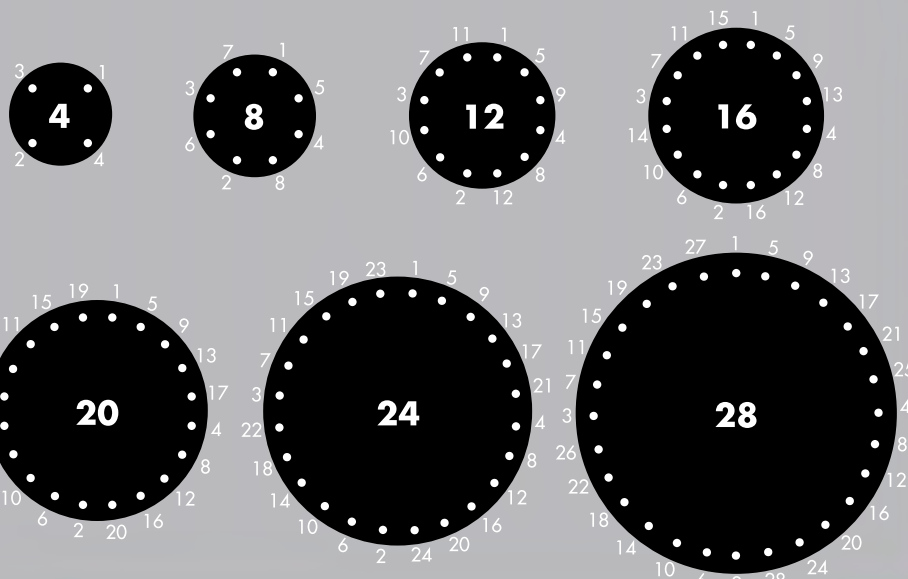


Right:

Well rounded smooth edge prevents damage to rubber.



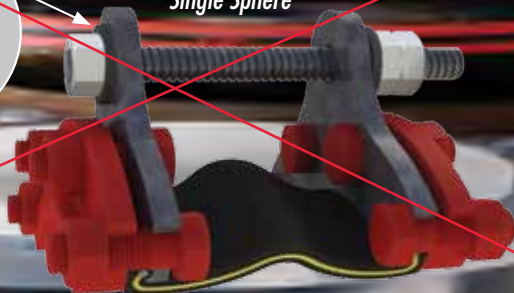
Tighten opposing nuts/bolts gradually according to the following sequence





240-ITR
Single Sphere

Optional
Spherical Washers



242-ITR
Twin Sphere

Optional
Spherical Washers



ALSO AVAILABLE FROM Proco Products, Inc.

Proco Products, Inc. can supply an Integral Tie Rod Design Joint when space prohibits use of typical rod designs.



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Toll-Free Phone: (800) 344-3246

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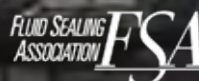
(209) 943-6088

email: sales@procoproducts.com

website: <http://www.procoproducts.com>

NATIONWIDE AND CANADA

INTERNATIONAL



REPRESENTED BY:

	MATERIAL SPECIFICATION HOSE FITTINGS	SPEC NO: 32.40
	UNIVERSAL HOSE COUPLING - MALLEABLE IRON	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Universal Hose Coupling, Malleable iron, male pipe thread on one end with other end for connecting to universal coupling.
RATING:	90 psig @ 140 DEG. F.
MANUFACTURER:	Chicago Pneumatic, or equal.
SIZES:	1/4" - C-36844Y 3/8" - C-36843Y 1/2" - C-36842Y 3/4" - C-36841Y 1" - C-36840Y NOTE: Above model number includes one standard type rubber gasket No. C-101158Y for air service. For water service use neoprene gasket No. C-101160Y.

Issue Date:

Revision Date:

Approved by Joseph P. McMahon on 10/30/98

PROPRIETARY AND CONFIDENTIAL

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UNIVERSAL COUPLINGS



MALE NPT



Ductile Iron

npt size	part number	list each
3/8	UM-38	6.88
1/2	UM-2	5.72
3/4	UM-3	6.09
1	UM-4	6.83



Brass

3/8	UMB-38	—
1/2	UMB-2	—
3/4	UMB-3	—
1	UMB-4	—

316 Stainless

1/2	UMSS-2	44.71
3/4	UMSS-3	38.75
1	UMSS-4	41.73

UNIVERSALOCK™
COUPLINGS

HOSE END

Ductile Iron
(machined serrations)

hose size	part number	list each
3/8	UH-38	7.98
1/2	UH-2	4.99
5/8	UH-58	7.61
3/4	UH-3	5.15
1	UH-4	6.88

Brass
(machined serrations)

3/8	UHB-38	—
1/2	UHB-2	12.60
5/8	UHB-58	—
3/4	UHB-3	14.49
1	UHB-4	18.59

316 Stainless
(machined serrations)

1/2	UHSS-2	43.47
3/4	UHSS-3	36.71
1	UHSS-4	40.57

BLANK END



Ductile Iron

size	part number	list each
All	UB	9.82

Brass

All	UBB	—
-----	-----	---

THREE WAY



Ductile Iron

size	part number	list each
All	UTW	17.85

Brass

All	UTWB	—
-----	------	---

UNIVERSAL WASHER



Nitrile

size	part number	list each
All	UG	0.53

Never use Universal Washers
in UniversaLock Couplings

SAFETY CLIP



size	part number	list each
All	SC	0.26

TWO-BOLT
UNIVERSAL CLAMP

Ductile Iron

hose o.d. min to max	part no.	list each
3/4 to 15/16	UC-2	5.78
1 to 1-1/4	UC-3	5.83
1-1/4 to 1-17/32	UC-4	10.08

DISTRIBUTOR AUTHORIZATION

Safety is of paramount concern to everyone. Due to the volatile nature of compressed air, and in accordance with our ISO 9000 quality system, we reserve the right to restrict sales of our UniversaLock® Couplings to only those distributors authorized by Campbell Fittings.

Please contact our customer service department for more information.

HOSE END

Ductile Iron
(machined serrations)

hose size	part number	list each
1/2	ULH-2	19.10
3/4	ULH-3	19.10
1	ULH-4	19.10

MALE END



Ductile Iron

npt size	part number	list each
1/2	ULM-2	19.10
3/4	ULM-3	19.10
1	ULM-4	19.10

FEMALE END



Ductile Iron

npt size	part number	list each
1/2	ULF-2	19.10
3/4	ULF-3	19.10

UNIVERSALOCK WASHER



Nitrile

size	part number	list each
All	ULW	2.13

Never use UniversalLock Washers
in standard Universal Couplings

	MATERIAL SPECIFICATION HOSE FITTINGS	SPEC NO: 32.60
	QUICK DISCONNECT MALE ADAPTER - ALUMINUM	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Quick disconnect male adapter, Aluminum, male NPT on one end with other end for connecting to quick disconnect female coupler.
RATING:	150 psig @ 100 DEG. F.
MANUFACTURER:	Dixon, Ever-Tite
SIZES:	1/2" thru 4"
MODELS:	Dixon "Andrews" line, type F, Ever-Tite Part F, or equal.

Issue Date: 04/16/90

Revision Date: 09/15/99

Approved by Matthew R. McGowan on 09/27/99

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Cam and Groove Information

3

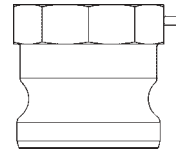
"EZ BOSS-LOCK"

No more fumbling with clamps, wire, clips or pins . .
*Just close the handles and the locking
 mechanism is engaged.*

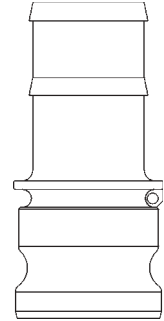
**Unlike other safety couplings . . .**

- The EZ Boss-Lock is extremely **EASY TO OPEN!!!** The release lever is under your thumb when you want to open the fitting. **ERGONOMIC.**
- The EZ Boss-Lock is resistant to accidental disconnection when being dragged. The release lever opens in the direction opposite to the cam arm, so movements that tend to open the release lever also tend to close the cam arm!!!
- The EZ Boss-Lock alerts you if it is not properly engaged. If the rotating lever is not flush with the handle, it is not properly engaged.
- The EZ Boss-Lock has no sliding pins to jam. The EZ Boss-Lock's rotating action helps keep the locking device free of debris.
- The EZ Boss-Lock has no sliding pins to pop open. The EZ Boss-Lock is designed to protect critical parts from impact and to withstand rugged use.
- The EZ Boss-Lock can be supplied with special shanks custom suited to your needs. The EZ Boss-Lock is available with Swaged and PF shank designs, for hard to couple chemical hoses.
- The EZ Boss-Lock cam arm assemblies are made of investment cast Stainless Steel with plated Carbon Steel pull rings.
- The EZ Boss-Lock is easier to insert into the hose tubes on Tank Trucks, and easier to use in restricted spaces. This is due to the smaller maximum O.D. and a more snag free exterior.
- The EZ Boss-Lock Cam Arm assemblies can be retrofitted onto Undamaged Stainless Steel Boss-Lock. This allows you to protect your investment in Stainless Steel Boss-Lock couplings while you upgrade.
- The EZ Boss-Lock is Made in the USA.

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CAM & GROOVE LINE DRAWINGS

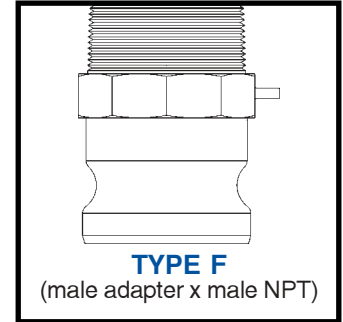
TYPE A
 (male adapter x female NPT)



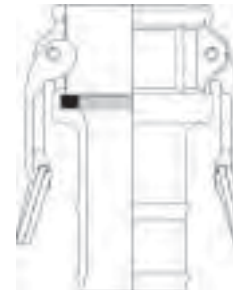
TYPE E
 (male adapter x hose shank)



TYPE B
 (female coupler x male NPT)



TYPE F
 (male adapter x male NPT)



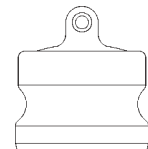
TYPE C
 (female coupler x hose shank)



TYPE DC *
 (dust cap)



TYPE D
 (female coupler x female NPT)



TYPE DP *
 (dust plug)

NOTE: Line drawings are representative of the Dixon / "Andrews" line of cam and groove.

* Dust Caps and Dust Plugs are NOT to be used in Pressure Applications for safety and environmental reasons.

WARNING:
UNDER NO CIRCUMSTANCES
should Cam and Groove couplings
be used for compressed air
or steam service!

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Dixon "Andrews" / "Boss-Lock" Type F Adapters



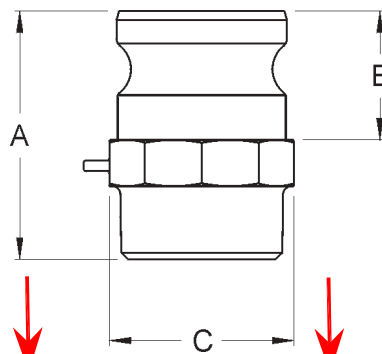
Male Adapter x Male NPT

	Aluminum	Aluminum Hard Coat	Brass	Unplated Malleable Iron	Plated Malleable Iron	Stainless Steel
Size	Part #	Part #	Part #	Part #	Part #	Part #
1/2"	50-F-AL	----	50-F-BR	----	----	50-F-SS
3/4" x 1/2"	7550-F-AL	----	7550-F-BR	----	----	7550-F-SS
3/4"	75-F-AL	----	75-F-BR	----	75-F-PM	75-F-SS
1"	100-F-AL	----	100-F-BR	----	100-F-PM	100-F-SS
1 1/4"	125-F-AL	----	125-F-BR	----	----	125-F-SS
1 1/2"	150-F-AL	150-F-ALH	150-F-BR	150-F-MI	150-F-PM	150-F-SS
2"	200-F-AL	200-F-ALH	200-F-BR	200-F-MI	200-F-PM	200-F-SS
2 1/2"	250-F-AL	----	250-F-BR	----	250-F-PM	250-F-SS
3"	300-F-AL	300-F-ALH	300-F-BR	300-F-MI	300-F-PM	300-F-SS
4"	400-F-AL	400-F-ALH	400-F-BR	400-F-MI	400-F-PM	400-F-SS
5"	500-F-AL	----	----	----	----	----
6"	600-F-AL	600-F-ALH	600-F-BR	----	600-F-PM	600-F-SS
8" AND*	800-F-AL	----	----	----	----	----
8" BL*	801-F-AL	----	----	----	----	----

* "Andrews" and "Boss-Lock" Cam and Groove Couplings **DO NOT INTERCHANGE IN THE 8" SIZE.**

- The 8" "Boss-Lock" were designed to interchange with 8" Cam & Groove Couplings manufactured by P.T. Coupling.

SAFETY
ALERT



ALUMINUM, BRASS and MALLEABLE IRON DIMENSIONS

Size	1/2"	3/4 x 1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8" AND	8" BL
A Overall Length	2 1/8	2 7/16	2 1/16	2 3/8	2 15/16	3 5/32	3 17/32	4 3/8	4 15/32	4 21/32	4 1/2	5 17/32	6 15/16	6 3/8
B Adapter Length	1	1	1	1 5/16	1 9/16	1 5/8	1 7/8	1 15/16	2	2 1/16	2 5/16	2 1/4	3 9/16	3 1/16
C Distance Across Flats	1	1 5/16	1 3/8	1 1/2	1 7/8	2 1/4	2 11/16	3 1/4	3 3/4	5	6 1/2*	8 1/32*	10 5/8*	10 5/8*

STAINLESS STEEL DIMENSIONS

Size	1/2"	3/4 x 1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8" AND	8" BL
A Overall Length	2 1/8	2 1/4	2 1/16	2 23/32	2 15/16	3 1/8	3 21/32	4 5/16	4 17/32	4 59/64	-----	4 15/16	-----	-----
B Adapter Length	1	1	1	1 5/16	1 9/16	1 5/8	1 7/8	1 15/16	2	2 1/16	-----	2 1/4	-----	-----
C Distance Across Flats	1	1 5/16	1 5/16	1 1/2	1 7/8	2 1/4	2 11/16	3 1/4	3 3/4	5	-----	7 3/4*	-----	-----

* Distance Over Lugs

	MATERIAL SPECIFICATION HOSE FITTINGS	SPEC NO: 32.61
	QUICK DISCONNECT FEMALE COUPLER - ALUMINUM	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Quick disconnect female coupler, Aluminum, Buna-N gaskets, male NPT on one end with other end for connecting to quick disconnect male adapter.
RATING:	150 psig @ 100 DEG. F.
MANUFACTURER:	Dixon, Ever-Tite
SIZES:	1/2" thru 4"
MODELS:	Dixon "Andrews" line - type B, Ever-Tite Part B, or equal.

Issue Date: 07/16/92

Revision Date: 09/15/99

Approved by Matthew R. McGowan on 09/27/99

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Cam and Groove Information

3

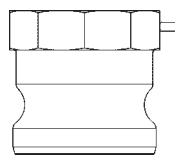
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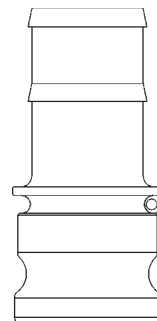
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CAM & GROOVE LINE DRAWINGS

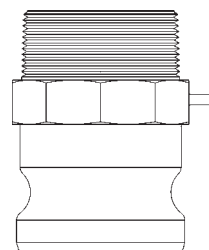
TYPE A
 (male adapter x female NPT)



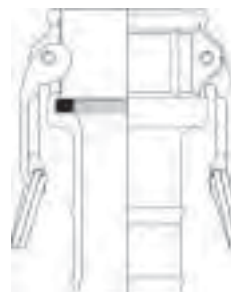
TYPE E
 (male adapter x hose shank)



TYPE B
 (female coupler x male NPT)



TYPE F
 (male adapter x male NPT)



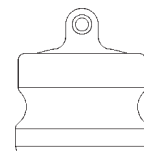
TYPE C
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TYPE DC *
 (dust cap)



TYPE D
 (female coupler x female NPT)



TYPE DP *
 (dust plug)

NOTE: Line drawings are representative of the Dixon / "Andrews" line of cam and groove.

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WARNING:
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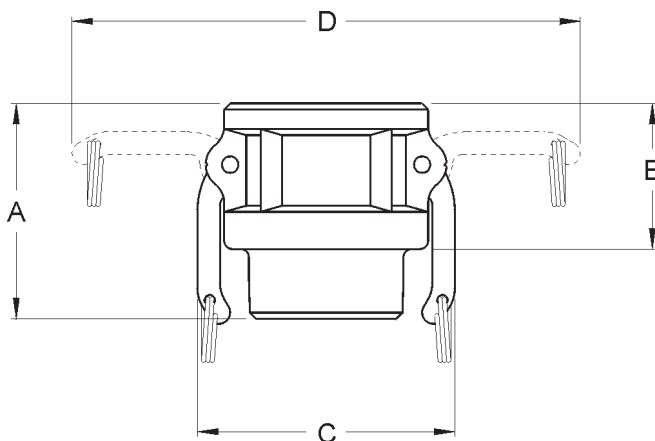
SAFETY
ALERT

Dixon "Andrews" Type B Couplers



Female Coupler x Male NPT

	Aluminum	Aluminum Hard Coat	Brass	Unplated Malleable Iron	Stainless Steel
Size	Part #	Part #	Part #	Part #	Part #
1/2"	50-B-AL	----	50-B-BR	----	50-B-SS
3/4"	75-B-AL	----	75-B-BR	----	75-B-SS
1"	100-B-AL	----	100-B-BR	----	100-B-SS
1 1/2"	150-B-AL	150-B-ALH	150-B-BR	150-B-MI	150-B-SS
2"	200-B-AL	200-B-ALH	200-B-BR	200-B-MI	200-B-SS
2 1/2"	----	----	----	----	250-B-SS
3"	300-B-AL	300-B-ALH	300-B-BR	----	300-B-SS
4"	400-B-AL	400-B-ALH	400-B-BR	300-B-MI	400-B-SS
5"	500-B-AL	----	----	400-B-MI	600-B-SS
6"	600-B-AL	600-B-ALH	----	----	----
8" *	800-B-AL	----	----	----	----



* "Andrews" and "Boss-Lock" Cam and Groove Couplings **DO NOT INTERCHANGE IN THE 8" SIZE.**

• See "Boss-Lock" for 1 1/4" and 2 1/2" couplers.

• The 8" "Andrews" design has 4 cam arms.

• **Finger rings are not supplied on 1/2" - 1" "Andrews" couplings.**

• 1/2" Andrews has only one cam arm.

**SAFETY
ALERT**

~~ALUMINUM, BRASS and MALLEABLE IRON DIMENSIONS~~

Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"
A Overall Length	2	2 3/16	2 17/32	2 7/8	2 13/16	3 9/32	----	3 15/16	4 1/32	4 3/16	4 7/16	8 7/16
B Coupler Length	1 7/32	1 3/8	1 19/32	1 31/32	1 29/32	2 7/32	----	2 15/16	2 11/32	2 5/16	2 5/8	3 13/16
C Distance Across Closed Cam Arms	1 17/32	2 1/8	2 7/16	3 1/4	3 9/16	3 15/16	----	5 15/32	6 9/16	7 9/16	10 3/32	12 1/32
D Distance Across Open Cam Arms	2 11/16	4 3/8	5 3/16	7 5/32	7 7/16	7 13/16	----	10 3/32	11 3/16	12 3/16	16 1/4	19 31/32

~~STAINLESS STEEL DIMENSIONS~~

Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"
A Overall Length	1 7/8	2 1/8	2 9/16	2 27/32	2 31/32	3 9/32	3 7/16	3 59/64	4 1/64	----	4 35/64	----
B Coupler Length	1 1/4	1 1/4	1 9/16	1 29/32	1 29/32	2 7/32	2 1/4	2 9/32	2 9/32	----	2 19/32	----
C Distance Across Closed Cam Arms	1 17/32	2 1/8	2 7/16	3 1/4	3 9/16	3 15/16	4 7/16	5 15/32	6 9/16	----	10 3/32	----
D Distance Across Open Cam Arms	2 11/16	4 3/8	5 3/16	7 5/32	7 7/16	7 13/16	8 11/32	10 3/32	11 3/16	----	16 1/4	----

	MATERIAL SPECIFICATION CARBON STEEL PIPE	SPEC NO: C02
	CARBON STEEL PIPE WITH STEEL FITTINGS	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Carbon steel pipe with steel fittings
RATING:	125 PSIG @ 350 DEG. F, 200 PSIG @ 150 DEG. F, Includes corrosion allowance of 0.050" min.
CONSTRUCTION:	Screwed for 1 1/2" and smaller, welded and/or flanged for 2" and larger.
PIPE:	Carbon steel, ASTM A53, Grade B: Threaded, schedule 80, seamless, 1 1/2" and smaller, plain end, schedule 40, seamless, 2" to 10", Plain end, 3/8" wall, seamless, 12" and above.
FITTINGS:	3000 lb ANSI B16.11, forged steel, threaded ends, 1 1/2" and smaller. Schedule 40, ANSI B16.9, ASTM A234, Grade WPB, carbon steel, butt welding ends, 2"-12". 3/8" wall, ANSI B16.9, ASTM A234, Grade WPB, carbon steel, butt welding ends, 14" to 24", or 125# flanged cast iron elbows and tees, ASTM A126, Class B with 125# ANSI B16.1 drilling with dimensions per ANSI A21.10 (AWWA C110). Location of tapped holes for drains shall be in accordance with ANSI B16.1. Use thread-o-lets on branch connections 1-1/2" and smaller, use stub-in or reducing tee connections for 2" and above.
UNIONS:	3000 lb forged steel, ASTM A105, Grade 2, integral steel seat, ground joint, threaded ends.
FLANGES:	150 lb ANSI B16.5, ASTM A105 forged carbon steel, slip-on, weld neck, or MSS lap joint/stub end for 2" and larger, threaded 1 1/2" and smaller. Where bolting to flat face cast iron flanges, flanges shall be furnished with a flat face. Others shall be raised face.

Issue Date: 12/01/89

Revision Date: 03/25/2008

Approved by Joseph P. McMahon on 03/25/2008

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	MATERIAL SPECIFICATION CARBON STEEL PIPE	SPEC NO: C13
	GALVANIZED CARBON STEEL PIPE	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Galvanized carbon steel pipe with galvanized iron or steel fittings.
RATING:	275 PSIG @ -20 to 150 DEG. F 215 PSIG @ 350 DEG. F Includes corrosion allowance of 0.050" minimum.
CONSTRUCTION:	Screwed 3" and smaller No bending permitted
PIPE:	Galvanized carbon steel, ASTM A53: Threaded, schedule 40, butt welded seam 2" and smaller. Threaded schedule 40, butt welded seam or seamless, 2 1/2" and 3".
FITTINGS:	150 lb., ANSI B16.3, ASTM A197, galvanized malleable iron, banded, threaded ends.
UNIONS:	150 LB., ASTM A197, galvanized malleable iron, integral iron seat, ground joint, threaded ends.
FLANGES:	150 lb., ANSI B16.5, ASTM A105, Grade 1, galvanized forged carbon steel, threaded. Where bolting to flat face cast iron flanges, steel flanges shall be furnished with a flat face. Others shall be raised face
ORIFICE FLANGES:	Instrument item.
BOLTING:	See attached Fastener Specification F03.
GASKETS:	See attached Gasket Specification G02.

Issue Date: 12/01/89

Revision Date: 04/10/92

Approved by Gerald Kirner on 11/09/2005

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	FASTENER	SPEC NO: F03
	MATERIAL SPECIFICATION	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Hex Bolt, low or medium carbon steel, ASTM A307 Grade B. 1/4" through 4" Proof load 55,000 psi. 1/4" through 4" Tensile strength: 60,000 psi minimum, 100,000 psi maximum. Zinc plated. Threads to be UNC unless specified UNF bolts to include (1) heavy hex nut, ASTM A563, Grade A.

Issue Date	Revision Date	Approved By	Approval Date
September 30, 2021		Robert Sprowls	September 30, 2021

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 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION GASKET	SPEC NO: G-46
	1/8" EPDM RUBBER (FDA)	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	EPDM, Color: Off-White, 1/8" thick.
RATING:	Durometer (Shore A +/- 5): 60
MANUFACTURER:	Garlock or equal.
SIZES:	Pipe gasket flange dimension per ANSI B16.21
MODELS:	Garlock- 8316 or equal.
SPECIFICATIONS:	Meets FDA Requirements
SERVICE CONDITIONS:	Temperature: -40 thru 300 degrees F. Pressure: 250 psig

Issue Date	Revision Date	Approved By	Approval Date
August 5, 2021		Robert Sprowls	August 5, 2021

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 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION PRESSURE INDICATING GAGES	SPEC NO: IS008
	PI-213 TO PI-218; PI-448 TO PI-560	

SAP PART NUMBER:																																																																
CCC DRAWING NUMBER:																																																																
MATERIAL:	As listed below: <table><tr><td>Case:</td><td colspan="3">4-1/2" size, stainless steel, steel, brass, aluminum and phenol.</td></tr><tr><td>Socket:</td><td colspan="3">1/2" NPT male bottom connection, stainless steel.</td></tr><tr><td>Dial:</td><td colspan="3">White litho with black figures.</td></tr><tr><td>Pointer:</td><td colspan="3">Balanced micrometer.</td></tr><tr><td>Bourdon Tube:</td><td colspan="3">Stainless steel.</td></tr><tr><td>Movement:</td><td colspan="3">Stainless steel and Delrin.</td></tr><tr><td>Accuracy:</td><td colspan="3">1% of full range.</td></tr><tr><td>Liquid Fill:</td><td colspan="3">None</td></tr></table>				Case:	4-1/2" size, stainless steel, steel, brass, aluminum and phenol.			Socket:	1/2" NPT male bottom connection, stainless steel.			Dial:	White litho with black figures.			Pointer:	Balanced micrometer.			Bourdon Tube:	Stainless steel.			Movement:	Stainless steel and Delrin.			Accuracy:	1% of full range.			Liquid Fill:	None																														
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RATING:	Temperature range of -4 DEG. F. to +150 DEG. F.																																																															
MANUFACTURER:	Ashcroft, WIKA																																																															
MODELS:	Ashcroft "Duragauge" - 1279, WIKA 232.34																																																															
NOTES:	As listed below: <table><tr><td colspan="4">1. Spec. IS008 replaces Spec. No. 7209A-CS263</td></tr><tr><td colspan="4">2. This specification replaces the Specs. listed below.</td></tr></table>				1. Spec. IS008 replaces Spec. No. 7209A-CS263				2. This specification replaces the Specs. listed below.																																																							
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RANGE:	As listed below: <table><tr><td>ITEM NO.</td><td>SCALE RANGE</td><td></td><td>REPLACES THESE ITEMS</td></tr><tr><td>PI-213</td><td>0-15 PSIG</td><td>PI-101,7</td><td>SPEC. No. 7209A-CS161,2 (IS001,2)</td></tr><tr><td>PI-214</td><td>0-30 PSIG</td><td>PI-102,8</td><td>SPEC. No. 7209A-CS161,2 (IS001,2)</td></tr><tr><td>PI-215</td><td>0-60 PSIG</td><td>PI-103,9</td><td>SPEC. No. 7209A-CS161,2 (IS001,2)</td></tr><tr><td>PI-216</td><td>0-100 PSIG</td><td>PI-104,10</td><td>SPEC. No. 7209A-CS161,2 (IS001,2)</td></tr><tr><td>→PI-217</td><td>0-160 PSIG</td><td>PI-105,11</td><td>SPEC. No. 7209A-CS161,2 (IS001,2)</td></tr><tr><td>PI-218</td><td>0-200 PSIG</td><td>PI-106,12</td><td>SPEC. No. 7209A-CS161,2 (IS001,2)</td></tr><tr><td>PI-448</td><td>0-300 PSIG</td><td></td><td></td></tr><tr><td>PI-557</td><td>0-300 PSIG *</td><td></td><td></td></tr><tr><td>PI-449</td><td>0-400 PSIG</td><td></td><td></td></tr><tr><td>PI-556</td><td>0-400 PSIG *</td><td></td><td></td></tr><tr><td>PI-450</td><td>0-800 PSIG</td><td></td><td></td></tr><tr><td>PI-558</td><td>0-800 PSIG *</td><td></td><td></td></tr><tr><td>PI-559</td><td>0-1500 PSIG</td><td></td><td></td></tr><tr><td>PI-560</td><td>0-1500 PSIG *</td><td></td><td>*With Steam Coil Siphon</td></tr></table>				ITEM NO.	SCALE RANGE		REPLACES THESE ITEMS	PI-213	0-15 PSIG	PI-101,7	SPEC. No. 7209A-CS161,2 (IS001,2)	PI-214	0-30 PSIG	PI-102,8	SPEC. No. 7209A-CS161,2 (IS001,2)	PI-215	0-60 PSIG	PI-103,9	SPEC. No. 7209A-CS161,2 (IS001,2)	PI-216	0-100 PSIG	PI-104,10	SPEC. No. 7209A-CS161,2 (IS001,2)	→PI-217	0-160 PSIG	PI-105,11	SPEC. No. 7209A-CS161,2 (IS001,2)	PI-218	0-200 PSIG	PI-106,12	SPEC. No. 7209A-CS161,2 (IS001,2)	PI-448	0-300 PSIG			PI-557	0-300 PSIG *			PI-449	0-400 PSIG			PI-556	0-400 PSIG *			PI-450	0-800 PSIG			PI-558	0-800 PSIG *			PI-559	0-1500 PSIG			PI-560	0-1500 PSIG *		*With Steam Coil Siphon
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GENERAL REQUIREMENTS:	Tag each assembly with Item No. and Service.																																																															

Issue Date: 01/01/89

Revision Date: 12/16/2005

Approved by Gerald Kirner on 03/21/2006

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Bourdon Tube Pressure Gauges Solid-Front Process Gauge - SS Wetted Parts

→ **Type 232.34 - Dry Case**

Type 233.34 - Liquid-filled Case

WIKA Datasheet 23X.34

Applications

- For applications with high dynamic pressure pulsations or vibration a liquid filled case and socket restrictor are available
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petrochemical, power stations, mining, on and offshore, environmental technology, mechanical engineering and plant construction

Special features

- Excellent load-cycle stability and shock resistance
- Solid front thermoplastic case
- Positive pressure ranges to 30,000 psi
- All lower mount connection gauges are factory prepared for liquid filling

(LBM: must install membrane prior to field filling)

Standard Features

Design

ASME B40.100

Sizes

4½" & 6" (115 & 160 mm) dial size

Accuracy class

± 0.5% of span (ASME B40.100 Grade 2A)

→ ± 1.0% of span (ASME B40.100 Grade 1A)
(for 20,000 psi range and above)

Ranges

Vacuum / Compound to 200 psi

Pressure from 15 psi to 30,000 psi

or other equivalent units of pressure or vacuum

Working pressure

Steady: full scale value

Fluctuating: 0.9 x full scale value

Short time: 1.5 x full scale value

Operating temperature

Ambient: -40°F to +150°F (-40°C to +66°C) - dry

-4°F to +150°F (-20°C to +66°C) - glycerine filled

-40°F to +150°F (-40°C to +66°C) - silicone filled

Medium: max. +212°F (+100°C) (See Note 1 on reverse)

Temperature error

Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% for every 18°F (10°C) rising or falling. Percentage of span.



Bourdon Tube Pressure Gauge Model 232.34

Weather protection

Weather resistant (NEMA 3 / IP54) - without membrane

→ Weather tight (NEMA 4X / IP65) - dry case or filled case with membrane installed

Pressure connection

Material: 316L stainless steel

Lower mount (LM) or lower back mount (LBM)
1/4" or 1/2" NPT with M4 internal tap

Restrictor

Material: Stainless steel (0.6 mm)

Bourdon tube

Material: 316L stainless steel

≤ 1,000 PSI: C-type

≥ 1,500 PSI: helical type

Movement

Stainless steel. Internal stop pin at 1.3 x full scale

Overload and underload stops - standard

Dampened movement - optional

Dial

White aluminum with black lettering, stop pin at 6 o'clock

Pointer

Black aluminum, adjustable

Case

Black fiberglass-reinforced thermoplastic (POCAN)

Solid front, blowout back

Turret-style case with built in rear flange lugs

Window

Clear acrylic with Buna-N gasket

Case filling

~~Glycerine 99.7% — Type 233.34~~

Cycle testing

400,000 - 2,000,000* cycles, depending upon pressure range

* Liquid filled

Note 1: The maximum continuous media temperature for this gauge is 212°F. However, higher temperatures can be maintained safely for short term exposure per table to the right. The user should consider temperature error and gauge component degradation when exposing gauge to any media or ambient temperature above 212°F. For continuous use in either ambient or media temperatures above 212°F, a diaphragm seal or other heat dissipating means is recommended. Consult factory for technical inquiries and application assistance.

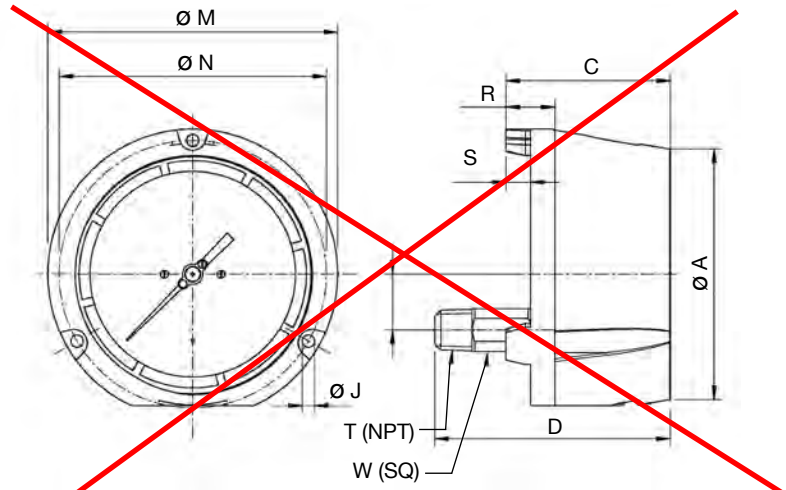
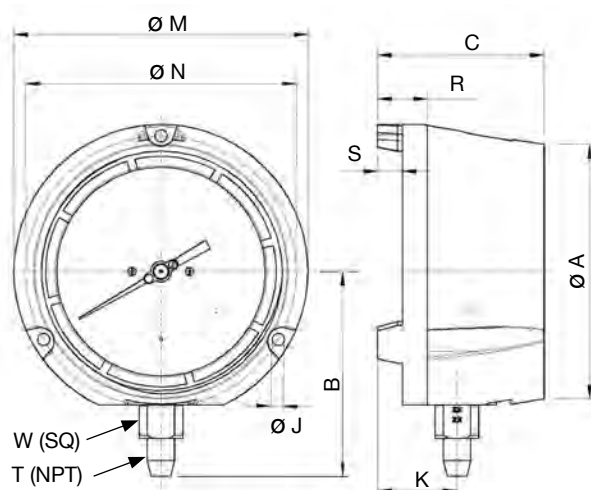
Optional extras

- ~~■ Silicone dampened movement~~
- ~~■ Panel mounting adaptor kit (field assembled)~~
- ~~■ Silicone case filling~~
- ~~■ Halocarbon case filling~~
- ~~■ Cleaned for oxygen service~~
- ~~■ Instrument glass or safety glass window~~
- ~~■ Drag pointer (maximum reading indicator)~~
- ~~■ Alarm contacts switches (magnetic or inductive)~~
- ~~■ Special process connections~~
- ~~■ Custom dial layout~~
- ~~■ External zero adjustment~~

Short term, intermittent maximum media temperature limits
(Optional glass window required for all these temperatures)

500°F (260 °C) -	Dry Gauge
250°F (130°C) -	Liquid filled gauge
300°F (150°C) -	Dampened movement gauge

Dimensions



Size		A	B	C	D	J	K	L	M	N	R	S	T	W	Weight ¹	
4.5"	mm	128	103	84	120.3	6.3	40	28.5	148	136.5	25	12.5		22	2 lb.	dry
	in	5	4.06	3.31	4.74	0.248	1.57	1.12	5.83	5.37	0.99	0.49	1/2"	0.87	3 lb.	filled
6"	mm	164	122.5	88	123.4	7.1	40.2	28.5	190	177.8	25.4	12.7		22	3 lb.	dry
	in	6.46	4.82	3.46	4.86	0.28	1.58	1.12	7.5	7	1	0.5	1/2"	0.87	4 lb.	filled

¹ Weight without optional accessories

Ordering information

Pressure gauge model / Nominal size / Scale range / Size of connection / Optional extras required
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.
Modifications may take place and materials specified may be replaced by others without prior notice.



WIKAL Instrument Corporation

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E-Mail info@wika.com
www.wika.com

	MATERIAL SPECIFICATION RUPTURE DISKS	SPEC NO: IS044
	DWC GRAPHITE RUPTURE DISKS	

SAP PART NUMBER:																																								
CCC DRAWING NUMBER:																																								
MATERIAL:	Impervious graphite Type: Standard.																																							
FLANGES:	150 # ANSI RF or FF companion flanges (furnished by others)																																							
MANUFACTURER:	Zook, BS&B																																							
SIZES:	As listed below: <table><tr><th>ITEM NO.</th><th>SIZE</th><th>BURSTING PRESSURE</th></tr><tr><td>PSE-157</td><td>2"</td><td>75 PSIG +/- 5%</td></tr><tr><td>PSE-170</td><td>2"</td><td>125 PSIG +/- 5%</td></tr><tr><td>PSE-252</td><td>3"</td><td>75 PSIG +/- 5%</td></tr><tr><td>PSE-307</td><td>3"</td><td>100 PSIG +/- 5%</td></tr><tr><td>PSE-577</td><td>3"</td><td>125 PSIG +/- 5%</td></tr><tr><td>PSE-305</td><td>3"</td><td>150 PSIG +/- 5%</td></tr><tr><td>PSE-605</td><td>3"</td><td>200 PSIG +/- 5%</td></tr><tr><td>PSE-582</td><td>4"</td><td>75 PSIG +/- 5%</td></tr><tr><td>PSE-583</td><td>4"</td><td>100 PSIG +/- 5%</td></tr><tr><td>PSE-580</td><td>4"</td><td>125 PSIG +/- 5%</td></tr><tr><td>PSE-581</td><td>4"</td><td>150 PSIG +/- 5%</td></tr><tr><td>PSE-606</td><td>4"</td><td>200 PSIG +/- 5%</td></tr></table>	ITEM NO.	SIZE	BURSTING PRESSURE	PSE-157	2"	75 PSIG +/- 5%	PSE-170	2"	125 PSIG +/- 5%	PSE-252	3"	75 PSIG +/- 5%	PSE-307	3"	100 PSIG +/- 5%	PSE-577	3"	125 PSIG +/- 5%	PSE-305	3"	150 PSIG +/- 5%	PSE-605	3"	200 PSIG +/- 5%	PSE-582	4"	75 PSIG +/- 5%	PSE-583	4"	100 PSIG +/- 5%	PSE-580	4"	125 PSIG +/- 5%	PSE-581	4"	150 PSIG +/- 5%	PSE-606	4"	200 PSIG +/- 5%
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MODELS:	Zook - Mono Type Disk, BS&B - Monobloc Model MB																																							
SPECIFICATIONS:	ASME UD stamp required.																																							
NOTES:	As listed below: 1. Tag with Item No. and Service. 2. Vacuum Support: Furnish for disks with bursting pressure of 15 psig or less																																							
SERVICE CONDITIONS:	As listed below: <table><tr><td>Fluid Under Disks</td><td>Water</td></tr><tr><td>Pressure Fluctuation:</td><td>Back Pressure:</td></tr><tr><td>Temperature:</td><td>40 to 150 degrees F.</td></tr><tr><td>Operating Pressure:</td><td>80% of bursting pressure.</td></tr><tr><td>Back Pressure:</td><td>Atmospheric.</td></tr></table>	Fluid Under Disks	Water	Pressure Fluctuation:	Back Pressure:	Temperature:	40 to 150 degrees F.	Operating Pressure:	80% of bursting pressure.	Back Pressure:	Atmospheric.																													
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Issue Date	Revision Date	Approved By	Approval Date
September 29, 2022		Robert Sprowls	September 29, 2022

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ZOOK®

Graphite Rupture Disks



ASME
CERTIFIED



ISO 9001



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E-Mail **zook@zook.cc**
www.zook.cc

ZOOK Rupture Disks provide many exclusive performance and service benefits. Information contained in this bulletin **should not** be applied to other rupture disks including impervious graphite designs of similar appearance.

ZOOK[®] Graphite Rupture Disks...

protect equipment and personnel from the effects of overpressurization in static and dynamic pressurized systems. The disk is designed to rupture at a predetermined burst rating when installed in a piping system.

Each disk is made from a single piece of graphite, a high-purity form of carbon, which is impregnated with phenolic resin. The resulting material, called impervious graphite, is impermeable and is resistant to most corrosives.

Easy to install and maintain, disks:

- are tamperproof
- have no springs or moving parts
- mount directly between standard flanges without special holders.

Options and accessories increase the flexibility of standard disks. TFE coated disks offer stick-resistant surfaces. Special gaskets and stainless steel armor are also available. Spacer rings let you replace metal rupture disks without requiring piping modification. For unique applications, our engineering department will work with you to create a custom-designed disk.

ZOOK is the first and largest company in the world committed to manufacturing **QUALITY** impervious graphite rupture disks, through product innovations and superior service. ZOOK is the first graphite rupture disk manufacturer to earn the ASME Code UD symbol stamp and certificate of authorization. Also, ZOOK's quality management system is certified to ISO 9001 and TÜV standards.

In addition:

- ZOOK offers 1-day shipment of disks with over 100 rating and diameter combinations. Service personnel are also available 24 hours-a-day, 7 days-a-week, 365 days-a-year to handle your emergency shut-down needs

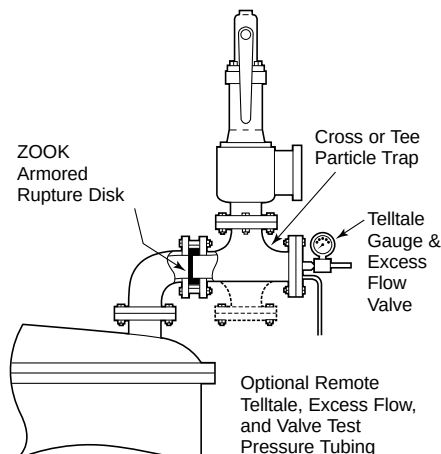
- produces a standard line of graphite disks as small as 1/2" diameter and disks with burst ratings as low as 0.25 psig
- tests disk performance at cryogenic and elevated temperatures

Applications

ZOOK Disks enhance **SAFETY** in chemical, petrochemical, pharmaceutical, food, medical, and related processing systems around the world. Other applications include: storage tanks, tank trailers, rail cars, barges, pressured switchgear, and air conditioning compressors.

ZOOK Disks also increase *system efficiency* by:

- eliminating back pressure effects on overpressure devices in common vent lines
- solving sourcing and cost problems for disks used with highly corrosive fluids
- offering ultra low rated pressure settings
- preventing relief valves from fouling and leaking



Installation

ZOOK Graphite Rupture Disks fit directly between standard flanges without the need for additional holders.

A flow arrow on each disk indicates proper orientation.

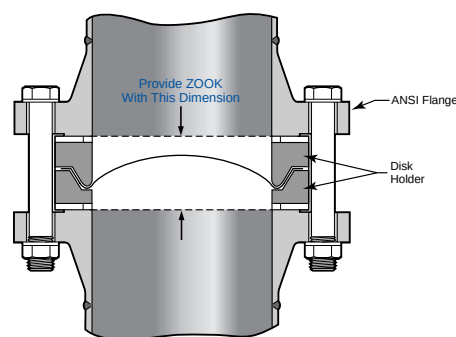
Armor provides additional protection from extraneous stress to the disk resulting from misaligned piping. Armor is standard on selected diameter and burst ratings and is required in fire case and toxic services. See **ARMOR**, page 7, for more information.

Gaskets should be ring type, non-metallic, relatively soft, and properly sized. See **GASKETS**, page 8, for more information.

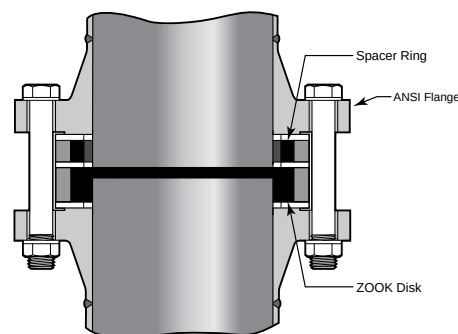
Normal good practice should be followed when making flange connections. Particular attention should be paid to ensure:

- concentric alignment of the disk and gaskets
- uniform cross-tightening of flange bolts
- adequate support of piping to withstand external loading and thrust during blowdown
- protection of personnel and equipment against high velocity open discharge of process material and rupture disk particles

METAL Rupture Disk Installation



Graphite Rupture Disk Replacement



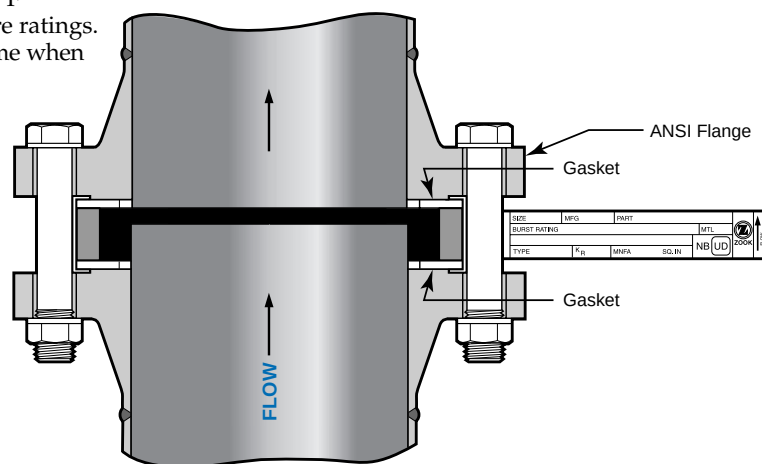
When replacing a metal rupture disk with a ZOOK Graphite Rupture Disk, a graphite lined armored spacer ring can be provided to fill the space of existing flange face-to-face distance, eliminating the need for piping modifications.

Detailed installation instructions are provided with each disk.

MONO Type Disks

the best choice for low and intermediate burst ratings

- Sizes 1/2" thru 24" diameters
 - Designed to fit ANSI Class 150 flanges (Higher ratings to fit Class 300 flanges are furnished in the INVERTED and DUPLEX Type Disks)
 - Burst ratings 0.25 to 150 psig
 - 0% manufacturing range
 - Operating pressures to 90% of the disk's marked burst pressure (Consult ZOOK for operating ratio for burst pressures below 15 psig)
 - Temperature ratings -290°F to +700°F (-179°C to +371°C). Maximum temperature rating without insulation is 430°F (221°C) or 700°F (371°C) with insulation. Consult ZOOK for higher temperature ratings. The specified temperature shall be at the disk location at the time when the disk is expected to rupture
 - Counterbored side of the disk contacts the process media
 - Vacuum supports are available for ratings below 25 psig
 - May be configured to withstand high back pressure generated in closed piping systems – request Bak-Pressure™ bulletin
 - Stocked MONO Disks, ready for immediate shipment
 - Sizes: 1", 1-1/2", 2", 3", 4", 6", 8" to fit ANSI Class 150 flanges
 - Burst Ratings: 10, 15, 20, 25, 30, 40, 50, 75, 100, 125, 150 psig @ 72°F (22°C)
- Note: Sizes 6" and 8" with burst ratings 125 and 150 psig @ 72°F (22°C) are stocked in INVERTED type
- ASME UD stamping available



Certified Flow Resistance Factor (K_f)

Support Style	K_f
MONO – no support	0.26
MONO – with bar	2.40
MONO – with cross	5.40
MONO – with ring	6.44
MONO – with plate	15.70

Required Vacuum Support Style for Full Vacuum Service

Size	Burst Rating	Support Style
1"	below 25 psig	MONO – with ring
1-1/2"	below 25 psig	MONO – with bar
2" - 14"	9 to 25 psig	MONO – with bar
2" - 14"	5 to below 9 psig	MONO – with cross
2" - 14"	below 5 psig	MONO – with plate

Specifications – ANSI Class 150

Disk Sizes	Minimum net flow area (MNFA) Sq. inches					Disk Dimensions				Burst Ratings psig	
	Full Bore	Vacuum support style				Diameter		Thickness*			
											
		Ring	Bar	Cross	Plate	I.D.	O.D.	Standard Disk	Insulated Unit	Min.	Max.
1/2"	0.19	N/A	N/A	N/A	N/A	1/2"	1-3/4"	5/8"	1-3/4"	25	150
3/4"	0.44	N/A	N/A	N/A	N/A	3/4"	2-1/8"	5/8"	1-3/4"	25	150
1"	0.78	0.44	0.60	0.47	0.32	1"	2-1/2"	7/8"	2-1/4"	10	150
1-1/2"	1.76	N/A	1.34	1.05	0.72	1-1/2"	3-1/4"	7/8"	2-1/4"	7	150
2"	3.14	N/A	2.39	1.86	1.30	2"	4"	7/8"	2-1/4"	3	150
3"	7.06	N/A	5.56	4.31	2.95	3"	5-1/4"	7/8"	2-1/4"	2	150
4"	12.56	N/A	10.56	8.81	5.47	4"	6-3/4"	7/8"	2-1/4"	1.5	150
6"	28.27	N/A	22.27	17.27	12.05	6"	8-5/8"	7/8"	2-1/4"	1	100
8"	50.26	N/A	40.26	31.82	21.14	8"	10-7/8"	1-1/8"	2-3/4"	0.50	100
10"	78.53	N/A	63.53	50.78	32.66	10"	13-1/4"	1-1/2"	3-3/8"	0.25	100
12"	113.09	N/A	89.09	69.09	47.24	12"	16"	2"	4-3/8"	0.25	75
14"	137.88	N/A	108.06	83.31	58.07	13-1/4"	17-5/8"	2-1/4"	4-7/8"	0.25	50
16"	182.65	N/A	144.52	112.65	84.49	15-1/4"	20-1/8"	2-1/2"	5-3/8"	0.25	50
18"	233.70	N/A	181.95	153.70	104.31	17-1/4"	21-1/2"	2-3/4"	5-7/8"	0.25	50
20"	291.03	N/A	233.28	184.53	122.49	19-1/4"	23-3/4"	3"	6-3/8"	0.25	40
24"	424.55	N/A	354.80	294.05	190.61	23-1/4"	28-1/8"	3"	6-3/8"	0.25	25

*Standard disk thickness does not include gaskets.

Insulated unit thickness includes all gaskets

Note: Maximum pressure rating of ANSI Class 150 flanges is 290 psig @ 100°F (38°C).

The maximum pressure rating is lower at higher temperatures.

Reference ASME/ANSI B16.5

ZOOK service personnel are available 24 hours-a-day, 7 days-a-week, 365 days-a-year

Technical Data

Testing Method

Standard disks are rated at the specified burst pressure without applying a Manufacturing Design Range (MDR) by bursting two or more disks to establish burst accuracy. Where higher than room temperature (+40°F to +100°F) service is specified, oven tests can be conducted, or disks can be room temperature tested with compensation made using a temperature curve developed specifically for our disks. (These disks are designated *Chart Compensated Disks*.)

ASME disks are tested at the specified coincident temperature.

ASME Code and Jurisdictional Regulations

Most jurisdictions require ASME Code compliance on Boiler and Pressure Vessel construction. All pressure vessels within the scope of the ASME Code Section VIII, Div. 1 shall be provided with pressure relief devices. It is the responsibility of the **user** to ensure that the required devices are properly installed prior to initial operation of the pressure vessels.

If company policy or jurisdictional regulation requires ASME Code compliance, the rupture disk devices used for pressure vessel overpressure protection shall bear the ASME Code UD symbol. The UD marking is the manufacturer's declaration that the device was manufactured in full compliance with the ASME Code.

Disks specified to ASME Code requirements are rated using a 0% MDR unless a special MDR is specified and agreed upon. 0% MDR disks are marked with the specified burst rating. Refer to the certified type for the flow resistance factors (K_R) and the Minimum Net Flow Area (MNFA).

Pressure Ratings and Burst Tolerances

Burst ratings range from 0.25 psig to above 1000 psig for sizes 1/2" thru 24". Refer to minimum and maximum values in tables provided for each disk. Standard burst tolerances are:

Pressure Rating psig @ 72°F (22°C)	Burst Tolerance
Above 40	±5%
15 to 40	±2.0 psi
5 to less than 15	±1.0 psi
Above 1 to less than 5	±0.75 psi
1 or less	+0.75 psi / -0

Consult ZOOK for tighter burst tolerance

Corrosion Resistance

Depending on the type and options, disks handle almost any corrosive except free fluorine. See CORROSION Guide, page 8.

Vacuum

Disks are self-supporting up to full vacuum at burst ratings of 25 psig and higher. At lower pressures, integral vacuum supports are available only for MONO Disks. External vacuum supports are available for DUPLEX Disks. Consult ZOOK for partial vacuum services.

Dimensional Standards

Standard disks fit directly between ANSI Class 150 or 300 flanges with flat or raised faces. Flat ring gaskets are required and can be attached to the disk before shipment. Consult ZOOK for flange requirements other than ANSI.

Capacity and Flow Resistance

Full bore opening at time of rupture is a consistent characteristic of ZOOK Disks and results in very low flow resistance values (K_R). Refer to K_R values in tables provided for each disk type.

Service Life

Indefinite service life is normal in static systems. Replacement is unnecessary at operating-pressure to burst-rating ratios to 90%. In cycling service, this ratio should be lowered.

Burst Sensors

For remote and quick detection of a ruptured condition, ZOOK offers the ZENSOR™: Rupture disk and sensing element are integral parts of the electrical circuit to eliminate false readings. Model BA: An external re-usable and replaceable indicator. Specify Model BA-L for optional leak detection.

Armor

Armor is available on any standard style, size and rating of graphite rupture disk. Standard material is Carbon Steel (316SS optional). Armor is required on the following:

- Disks for ANSI Class 300 flanges
- TWO-WAY Type Disks
- Disks rated for temperatures above 338°F (170°C), regardless of disk style or flange class
- Disks for ANSI Class 150 flanges. See table at right with the following sizes and burst ratings:

Sizes	Rated Over psig @ 72°F (22°C)
1/2" - 3"	150
4"	100
6" - 10"	75
12" - 24"	50

Where fire or blowdown temperatures exceeding 338°F (170°C) are design considerations, armor is required. Armored disks typically withstand the same conditions, i.e. blowdown temperatures, as the piping.

Disks not covered above are furnished unarmored unless armor is specifically ordered. Armor is highly recommended for:

- added safety
- greater reliability
- easier installation

WARNING

If a disk ruptures, material may:

- vent at high velocity with significant reaction thrust force
- contain disk particles and other solids and liquids
- be toxic or flammable.

The end user must make provisions to prevent personal injury and equipment damage. Use of disks described in this bulletin are intended for use only by persons with requisite technical skill and at their own discretion and risk. Because application, installation, and use are beyond our control, we make no warranties expressed or implied and do not assume any liability exceeding purchase price of the disk.

It is the responsibility of the end user to fully understand his process and determine the disk needed to properly protect the system.

Gaskets



Gaskets used with graphite disks are stocked in the following materials: Neoprene, Non-asbestos, solid PTFE, and PTFE envelope. Gaskets can be supplied loose or attached to the disk (Note: field installation of gaskets NOT recommended on TWO-WAY Disks or Insulated Units)

When supplying your own gaskets, follow dimensions in the chart, especially the inside diameter which provides proper clearance to ensure accurate burst. 1/8" thick gasket is recommended. Gaskets for INSULATED Disks are made from high-temperature material and are always supplied attached.

Gasket Dimensions

Disk Size	Flanges			
	ANSI Class 150		ANSI Class 300	
	I.D.	O.D.	I.D.	O.D.
1/2"	3/4"	1-3/4"	3/4"	2"
3/4"	1"	2-1/8"	1"	2-1/2"
1"	1-5/16"	2-1/2"	1-5/16"	2-3/4"
1-1/2"	1-29/32"	3-1/4"	1-29/32"	3-5/8"
2"	2-1/2"	4"	2-1/2"	4-1/4"
3"	3-3/4"	5-1/4"	3-3/4"	5-3/4"
4"	5"	6-3/4"	4-3/4"	7"
6"	7-1/8"	8-5/8"	7-1/8"	9-3/4"
8"	8-7/8"	10-7/8"	9"	12"
10"	11-5/8"	13-1/4"	N/A	N/A
12"	13-3/4"	16"	N/A	N/A
14"	14-1/2"	17-5/8"	N/A	N/A
16"	17"	20-1/8"	N/A	N/A
18"	19-1/2"	21-1/2"	N/A	N/A
20"	21-3/4"	23-3/4"	N/A	N/A
24"	25"	28-1/8"	N/A	N/A

Corrosion Guide

Refer to the chart to determine which disk is best suited for your system fluid. Corrosives not shown can typically be accommodated by our unlined Graphite Disks. If in doubt, use the DUPLEX Disk or contact ZOOK to obtain a material sample for testing.

INSULATED Disks cannot be used with liquids, hydro-fluoric and phosphoric acids or concentrated alkalis.

	MONO and INVERTED Disks	DUPLEX Disks*
Aluminum Hydroxide	No	Yes
Ammonium Hydroxide	No	Yes
Bromine (free)*	No	Yes
Calcium Chlorate	No	Yes
Calcium Hydroxide	No	Yes
Calcium Hypochlorite	No	Yes
Chloral	No	Yes
Chlorine (free)	No	Yes
Chromic Acid (plating)	No	Yes
Fluorine (free)	No	No
Hydrofluoric Acid	No	Yes
Iodine (free)	No	Yes
Molten Metal Alkalis	Yes	Yes
Nitric Acid	No	Yes
Oleum	No	Yes
Ozone	No	Yes
Potassium Chlorate	No	Yes
Potassium Hydroxide	No	Yes
Potassium Hypochlorite	No	Yes
Sodium Chlorate	No	Yes
Sodium Hydroxide	No	Yes
Sodium Hypochlorite	No	Yes
Sulfur Trioxide	No	Yes
Sulfuric Acid	No	Yes

*Upon request we will furnish liners in Kynar, FEP, PFA, or PTFE

Other Rupture Disks

Metal Rupture Disks and Disk Holders...

- Forward and Reverse-Acting Designs
- Full range of burst ratings and materials
- Non-fragmenting designs available
- Available with insert holders for bubbletight, metal-to-metal sealing

Sanitary Rupture Disks...

protect sanitary piping systems

- Metal or Graphite materials
- Ideal for food, pharmaceutical, medical, biotech other high purity systems
- Full range of burst ratings
- Comply with FDA requirements
- Full size range available
- No special holders or fittings required

Rail Car Rupture Disks...

can be used for a full year without change-out (regardless of number of trips)

- 60, 100, 135 or 165 psig burst ratings
- Meets or exceeds AAR A5.03 and A5.04 specifications
- Steel armored for added safety and greater reliability

Bak-Pressure™ Disks...

guard against excess pressure in common piping systems

- Burst ratings from 0.25 to over 1000 psig
- Sizes from 1/2" thru 24"

Transportation Rupture Disks...

protect over-the-road tank trailers and intermodal tanks

- Sizes from 2" thru 4"
- Metal or graphite materials available
- Stocked burst ratings: 30, 35, 40, 45, and 50 psig in graphite disks
- Last up to one year without change-out

For more information on any ZOOK Graphite Rupture Disks or to place an order contact:



ZOOK Enterprises, LLC
16809 Park Circle Drive
Box 419
Chagrin Falls, OH 44022

Local 440.543.1010
U.S.A. Toll Free 800.543.1043
Fax 440.543.4930
E-Mail zook@zook.cc
www.zook.cc

	MATERIAL SPECIFICATION PRESSURE SWITCH	SPEC NO: IS052
	PDS-294	

SAP PART NUMBER:	1001573
CCC DRAWING NUMBER:	
MATERIAL:	Dual indicating differential pressure switch with center zero indicating gage. MATERIALS: Case: Cast aluminum. Diaphragm: Buna-N Springs: 316 stainless steel. Magnet: Ceramic coated CASE: Type Enclosure: NEMA 4X Pressure Connections: 1/4" FNPT. Electrical Connections: 1/2" FNPT. Style: Panel Mount. MEASURING ELEMENT: Type: Diaphragm-Magnet Maximum Line Pressure: 500 PSIG. Maximum Range: 20-0-20 PSID. Dial: 4" diameter (minimum), calibrated. SWITCH: Type: Two SPST Rating: 0.7 amp @ 125 VAC Adjustment: External over range shown on the nameplate. Accuracy: +/-3% (1.2 PSI) Set Point: Factory set, +/- 18 PSIG differential pressure, switches to be wired.
MANUFACTURER:	Orange Research Inc.
MODELS:	Orange model # 1518 DGS-1A-4.5F-A-A-20-0-20
NOTES:	1 - Tag with item number.

Issue Date: 12/01/89

Revision Date: 04/19/2011

Approved by Joseph P. McMahon on 04/19/2011

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0-5" H₂O to 0-50 psid Diaphragm Sensor for Liquids or Gases

Features

- Low DP ranges at high line pressures, down to 0-5 inches H₂O
- Rugged, weather-proof design
- Gauge, switch and transmitter versions
- Popular in filtration, flow and level measurements

Select these diaphragm sensor models where low differential pressures exist. The popular 1516 model measures from 0-1 psid up to 0-50 psid. Our 1800 series models include our most sensitive diaphragm which can measure from 0-5" H₂O to 0-8 psid. We also offer compound range models with a zero center.

The diaphragm sensor separates the high and low-pressure ports making them popular for gases as well as liquids. There is no bypass between these ports as with our piston models.

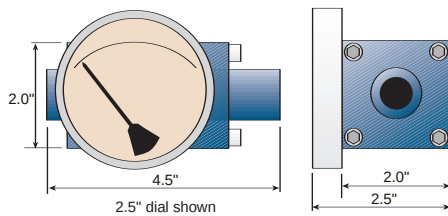
As differential pressure changes the diaphragm sensor magnet moves proportionally. This movement is tracked by a pointer magnet, which rotates, relaying the reading onto an easy-to-read 2.5 to 6 inch dial.

Select from a variety of options such as follower pointers, red arcs and mounting brackets along with switch, relay or transmitter outputs. More details on these models can be found on our DP introduction pages 2-5. Electrical details are on pages 26-27.

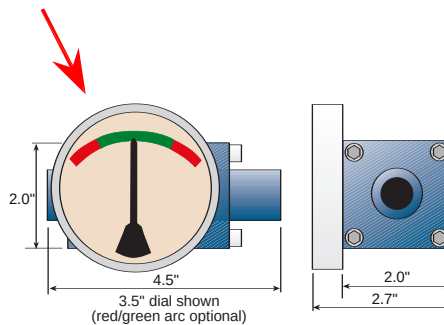


Dimensions

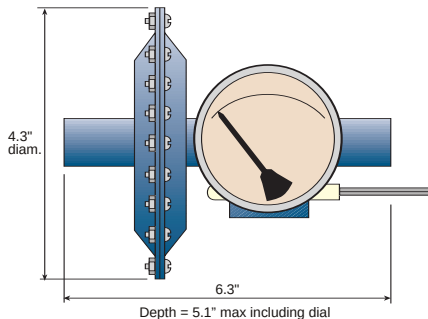
Detailed drawings on website.



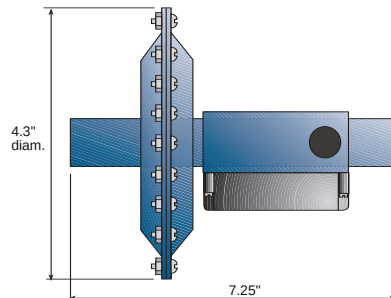
1516DG



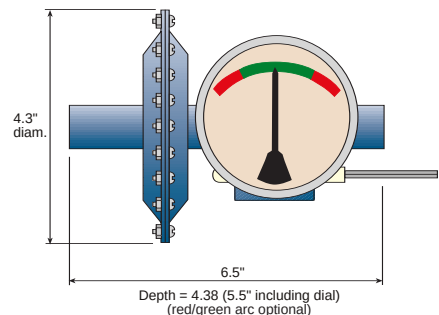
1518DG



1831DGS



1833DS



1835DGS

Specifications (Detailed Specification Sheets on Website)

Model	Differential pressure range	Maximum line pressure/temperature	Accuracy (F.S.) (Ascending)	Porting (Many porting types available)	Electrical Available*
1516DG/DGS/DS	0-1 to 0-50 psid (0-0.07 to 0-3.3 bar)	1500 psig (100 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches Class 1 Div. 2
1518DG/DGS	10-0-10 to 50-0-50 psid (0.5-0-0.5 to 3.3-0-3.3 bar)	1500 psig (100 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches Class 1 Div. 2
1831DG/DGS	0-5" H ₂ O to 0-8 psid (0-125 mm H ₂ O to 0-0.5 bar)	Aluminum body 100 psig (7 bar)/200°F (93°C) Stainless steel body 150 psig (10 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches No enclosure
1833DGS/DS/DGT/DT	0-5" H ₂ O to 0-8 psid (0-125 mm H ₂ O to 0-0.5 bar)	Aluminum body 100 psig (7 bar)/200°F (93°C) Stainless steel body 150 psig (10 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches 1 relay transmitter Class 1 Div.
1835DG/DGS/DS	5-0-5" H ₂ O to 8-0-8 psid (125 mm-0-125 mm H ₂ O to 0.5-0-0.5 bar)	Aluminum body 100 psig (7 bar)/200°F (93°C) Stainless steel body 150 psig (10 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches No enclosure

D=Diaphragm G=Gauge S=Switch T=Transmitter

*NEMA 4X switch models have a 1/2 inch NPT conduit port as standard. A DIN 43650A-PG11 with mating connector is optional, rated IP65 & NEMA 4X

How to Order

Select from each of the applicable categories to construct a model number. Use the model number when ordering or obtaining additional information and pricing from Orange Research or your local distributor.

Reordering? You must supply the Part Number from your instrument label.

Sample Model Number
1516DGS - 1A - 2.5B - A 0-1 psid, 1, 3, E

1516DGS	1A	2.5B	A	0-1 psid	1, 3, E
Model	Pressure Body	Dial Case	Electrical	Range	Options (more on pg. 5)
1516DG	<i>In-line ports:</i>	2.5B = 2.5" basic	A = SPST, N.O.	Model 1516:	1 = 1/2" NPT
1516DGS	1A = aluminum	3.5B = 3.5" basic	B = SPST, N.C.	0-1, 0-2, 0-3, 0-5, 0-8,	2 = plastic lens
1516DS	1C = 316 stainless steel	4.5B = 4.5" basic	C = SPDT	0-10, 0-15, 0-20, 0-25,	3 = liquid filled (glycerine)
1518DG	1E = brass	6B = 6.0" basic	A-A = 2 ea. - A	0-30, 0-35, 0-40, 0-50	4 = follower pointer
1518DGS			B-B = 2 ea. - B	psid	5 = Teflon coated magnet/spring
1831DG	<i>Change "1" above to</i>	<i>Change "B" to "F"</i>	C-C = 2 ea. - C	Models 1831 & 1833:	6 = red arc (specify range)
1831DGS	<i>"4" for back ports; to</i>	<i>above for flanged</i>	R2 = relay	0-5", 0-10", 0-15", 0-20",	7 = dual scale (specify both)
1833DGS	<i>"5" for bottom ports</i>	<i>dial case</i>	T1 = transmitter	0-25", 0-30", 0-40",	8 = high temperature
1833DS				0-50", 0-60", 0-80",	Special Diaphragm & Seals
1835DG	<i>1518 & 1800 series in-</i>			0-100", 0-150",	(Buna-N standard):
1835DGS	<i>line only; 1835 SS only</i>			0-200" H ₂ O; 0-8 psid	E = EPDM
1835DS					F = Fluorosilicone
					V = Viton
					T = Teflon (o-ring seals only)
<i>More models above</i>				<i>For compound ranges, see p 5</i>	

	MATERIAL SPECIFICATION STAINLESS STEEL PIPE	SPEC NO: S06
	INSTRUMENT PIPING, HEAT TRACING, ETC.	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Stainless steel tubing and flareless compression fittings, and stainless steel pipe and fittings.
RATING:	150 PSIG @ 365 DEG. F. 300 PSIG @ 100 DEG. F.
CONSTRUCTION:	For tubing systems 1" and smaller. Pipe and screwed pipe fittings to be used for take-off connections on larger pipe, manifolding, connections to screwed instruments, equipment, etc. Tubing to be used for all other piping in the system.
PIPE NIPPLES:	ASTM A312, Type 316, seamless, Schedule 80S, ANSI B36.19, annealed and pickled.
PIPE FITTINGS:	Type 316 stainless steel screwed fittings, dimensions per ANSI B16.3, forged, wrought or cast material rated 150 lb. Camco Fittings Co., or equal.
TUBING:	Type 316 stainless steel seamless tubing, 0.035" wall thickness, annealed and pickled, hardness 70-74 Rockwell "B", 1/4 O.D.
TUBE FITTINGS:	Type 316 stainless steel, flareless compression fittings, Crawford Fitting Company "Swagelok", or equal.

Issue Date: 01/01/89

Revision Date:

Approved by Joseph P. McMahon on 07/24/98

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	MATERIAL SPECIFICATION STAINLESS STEEL PIPE	SPEC NO: S15
	TYPE 316 STAINLESS STEEL PIPE AND FITTINGS	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Type 316 stainless steel pipe and fittings.
RATING:	150 PSIG @ 365 DEG. F. 300 PSIG @ 100 DEG.F.
CONSTRUCTION:	Screwed for 3" and smaller
PIPE:	Threaded, Schedule 40S, ASTM A312, Type316, welded, ANSI B36.19, annealed and pickled.
FITTINGS:	Type 316 stainless steel screwed fittings, general dimensions to conform to ANSI B16.3 for malleable iron screwed fittings. Forged, wrought or cast material rated 150 Lb. @ 365 DEG.F., Camco Fittings Co., or equal.
FLANGES:	Type 316 stainless steel, threaded, MSS-SP-51, 150 Lb. flat face, serrated finish.
ORIFICE FLANGES:	Instrument Item.
BOLTING:	See attached Fastener Specification F03.
GASKETS:	See attached Gasket Specification G02.

Issue Date: 12/01/89

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Approved by Gerald Kirner on 06/21/2001

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SECTION 3

LINING



TAB 1

ABOVE CONE LINING



Specification No. VS7

For

Vessel Lining Application Specification Using Vinyl Ester For Immersion Service

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**SPECIFICATION
FOR
VINYL ESTER VESSEL LINING**

**Specification No. VS7
Revised 8/7/2019 T.A.B.
Rev. 6
Page 2**

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1. QUALITY REQUIREMENTS

- 1.1. Calgon Carbon Corporation relies on the joint effort between supplier and buyer to emphasize conformance to specification. If conflict exists between this specification, drawings, purchase orders, data sheets or appendix documents, it is the responsibility of the supplier to bring such conflict to the attention of Calgon Carbon Corporation for resolution.
- 1.2. All vendors are expected to supply products and services with zero defects. Vendors are encouraged to use error prevention processes in their manufacturing procedures to obtain this goal. Calgon Carbon Corporation prefers to address quality issues prior to, and during the lining process rather than at the end. Where the vendor does not fully meet the requirements of this specification, implementation of a corrective action plan to address any deficiencies will be required in writing and subject to Calgon Carbon Corporation approval.
- 1.3. The vendor agrees to retain objective evidence, including written records of the inspections, measurements and tests performed in the course of blasting, lining, testing, and inspecting. These records shall be made available to the Calgon Carbon Corporation's Quality Inspector for review upon request. Calgon Carbon Corporation may at its discretion use a third party quality inspector for auditing purposes. The vendor's quality department will be notified if this is the course of inspection. Calgon Carbon Corporation requires third party inspectors to perform inspections using the coating manufacture's standards, calibrations and methodologies. All inspectors are to identify themselves at the vendor's facility, inform the vendor of the purpose and scope of the inspection and to conduct themselves in a professional non-confrontational manner.
- 1.4. The vendor shall submit their corporate QA/QC program, QC personnel with contact info and responsibilities. Inspection, testing procedures and documents are to be submitted to Calgon Carbon Corporation for approval. Please send to the attention of Quality Inspector, Equipment and Assembly Plant, at 4301 Grand Ave, Neville Island, PA 15225.

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**SPECIFICATION
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Page 4**

- 1.5. In the event of failure of the lining to withstand the service conditions set forth in Article 4.0, of this specification, the Vendor shall, at his expense, replace the defective materials and workmanship to Calgon Carbon Corporation's satisfaction.

2. SCOPE OF WORK

- 2.1. This specification covers materials, surface preparation, application and testing of protective coatings for internal lining of carbon steel vessels.
- 2.2. The scope of work includes all labor, materials, equipment and services required for surface preparation, lining and testing the vessels indicated on the drawings.
- 2.3. The entire internal surface of the designated vessels including all nozzles and manways shall be lined.
- 2.4. The lining must completely protect the internal metal surfaces from corrosion.

3. REFERENCE DOCUMENTS

- 3.1. Carboline Plasite 4110 Technical Bulletin, Carboline Company's or Hemple TL-220S AR most current version.
- 3.2. When needed use Carboline Plasite PA-3 Specification.
- 3.3. SSPC, "Pictorial Surface Preparation Standards."
- 3.4. SSPC, "Profile Comparative Panels."
- 3.5. NACE Publication RP0288-94, "Recommended Practices for Inspection of Linings on Steel and Concrete."

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**SPECIFICATION
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- 3.6. NACE Publication 6F-166, "Recommended Practices for Inspection of Linings on Steel and Concrete."
- 3.7. D.M. Berger and S.E. Mrox, "Instruments for Inspection of Coatings," ASTM, Journal of Testing & Evaluation, Vol. 4, No.1, 1969.
- 3.8. NACE Publication 6J-162, "Guide to the Preparation of Contracts and Specifications for the Application of Protective Coatings."
- 3.9. NACE Standard RP-01-78, "Design, Fabrication and Surface Finish of Metal Tanks and Vessels to be lined for Chemical Immersion Service."
- 3.10. Ferrous Metals-Preparation Methods
- 3.10.1 Solvent Cleaning (SSPC-SP1): Solvents such as water, mineral spirits, xylol, toluol, ect., are used to remove solvent-soluble foreign matter from the surface of ferrous metal. Rags and solvents must be replenished frequently to avoid spreading the contaminant rather than removing it. Low-pressure (1500-4000 psi) high volume (3-5) gal./min.) water washing with appropriate cleaning chemicals is a recognized "solvent cleaning" method. All surfaces should be cleaned per this specification prior to using hand tools or blast equipment.
- 3.10.2 Hand Tool Cleaning (SSPC-SP2) (SSI-St2): A mechanical method of surface preparation involving wire brushing, scraping, chipping and sanding. Not the most desirable method of surface preparation, but can be used for mild exposure conditions. Optimum performances of protective coatings systems should not be expected when hand tool cleaning is employed.
- 3.10.3 Power Tool Cleaning (SSPC-SP3) (SSI-St3): A mechanical method of surface preparation widely used in industry and involving the use of power sanders or wire brushes, power chipping hammers, abrasive grinding wheels, needle guns, ect. Although usually more effective than hand tool cleaning, it is not considered adequate for use under severe exposure conditions or for immersion applications.

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- 3.10.4 Power Tool Cleaning to Bare Metal (SSPC-SP11): Utilizing same equipment as Power Tool Cleaning to remove all visible coatings and contaminants to bare metal substrate.
- 3.10.5 White Metal Blasting (SSPC-SP5), (SSI-Sa3), or (NACE #1): The removal of all visible rust, mill scale, paint, and contaminants, leaving the metal uniformly whit or gray in appearance. This is the ultimate in blast cleaning. Use where maximum performance of protective coatings is necessary due to exceptionally severe conditions such as constant immersion in water or liquid chemicals.
- 3.10.6 Near White Blast (SSPC-SP10), (SSI-Sa2½), or (NACE #2): In this method all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint, or other foreign matter have been completely removed from the surface by abrasive blasting, except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint of coating. At least 95% of each square inch of surface areas shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above. From a practical standpoint, this is probably the best quality surface preparation that can be expected today for existing plant facility maintenance work.
- 3.10.7 Commercial Blast (SSPC-SP6), (SSI-Sa2), or (NACE #3): All oil, grease, dirt, rust scale and foreign matter are completely removed from the surface and all rust, mill scale and old paint are completely removed by abrasive blasting except for slight shadows, streaks, or discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint of coating that may remain. If the surface is pitted, slight residues of rust or paint may be found in the bottom of pits: at least two-thirds of each square inch of surface area shall be free of all visible residues and the remainder shall be limited to the light residues mentioned above.

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- 3.10.8 Brush Off Blast (SSPC-SP7), (SSI-Sa1), or (NACE #4): A method in which all oil, grease, dirt, rust scale, loose mill scale, loose rust, and loose paint or coatings are removed completely. Tight mill scale and tightly-adhered rust, paint and coatings are permitted to remain. However, all mill scale and rust must have been exposed to the abrasive blast pattern sufficiently to expose numerous flecks of the underlying metal fairly uniformly distributed over the entire surface.
- 3.10.9 High and Ultra-High Pressure Water Jet Cleaning (SSPC-SP12), or (NACE #5): As part of the surface preparation, deposits of oil, grease, and foreign matter must be removed by ultra-high pressure water jetting, by steam cleaning with detergent, or by methods in accordance with SSPC-SP1. The difference in the degrees of surface cleanliness is defined by the amount of pressure as follows:

Low Pressure		
Water Cleaning (LP WC)	34 MPa	(5 000 psi)
High Pressure		
Water Cleaning (HP WC)	34 to 70 MPa	(5,000 to 10,000 psi)
High Pressure		
Water Jetting (HP WJ)	70 to 170 MPa	(10,000 to 25,000 psi)
Ultra-High Pressure		
Water Jetting (UHP WJ)	Above 170 MPa	(25,000 psi)

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4. SERVICE CONDITIONS

- 4.1. The lining will be exposed to static and moving water slurries of granular activated carbon, resin and other abrasive media's.
- 4.2. The characteristics of the slurries will be as follows:
 - 4.2.1 Media in Water
 - 4.2.2 Temperature - 35-100F
 - 4.2.3 pH - 5.0 to 9.0
 - 4.2.4 Density - 26 lbs./cu.ft. up to 36 lbs.cu.ft., Dry
 - 4.2.5 Abrasive - Yes

5. MATERIALS

- 5.1. Acceptable coatings are Plasite 4110 as supplied by Carboline Company or Hemple TL-220S AR. Products from other suppliers or manufacturers are not approved.

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6. DELIVERY, STORAGE AND HANDLING

- 6.1. Product Delivery: Lining material shall be delivered to the site in sealed, original, labeled containers with the manufacturers name, product number, batch number, color designation, and instructions for mixing and thinning.
- 6.2. Storage: Vendor shall be responsible for the proper storage of all coating materials. Damaged, leaking, or unlabeled containers shall be disposed of daily.
- 6.3. Storage Location: Lining materials shall be stored in a place specifically assigned for that purpose which is dry and out of direct sunlight and stored in a manner so as not to exceed the manufacturer's temperature limitations. In all cases, the storage and handling of lining material shall conform to the requirements of the manufacturer and the applicable safety regulatory agencies.

7. APPLICATION

7.1. Surface Preparation

- 7.1.1 The lining vendor shall install and maintain protective coverings on any surface not to be lined to protect the surface during surface preparation and lining application.
- 7.1.2 Grease, Oil & Interference Material: Surface contamination on bare steel such as grease, oil, tape tags, markings, etc. shall be removed by the vendor by solvent cleaning per SSPC-SPI, SSPC-SP12, or NACE #5 prior to blast cleaning.
- 7.1.3 Surface Irregularities: Prior to blast cleaning, all surfaces shall be inspected for weld spatter, weld flux, or any other surface irregularities. When discovered, they will be removed by grinding.

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- 7.1.4 Edges: All sharp edges will be ground to a smooth 1/8 inch radius. Areas inside the vessel that are not expected to be in direct contact with media are not required to be chamfered unless noted on the specific detail. (A specific example: the holes in the internal cone design. They do not require a radius or chamfer on their edge since filter nozzles must fit snugly into these holes for proper service.)
- 7.1.5 Ambient Conditions: Final blast cleaning shall not be performed when the surface temperature is less than 5°F greater than the dew point temperature of the surrounding air, nor when the relative humidity is greater than 90%.
- 7.1.6 Compressed Air Cleanliness: The air supply used for blast cleaning shall be free from moisture and oil contamination. The air cleanliness shall be verified at least once per shift for each compressor used. The test involves directing the air stream onto a piece of white paper held not more than 18-inches away from the air outlet. The test shall be run downstream of moisture and oil separators for a period of not less than two-minutes. Sufficient freedom from oil and water is confirmed if no soiling or discoloration is visible on the paper. If air contamination is evidenced, the filters shall be changed or cleaned, traps emptied, after-coolers, moisture separators or filters added, the equipment maintained, or such adjustments made as may be otherwise required to achieve clean, dry air for all blast cleaning, coating application, blow-down, or any other quality operations involving compressed air. Verification of this activity will be required by Calgon Carbon Corporation's inspector.
- 7.1.7 Abrasive/Profile: The abrasive selected shall be identified by the vendor prior to use. The abrasive shall have a sharp, hard cutting surface and shall be dry and free of oil or soluble salt contaminants. Copper slag shall not be used. The abrasive shall provide an anchor pattern of at least 4.0 mils in depth. The surface profile shall be measured using the WPCC 4000 Series Anchor Profile Comparator or Testex replica tape and measuring the results with a calibrated micrometer.

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7.1.8 Abrasive Blasting of Carbon Steel: The preparation of all carbon steel shall be by abrasive blast cleaning to remove all mill scale, rust and coatings.

7.1.9 Dry abrasive blast all interior steel surfaces in accordance with SSPC-SP5 or NACE #1, "White Metal Blast Cleaning."

7.2. Coating Application Equipment: Reference Source: Carboline Pa-3 Specification

7.2.1 CONVENTIONAL AIR SPRAY GUNS: The following chart indicates the standard types of conventional air spray guns, nozzles and air caps recommended for the best atomization, material break-up and high production rates. Use of a pot with an agitator is preferred.

Gun Fluid Air
Binks #2001 66-SS 63-PB

DeVilbiss JGA-510 E 797

Graco P-800 04-02
Note: The same guns may be used with a stainless needle and tip. GUN FLUID AIR Binks #2001 59ASS 251 with a 559SS needle.

7.2.2 Airless Spray Equipment: The airless pump shall be of sufficient size to properly atomize the coating with the spray tip selected. The orifice size required will range between .013" to .035" varying with the viscosity of the coating. In selecting a spray tip, a suitable fan width for the configuration of the substrate shall be of major consideration. The amount of thinner required will vary up to approximately 20% depending on temperature, substrate size and individual technique.

Note: If using Hemple TL-220S AR use a hopper/gravity set up.

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GUN TIP Graco Bulldog (or equivalent) .013"-.035"

The high build vinyl ester coatings require a large capacity pump with a capability of 3 gpm, a minimum tip size of .025" with a 12" spray width recommended. The liquid pressure shall be in the range of 1800 to 2200 psi. Airless spray is not recommended for abrasion resistant formulations because of the extreme wear on the tips and lower units of the pump unless the airless unit is designed for abrasive type of materials.

7.2.3 Airless Spray Advantages and Disadvantages:

Advantages: No problem with contaminated air. Overspray is kept to a minimum and the production rate is high. Thick films may be obtained without runs or sags under some conditions.

Disadvantages: The large output of the gun makes it difficult to handle in small tanks where working conditions are crowded or cramped causing runs or sags.

Due to the large amount of liquid handled and the easy build properties of this equipment, it is possible, with improper thinning and improper technique, to apply the coating material at too high a rate per pass. The end result usually being solvent entrapment and porous film, runs and sags.

7.2.4 Equipment Manufacturers:

Supplier Name Supplier Address Product or Service

Binks Manufacturing Co.
9201 W. Belmont Avenue
Franklin Park, IL 60131
Air Atomizing & Airless Spray Equipment

DeVilbiss Ransburg
1724 Indian Wood Circle, Ste. F
Maumee, OH 43537

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Air Atomizing & Airless Spray Equipment

Graco, Inc.
P.O. Drawer 1441
Minneapolis, MN 55440
Airless Spray Equipment
Nordson Corporation 555 Jackson Street
Amherst, OH 44001
Airless Spray Equipment

7.3. Coating Application

7.3.1 All coatings must be applied in a controlled environment.

Surface Cleanliness: The surface of the prepared steel shall be blown down (clean, dry, compressed air), vacuumed prior to coating application to remove spent abrasive, dust and other interference material. If grease or oil is deposited on the surface, they shall be removed by solvent cleaning (SSPC-SP1) prior to coating application. Any rust which has formed shall be removed to the specified degree of cleanliness prior to lining, which may require reblasting.

7.3.2 Ambient Conditions: Coatings shall be applied only when the interior surface and air temperatures are between 60°F and 100°F, the relative humidity in the tank is less than 90%, and the temperature of the surface to be painted is at least 5°F above the dew point temperature of the air in the tank. Metal temperature shall be recorded on the form EAP-2A provided before application of coating under application data, under ST designation, see Appendix A.

7.3.3 Mixing: Lining's to be mixed shall have been delivered to the jobsite and stored in accordance with Section 6 of this specification and shall not have exceeded its shelf life. Mixing shall conform to the requirements of the coating manufacturer.

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Mix Part A into Part B using a high-speed mechanical air or an explosion proof motor agitator with mixing blades fitting close to sides of container, making sure all of Part A is completely mixed with Part B for approximately 15 to 30 minutes to be properly blended. Mix Part D (the promoter) into Part A & B until obtaining a smooth liquid free of any streaking from Part D is complete. Part C (the catalyst) can then be mixed into Part A, Part B & Part D blend.

Note: Splitting of kits must not be done.

Caution: The promoter (Part D) and the catalyst (Part C) must be separately mixed into Part A/Part B blend.

Any contact of

Unmixed Part D with Part C may lead to a fire or explosion.

Caution: Avoid breathing dust.

Hemple TL-220S AR

Is only a two part mix (Part A and Part B), only mix just prior to spraying, not in advance. Refer to technical bulletin when using. Thin only when strip coating.

Only complete kits shall be mixed. Lining which has skinned, gelled, separated, or otherwise deteriorated during storage to the extent that it cannot be remixed to a homogeneous film of the intended viscosity, uniformity and consistency shall not be used. Mixed coatings shall not be used beyond their pot life.

- 7.3.4 Thinning: Only Plasite 20 or other approved Calgon Carbon thinner shall be used for thinning. The amount of thinning will be limited (except for stripe coat). Thinners, as specified, shall be used to adjust coating for various application conditions. A ratio of 5-20% shall be used depending on ambient conditions and metal temperatures. At 75°F, a suggested thinning ratio is 5-10%; the amount of thinner may be increased at a ratio of approximately 5% per 5°. At higher temperatures, a slower evaporating solvent must be utilized. Thinner

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should be added if surface temperatures are lower than ambient. A faster evaporating solvent must be utilized in this case.

- 7.3.5 Methods: Coatings shall be applied by conventional or airless spray equipment. Coating applications shall be in accordance with the requirements of Calgon Carbon Corporation VS-7 Spec, SSPC-PA1 and the manufacturers Technical Bulletin. In the event of a conflict, the requirements of this specification, manufacturer's instructions and SSPC-PA1I shall prevail in that order. If NSF 61 is specified on the drawing, follow manufacturer's instructions for compliance to this standard.

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- 7.3.6 **Stripe Coat:** A stripe coat of vinyl ester thinned approximately 50% shall be applied to all edges, corners, welds, crevices and irregularities prior to each full coat application. Such striping shall extend a minimum of 3-inches beyond the edge or irregularity.
- 7.3.7 **Brush Application:** Brush application is not allowed except for touch-up repairs, inaccessible areas and stripe coating. Those areas for which the contractor desires to use brush application shall be carefully defined prior to the start of all work.
- 7.3.8 **Agitation:** Lining must be kept agitated in conventional spray pots or containers during lining application.
- 7.3.9 **Coating Thickness:** The coating shall be applied in a minimum of two coats. Each coat shall have a dry film thickness of between 17 and 23 mils, with a total system thickness of between 35 and 45 mils. Dry Film Thickness readings need to be taken after each coating of lining. The area then needs to be mapped to recognize the high and low areas. This must be done to avoid too little or too much mileage on the interior of the vessel. High mileage is not an acceptable condition, in most cases the coating will need to be removed to the 35 to 45 mils and the surface condition back to a smooth streamline surface. This is a very expensive process and should be avoided at all cost.
- 7.3.10 **Coating Continuity:** All coats shall have smooth, streamline surfaces free of dry spray, over spray, orange peel, fish eyes, craters, bubbles and other significant defects. Shadow-through, honey-comb spray, skips and misses are not acceptable. Runs or sags can be brushed out while the material remains wet. Areas where blast products or other debris have become embedded in the paint film shall be prepared by removing these products and touching up the area. In addition, the final coat shall be tested for discontinuities by performing high-voltage holiday testing at 3,500 volts to obtain a pinhole-free film. Holiday testing shall be performed only after a minimum cure time of 48-hours at 70°F with ventilation has elapsed after application of the final coat.

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- 7.3.11 Re-coat Time and Cleanliness: Subsequent coats shall be applied only after the previously-applied coat has been allowed to dry as required by the manufacturers Technical Bulletin, but as soon as possible in order to minimize exposure to inter-coat contamination. Any such surface contamination which is present shall be removed prior to the application of subsequent coats.

8. INSPECTION AND TESTING

8.1. Inspection

- 8.1.1 The lining vendor shall be responsible for inspecting all phases of the surface preparation and lining application in accordance with Calgon Carbon Corporation's and/or the coating manufacturer's inspection procedures.
- 8.1.2 Calgon Carbon Corporation reserves the right to inspect all phases of the lining operation to assure compliance with specification requirements. The vendor shall repair/correct any and all deficiencies at his own expense. The vendor shall provide accessibility and lighting for any inspections. It is not intended, however, that the presence or activity of such inspection shall in any way whatsoever relieve the vendor of his obligation to provide inspection of his own to assure compliance with this specification. In all cases, Calgon Carbon Corporation or its approved agent will perform final inspection before acceptance.
- 8.1.3 Calgon Carbon Corporation reserves the right to stop any and all work at any time for non-compliance with the requirements of this specification.

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8.2. Testing

8.2.1 Use a properly calibrated non-destructive Type II dry film thickness gage:

- Positector: Measures non-magnetic coating thickness over ferrous substrates with an accuracy of $\pm 3\%$. Digital reading remains until next measurement taken.
- MikroTest Thickness Gauge: A highly accurate hand gauge which operates on the attraction power of a permanent magnet through a non-magnetic coating to the base steel with an accuracy of $\pm 5\%$.

Frequency and method of calibration shall be in accordance with the SSPC-PA-2.

8.2.2 Determine the average dry film thickness of the lining. All areas with less than 30 mil DFT must have additional lining sprayed on before spark test. High or low areas that require remedial action will be marked so on the lining with chalk. When work is completed, all chalk markings shall be removed. Run thickness test prior to spark test.

8.2.3 One (1) reading shall be taken every 10-ft² and any reading outside of the manufacturer's acceptable range, either higher or lower, will require four (4) additional readings 1-ft in each direction from the suspect reading. Any average of the five (5) readings will be figured and must fall within the manufacturer's acceptable range. If not, mark the area to be corrected with chalk.

8.2.4 After all the readings are taken, they are to be averaged in three (3) sections: top head, shell, and the bottom head or cone. These three averages, along with all the readings taken, shall be recorded on a Calgon Carbon Lining Inspection Report (Appendix A).

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- 8.2.5 For method and frequency of calibration for the dry-film thickness gauge, see the calibration section of the Manufacturer's information. Any areas not in compliance shall be marked for remedial action with chalk by the inspector.
- 8.2.6 Spark test for pinholes with a 4500 VDC detector on all coated surfaces. A Tinker and Razor Model AP-W, or equivalent device, is required for this operation; 3500-volt maximum, minimum 48-hours at 70°F cure before spark test is run.

9. SPECIAL REQUIREMENTS FOR NSF-61 (WHEN SPECIFIED)

- 9.1. When the end-use application requires compliance with NSF-61, the vinyl ester lining must be applied in accordance with specific instructions found in the product bulletin. Applicator must follow these specific instructions.
- 9.2. Calgon Carbon Corporation will notify lining vendor that this section (9.0) applies by signifying such in the purchase order and/or drawings.
- 9.3. Force curing may follow the date of application but must be completed prior to the disinfection of the vessel at customer site.
- 9.4. The NSF criteria specified by the coating manufacturer cannot be altered.
- 9.5. Force curing must be conducted in a controlled manner. Heat rise shall be not greater than 1 degree per minute, up to the maximum temperature needed to achieve a 200 F minimal surface temperature. This is critical to avoid blistering or post-cure holidays.
- 9.6. Heat should be applied at top or bottom head to allow equal flow of hot air. If heating in the shell, there should be an internal attachment to allow heat to distribute equally so there is not a section of lining that heats faster than the rest. See appendix for recommended flow distribution according to Plasite's guide.

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- 9.7. A strip recorder with multiple thermocouples (or other similar device) is preferred to record the temperature during the force cure process. Records shall be forwarded to Calgon Carbon Corporation for retention. Please send to the attention of Quality Inspector, Equipment and Assembly Plant, at 4301 Grand Ave, Neville Island, PA 15225.

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10. APPENDIX A- INSPECTION PROCEDURE

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10. APPENDIX A-INSPECTION PROCEDURE

10.1. SECTION ONE SURFACE PREPARATION

- 10.1.1 Verify prior to blast cleaning that sharp edges weld spatter, slivers, laminations, scabs or any other surface irregularities have been adequately removed to provide a surface suitable for coating application.
- 10.1.2 Verify prior to blast cleaning that all heavy deposits of oil and/or grease have been adequately removed in accordance with "Solvent Cleaning" (SSPC-SPI).
- 10.1.3 Prior to blast cleaning operations, perform compressed air cleanliness test at least once per eight-hour shift. Insert a clean, white blotter or clean, white paper into the air stream no more than 18-inches from air source downstream of moisture and oil separators for approximately two minutes. Examine the blotter or paper for signs of moisture and/or oil contamination. Blast cleaning should not begin unless air is free of detrimental amounts of oil and/or water.
- 10.1.4 Verify that only clean and dry abrasives will be used. If bulk abrasive is to be used, verify that the abrasive is properly protected from rain, moisture and oil.
- 10.1.5 If abrasives are recycled, test for the presence of abrasive contamination. Add approximately one ounce of recycled abrasive to several ounces of clean water. Shake contents vigorously and visually examine the water level for signs of oil contamination.
- 10.1.6 Angular abrasive that will provide an anchor profile depth minimum equal to the SPCC 4000 Series Blast Comparator will be used.

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- 10.1.7 Verify that required protective coverings are intact to assure that previously-coated surfaces will not be damaged during blast cleaning operations.
- 10.1.8 Monitor and record ambient conditions and surface temperatures during blast cleaning operations using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables.
- 10.1.9 "Final blast cleaning" shall not be performed unless the surface temperature is at least 5°F higher than the dew point. "Rough blasting" may be performed regardless of ambient conditions, but must be "final blast cleaned" when conditions become favorable.
- 10.1.10 Verify that blast cleaned surfaces have been prepared in accordance with SSPC-SP5, SSI-Sa3, or NACE#1, "White Metal Blast Cleaning". SSPC-VIS-1 may be used as a visual reference. Mark all non-conforming areas with chalk or spray paint for rework.
- 10.1.11 Verify the profile (4 mils minimum) has been achieved using the WPCC 4000 Series Blast Comparator.
- 10.1.12 Using a dry film thickness gage, determine the magnetic base reading and record.

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10.2. SECTION TWO LINING MATERIAL PREPARATION

- 10.2.1 Verify that all containers are sealed, intact and properly labeled.
- 10.2.2 Verify that all coating material temperatures are at least 60°F before mixing by the use of a stem thermometer.
- 10.2.3 Verify type of coating mixed, record and retain batch numbers of all components, type of thinner and batch number, thinning ratios, time of mix, maximum pot life, etc.
- 10.2.4 Verify that all components are combined and thoroughly mixed in the proper proportions to obtain a uniform color, free of lumps.
- 10.2.5 Verify that only the recommended thinner is used.
- 10.2.6 Verify that the pot life is observed.

10.3. SECTION THREE APPLICATION LINING

- 10.3.1 Monitor and record ambient conditions and surface temperatures every three to four hours during lining application using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables. Coating application shall not be permitted when the surface temperature is less than 50°F above the dew point. No coatings shall be applied when the surface and/or material temperatures are less than 70°F. No coating shall be applied when the surface temperature is expected to drop below 60°F before it has dried. Coating application shall not be permitted when the relative humidity is greater than 90%.

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- 10.3.2 Verify compressed air cleanliness and test for conventional spray application and blow down operations (see Section 9.1.3). Coating material must be applied using an agitated conventional pressure pot using continuous agitation during application.
- 10.3.3 Verify that protective coverings previously established are intact.
- 10.3.4 Verify that surrounding air is free of airborne contaminants prior to the application of coatings.
- 10.3.5 Verify intercoat cleanliness and that blast-cleaned surfaces have been cleaned to assure that coatings will not be applied over oil, grease, dirt, dust, spent abrasive, etc.

10.4. SECTION FOUR APPLICATION OF FIRST COAT

- 10.4.1 Verify that vinyl ester has been applied to all surfaces prepared that day before visual oxidation takes place. Any surfaces not primed the same day shall be reblasted prior to primer application.
- 10.4.2 Verify that weld seams have been brush-coated at least 3-inches on each side of seam prior to spray application.
- 10.4.3 Verify that the first coat has been applied to a dry film thickness of 17-23 mils. Perform dry film thickness tests in accordance with SSPC-PA2. (Deduct magnetic base reading.)

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10.5. SECTION FIVE APPLICATION OF FINAL COAT

- 10.5.1 Verify that previously-coated surfaces have dried at least eight hours at 70°F with ventilation prior to application of second coat.
- 10.5.2 Verify that the final coat has been applied to a dry film thickness of 17-23 mils. Perform dry film thickness test in accordance with SSPC-PA2. (Deduct primer thickness.)

10.6. SECTION SIX FINAL INSPECTION OF LINED SURFACES

- 10.6.1 Verify that all surfaces have a smooth and uniform appearance free of any irregularities such as debris inclusions, scuff marks or spatter.
- 10.6.2 Verify that the total dry film thickness (minimum two coats) is 35-45 mils. Perform dry film thickness test in accordance with SSPC-PA2.
- 10.6.3 Allow 48-hours cure at 70°F before holiday testing. Verify that a void-free, continuous film has been achieved by performing high-voltage holiday detection on 100% of the coated surfaces. The voltage shall be set at 3,500-volts. Mark all discovered holidays and re-test all repairs.
- 10.6.4 All repairs shall be made in strict accordance with this specification.

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APPENDIX A

**BLP-002 A
Lining and Coating
Report Summary**

PROJECT/STOCK NO. _____ N.B. NO. _____ DATE _____

COMPANY _____ INSPECTOR _____

TYPE OF LINING _____ D.F.T. REQUIRED _____

TYPE OF PAINT _____ D.F.T. REQUIRED _____

TYPE OF PAINT _____ D.F.T. REQUIRED _____

EXTERIOR INSPECTION SUMMARY: _____

INTERIOR INSPECTION SUMMARY (VISUAL & UNDER CONE): _____

AVG. D.F.T. READINGS (PAINT): TOP _____ BOTTOM _____ SHELL _____ LEGS _____

AVG. D.F.T. READINGS (LINING):
TOP _____ BOTTOM _____ SHELL _____ UNDER CONE _____

CONTINUITY TEST (VOLTS _____) _____

REPAIRS REQUIRED: NO _____ YES _____

COMMENTS: _____

NOZZLES INSTALLED BY: _____ DATE: _____ SAP #: _____

NOZZLES VERIFIED BY: _____ DATE: _____ SAP #: _____

ALL REPAIRS HAVE BEEN MADE/INSPECTED AS DIRECTED ABOVE: DATE _____

BY _____ AUTHORIZED APPROVAL BY _____

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APPENDIX A

**BLP-001 A
Blasting Condition Report**

PROJECT SHORTNAME _____ NAT=L. BOARD NO. _____

PRE-SURFACE PREPARATION

RADIUS EDGES: Y___ N___ WELD SURFACE CONDITION: G___ B___
WELD SPATTER: Y___ N___ STEEL CLEANLINESS: G___ B___

SURFACE PREPARATION

INTERIOR BY _____ REQ=D. SSPC SP _____

REQ=D. ANCHOR PATTERN _____ MILS ACTUAL _____

PROFILE CLEANED: Y___ N___

LAP JOINTS FREE: Y___ N___

EXTERIOR BY _____ REQ=D. SSPC SP _____

SUBSTRATE CLEANED: Y___ N___

METHOD: TESTEX TAPE: _____ PROFILE COMPARATOR: _____

AMBIENT CONDITION

DATE	BAROMETRIC PRESSURE	WET BULB	DRY BULB	DEW POINT	RELATIVE HUMIDITY	SURFACE TEMP.

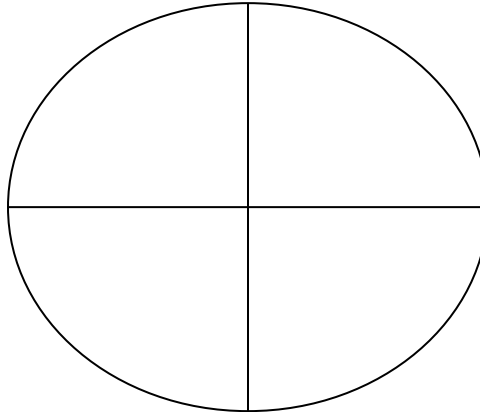


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APPENDIX A
BLP-002A REV.2
LINING DATA SHEET
Lining:

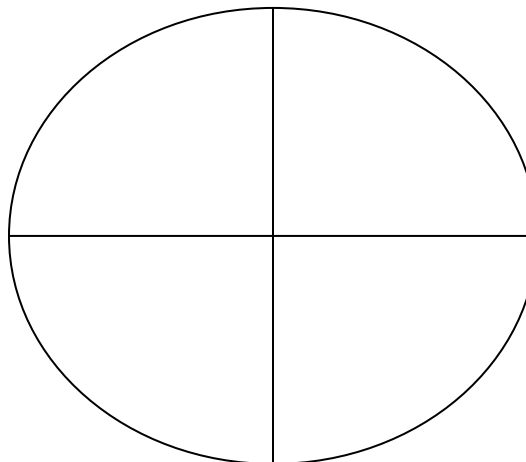
Top Head



Main Body



Bottom Head



Under Cone



**SPECIFICATION
FOR
VINYL ESTER VESSEL LINING**

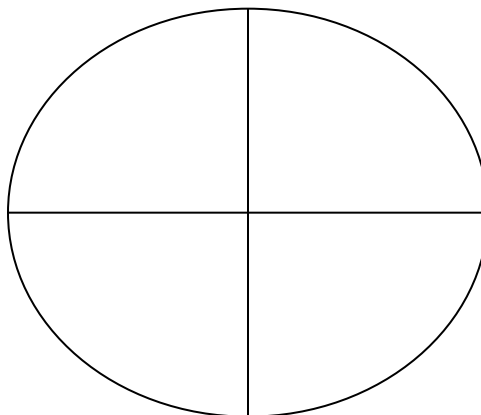
**Specification No. VS7
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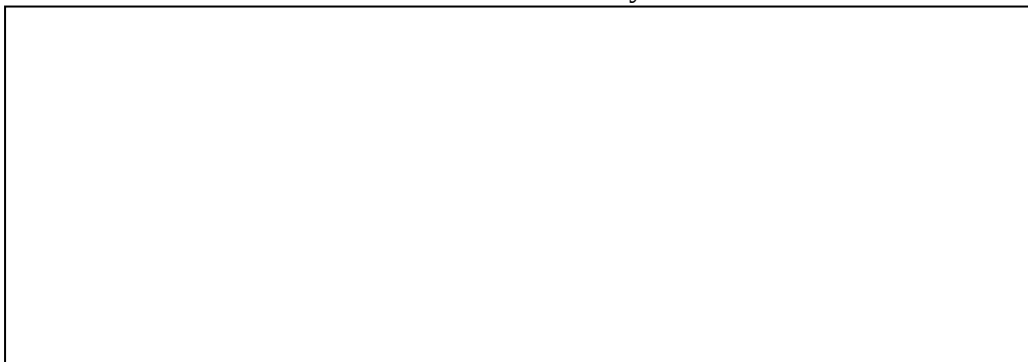
**BLP-002 A REV.2
EXTERIOR COATING SHEET**

Paint:

Top Head
Exterior

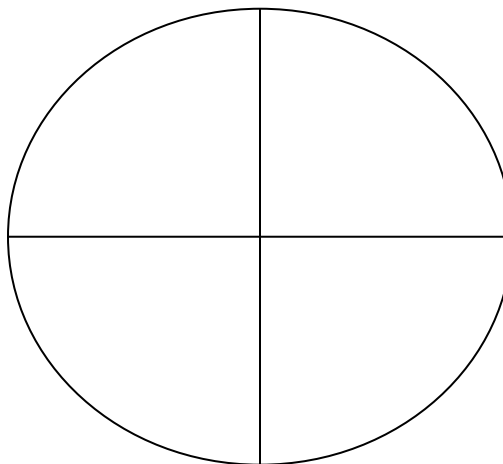
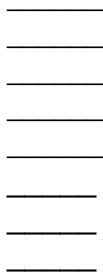


Main Body



Bottom Head
Exterior

Legs





**SPECIFICATION
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APPENDIX A

**BLP-002 A REV.2
FINAL LINING HOLIDAY SUMMARY**

NATIONAL BOARD: _____ MODEL # : _____

INSPECTION #1, DATE: _____
RESULTS:

INSPECTION #2, DATE: _____
RESULTS:

INSPECTION #3, DATE: _____
RESULTS:

INSPECTION #4, DATE: _____
RESULTS:

HOLIDAY FREE DATE: _____



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11. APPENDIX B- MANUFACTURER'S PRODUCT DATA

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SELECTION & SPECIFICATION DATA

Generic Type	Vinyl ester
Description	Vinyl ester resin combined with special curing system and inert flake pigment to provide outstanding chemical and physical properties. Specially formulated for excellent abrasion resistance. PLASITE 4110 meets the FDA requirements for 21 CFR, 175.300 and 177.2420 and is suitable for potable water service per NSF Std. 61. Uses: As a high chemical abrasion-resistant thick film for tank lining service and as a maintenance coating for severe exposure.
Features	Meets the criteria of NSF/ANSI/CAN 600
Color	Charcoal gray
Primer	For steel surfaces, coating is considered to be a "self-priming" system. Do not apply PLASITE 4110 directly to concrete. See reference to fillers and sealers in CONCRETE section.
Dry Film Thickness	35 - 45 mils (889 - 1143 microns) total thickness achieved in 2-3 multi-pass spray coats recommended for immersion service. Consult Carboline Technical Service Department for any deviation to this film thickness. Refer to APPLICATION section.
Coverage Rate	Plasite 4110 will cover approximately 960 mil ft. ² /gal. or 86.4 sq. m. per 25 microns/gal. This is a coverage obtained from field use on small jobs and includes loss in can, spray loss, small amount of shrinkage, etc. Application by conventional spray equipment may affect coverage.
VOC Values	As Supplied : 0.50 lbs/gal (60 g/L) Plasite Thinner #20 : Thinned 5% by volume 0.78 lbs/gal (93 g/L)
Dry Temp. Resistance	Continuous: 380°F (193°C) Non-Continuous: 460°F (238°C) Limited short excursions to 460 °F (238 °C) acceptable. Wet temperature resistance depends upon concentration and reagent exposure.
Topcoats	Not Applicable
Density	79.1 lbs/ft ³ (0.26384 lbs/ft ² at 40 mils)

SUBSTRATES & SURFACE PREPARATION

General	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.
Steel	Cleanliness: Abrasive blast to SSPC-SP10 (minimum) Profile: Minimum 4 mil (100 micron) dense, sharp anchor profile free of peening, as measured by ASTM D 4417. Defects exposed by blasting must be repaired.

SUBSTRATES & SURFACE PREPARATION

Aluminum Surface shall be clean and grease-free with a blast produced anchor pattern or "tooth" as described earlier under "Steel". In addition, the blasted surface shall be given a chemical treatment such as: Alodine 1200S available from Henkel Surface Tech, Iridite 14-2 produced by MacDermid Incorporated, Oakite Cryscoat 747 LTS and Oakite Cryscoat Ultraseal produced by Oakite Products.

Concrete or CMU Concrete shall be designed, placed, cured, and prepared per NACE No. 6/SSPC-SP 13, latest edition. Abrade to remove all laitance, loose concrete, etc. and to create surface profile in accordance with the appropriate ICRI CSP 5-7.

PERFORMANCE DATA

All test data was generated under laboratory conditions. Field testing results may vary.

Test Method	System	Results
Abrasion Resistance	Plasite 4110	11 milligrams average loss per 1000 cycles Taber CS-17 Wheel, 1000 gram weight
Elongation	Plasite 4110	1.7% using Method ASTM D638
Film Density	Plasite 4110	79.1 lbs/ft ³ 0.26384 lbs/ft ² at 40 mils
Pigments	Plasite 4110	Inert fillers and flake
Surface Hardness	Plasite 4110	Konig Pendulum Hardness of 134 seconds (Glass Standard = 250 seconds); ASTM Method D4366-84.
Thermal Shock	Plasite 4110	Unaffected by minus 70 °F to plus 200 °F in 5 cycles, or 40 to 380 °F in 10 cycles

MIXING & THINNING

Mixing Mix Part B into Part A using a mechanical high speed agitator, making sure all Part B is completely mixed with Part A. Maintain a good vortex while mixing until a smooth liquid, free of any unmixed particles of pigment, is obtained (approximately 15-30 minutes). After the pigments and liquid are thoroughly mixed, add the entire amount of the measured liquid promoter (Part D). Mix completely. (no color streaking or residue of part D should remain on the container sidewalls). Allow to cool if material temperature increases, then add Part C and necessary amount of Plasite Thinner 20. Mix an additional three to five minutes.

WARNING! The promoter (Part D) and the catalyst (Part C) must be separately mixed into the coating (Parts A&B). Any contact of unmixed Part C with Part D may lead to a fire or an explosion! Continuous mixing during use is required. Part A, Part B and Part D may be premixed up to 72 hours prior to adding Part C. Operator should wear face mask during high speed mixing of the coating components. Avoid breathing dust.

Kit components match as follows:

Small, 1 gallon kit:

Part A - Approximately 3/4 of a gallon in a one gallon container

Part B - Approximately 5.5 pounds in a one gallon container

Part C - Approximately 3.5 fluid ounces in a 6 ounce plastic bottle

Part D - Less than 0.5 fluid ounce in a 2 ounce plastic bottle

Large, 5 gallon kit:

Part A - Approximately 3.75 gallons in a 6 gallon container

Part B - Approximately 27 pounds in a one gallon container

Part C - Approximately 18 fluid ounces in a 1 quart plastic bottle

Part D - Approximately 1.4 fluid ounces in a 2 ounce plastic bottle

MIXING & THINNING

Thinning	Use 2 to 10% thinning with PLASITE Thinner #20 as needed to adjust coating for higher temperatures and various application conditions. Topcoating of previously coated films will require the addition of 2 to 20% thinner. Consult Carboline laboratory for unusual thinning requirements. See RECOATING TIME SECTION.
Pot Life	1.5-3 hours in one gallon cans and 1.5-2 hours in five gallon cans at 70 to 90 °F (21-32 °C) MATERIAL temperature. MATERIAL temperatures in excess of 90 °F will significantly reduce pot life. CAUTION! Do not attempt to extend pot life by mixing newly catalyzed coating into coating near the end of its pot life.

APPLICATION EQUIPMENT GUIDELINES

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

Conventional Spray	59ASS Fluid Nozzle 251 Air Cap 559SS Needle Pot pressure of approximately 50 psi Atomizing pressure of approximately 60 psi Use standard production type pressure pot with air motor drive agitator. Heavy-duty trigger spring recommended. Note: Application by conventional spray equipment may affect maximum film building capabilities and coverage rates. Applicators may prefer to apply additional coats to achieve the 40 mil nominal DFT.
Airless Spray	GPM Output 3.0 (minimum) Material hose 3/8" I.D. (minimum) Fluid nozzle 0.025" or larger Output PSI 1800-2200 12" minimum spray width All screens should be removed from pump and gun. CONTINUOUS MIXING DURING USE IS REQUIRED. Note: Conventional spray equipment is preferred. Expect higher wear rates to airless spray equipment lower units and spray tips.
Brush	Brush application is not recommended, but may be used for repairs or touch-up. Continuous mixing during use is required.

APPLICATION PROCEDURES

General

A minimum surface temperature of 70 °F (21 °C) is required to obtain polymerization of the coating system. Coating can be applied at a surface temperature as low as 60 °F (16 °C) but polymerization will be inhibited. Succeeding coats cannot be applied without damaging the system until the surface temperature rises sufficiently to obtain partial polymerization. This will require raising to the minimum surface temperature of 70 °F (21 °C) within 12 hours of application. Refer to CURING section. When surface temperatures are over 100 °F (38 °C), consult Carboline Technical Service for special instructions.

The mixed coating shall be applied utilizing a multi-pass spray system. Apply horizontal and vertical passes with 50% overlap. Special precautions are required at overlaps and welds to eliminate excessive film build. Spray gun should be perpendicular to surface at all times, approximately 14 in/36 cm from surface. For non-NSF applications, coating may be overcoated after initial "set" which will occur normally in 3 to 6 hours at 70 °F (21 °C) with proper ventilation. Initial "set" time will decrease as surface temperature increases. Refer to RECOATING TIME section.

When physical contact (foot traffic, scaffolding, etc.) with the previously applied coating, or for NSF applications is needed, a minimum of 10 hours at 70 °F (21 °C) substrate and air temperature with ventilation is required before proceeding. Previously applied coats must have reached a "non-tacky" state before being exposed to physical contact. This condition will occur in less time as surface temperature increases. Overcoating shall be performed as soon as possible to prevent contamination.

LINING REPAIR

Clean damaged area, removing all contaminants and loose coating. Abrasive blast substrate to original specification where coating has been exposed to environment and where oxidation is evident. Feather the original coating not less than 2 in/5 cm from damaged area.

If new coating is physically damaged and has not been in service, repair as shown above. For repairing holidays, sand surface and brush apply proper thickness of coating. Apply coating by brush or spray. Do not apply by brush on areas larger than 1 sq. ft./0.93 sq.m.

RECOATING TIME

May be recoated after initial 10 hour cure. Following coating must be applied within 30 days. Each following coat should be diluted approximately 2 to 20% with PLASITE Thinner 20. Note: Previously applied coating exposed to an accumulation of 24 hours of sunlight or surface temperatures in excess of 130 °F may result in intercoat disbondment. An applied coating film must be topcoated before an accumulation of 24 hours exposure has occurred or special procedures (such as shading with tarps) must be used.

Warning: Contamination of previously exposed coating film may be detrimental to adhesion of the repair and may affect life expectancy.

APPLICATION CONDITIONS

Condition	Material	Surface	Ambient	Humidity
Minimum	70°F (21°C)	60°F (16°C)	60°F (16°C)	0%
Maximum	90°F (32°C)	100°F (38°C)	100°F (38°C)	80%

A minimum surface temperature of 70 °F (21 °C) is required to obtain polymerization of the coating system. Coating can be applied at a surface temperature as low as 60 °F (16 °C) but polymerization will be inhibited. Succeeding coats cannot be applied without damaging the system until the surface temperature rises sufficiently to obtain partial polymerization. This will require raising to the minimum surface temperature of 70 °F (21 °C) within 12 hours of application. Refer to CURING. When surface temperatures are over 100 °F (38 °C), consult Carboline Technical Service Department for special instructions.

CURING SCHEDULE

Surface Temp.	Cure Time
70°F (21°C)	10 Days
90°F (32°C)	7 Days

Although coating may be applied at substrate temperatures as low as 60 °F (16 °C), the substrate temperature must be raised to at least 70 °F (21 °C) within 12 hours and held until coating surface is tack-free (approximately 10 hours) to avoid possible loss of cure. A minimum of 70 °F (21 °C) surface temperature is required to obtain polymerization of this coating.

Surface Temp.	Cure Time
110°F (43°C)	72 Hours
120°F (49°C)	36 Hours
130°F (54°C)	18 Hours
140°F (60°C)	10 Hours
150°F (66°C)	6 Hours
160°F (71°C)	4.5 Hours
170°F (77°C)	3.5 Hours
180°F (82°C)	2.5 Hours
190°F (88°C)	2 Hours
200°F (93°C)	1.75 Hours

Listed are a few curing schedules that may be used for time and work planning. Prior to raising the metal to the force curing temperature, it is necessary that an air dry time of 2 to 5 hours at temperatures from 70 °F (21 °C) to 100 °F (38 °C) be allowed. After the air dry time has elapsed, the temperature should be raised in increments of approximately 30 °F (17 °C) every 30 minutes until the desired force curing metal temperatures are reached. Any moisture from condensation of any source will kill the cure on freshly applied coating before it reaches a “non-tacky” stage. A force cure at 200 °F (93 °C) metal temperature for 4 hours is necessary to comply with NSF Standard 61 requirements. See NSF instructions below for compliance requirements.

CLEANUP & SAFETY

Cleanup	Clean with PLASITE Thinner 20. In case of spillage, absorb and dispose of in accordance with local applicable regulations.
Safety	Read and follow all caution statements on this product data sheet and on the SDS for this product. Employ normal workmanlike safety precautions. Keep container closed when not in use.
Ventilation	When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure, use MSHA/NIOSH approved respirator.
Caution	This product contains flammable solvents. Keep away from sparks and open flames. All electrical equipment and installations should be made and grounded in accordance with the National Electric Code. In areas where explosion hazards exist, workers should be required to use non-ferrous tools and wear conductive and non-sparking shoes.

TESTING / CERTIFICATION / LISTING

TESTING / CERTIFICATION / LISTING

Potable Water Certifications

- PLASITE 4110 is certified to NSF/ANSI Standard 61 for ambient potable water when the following requirements are met:
- The tank is 3,000 gallons/11,100 liters or larger.
- PLASITE Thinner #20, up to maximum of 20% by volume, may be used for thinning purposes.
- The coating must be applied in 2 to 3 coats to a maximum DFT of 45 mils/1125 microns.
- 10 hours of dry time between coats at 70°F to 100°F.
- 12 hours dry time of the final coat at 70°F to 100°F before force curing.
- Prior to placing the lining in service, it must be force cured at 200 °F/93 °C metal temperature for 4 hours.

PACKAGING, HANDLING & STORAGE

Packaging

- 1 gallon kit:**
Part A: Partially filled 1 gallon container
Part B: Partially filled 1 gallon container<
Part C: Partially filled 6 ounce plastic bottle
Part D: Partially filled 2 ounce plastic bottle
- 5 gallon kit:**
Part A: Partially filled 6 gallon container
Part B: Partially filled 5 gallon container
Part C: Partially filled 1 quart plastic bottle
Part D: Partially filled 2 ounce plastic bottle

Shelf Life

- At 75 °F (24 °C)
Part A : 4 months
Part B: 24 months
Part C: 12 months
Part D: 24 months

Cooler storage temperatures will increase shelf life. Storage at higher temperatures can result in substantially shorter shelf life.

Storage

Keep out of direct sunlight. Avoid excessive heat and do not freeze.

Shipping Weight (Approximate)

- 12 lbs. per 1 gallon kit
60 lbs. per 5 gallon kit

WARRANTY

To the best of our knowledge the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Carboline Company to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance, injuries or damages resulting from use. Carbolines sole obligation, if any, is to replace or refund the purchase price of the Carboline product(s) proven to be defective, at Carbolines option. Carboline shall not be liable for any loss or damage. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY CARBOLINE, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. All of the trademarks referenced above are the property of Carboline International Corporation unless otherwise indicated.



TAB 2

BELOW CONE LINING

SPECIFICATION NUMBER VS9 FOR UNDER CONE VESSEL COATING VINYL ESTER VESSEL LINING

1.0 SCOPE OF WORK

- 1.1 This specification covers materials, surface preparation, application and testing of protective coatings for coating under the internal cone of Carbon Steel Vessels.
- 1.2 The scope of work includes all labor, materials, equipment and services required for lining and testing the vessels indicated on the drawing and/or applicable documents.
- 1.3 The entire internal surface under the cone of the designated vessels shall be lined. This includes the under side of the internal cone, the inside of the bottom head and the portion of the straight side below the cone to shell seam..
- 1.4 The coating must satisfactorily protect the internal metal surfaces from corrosion and erosion by the treated water.
- 1.5 The Contractor shall guarantee that all materials and workmanship shall be free of defects and that they will conform to standards set forth for first-class workmanship and quality. In the event of failure of the coating to withstand the service conditions set forth in Article 3.0, the Contractor shall, at his expense, replace the defective materials and workmanship to the Buyer's satisfaction.

2.0 REFERENCE DOCUMENTS

- 2.1 Steel Structures Painting Council Surface Preparation Specification No. 1, "Solvent Cleaning" (SSPC-SP1-85).
- 2.2 Steel Structures Painting Council Surface Preparation Specification No. 2, "Hand Tool Cleaning" (SSPC-SP2-85).
- 2.3 Steel Structures Painting Council Surface Preparation Specification No. 3, "Power Tool Cleaning" (SSPC-SP3-85).
- 2.4 Steel Structures Painting Council Surface Preparation Specification No. 5, "White Metal Blast Cleaning" (SSPC-SP5-85).
- 2.5 NACE 6F-166 "Recommended Practices for Inspections of Linings on Steel and Concrete".

2.6 Plasite 4100 (4110) or Hemple TL-220S AR Technical Bulletin.

2.7 Caulking Materials Compound Semstone Thoxatropo-C Technical Bulletin.

3.0 SERVICE CONDITIONS

3.1 The coating will be exposed to static and turbulent water flow.

3.2 The characteristics of the slurries will be as follows:

3.2.1 Treated Wastewater or Groundwater

3.2.2 Temperature - 35 -100°F

3.2.3 PH - 5.0 to 9.0

3.2.4 Density Water

3.2.5 Abrasive - Minimal

4.0 MATERIALS

4.1 The coating shall be a heavy-duty, thick film, high-resistant vinyl ester resin material with abrasion resistant qualities. The lining material shall be suitable for spray application to a nominal 20 to 25 mil dry film thickness on a steel surface. The Semstone Thoxatropo-C mixed with vinyl ester shall be a thick brushable consistency.

4.2 The coating shall be Plasite No. 4110 or Hemple TL-220S AR , no other material is acceptable..

5.0 DELIVERY, STORAGE AND HANDLING

5.1 Product Delivery: Materials shall be delivered to the site in sealed, original, labeled containers with the product name, product number, batch number, color designation, and instructions for mixing and thinning.

5.2 Storage: Contractor shall be responsible for the proper storage of all coating materials. Damaged, leaking, or unlabeled containers shall be disposed of daily.

5.3 Storage Location: Materials shall be stored in a place specifically assigned for that purpose which is dry and out of direct sunlight. Materials shall be stored in a manner so as not to exceed the manufacturer's temperature limitations. In all cases, the storage and handling of materials shall conform to the requirements of the manufacturer and the applicable safety regulatory agencies.

- 5.4 Fire Prevention: All precautions to prevent fire shall be taken. Containers of flammable materials shall be opened only when needed. Rubbing cloths and oil rags shall be kept in tightly closed containers and removed from the site daily. Fire or other damage due to spontaneous combustion or other names shall be the Contractor's responsibility.

6.0 APPLICATION

6.1 UNDER THE CONE SURFACE PREPARATION

- 6.1.1 The Contractor shall install and maintain protective coverings on any surface not to be coated to protect the surface during surface preparation and coating application.
- 6.1.2 Grease, Oil, and Interference Material: Surface contamination on bare steel such as grease, oil, tape tags, markings, etc. shall be removed by the Contractor by solvent cleaning per SSPC-SP1 prior to blast cleaning.
- 6.1.3 Surface Irregularities: Prior to blast cleaning, all surfaces shall be inspected for weld spatter, weld flux, or any other surface irregularities. When discovered, they will be removed by the Contractor.
- 6.1.4 Edges: All sharp edges will be ground to a smooth radius. Areas inside the vessel that are not expected to be in direct contact with activated carbon are not required to be chamfered unless noted on the specific detail. (A specific example: the holes in the internal cone design. They do not require a radius or chamfer on their edge since filter nozzles must fit snugly into these holes for proper service.)
- 6.1.5 Ambient Conditions: Final blast cleaning shall not be performed when the surface temperature is less than 5°F greater than the dew point temperature of the surrounding air, nor when the relative humidity is greater than 90%.
- 6.1.6 Compress Air Cleanliness: The air supply used for blast cleaning shall be free from moisture and oil contamination. The air cleanliness shall be verified at least once per shift for each compressor used. The test involves directing the air stream onto a piece of white paper held not more than 18" away from the air outlet. The test shall be run downstream of moisture and oil separators for a period of not less than two minutes. Sufficient freedom from oil and water is confirmed if no soiling or discoloration is visible on the paper. If air contamination is evidence, the filters shall be changed or cleaned, traps emptied, after coolers, moisture separators or filters added, the equipment maintained, or such adjustments made as may be otherwise required to achieve clean, dry air for all blast cleaning, coating application, blow-down, or any other quality operations involving compressed air.
- 6.1.7 Abrasive/Profile: The abrasive selected shall be identified by the Contractor prior to use. The abrasive shall have a sharp, hard cutting surface and shall be dry and free of oil or soluble salt contaminants. Copper slag shall not be used. The abrasive shall provide an anchor pattern of 3.0 to 4.0 mils minimum in depth. The surface profile shall be measured using Testex Press-O-Film replica tape and a spring micrometer, or a visual comparator.

- 6.1.8 Abrasive Blasting --
Abrasive Blasting of Carbon Steel: The preparation of all carbon steel shall be by abrasive blast cleaning to remove all mill scale, rust, and coatings.
- 6.19. Dry abrasive blast clean all interior steel surfaces in accordance with SSPC-SP5, "White Metal Blast Cleaning".

6.2 COATING APPLICATION

- 6.2.1 Surface Cleanliness: The surface of the prepared steel shall be blown down (clean, dry, compressed air), brushed and/or vacuumed prior to coating application to remove spent abrasive, dust, and other interference material. If grease or oil have become deposited on the surface, they shall be removed by solvent cleaning (SSPC-SP1) prior to coating application. Work schedule shall be such that a minimal amount of time is allowed between surface preparation and coating application. Any rust, which has formed, shall be removed to the specified degree of cleanliness prior to coating.
- 6.2.2 Ambient Conditions: Coatings shall be applied only when the interior surface and air temperatures are between 60°F and 100°F, the relative humidity in the tank is less than 90%, and the temperature of the surface to be painted is at least 5°F above the dew point temperature of the air in the tank.
- 6.2.3 Mixing: Materials to be mixed shall have been delivered to the jobsite and stored in accordance with Section 5 and shall not have exceeded its shelf life. Mixing shall conform to the requirements of the coating manufacturer.
- 6.2.4 For 4100 (4110), mix Part II into Part I using a high-speed mechanical agitator with mixing blades fitting close to sides of container, making sure all of Part II is completely mixed with Part I. Mix well until obtaining a smooth liquid free of any unmixed particles of pigment. Add Part III and mix well. Part I is the liquid resin, Part II is the pigment, and Part III is the small portion of catalyst. Splitting of kits is not recommended. If necessary, mix Part I and Part II thoroughly and proportion mixture accurately with Part III. Continuous mixing during use is required. Operator should wear a facemask during high-speed mixing of the coating components. Avoid breathing dust.

Hemple TL-220S AR

Is only a two part mix (Part A and Part B), only mix just prior to spraying, not in advance. Refer to technical bulletin when using. Thin only when strip coating.

- 6.2.5 Only complete kits shall be mixed. Paint which has skinned, gelled, separated, or otherwise deteriorated during storage to the extent that it cannot be remixed to a homogeneous film of the intended viscosity, uniformity and consistency shall not be used. Mixed coatings shall not be used beyond their pot life.

- 6.2.6 Thinning: Only Plasite 20 thinner shall be used for thinning Plasite 4100 (4110) and the amount of thinning will be limited to about 10%. If NSF 61 criteria is specified, follow Plasite requirements for Thinner content. Hemple TL-220 AR is not recommended to be thinned.
- 6.2.7 Methods: 4100 (4110) coatings shall be applied by conventional spray. Coating applications shall be in accordance with the requirements of SSPC-PA1 and the Plasite 4100 (4110) Technical Bulletin. In the event of a conflict, the requirements of this specification, manufacturer's instructions and PA1 shall prevail in that order. Hemple TL-220 AR shall be applied by airless pump and hopper/gravity feed set up.
- 6.2.8. Methods: Semstaone Thixatrope-C shall be mixed with appropriate vinyl ester at an approximate 75% lining to 25% Semstone by hand to a paste like consistency than add hardener.
- 6.2.9 Agitation: Plasite 4100 (4110) material must be kept agitated in spray pots or containers during application.
- 6.2.10 Coating Thickness: Vinyl ester shall be applied to a dry film thickness of between 20 and 25 mils. The Semstone caulking mix shall be applied to a sufficient thickness to fill in all crevices and irregularities.
- 6.2.11 Coating Continuity: Coating shall have smooth, streamline surfaces relatively free of dry spray, over spray, orange peel, fish eyes, craters, bubbles, and other significant defects. Shadow-through, skips and misses are not acceptable. Runs or sags can be brushed out while the material remains wet. Areas where blast products or other debris have become embedded in the paint film shall be repaired by removing these products and touching up the area. Coatings shall be commercially continuous as defined by NACE Publication 6F-166; Calgon Carbon Corporation reserves the right to verify coating continuity.
- 6.2.12 Re-Coat Time and Cleanliness: Any required subsequent coats shall be applied only after the previously applied coat has been allowed to dry as required by the manufacturer's Technical Bulletins, but as soon as possible in order to minimize exposure to intercoat contamination. Any such surface contamination, which is present, shall be removed prior to the application of subsequent coats.

6.3 SAFETY

- 6.3.1 The coating system may be handled safely by trained personnel following normal laboratory and plant standards for good housekeeping and personal hygiene. In the event of skin contact complications, the affected areas should be washed with soap and water. Eye protection is recommended. Work shall be performed in well-ventilated areas away from an open flame. When in enclosed areas, although ventilated, fresh air masks should be provided.
- 6.3.2 The Plasite catalyst or curing agent is relatively stable at room temperature but must be protected from contamination, heat and fire and is classified by the Interstate

Commerce Commission as an “oxidizing material” and subsequently all shipping containers bear a yellow caution label. The catalyst is highly irritating if it gets into the eyes. Immediately rinse eyes thoroughly with water and get medical attention. The catalyst also can be a skin irritant and this should be removed with large quantities of soap and water. Since this is an oxidizing material, it should not be allowed to accumulate or remain in soaked rags or clothing.

7.0 INSPECTION AND TESTING

7.1 INSPECTION

7.1.1 Contractor Inspection: The Contractor shall be responsible for inspection of all phases of the surface preparation and coating application in accordance with the Inspection Procedure.

7.1.2 Owner Inspection: Calgon Carbon reserves the right to inspect all phases of the coating operation to assure compliance with specification requirements. The Contractor shall repair/correct any and all deficiencies at his own expense. The Contractor shall provide accessibility and lighting for any inspections. It is not intended, however, that the presence or activity of such inspection shall, in any way whatsoever, relieve the Contractor of his obligation to provide inspection of his own to assure compliance with this specification. In all cases, Calgon Carbon or its approved agent will perform final inspection before acceptance.

7.1.3 Work Stoppage: Calgon Carbon reserves the right to stop any and all work at any time for non-compliance with the requirements of this specification.

7.2 TESTING

7.2.1 Check dry film thickness of coating by means of a fixed probe or magnetic pull-off type gage. Dry film testing to be in accordance with SSPC-PA2.

8.0 INSPECTION PROCEDURE

8.1 SURFACE PREPARATION

8.1.1 The applicator is required to fill out an EAP-2A form (supplied by Calgon Carbon Corporation) and have the form available for the Calgon Carbon Corporation inspector at the time of his inspection. Approved lining applicators may use their own inspection format if agreed to by Calgon Carbon Corporation.

8.1.2 Verify prior to blast cleaning that sharp edges, weld splatter, slivers, laminations, scabs or any other surface irregularities have been adequately removed to provide a surface suitable for coating application.

8.1.3 Verify prior to blast cleaning that heavy deposits of oil and/or grease have been adequately removed in accordance with “Solvent Cleaning” (SSPC-SP1).

8.1.4 Prior to blast cleaning operations, perform compressed air cleanliness test at least once per eight-hour shift. Insert a clean, white blotter or clean, white paper into the

air stream no more than 18 inches from air source downstream of moisture and oil separators for approximately two minutes. Examine the blotter or paper for signs of moisture and/or oil contamination. Blast cleaning should not begin unless air is free of detrimental amounts of oil and/or water.

- 8.1.5 Verify that only clean and dry abrasives will be used. If bulk abrasive is to be used, verify that the abrasive is properly protected from rain, moisture, and oil.
- 8.1.6 If abrasives are recycled, test for the presence of abrasive contamination. Add approximately one ounce of recycled abrasive to several ounces of clean water. Shake contents vigorously and visually examine the water level for signs of oil contamination.
- 8.1.7 Angular abrasive that will provide an anchor profile depth minimum equal to two mils as measured by Testex Press-O-Film replica tape.
- 8.1.8 Verify that required protective coverings are intact to assure that previously coated surfaces will not be damaged during blast cleaning operations.
- 8.1.9 Monitor and record ambient conditions and surface temperatures during blast cleaning operations using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables and record on the EAP-2A form.
- 8.1.10 "Final blast cleaning" shall not be performed unless the surface temperature is at least 5°F higher than the dew point. "Rough blasting" may be performed regardless of ambient conditions, but must be "final blast cleaned" when conditions become favorable.
- 8.1.11 Verify that blast cleaned surfaces have been prepared in accordance with SSPC-SP5, "White metal blast cleaning". SSPC-VIS-1 may be used as a visual reference. Mark all non-conforming areas with chalk or spray paint for rework.
- 8.1.12 Verify the profile (one to two mils minimum) has been achieved using the Testex Press-O-Film replica tape.
- 8.1.13 Using a dry film thickness gage, determine the magnetic base reading and record.

8.2 COATING PREPARATION

- 8.2.1 Verify that all containers are sealed, intact and properly labeled.
- 8.2.2 Verify that all coating material temperatures are at least 60°F before mixing.
- 8.2.3 Verify type of coating mixed, batch numbers of all components, type of thinner and batch number, thinning ratios, time of mix, maximum pot life, etc. and record batch numbers on the EAP-2A form.
- 8.2.4 Verify that all components are combined and thoroughly mixed in the proper proportions to obtain a uniform color, free of lumps.

8.2.5 Verify that only the recommended thinner is used.

8.2.6 Verify that the pot life is observed.

8.3 APPLICATION OF ALL COATINGS

8.3.1 Monitor and record ambient conditions on the EAP-2A form and surface temperatures every three to four hours during coating application using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables. Coating application shall not be permitted when the surface temperature is less than 5°F above the dew point. No coatings shall be applied when the surface and/or material temperatures are less than 70°F. No coatings shall be applied when the surface temperature is expected to drop below 60°F before it has dried. Coating application shall not be permitted when the relative humidity is greater than 90%.

8.3.2 Verify compressed air cleanliness and test for conventional spray application and blowdown operations (see Section 8.1.3). Plasite 4100 (4110) must be applied using an agitated conventional pressure pot using continuous agitation during application.

8.3.3 Verify that protective coverings previously established are intact.

8.3.4 Verify that surrounding air is free of airborne contaminants prior to the application of coatings.

8.3.5 Verify intercoat cleanliness and that blast-cleaned surfaces have been cleaned to assure that coatings will not be applied over oil, grease, dirt, dust, spent abrasive, etc.

8.4 APPLICATION

8.4.1 Verify that vinyl ester has been applied to all surfaces prepared that day before visual oxidation takes place. Any surfaces not coated the same day shall be reblasted prior to coating application.

8.4.2 Verify that weld seams, crevices and irregularities have been brush coated and filled in with the Semstone vinyl ester mix prior to the spray application of the vinyl ester.

8.4.3 Verify that the first coat has been applied to a dry film thickness of 20-25 mils. Perform dry film thickness tests in accordance with SSPC-PA2.

8.5 FINAL INSPECTION OF COATED SURFACES

- 8.5.1 Verify that all surfaces have a smooth and uniform appearance free of any irregularities.
- 8.5.2 Verify that the total dry film thickness (minimum two coats) is 20-25 mils. Perform dry film thickness tests.
- 8.5.3 All repairs shall be made in strict accordance with this specification. If repairs are required, the EAP-2 inspection form shall be completed as directed by the Calgon Carbon Corporation inspector.

9.0 SPECIAL REQUIREMENTS FOR NSF-61 (WHEN SPECIFIED)

- 9.1 When the end-use application requires compliance with NSF-61, Plasite must be applied in accordance with specific instructions found in the product bulletin. Applicator must follow these specific instructions.
- 9.2 CCC will notify applicator that this section (9.0) applies by signifying such in the purchase order and/or drawings and specifications.
- 9.3 Force curing may follow the date of application but must be completed prior to the disinfection of the vessel at customer site.
- 9.4 The NSF criteria specified by the manufacturer cannot be altered. Any deviation must be in writing to CCC for interpretation and decision making.
- 9.5 Force curing must be conducted in a controlled manner. Heat rise shall be not greater than 1 degree per minute, up to the maximum temperature needed to achieve a 200°F minimal surface temperature. This is critical to avoid blistering or post-cure holidays.
- 9.6 Heat should be applied at top or bottom head to allow equal flow of hot air. If heating in the shell, there should be an internal attachment to allow heat to distribute equally so there is not a section of lining that heats faster than the rest. See appendix for recommended flow distribution according to Plasite's guide.
- 9.7 A strip recorder with multiple thermocouples (or other similar device) is preferred to record the temperature during the force cure process. Records shall be forwarded to CCC for retention.

**** REVISIONS ****

This specification has been revised as indicated below. The new pages added and/or the existing pages revised are attached as replacements for those previously issued.

REVISION	DATE	BY	PAGE	REMARKS
A	11/15/1993	JMcM	All	Issued For Comment
1	6/18/1992	FRF	All	Issued For Construction
2	5/10/2000	MRM		Revised Paragraph 6.1.4
3	12/15/2005	JMcM	All	General Revision
4	11/9/07	RES	9	Added 9.0, NSF Force Curing
5	8/7/2019	TAB	All	Include Hemple TL-220S AR
6	09/21/2021	TAB	All	Increased millage to 20-25

ISSUED: JUNE, 1992



SECTION 4

PAINT SPECIFICATIONS

Specification Number: RS15
Polyurethane Painting (Top Coat)

Scope

- 1.1. This specification covers the minimum procedures required for the surface preparation and coating of equipment that has been painted previously.
- 1.2. The work to be performed under this specification consists of painting all metal materials including vessels, supports, base plates, skids, pipe, pipe supports, brackets, hanger rods, pipe clamps, and all other metal surfaces, not mentioned in Section 4.0, that are part of the system **references BLP-003 Painting and Coating of Metal Surfaces with Inspection.**
- 1.3. The “applicator” referred to in this specification could be Calgon Carbon Corporation or a sub-contractor.
- 1.4. Unless otherwise specified, the applicator shall furnish all paints and solvents, necessary tools, scaffolds, ladders, compressed air, etc.
- 1.5. The applicator will familiarize himself with rules and regulations as set forth by the Safety Department of the facility where painting is to be conducted and comply with these regulations.

2.0 Surface Preparation Of Painted Surfaces

- 2.1. Previously coated surfaces that are in good condition:

Maintenance painting will frequently not permit or require complete removal of all old coatings prior to re-painting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold mildew, mortar, efflorescence and sealers must be removed to assure sound bonding to the tightly adhering old paint.

In addition, glossy surfaces of old paint films must be clean and dull before re-painting. Thorough washing with an abrasive kitchen cleanser will clean and dull in one operation, or wash thoroughly and dull by sanding. Remove all sanding dust.

The applicator shall recognize that any surface preparation short of total removal of the old coatings may compromise the service length of the new coating system. The applicator shall always check for the compatibility of the previously-painted surface with the new coating by applying a test patch of 2-3 square feet. Allow to dry thoroughly; then check adhesion.

- 2.2. Previously coated surfaces that are not in good condition:

The applicator will hand-tool clean the surfaces to remove loose rust, loose mill scale and loose paint to the degree specified by SSPC-SP2-63 **and references Procedure BLP-001 Media Blasting of Steel Vessels, Pipe, and Structural which includes surface cleaning and prep.** The applicator shall accomplish this by hand chipping, scraping, sanding, wire brushing or abrasive blasting. The applicator shall further prepare the hand-tool cleaned surface per Paragraph 2.1 above.

3.0 Paint Application

- 3.1. Ensure base coat is cured before applying top coat of polyurethane.
- 3.2. The coating shall be applied in accordance with the manufacturer's instructions.
- 3.3. The system shall consist of at least one (1) coat of acrylic polyurethane to a total DFT of 3 nominal mils (acceptable range: 2-4 mils).
- 3.4. All paint shall be within its expiration date and furnished in unopened containers.
- 3.5. Thinners shall be used only as specified in the coating manufacturer application procedures.
- 3.6. Painting will not be allowed when the relative humidity is above 85% or the surface temperature is below 55°F without special permission from Calgon Carbon Corporation.
- 3.7. Any surface that develops rust or discoloration prior to painting shall be re-prepared per Section 2.2 above.

4.0 Areas NOT to be painted

- 4.1. Galvanized steel (new) and plastic, such as PVC pipe, are not to be painted.
- 4.2. Inside of pipes shall not be painted.
- 4.3. Gauge faces, nameplates, plastic or S/S fittings, flange faces, etc. shall be masked to protect against overspray and the masking shall be removed prior to shipping.
- 4.4. Inside of a vessel. Vessel lining is covered in a different specification.

5.0 Material Specification

- 5.1. The paint used shall be a two part acrylic polyurethane. The approved manufacturers and products are listed below. The manufacturer's specifications shall be followed along with any recommendations and precautions stated on the container's label.

Approved products include:

Hempel Hempthane HS 55610

Carboline -- Carbothane 134 HG

Sherwin Williams -- Acrolon 218 HS

International -- Interthane 990HS

Other manufacturers/products may be proposed, but are subject to Calgon Carbon Corporation approval prior to use.

- 5.2. The color shall match Carboline #A767 "Slate Gray" or as specified on the project drawings.

**** Revisions ****

This specification has been revised as indicated below. The new pages added and/or the existing pages revised are attached as replacements for those previously issued.

REVISION	DATE	BY	PAGE	REMARKS
0	7/19/1983	JDH	All	Issued for Construction
1	01/20/2010	RES	All	New format
2	08/27/2013	RES	2	Added Carbothane 134 HG
3	10/10/2016	TIG	1-2	Updated Procedure
4	10/16/2018	RES	3	Added Hempthane HS

Selection & Specification Data

Generic Type	Aliphatic Acrylic Polyurethane
Description	Thin film, high gloss finish with exceptional weathering performance characteristics. Used extensively in virtually all industrial markets, 134 HG provides a smooth, durable finish that has superior resistance to corrosion, abrasion and chemical exposure.
Features	• High solids, low VOC content • Excellent weatherability • Exceeds SSPC Paint 36 specification for a Level 3 urethane • Available in all Carboline colors including metallic-pigmented colors • Excellent flow characteristics allow for application by spray or roller • Superior impact and abrasion resistance • Indefinite recoatability • VOC compliant to current AIM regulations • Suitable for use in USDA inspected facilities
Color	Refer to Carboline Color Guide. Certain colors, particularly in non-lead safety oranges, reds and yellows may require multiple coats for adequate hiding. Check color suitability before use.
Finish	Gloss
Primer	Refer to Substrates & Surface Preparation.
Topcoat	Carbothane® 134 Clear Coat when required
Dry Film Thickness	2.0 - 3.0 mils (51 - 76 microns) per coat
Solids Content	By Volume 70% +/- 2%
Theoretical Coverage Rate	1123 ft ² at 1.0 mils (27.6 m ² /l at 25 microns) 561 ft ² at 2.0 mils (13.8 m ² /l at 50 microns) 374 ft ² at 3.0 mils (9.2 m ² /l at 75 microns)
VOC Values	Thinner 214 25 oz/gal 2.9 lbs./gal (348 g/l) Thinner 215 25 oz/gal 3.0 lbs./gal (362 g/l) Thinner 25 25 oz/gal 3.06 lbs./gal (366 g/l) As Supplied 2.2 lbs./gal (264 g/l) These are nominal values and may vary slightly with color.
Dry Temp. Resistance	Continuous: 200 °F (93 °C) Non-Continuous: 250 °F (121 °C) Discoloration and loss of gloss is observed above 200°F (93°C).
Limitations	*The alignment of aluminum flakes in aluminum-filled finishes is very dependent on application conditions and techniques. Care must be taken to keep conditions as constant as possible to reduce variations in final appearance. It is also advisable to work from a single batch of material since variations can occur from batch to batch. For more information consult Carboline Technical Service Department.

Substrates & Surface Preparation

General	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating. For all surfaces prime with specific Carboline primer as recommended by your Carboline sales representative. Refer to the specific primer's Product Data Sheet for detailed requirements.
Galvanized Steel	Prime with specific Carboline primer as recommended by your Carboline Sales Representative. Refer to the specific primer's Product Data Sheet for substrate preparation requirements.
Previously Painted Surfaces	Lightly sand to roughen and degloss the surface. Existing paint must attain a minimum 3A rating in accordance with ASTM D3359 "X-Scratch" adhesion test.

Performance Data

Test Method	System	Results
ASTM B117 Salt Fog	Blasted Steel 1 ct Org Zinc 1 ct. Epoxy 1 ct 134 HG	No rusting, blistering, loss of bond or any measurable creepage from the scribe after 3000 hours.
ASTM D2794 Impact Resistance	Blasted Steel 1 ct 134 HG	155 inch-pounds; no visible cracking. Gardner Impact Tester
ASTM D3359 Adhesion	Blasted Steel 1 ct. Epoxy 1 ct 134 HG	5A
ASTM D3363 Hardness	Blasted Steel 1 ct Epoxy 1 ct 134 HG	H
ASTM D4060 Abrasion	Blasted Steel 1 ct 134 HG	70 mg. loss after 1000 cycles, CS17 wheel, 1000 gm. load
ASTM D4541 Adhesion	Blasted Steel 1 ct. Epoxy 1 ct. 134 HG	2562 psi Pneumatic
ASTM D870 Immersion Resistance	Blasted Steel 1 ct. Org. Zinc 1 ct Epoxy 1 ct 134 HG	No rusting in the scribe; no blistering, softening or discoloration either 30 days of soft water imm
ASTM G26 Weatherometer	Blasted Steel 1 ct. Epoxy 1 ct. 134 HG	No blistering, rusting or cracking; gloss retention of 85%; color change of 1 McAdam unit after 2000
ASTM G53 ASTM D4587 Accelerated Weathering	Blasted Steel 1 ct. Org. Zinc 1 ct. Epoxy 1 ct. 134 HG	No rusting, blistering or loss of adhesion; less than 5% gloss loss after 3000 hours

Test reports and additional data available upon written request.

Mixing & Thinning

Mixing	Power mix Part A separately, then combine with Part B and power mix. DO NOT MIX PARTIAL KITS.
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Carbothane® 134 HG

Mixing & Thinning

Thinning	Spray: Up to 25 oz/gal (20%) w/ Thinner 214 or 25
	Brush: Up to 25 oz/gal (20%) w/ Thinner 215
	Roller: Up to 25 oz/gal (20%) w/ Thinner 215
	Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied. Carboline Thinner 236E may also be used to minimize HAP and VOC emissions.
Ratio	4:1 Ratio (A to B)
Pot Life	4 Hours at 75°F (24°C) and less at higher temps. Pot life ends when coating becomes too viscous to use. MOISTURE CONTAMINATION WILL SHORTEN POT LIFE AND CAUSE GELLATION.

Application Equipment Guidelines

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

Spray Application (General)	This is a high solids coating and may require adjustments in spray techniques. Wet film thickness is easily and quickly achieved. Spray equipment is available from manufacturers such as Binks, DeVilbiss and Graco.
Conventional Spray	Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, .070" I.D. fluid tip and appropriate air cap.
Airless Spray	*Pump Ratio: 30:1 (min.) GPM Output: 3.0 (min.) Material Hose: 3/8" I.D. (min.) Tip Size: .015-.017" Output PSI: 2100-2400 Filter Size: 60 mesh *Teflon packings are recommended and available from the pump manufacturer.
Brush & Roller (General)	Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or rerolling. For best results, tie-in within 10 minutes at 75°F (24°C).
Brush	Recommended for touch-up only. Use a medium, natural bristle brush.
Roller	Use a short-nap mohair roller cover with phenolic core.

Application Conditions

Condition	Material	Surface	Ambient	Humidity
Minimum	50 °F (10 °C)	35 °F (2 °C)	35 °F (2 °C)	10%
Maximum	100 °F (38 °C)	120 °F (49 °C)	95 °F (35 °C)	80%

Industry standards are for substrate temperatures to be above 5°F (3°C) the dew point. **Caution:** This product is moisture sensitive in the liquid stage and until fully cured. Protect from high humidity, dew and moisture contact until fully cured. Application and/or curing in humidities above maximum, or exposure to moisture from rain or dew may result in a loss of gloss and/or microbubbling of the product.

Curing Schedule

Surface Temp.*	Dry to Handle	Dry to Recoat & Topcoat w/ other finishes	Final Cure General
35 °F (2 °C)	36 Hours	36 Hours	14 Days
50 °F (10 °C)	16 Hours	16 Hours	10 Days
75 °F (24 °C)	8 Hours	8 Hours	7 Days
90 °F (32 °C)	4 Hours	4 Hours	5 Days

These times are based on a 2.0 mil (50 micron) dry film thickness. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure.

***Maximum recoat times are indefinite.** Surface must be clean and dry. As part of good painting practice it is recommended to test for adhesion by wiping the surface with Thinner 214 or 215. If the film shows a slight "tack" the surface is suitable for recoating without extensive surface preparation such as abrading.

Carboline Additive 101 can be used to accelerate the film forming process in this product for conditions outside of the parameters of this data sheet. Carboline Additive 101 is added at a rate of 1.0-2.0 oz per mixed gallon or a maximum of 6 oz per mixed five gallons. At this addition rate, Additive 101 will accelerate the cure rate of the urethane product between 25-40% depending on the substrate temperature range and reduce the pot life of the product by approximately 40-50% of that stated on the product data sheet. With the use of Additive 101, this product will continue to cure at temperatures as low as 20°F (-7°C).

Cleanup & Safety

Cleanup	Use Thinner 2 or Acetone. In case of spillage, dispose of in accordance with local applicable regulations.
Safety	Read and follow all caution statements on this product data sheet and on the MSDS for this product and use personal protective equipment as directed.
Ventilation	When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not able to monitor levels, use MSHA / NIOSH approved respirator.

Packaging, Handling & Storage

Shelf Life	Part A: Min. 36 months at 75°F (24°C) Part B: Min. 24 months at 75°F (24°C) *Shelf Life: when kept at recommended storage conditions and in original unopened containers.
Shipping Weight (Approximate)	1 Gallon Kit - 13 lbs (5kg) 5 Gallon Kit - 57 lbs (26 kg)
Storage Temperature & Humidity	40° -110°F (4°-43°C) 0-80% Relative Humidity
Flash Point (Setflash)	Carbothane 134 HG Part A: 50°F (10°C) Urethane Converter 811 Part B: 127°F (53°C)
Storage	Store Indoors.

This product is solvent based and not affected by excursions below these published storage temperatures, down to 10°F, for a duration of no more than 14 days. Always inspect the product prior to use to make sure it is smooth and homogeneous when properly mixed.



June 2015

To the best of our knowledge the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Carboline Company to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of products. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY CARBOLINE, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Carboline® and Carboguard® are registered trademarks of Carboline Company.

0859

Specification Number: RS17
EPOXY PAINTING

1.0 SCOPE

- 1.1 This specification covers the minimum procedures required for the surface preparation and coating of equipment that has not been previously painted. It also covers equipment that has been previously painted and **BLP-003 Painting and Coating of Metal Surfaces with Inspection and reference BLP-001 Media Blasting of Steel Vessels, Pipe and Structural which includes surface cleaning and prep.**
- 1.2 The work to be performed under this specification consists of painting all metal materials including vessels, supports, base plates, skids, pipe, pipe supports, brackets, hanger rods, pipe clamps, and all other metal surfaces, not mentioned in Section 5.0, that are part of the system.
- 1.3 The “applicator” referred to in this specification could be Calgon Carbon Corporation or a sub-contractor.
- 1.4 Unless otherwise specified, the applicator shall furnish all paints and solvents, necessary tools, scaffolds, ladders, compressed air, etc.
- 1.5 The applicator will familiarize himself with rules and regulations as set forth by the Safety Department of the facility where painting is to be conducted and comply with these regulations.

2.0 SURFACE PREPARATION OF PAINTED SURFACES

2.1 *Previously coated surfaces that are in good condition:*

Maintenance painting will frequently not permit or require complete removal of all old coatings prior to re-painting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold mildew, mortar, efflorescence and sealers must be removed to assure sound bonding to the tightly adhering old paint.

In addition, glossy surfaces of old paint films must be clean and dull before re-painting. Thorough washing with an abrasive kitchen cleanser will clean and dull in one operation, or wash thoroughly and dull by sanding. Remove all sanding dust.

It is recommended that water blasting be used (NACE Standard RP-01-72) which removes foreign matter by water (with cleanser) at pressures of 2,000-5,000 PSI at a flow of 4-14 gallons per minute.

The applicator shall recognize that any surface preparation short of total removal of the old coatings may compromise the service length of the new coating system. The applicator shall always check for the compatibility of the previously-painted surface with the new coating by applying a test patch of 2-3 square feet. Allow to dry thoroughly; then check adhesion.

2.2 *Previously coated surfaces that are not in good condition:*

The applicator will hand-tool clean the surfaces to remove loose rust, loose mill scale and loose paint to the degree specified by SSPC-SP2-63. The applicator shall accomplish this by hand chipping, scraping, sanding, and wire brushing. The applicator shall further prepare the hand-tool cleaned surface per Paragraph 2.1 above.

3.0 SURFACE PREPARATION OF UNPAINTED SURFACES

- 3.1 The metal surface shall be free of dirt, rust, rust-proofing, drawing oils and compounds, finger prints, mill scale, and other foreign substances both visible and invisible; thereby improving adhesion and reducing the tendency to blister and corrode on exposure.
- 3.2 The applicator shall use remove all loose rust and mill scale to the degree specified by SSPC-SP3-63 by power-tool chipping, de-scaling, sanding, wire brushing, grinding, or media blasting as a minimum. **SSPC-SP10** Near White Blast cleaning is preferred **reference BLP-001 Media Blasting of Steel Vessels, Pipe and Structural which includes surface cleaning and prep.**

4.0 PAINT APPLICATION

- 4.1 The coating shall be applied in accordance with the manufacturer's instructions and also references **BLP-003 Painting and Coating of Metal Surfaces with Inspection.**
- 4.2 The system shall consist of at least one (1) coat of epoxy mastic to a total DFT of 12 nominal mils (acceptable range: 10-14 mils).
- 4.3 All paint shall be within its expiration date and furnished in unopened containers.
- 4.4 Thinners shall be used only with the permission of Calgon Carbon Corporation.
- 4.5 Painting will not be allowed when the relative humidity is above 85% or the temperature is below 55°F without special permission from Calgon Carbon Corporation which references **BLP-003 Painting and Coating of Metal Surfaces with Inspection.**
- 4.6 Any surface that develops rust prior to painting shall be re-prepared per Sections 2.0 or 3.0 above.
- 4.7 Flange faces shall be fully painted from the outside diameter of the flange to the inside diameter of the flange to reduce the tendency for rust bleeding out from flanged joints after hydro testing. If customer specifications prohibit this practice, verify with engineering which specification is to prevail.

5.0 AREAS NOT TO BE PAINTED

- 5.1 Galvanized steel (new) and PVC pipe are not to be painted.

- 5.2 Inside of pipes shall not be painted.
- 5.3 Gauge faces, nameplates, plastic or S/S fittings and similar items shall be taped to protect against overspray. Tape shall be removed prior to shipping.
- 5.4 Inside of vessel shall be lined by others.

6.0 MATERIAL SPECIFICATION

- 6.1 The paint used shall be Hempel Hempadur Mastic 45880/45881 (two-part) epoxy coating system, or equal. The manufacturer's specifications are attached and shall be followed along with any recommendations and precautions stated on the paint can label.

Accepted substitutes are:

Carboline Carboguard 60
Sherwin-Williams -- Macropoxy 646 Series
International Protective Coatings -- Interseal 670

Other manufacturers may be proposed, but are subject to Calgon Carbon approval prior to use.

- 6.2 The color shall match Carboline #A767 "Slate Gray" or as specified on the project drawings.

**** REVISIONS ****

This specification has been revised as indicated below. The new pages added and/or the existing pages revised are attached as replacements for those previously issued.

REVISION	DATE	BY	PAGE	REMARKS
0	9/8/1989	FRF	All	Issued for Construction
1	1/30/1996	JPM	All	All New Pages; Revised Paragraph 4.1
2	4/15/1996	JPM	1-2-3	Revised Paragraphs 1.3, 2.2, 3.2, 4.1, 5.3, 6.1 and 6.2
3	6/4/2002	JPM	All	Revised 1.2, 1.5, 3.2, 5.3, 6.1, 6.2
4	6/08/2007	TAB	3	Revised 6.1 and 6.2
5	4/22/2008	RES	All	General Revision
6	01/13/2010	RES	3	Revised Paragraph 6.1 to SW 646
7	04/09/2013	RES	3	Revised Paragraphs 6.1 and 6.2
8	07/05/2016	RES	2	Revised Paragraphs 4.7 & 5.3, Flange Faces
9	10/10/2016	TIG	1-2	Revised Procedure
10	3/29/2018	RES	2	Revised Paragraph 4.2, Changed DFT
11	10/16/2018	RES	3	Revised Paragraph 6.1 to Hempel
12	2/19/2020	TIG	2	Revised Paragraph 3.2 changed SP7 to SP10

ISSUED: SEPTEMBER 8, 1989

SELECTION & SPECIFICATION DATA

Generic Type	Epoxy Polyamide
Description	Carboguard 60 is a high solids, versatile, abrasion resistant, chemical resistant, and corrosion resistant coating. It can be used as a primer, intermediate coat, or self-priming finish over steel or inorganic zinc primers. May be topcoated with itself, or a broad variety of high performance finish coats. This product has excellent wetting properties giving it the capability of going over marginally prepared substrates. It is ideal for maintenance and fabrication shop applications. An optional Glass Flake (GF) additive or micaceous iron oxide (MiO) additive can be purchased separately and may be used to enhance film strength for more abusive applications for severe marine or heavy industrial uses. Consult Technical Service for suitability as a lining or other exposures.
Features	• Low odor and low VOC • Available in a variety of rapid tint colors* • Attractive medium sheen for tank exteriors • Good chemical resistance • Used as a primer, intermediate, or finish coat • Fast cure & dry times • Can be applied over power tool cleaned surfaces • VOC compliant to current AIM regulations • Good abrasion resistance *RTS not recommended for immersion service.
Color	Primer color (0700) gray. Variety of other finish coat colors in rapid tint service. MiO additive will darken (grey) all colors.
Finish	Semi-Gloss
Primer	Self-priming. May be applied over organic and inorganic zinc rich primers. A mist coat may be required to minimize bubbling over zinc rich primers.
Dry Film Thickness	4 - 6 mils (102 - 152 microns) per coat as a primer or an intermediate without additives 4 - 10 mils (102 - 254 microns) per coat (2 coats) may be used direct-to-metal 8 - 12 mils (203 - 305 microns) per coat with GF or MiO additives Do not exceed 10 mils in a single coat (without additives)
Solids Content	By Volume 72% +/- 2%
Theoretical Coverage Rate	1155 ft²/gal at 1.0 mils (28.3 m²/l at 25 microns) 289 ft²/gal at 4.0 mils (7.1 m²/l at 100 microns) 96 ft²/gal at 12.0 mils (2.4 m²/l at 300 microns) Allow for loss in mixing and application.
VOC Values	Thinner 2 13 oz/gal 2.47 lbs./gal 296 g/l Thinner 2 6 oz/gal 2.23 lbs./gal 267 g/l Thinner 33 15 oz/gal 2.57 lbs./gal 308 g/l As Supplied 2.00 lbs./gal 240 g/l These are nominal values for the liquid components only and may vary slightly with color and with the addition of GF or MiO fillers.

SELECTION & SPECIFICATION DATA

Dry Temp. Resistance	Continuous: 300°F (149°C) Non-Continuous: 350°F (177°C)
	Exposure above 200°F/93°C may cause discoloration (darkening) or loss of gloss, but will not affect performance.
Limitations	RTS colors and the use of Additive 8505 with this product are not recommended for immersion service. Additive 8505 will cause discoloration of this product, but will not affect product performance in atmospheric service.
Topcoats	May be topcoated with Acrylics, Epoxies, Alkyds, or Polyurethanes depending on exposure and need.

SUBSTRATES & SURFACE PREPARATION

General	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.
Steel	For most applications: Immersion: SSPC-SP10 Non-immersion: SSPC-SP6 1.5-3.0 mils (38-75 microns)
Galvanized Steel	SSPC-SP16
Concrete or CMU	Concrete must be cured 28 days at 75°F (24°C) and 50% relative humidity or equivalent. Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.
Previously Painted Surfaces	SSPC-SP2 or SP3

PERFORMANCE DATA

Test Method	System	Results
ASTM D2794 Impact resistance	Blasted Steel 1ct.	100 in. lbs (direct)
ASTM D3366 Pencil Hardness	Blasted Steel 1 ct.	4H-5H
ASTM D4541 Adhesion	Blasted Steel 1ct. 2ct.	(Pneumatic) 1 ct. 1500+psi 2 ct. 1500+ psi
ASTM D522 Flexibility	Blasted Steel 1 ct.	No cracking, 5/8" Conical Mandrel Bend

Data based on Carboguard 60 without filler additives.

MIXING & THINNING

Mixing	Power mix separately, then combine and power mix. Allow mixed product 15 minute sweat in time before thinning if material is under 70°F. No sweat in needed above 70°F DO NOT MIX PARTIAL KITS. For GF or MiO additives, slowly add while mixing.
Thinning	Spray: Up to 13 oz/gal (10%) with Thinner #2. Brush & Roller: Up to 15 oz/gal (12%) with Thinner #33. Thinner 236E or 250E may be used as an exempt thinner in lieu of those listed above. Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied.

MIXING & THINNING

Ratio	• Liquid Components: 1:1 Ratio (A to B) • Glass Flake (GF) Additive: (1.8 lbs/mixed gal) • Micaceous Iron Oxide (MiO) Additive: (2.0 lbs/gal)
Pot Life	4 Hours at 75°F (24°C) Pot life ends when coating loses body and begins to sag. Pot life times will be less at higher temperatures. Carboline Additive 8505 can be used to aid the film forming process in the product for temperatures down to 35°F. Carboline Additive 8505 is added at a rate of 4 oz per mixed two gallon kit or 20 oz per mixed ten gallon kit. Allow mixed product 15 minute sweat in time before thinning, if material is under 70°F, and 24 hrs cure prior to topcoating for surface temperatures down to 40°F. At this addition rate, Additive 8505 will accelerate the cure rate of the epoxy product and reduce the pot life of the product.

APPLICATION EQUIPMENT GUIDELINES

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

Conventional Spray	Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, 0.070" I.D. fluid tip and appropriate air cap. For filler additives use a 0.110" I.D. fluid tip.
Airless Spray	Pump Ratio: 30:1 (min.) GPM Output: 2.5 (min.) Material Hose: 3/8" I.D. (min.) Tip Size: 0.017"-0.021" (0.035"-0.041" for filler additives) Output PSI: 2100-2500 Filter Size: 60 mesh (remove mesh for filler additives) PTFE packings are recommended and available from the pump manufacturer.
Brush & Roller (General)	Not recommended for tank lining applications except when striping welds. Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or re-rolling. For best results, tie-in within 10 minutes at 75°F (24°C). The addition of GF or MiO fillers is best applied by spray application.
Brush	Use a medium bristle brush.
Roller	Use 3/8" nap roller with a solvent resistant core.

APPLICATION CONDITIONS

Condition	Material	Surface	Ambient	Humidity
Minimum	50°F (10°C)	40°F (4°C)	40°F (4°C)	0%
Maximum	90°F (32°C)	140°F (60°C)	120°F (49°C)	85%

This product simply requires the substrate temperature to be above the dew point. Condensation due to substrate temperatures below the dew point can cause flash rusting on prepared steel and interfere with proper adhesion to the substrate. Special application techniques may be required above or below normal application conditions.

CURING SCHEDULE

Surface Temp.*	Dry to Handle	Dry to Recoat	Dry to Touch	Maximum Recoat Time
40°F (4°C)	30 Hours	48 Hours	3 Hours	1 Year
50°F (10°C)	20 Hours	24 Hours	2 Hours	1 Year
60°F (16°C)	8 Hours	10 Hours	1 Hour	1 Year
75°F (24°C)	5 Hours	7 Hours	45 Minutes	1 Year
90°F (32°C)	3 Hours	4 Hours	30 Minutes	1 Year

*These times are based on a 5.0 mil (125 micron) dry film thickness and 50% RH. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure. Excessive humidity or condensation on the surface during curing can interfere with the cure, can cause discoloration and may result in a surface haze. Any haze or blush must be removed by water washing before recoating.

NOTE: The maximum recoat times in the chart above are for atmospheric exposures. When used as a blast-hold primer for a tank lining, maximum recoat time is limited to 30 days. If the maximum recoat times have been exceeded, the surface must be abraded by sweep blasting or sanding prior to the application of additional coats. For force curing, contact Carboline Technical Service for specific requirements.

CLEANUP & SAFETY

Cleanup	Use Thinner 2 or Acetone. In case of spillage, absorb and dispose of in accordance with local applicable regulations.
Safety	Read and follow all caution statements on this product data sheet and on the SDS for this product. Employ normal workmanlike safety precautions. Use adequate ventilation. Keep container closed when not in use.
Ventilation	When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved respirator.

PACKAGING, HANDLING & STORAGE

Shelf Life	Part A & B: Min. 36 months at 75 °F (24 °C) Shelf Life: (actual stated shelf life) when kept at recommended storage conditions and in original unopened containers.
Storage Temperature & Humidity	40-100 °F (4-37.8 °C) 0-100% Relative Humidity
Storage	Store Indoors. This product is solvent based and not affected by excursions below these published storage temperatures, down to 10°F, for a duration of no more than 14 days. Always inspect the product prior to use to make sure it is smooth and homogeneous when properly mixed.
Shipping Weight (Approximate)	<u>2 Gallon Kit</u> 26 lbs. (12 kg) <u>10 Gallon Kit</u> 127 lbs. (58 kg)

PACKAGING, HANDLING & STORAGE

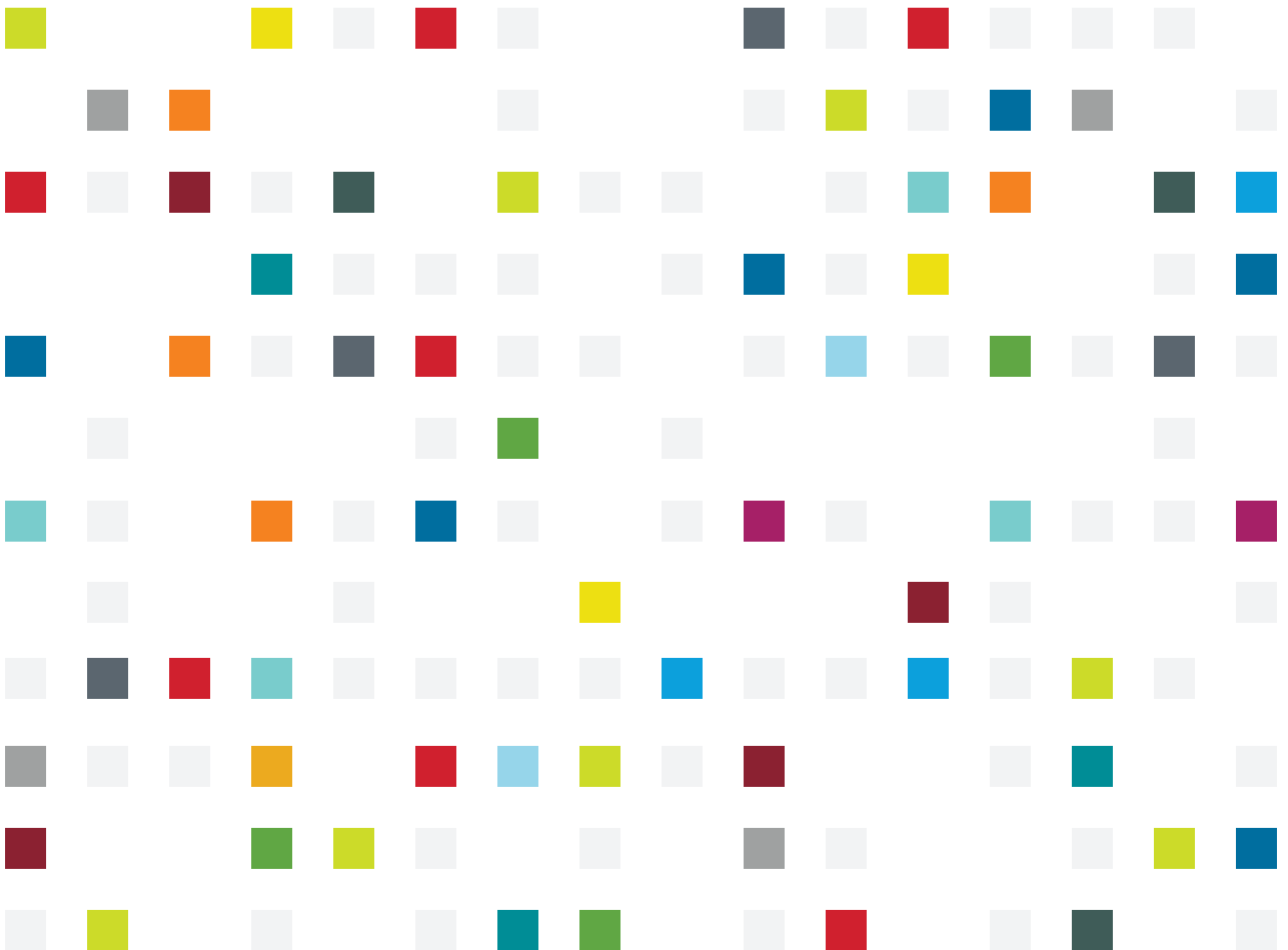
Flash Point (Setaflash)	Part A: 82°F (27.8°C)
	Part B: 71°F (21.7°C)
	Mixed: 78°F (25.6°C)

WARRANTY

To the best of our knowledge the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Carboline Company to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of products. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY CARBOLINE, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. All of the trademarks referenced above are the property of Carboline International Corporation unless otherwise indicated.

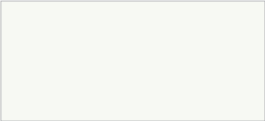
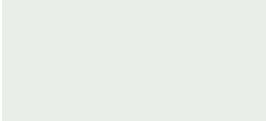
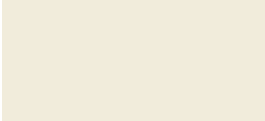
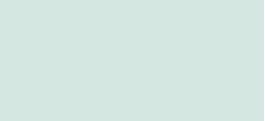
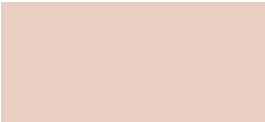
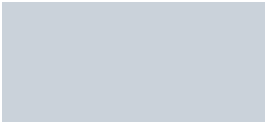
Color Logic

Intelligent Color Selection



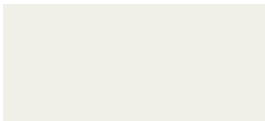
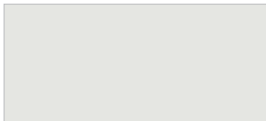
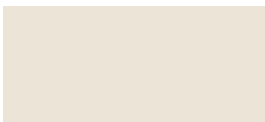
directions

new color developments and trends

				
1864 Vestal White	0832 Aviation White	0820 Carrera White	A882 Daybreak	C132 Blue Ice
				
G248 Sandcastle	8525 Classical	G171 Stratus Blue	G170 Viola	G169 Lapis Blue
				
7801 Constitution	G760 Grey Fog	J749 Louisiana Gray	4755 Pearl Gray	6225 Dark Beige
				
5255 Basket Weave	0855 Bamboo	0217 Desert Tan	B223 Cinnamon Kiss	7594 Merlot
				
F186 Window Pane	0381 Aleutian Green	4372 Hunter Green	F304 Wimbledon Green	2380 Rain Forest Green
				
1143 Nautilus	2127 Cyanine Blue	F193 Engine Blue	F140 Sapphire Blue	A700 Past Midnight

utility toolbox

maintenance and safety standards

				
A826 White Lotus	S800 Safety White	2133 Aquarius Blue	5141 Open Sky	S150 Safety Blue
				
C705 Light Gray	2716 Edison Gray	2713 Gull Gray	C703 Medium Gray	0754 Machine Gray
				
1675 Ignition Yellow	N625 Sun Yellow	6666 Safety Yellow	4444 Safety Orange	5555 Safety Red
				
1898 Aden White	9225 Cashew	G245 Dunes Tan	G250 Weathered Copper	F235 Dark Bronze
				
2394 Green Back	2383 Safety Green	D337 Offshore Green	C900 Black	

Colors shown are ink representation of actual color standards. Actual product appearance may vary slightly due to product, gloss, surface texture or method of application. Vibrant colors may require additional coats or a primer similar in color to the finish coat for optimum color rendition.

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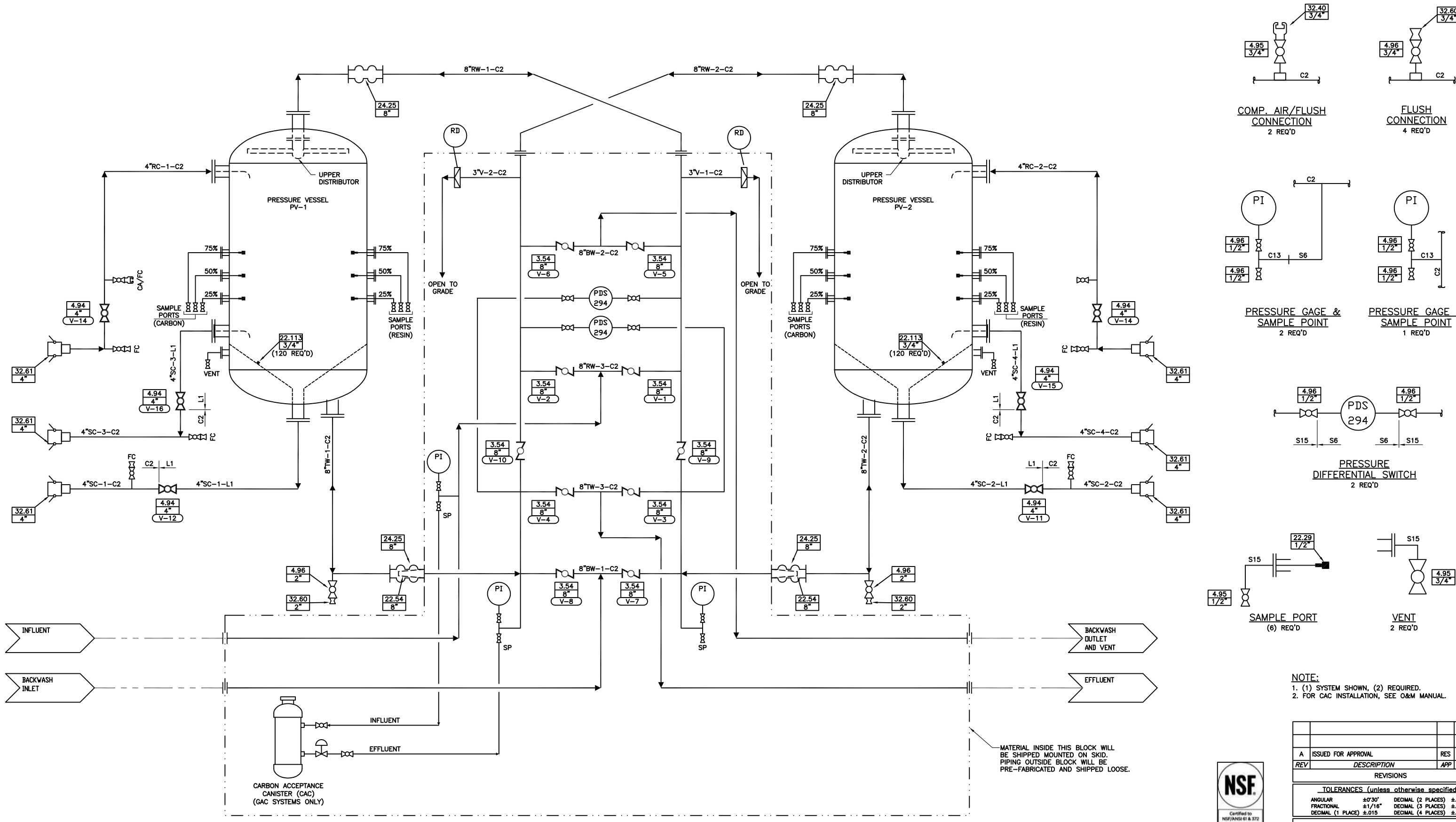
SECTION 5

DRAWINGS

SECTION 5

DRAWING INDEX

DRAWING NUMBER	REVISION	TITLE
91224266	A	Drinking Water Treatment System Model 12-40 DWC, 8" Piping Flow Diagram
91224267	B	Model 12-40, 125 PSIG 12 Ft. Dia., Internal Cone Vessel Arrangement, PV-1
91224268	B	Model 12-40, 125 PSIG 12 Ft. Dia., Internal Cone Vessel Arrangement, PV-2
91224269	C	Modular Adsorber System Model 12-40 DWC, 8" Piping General Arrangement
NEWARK-017	--	12" Sample Port Detail



NOTE:
1. (1) SYSTEM SHOWN, (2) REQUIRED.
2. FOR CAC INSTALLATION, SEE O&M MANUAL.



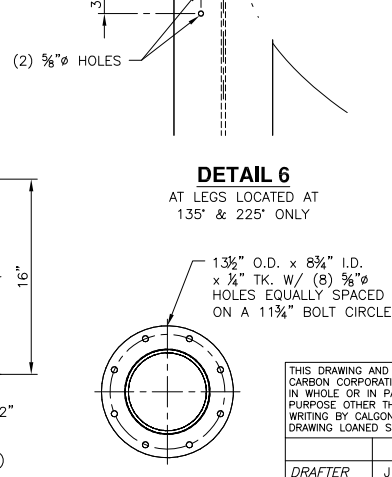
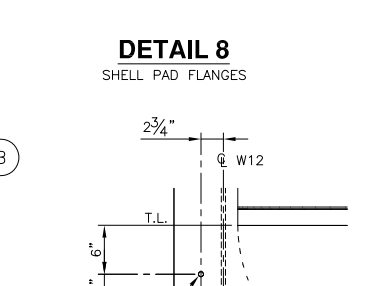
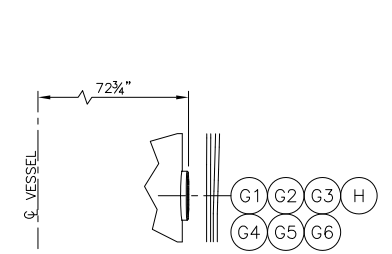
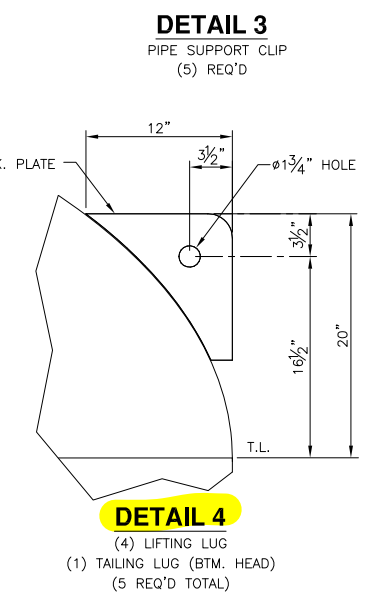
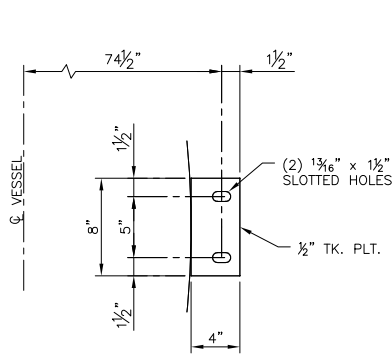
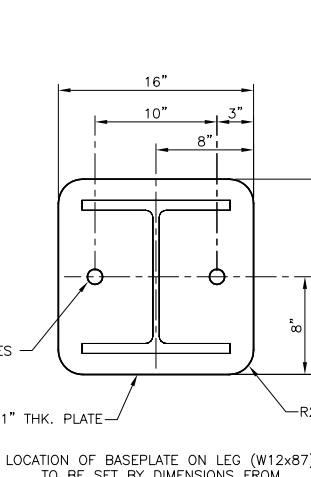
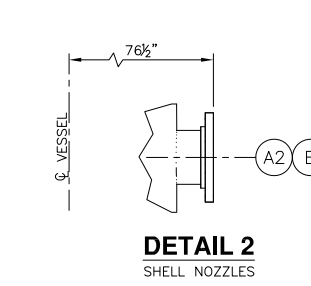
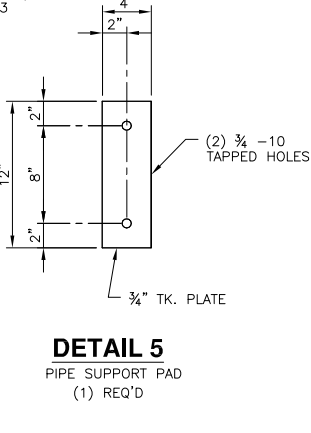
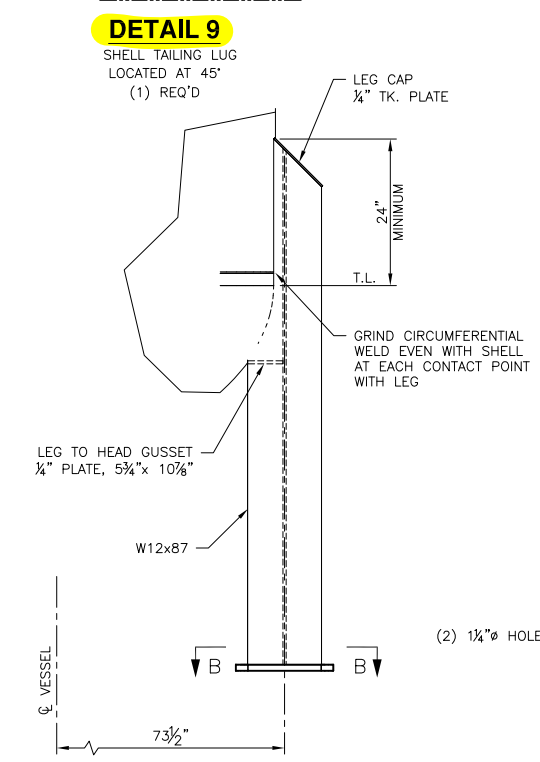
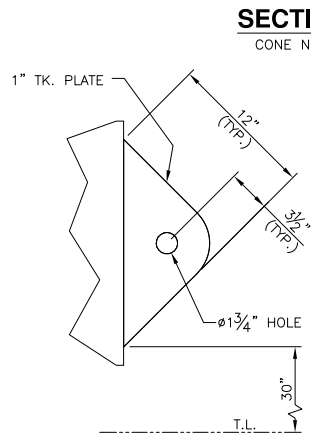
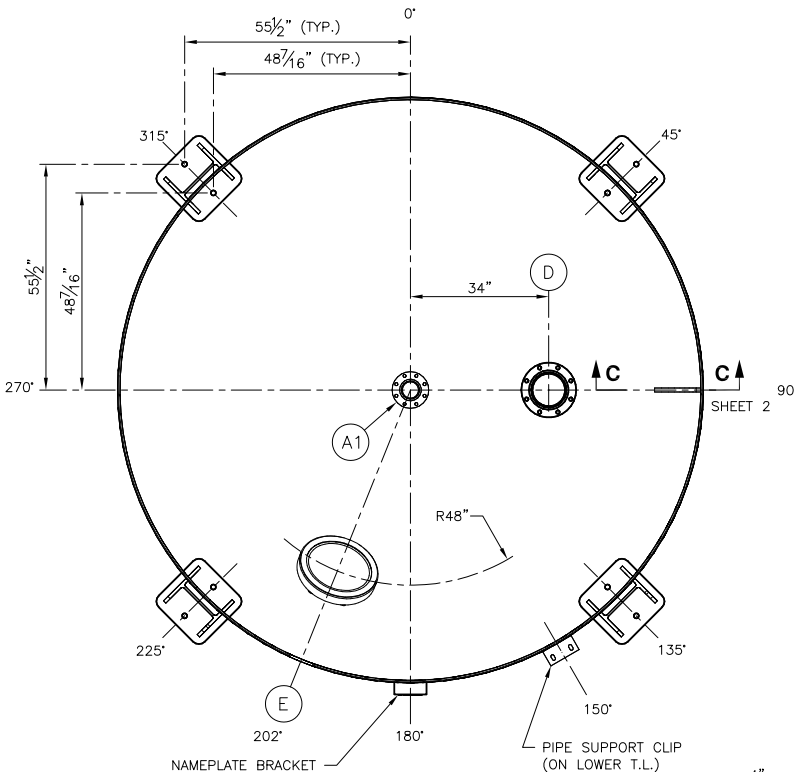
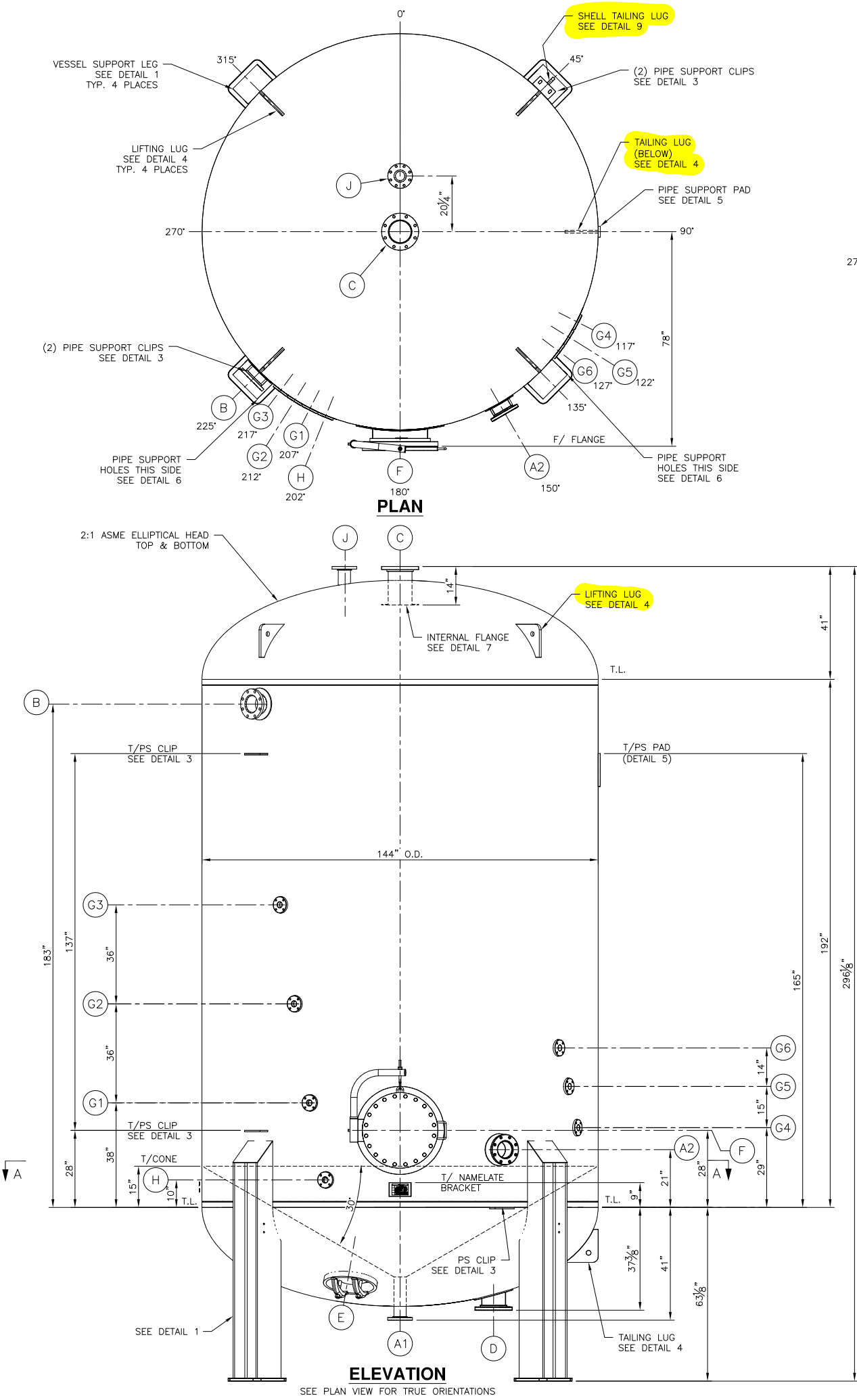
A	ISSUED FOR APPROVAL	RES	9/30/22
REV	DESCRIPTION	APP	DATE
REVISIONS			
TOLERANCES (unless otherwise specified)			
ANGULAR	±0°30'	DECIMAL (2 PLACES)	±0.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±0.005
DECIMAL (1 PLACE)	±0.015	DECIMAL (4 PLACES)	±0.0005



CLIENT		CITY OF NEWARK SOUTH WELL FIELD PLANT	
TITLE		DRINKING WATER TREATMENT SYSTEM MODEL 12-40 DWC, 8" PIPING FLOW DIAGRAM	
DWG. Size	D	SHEET No.	1 OF 1
DWG. No.	IXO.220002.NEWARK	SCALE	NONE
PROJECT No.	IXO.220002.NEWARK	REV.	A

MEDIA	SPECIALTIES	VALVES	DESIGN CONDITIONS	LEGEND	VESSELS	UTILITY REQUIREMENTS
MEDIA: GAC OR RESIN QUANTITY PER VESSEL: 40,000 LBS. OF GAC OR 828 CU.FT. RESIN SERVICE: POTABLE WATER (NSF/ANSI 61 CERTIFIED)	PRESSURE INDICATOR: 0-160 PSIG, WIKA 232.34 RUPTURE DISK: 125 PSIG BURST PRESSURE ZOOK PRESSURE DIFFERENTIAL SWITCH: ORANGE RESEARCH, 0-20-0 PSIG	PROCESS VALVES: CENTERLINE SERIES 200 CARBON VALVES: SHARPE SERIES 50 SAMPLE/VENT VALVES: SHARPE 50M76 UTILITY VALVES: HAMMOND MODEL UP8901	FLOW RATE: 1000 GPM (SERIES) 1400 GPM (PARALLEL) INFLUENT PRESSURE: 100 PSIG MAX. INFLUENT TEMP.: 120°F MAX. BACKWASH RATE: T.B.D. GPM @ 55°F. ELECTRIC POWER: 120 V, 60~ SINGLE PHASE, 15 AMP	BW - BACKWASH WATER FC - FLUSH CONNECTION RC - REACT.(OR VIRGIN) CARBON RW - RAW WATER SC - SPENT CARBON SLURRY SP - SAMPLE PORT TW - TREATED WATER V - VENT	12'-0" O.D. x 16'-0" S.S. ASME 2:1 ELLIPTICAL TOP AND BOTTOM HEADS. CARBON STEEL CONSTRUCTION. ASME SECT. VIII, DIV. 1 125 PSIG @ 140°F DESIGN. LINING TO BE FORCE CURED PER NSF/ANSI 61 PLASITE 4110	AIR, CARBON TRANSFER - 100 SCFM @ 30 PSIG MIN. PLANT WATER - 100 GPM @ 30 PSIG MIN. WIRING - MIN. AWG #16 TO PDS 294

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VESSEL DESCRIPTION		VESSEL PV-1	
REFERENCES		VESSEL SPECIFICATION VS1	
DESIGN CONDITIONS		125 PSIG @ 140° F	
OPERATING CONDITIONS			
PROCESS FLUID		WATER, S.G. = 1.0	
WALL THICKNESS		PER CODE REQUIREMENTS	
MATERIALS OF CONSTRUCTION	SHELL	SA-516 GR. 70	
	TOP HEAD	SA-516 GR. 70	
	BOT. HEAD	SA-516 GR. 70	
	NOZZLES	SA-106 GR. B (UNLESS NOTED)	
	FLANGES	SA-105N (UNLESS NOTED)	
	LINING ABOVE CONE	PLASITE 4110 35-45 MIL NOMINAL DFT PER CCC SPEC. VS-7	
	LINING BELOW CONE	PLASITE 4110 10-15 MIL NOMINAL DFT PER CCC SPEC. VS-9	
	UNDER CONE SEALANT	THIXATROPE "c"	
	FORCE CURED	PER NSF 61 CRITERIA	YES
	SUPPORTS	A-992	
BOLTING	MANWAY: A-325 GR 1, GALVANIZED NOZZLES: A-307 GR B, ZINC PLATED		
GASKETS	EPDM (45-55 DUROMETER)		
TYPE CONSTRUCTION	FUSION WELDED		
CORROS. ALLOW	NONE		
CODE	ASME SECTION VIII, DIVISION 1, LATEST EDITION		
INSPECTION	BY CALGON & CODE AGENCY		
STAMPING	ASME, NB		
TESTING	HYDROSTATIC PER CODE		
STRESS RELIEF	PER CODE		
RADIOGRAPH	PER CODE AND CALGON CALCULATIONS		
NAMEPLATE	ASME		
STENCILS	LINED TANK - DO NOT WELD OR BURN		
SEISMIC LOAD	IBC, SITE CLASS D, S _s = 0.84, I = 1.25		
INSULATION	NONE - SEE NOTE 6		
SURFACE PREP	EXTERIOR	NEAR WHITE BLAST PER SSPC-SP10	
	INTERIOR	WHITE METAL BLAST PER SSPC-SP5	
PAINTING	EPOXY BASE COAT, 10-14 MILS DFT, PER CCC SPEC. RS-17. POLYURETHANE TOP COAT, 2-4 MILS DFT PER RS-15. COLOR: RAIN FOREST GREEN		
CAPACITIES	FULL	16,600 GAL	
	OPERATING	16,600 GAL	AT 100% FILL
	MEDIA	40,000 LBS.	
WEIGHTS	EMPTY	31,000 LBS.	
	FULL H ₂ O	170,000 LBS.	
	FULL PRODUCT	71,000 LBS. (DRY CARBON)	
	OPERATING	191,000 LBS.	

NOZZLE SCHEDULE					
MARK	REQ'D	SIZE	DRILLING	FACING	DESCRIPTION
A1	1	4"	150#	F.F.	CARBON OUTLET (LOWER)
A2	1	6"	150#	F.F.	CARBON OUTLET (UPPER)
B	1	6"	150#	F.F.	CARBON INLET
C	1	8"	150#	F.F.	INFLUENT W/INTERNAL NOZZLE
D	1	8"	150#	F.F.	EFFLUENT
E	1	14X18	ELLIP.		MANWAY W/ 1/4" THK. GASKET
F	1	20"	150#	F.F.	MANWAY W/BLIND FLANGE & GASKET
G	6	2"	150#	F.F.	SAMPLE POINT
H	1	2"	150#	F.F.	UNDERCONE VENT
J	1	4"	150#	F.F.	SPARE

NOTES:

1. ALL INTERIOR WELDS & EDGES TO BE GRIND TO 1/8" RADIUS MIN.

2. ALL NOZZLES MUST BE FLUSH ON INSIDE OF SHELL, U.O.N

3. 20" MANWAY FLG. TO BE SECURED WITH (2) BOLTS. REMAINDER OF BOLTS & NUTS TO BE PACKAGED AND SHIPPED IN THE CRATE.

4. REMOVE ALL WATER & DIRT AFTER HYDROTEST.

5. REMOVE ALL WELD SPATTER.

6. CONTACT CCC FOR HEAT TRACE REQUIREMENTS.

7. ALL FLANGE BOLT HOLES TO STRADDLE CENTERLINES.

8. FOR MANWAY DETAIL SEE DWG. 90110066.

B	BED ELEVATIONS, SPARE MW GASKET	RES	2/21/23
A	ISSUED FOR APPROVAL	RES	9/30/22
REV	DESCRIPTION	APP	DATE

REVISIONS

TOLERANCES (unless otherwise specified)

ANGULAR	±0°30'	DECIMAL (2 PLACES)	±0.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±0.005
DECIMAL (1 PLACE)	±0.015	DECIMAL (4 PLACES)	±0.0005

A Kuraray Company

CLIENT CITY OF NEWARK
SOUTH WELL FIELD PALNT

TITLE MODEL 12-40, 125 PSIG
12 FT DIA., INTERNAL CONE
VESSEL ARRANGEMENT, PV-1

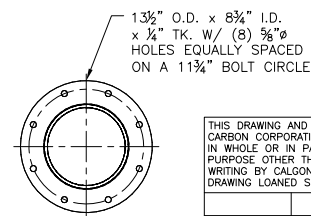
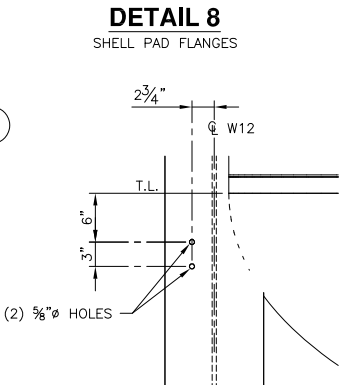
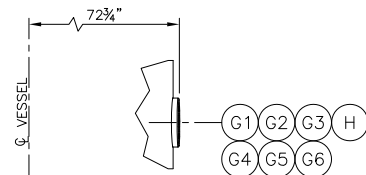
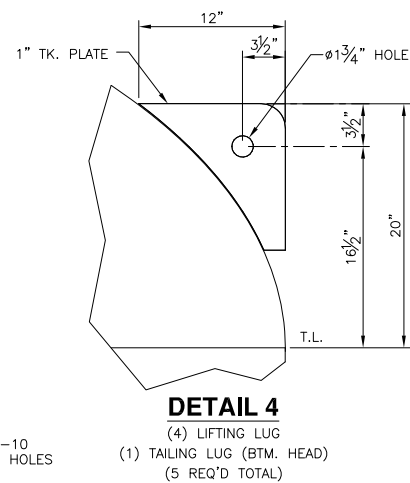
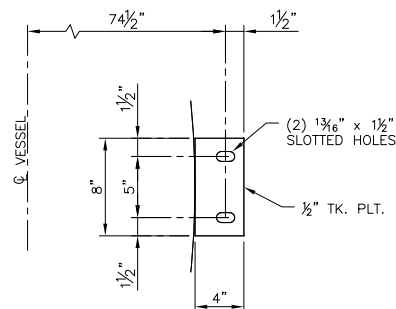
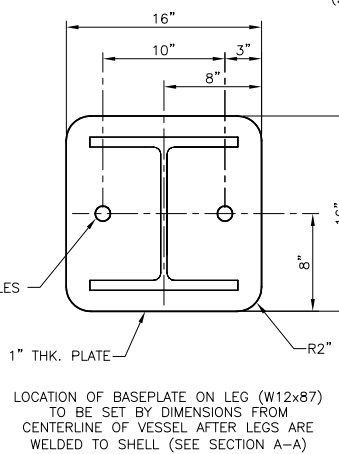
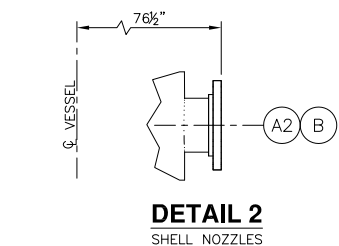
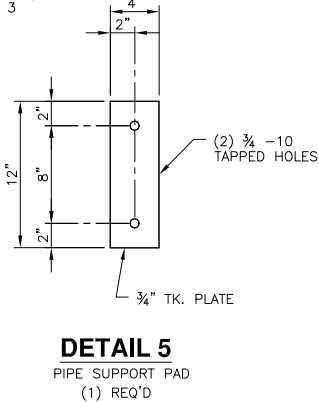
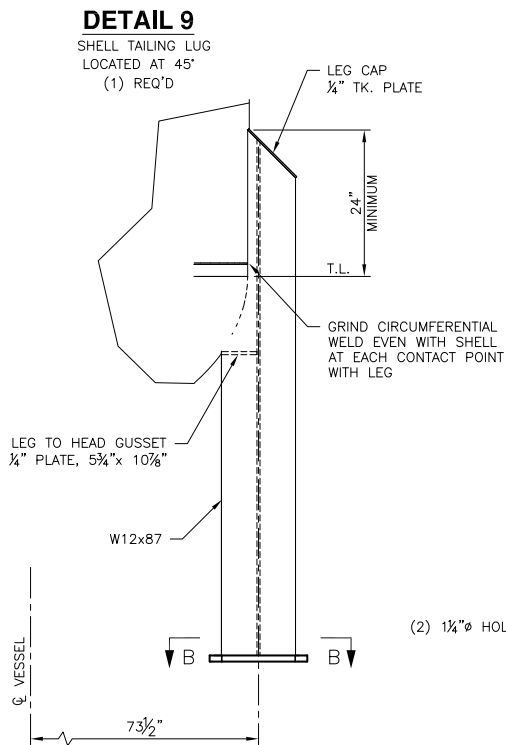
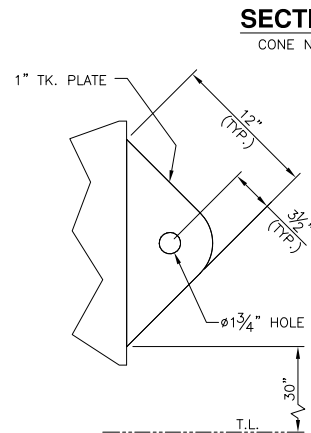
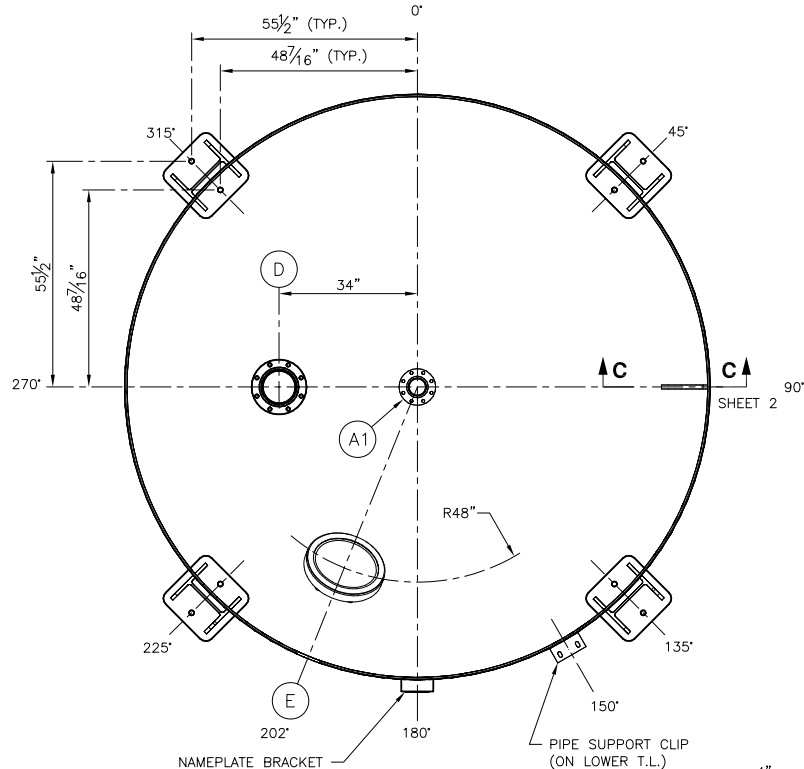
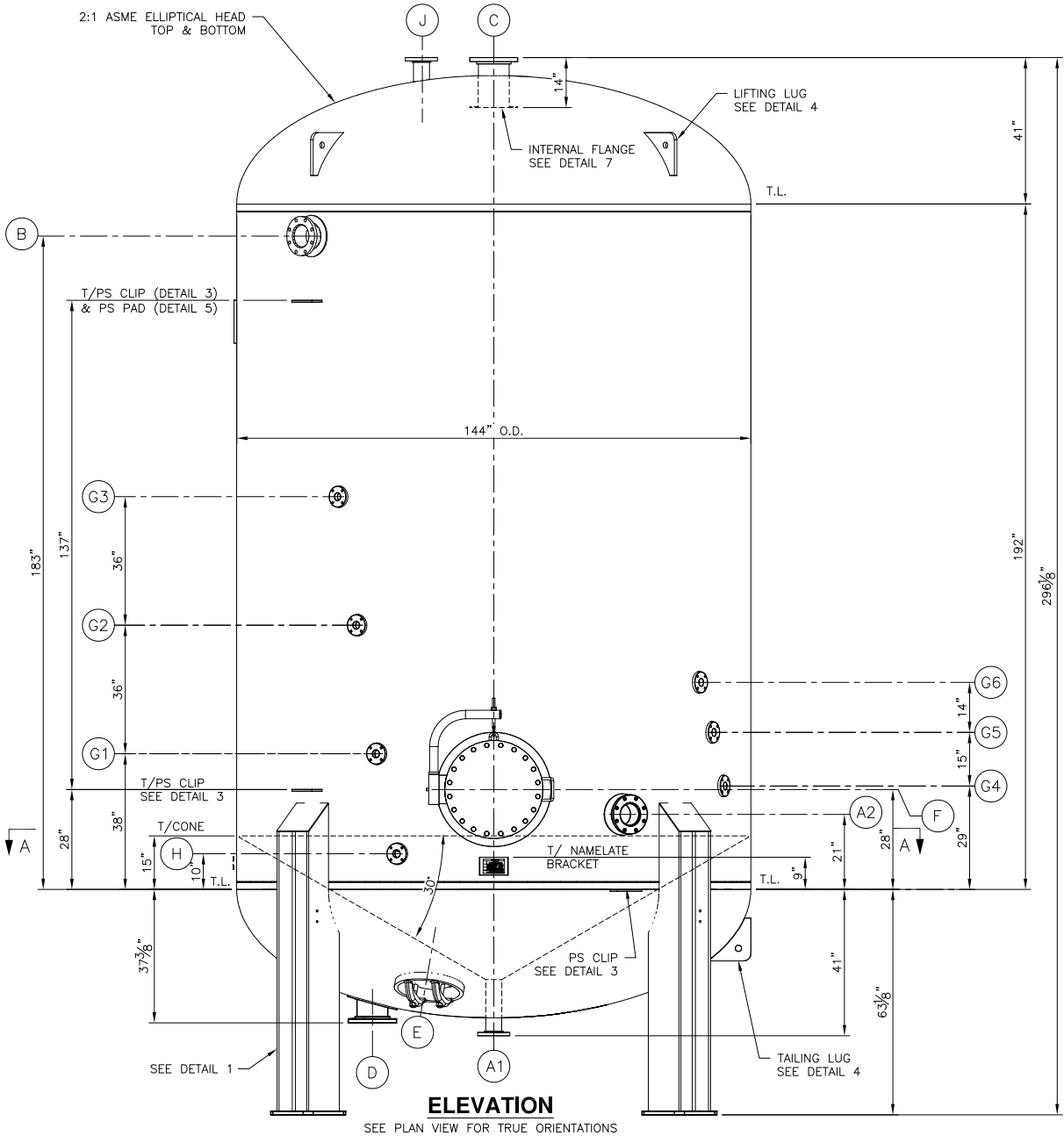
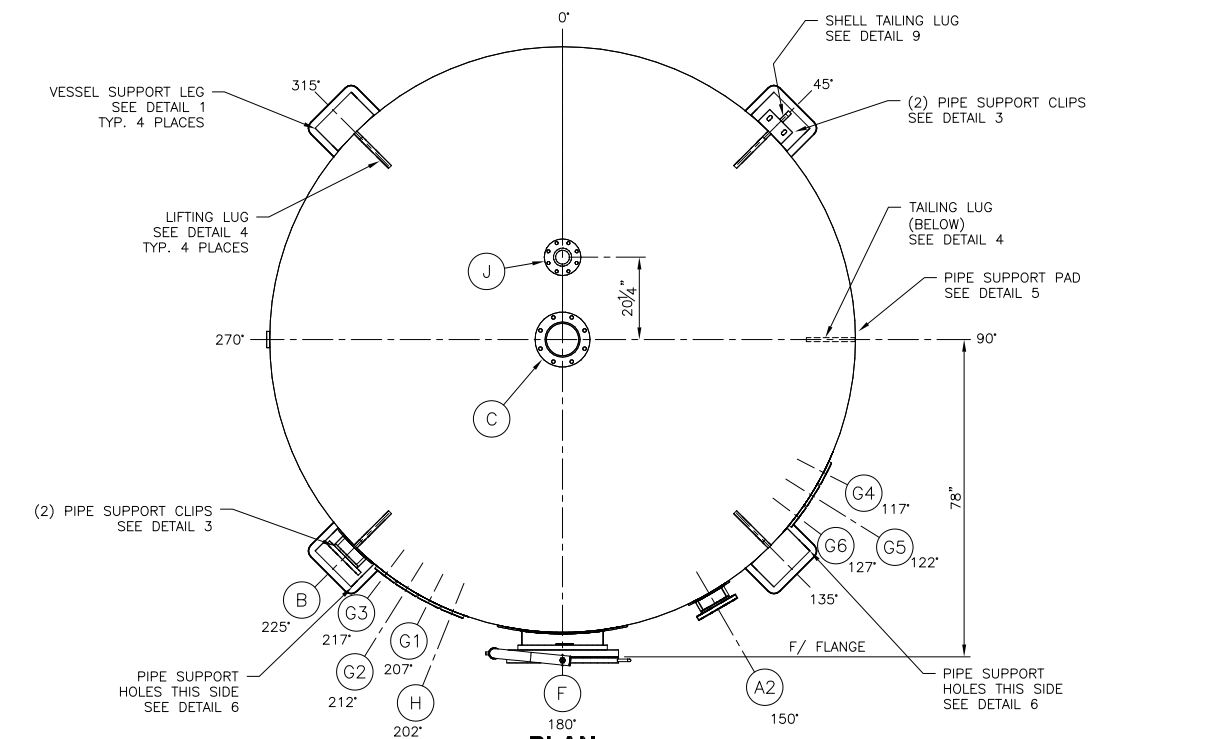
DWG. Size D SHEET No. 1 OF 2 SCALE AS NOTED

DWG. No. 91224267 REV. B

IS THE PROPERTY OF CALGON
IS NOT TO BE REPRODUCED
EMPLOYED FOR ANY
SPECIFICALLY PERMITTED IN
CORPORATION. THIS
TO RETURN ON DEMAND.

ME DATE
9/13/22

0002.NEWARK



VESSEL DESCRIPTION		VESSEL PV-2	
REFERENCES		VESSEL SPECIFICATION VS1	
DESIGN CONDITIONS		125 PSIG @ 140° F	
OPERATING CONDITIONS			
PROCESS FLUID		WATER, S.G. = 1.0	
WALL THICKNESS	PER CODE REQUIREMENTS		
MATERIALS OF CONSTRUCTION	SHELL	SA-516 GR. 70	
	TOP HEAD	SA-516 GR. 70	
	BOT. HEAD	SA-516 GR. 70	
	NOZZLES	SA-106 GR. B (UNLESS NOTED)	
	FLANGES	SA-105N (UNLESS NOTED)	
	LINING ABOVE CONE	PLASITE 4110 35-45 MIL NOMINAL DFT PER CCC SPEC. VS-7	
	LINING BELOW CONE	PLASITE 4110 10-15 MIL NOMINAL DFT PER CCC SPEC. VS-9	
	UNDER CONE SEALANT	THIXATROPE "C"	
	FORCE CURED	PER NSF 61 CRITERIA	YES
	SUPPORTS	A-992	
BOLTING	MANWAY: A-325 GR 1, GALVANIZED NOZZLES: A-307 GR B, ZINC PLATED		
GASKETS	EPDM (45-55 DUROMETER)		

TYPE CONSTRUCTION	FUSION WELDED	
CORROS. ALLOW	NONE	
CODE	ASME SECTION VIII, DIVISION 1, LATEST EDITION	
INSPECTION	BY CALGON & CODE AGENCY	
STAMPING	ASME, NB	
TESTING	HYDROSTATIC PER CODE	
STRESS RELIEF	PER CODE	
RADIOGRAPH	PER CODE AND CALGON CALCULATIONS	
NAMEPLATE	ASME	
STENCILS	LINED TANK – DO NOT WELD OR BURN	
SEISMIC LOAD	IBC, SITE CLASS D, $S_s = 0.84$, $I = 1.25$	
INSULATION	NONE – SEE NOTE 6	
SURFACE PREP	EXTERIOR	NEAR WHITE BLAST PER SSPC-SP10
	INTERIOR	WHITE METAL BLAST PER SSPC-SP5
PAINING	EPOXY BASE COAT, 10–14 MILS DFT, PER CCC SPEC. RS-17. POLYURETHANE TOP COAT, 2–4 MILS DFT PER RS-15. COLOR: RAIN FOREST GREEN	

CAPACITIES	FULL	16,600 GAL	
	OPERATING	16,600 GAL	AT 100% FILL
	MEDIA	40,000 LBS.	
WEIGHTS	EMPTY	31,000 LBS.	
	FULL H ₂ O	170,000 LBS.	
	FULL PRODUCT	71,000 LBS.	(DRY CARBON)
	OPERATING	191,000 LBS.	

NOZZLE SCHEDULE					
MARK	REQ'D	SIZE	DILLING	FACING	DESCRIPTION
A1	1	4"	150#	F.F.	CARBON OUTLET (LOWER)
A2	1	6"	150#	F.F.	CARBON OUTLET (UPPER)
B	1	6"	150#	F.F.	CARBON INLET
C	1	8"	150#	F.F.	INFLUENT W/INTERNAL NOZZLE
D	1	8"	150#	F.F.	EFFLUENT
E	1	14X18	ELLIP.		MANWAY W/ ¼" THK. GASKET
F	1	20"	150#	F.F.	MANWAY W/BLIND FLANGE & GASKET
G	6	2"	150#	F.F.	SAMPLE POINT
H	1	2"	150#	F.F.	UNDERCONE VENT
J	1	4"	150#	F.F.	SPARE

NOTES:

1. ALL INTERIOR WELDS & EDGES TO BE GROUND TO 1/8" RADIUS MIN.
2. ALL NOZZLES MUST BE FLUSH ON INSIDE OF SHELL, U.O.N
3. 20" MANWAY FLG. TO BE SECURED WITH (2) BOLTS. REMAINDER OF BOLTS & NUTS TO BE PACKAGED AND SHIPPED IN THE CRATE.
4. REMOVE ALL WATER & DIRT AFTER HYDROTEST.
5. REMOVE ALL WELD SPATTER.
6. CONTACT CCC FOR HEAT TRACE REQUIREMENTS.
7. ALL FLANGE BOLT HOLES TO STRADDLE CENTERLINES.
8. FOR MANWAY DETAIL SEE DWG. 901110066.

B	BED ELEVATIONS, SPARE MW GASKET	RES	2/21/23
A	ISSUED FOR APPROVAL	RES	9.30/22
REV	DESCRIPTION	APP	DATE

REVISIONS			
<u>TOLERANCES (unless otherwise specified)</u>			
ANGULAR	$\pm 0^{\circ} 30'$	DECIMAL (2 PLACES)	± 0.10
FRACTIONAL	$\pm 1/16''$	DECIMAL (3 PLACES)	$\pm .005$
DECIMAL (1 PLACE)	± 0.15	DECIMAL (4 PLACES)	$\pm .0005$



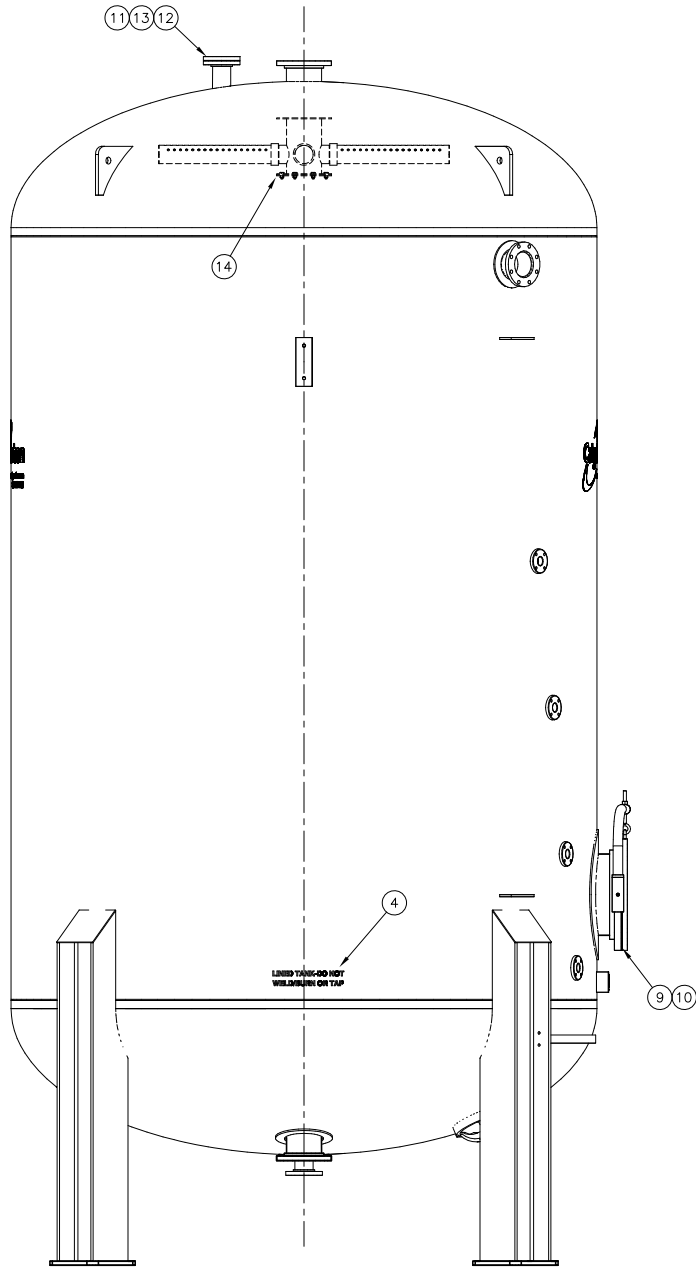
CLIENT CITY OF NEWARK
SOUTH WELL FIELD PALNT

TITLE	MODEL 12-40, 125 PSIG 12 FT DIA., INTERNAL CONE VESSEL ARRANGEMENT, PV-2
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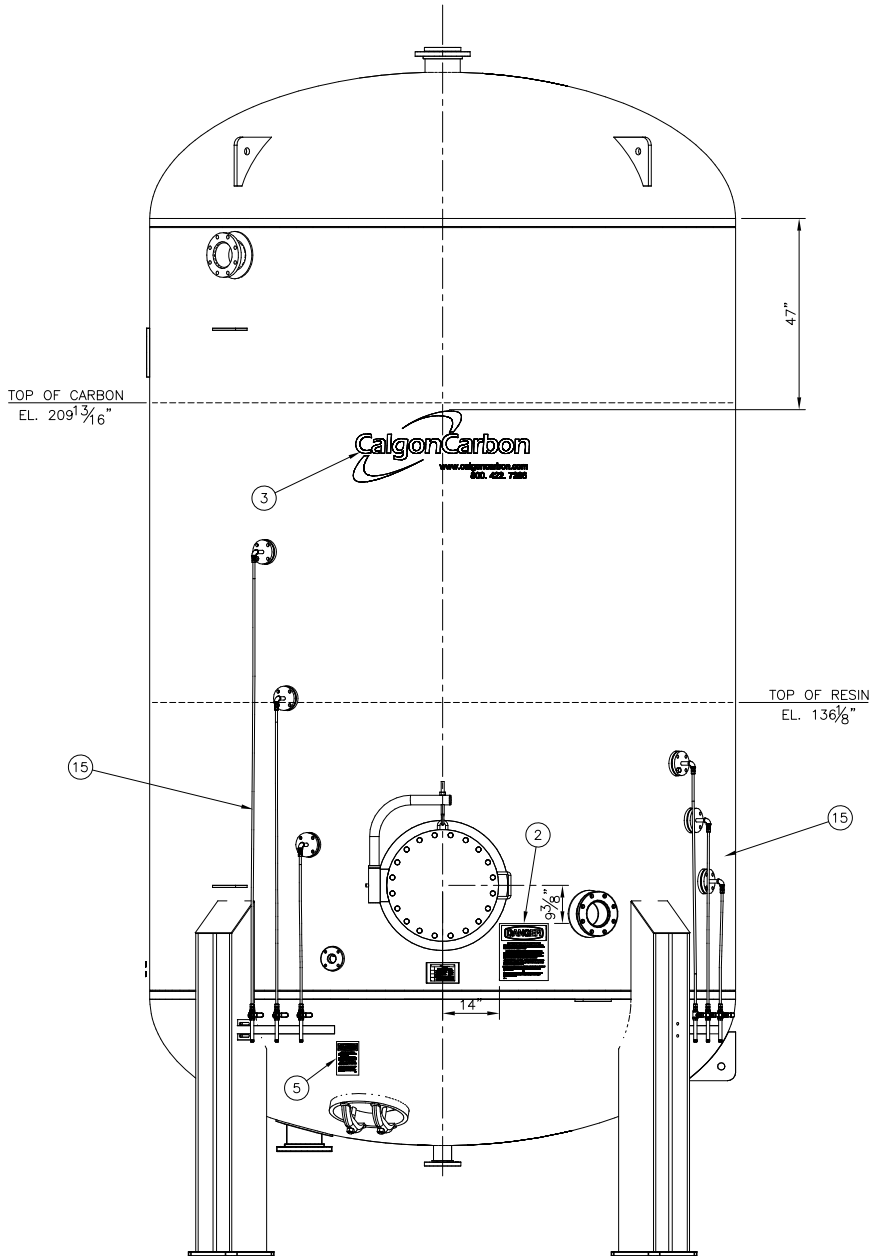
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	NAME	DATE
DRAFTER	JFS	9/13/22
DESIGNER		
CHECKER		
APPROVAL		
PROJECT NO.	IXO.220002.NEWRARK	

DWG. Size	D	SHEET No.	1 OF 2	SCALE AS NOTED
DWG. No.	91224268			REV. B

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LEFT ELEVATION



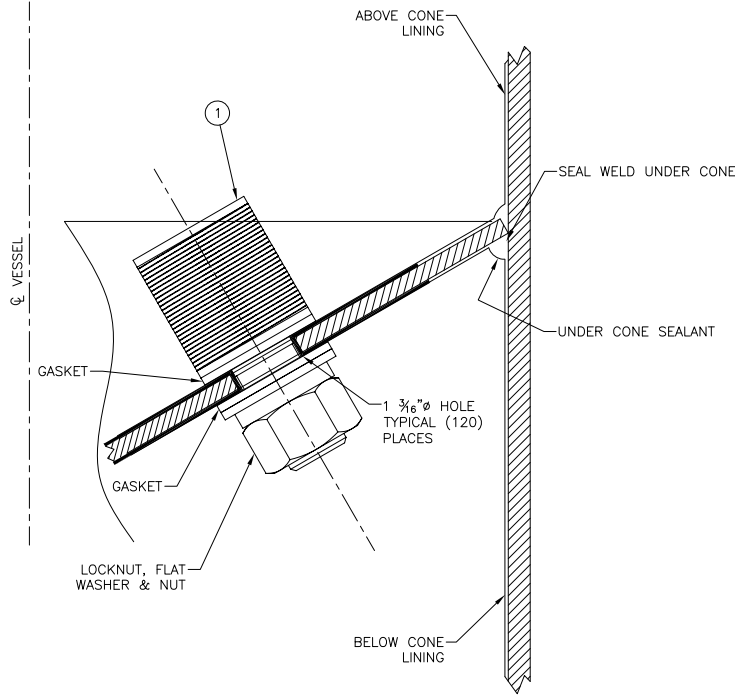
FRONT ELEVATION

BILL OF MATERIAL					
ITEM	QTY.	DESCRIPTION	MATERIAL	SAP No.	CCC SPEC
1	120	SEPTA	SS	1081827	22.113
2	1	DECAL, DANGER, MANWAY	---	1058401	---
3	2	DECAL, CALGON LOGO	---	1080872	---
4	2	DECAL, LINED TANK	---	1025014	---
5	1	DECAL, DANGER, ELLIPTICAL MANWAY	---	1002706	---
6	1	DECAL, CAUTION	---	1001322	---
7	1	DECAL, MATERIAL HAZARD	---	1076681	---
8	1	GASKET, ELLIPTICAL 14" x 18" x ¼" THICK	WHITE EPDM	1053980	G46
9	2	GASKET, 20", 150#, ¼" THICK	WHITE EPDM	1054140	G46
10	20	BOLT, 1½" x 5" LG, HVY. HEX W/NUT & (2) SAE WASHERS, GALVANIZED	A-325 GR 1	1060550	---
11	1	FLANGE, 4" 150# FF BLIND	SA-105	1001712	C2
12	1	GASKET, 4" 150# BLIND, ⅛" THK	WHITE EPDM		G46
13	8	BOLT, ¾" x 3¼" LG, HVY. HEX W/NUT & (2) SAE WASHERS, ZINC PLATED	A-307 GR B	1001076	---
14	1	UPPER DISTRIBUTOR (DWG. 90190646)	316 SS		---
15	1	(6) PORT SAMPLE PIPING ASSEMBLY	SS		

MATERIAL FOR ONE VESSEL.

NOTES:

- 1.) LOCATE MANWAY DANGER DECALS ITEMS (2) & (5) AS SHOWN.
- 2.) LOCATE LINED TANK DECALS ITEM (4) NEAR BOTTOM WELD SEAM TO CLEAR PIPING.
- 3.) LOCATE CCC LOGOS ITEM (3) AT 0' & 180', HEIGHT AS SHOWN.
- 4.) ITEMS (14) AND (15) TO BE FACTORY INSTALLED BY CCC.
5. MANWAY GASKET QTY. INCLUDES (1) SPARE.

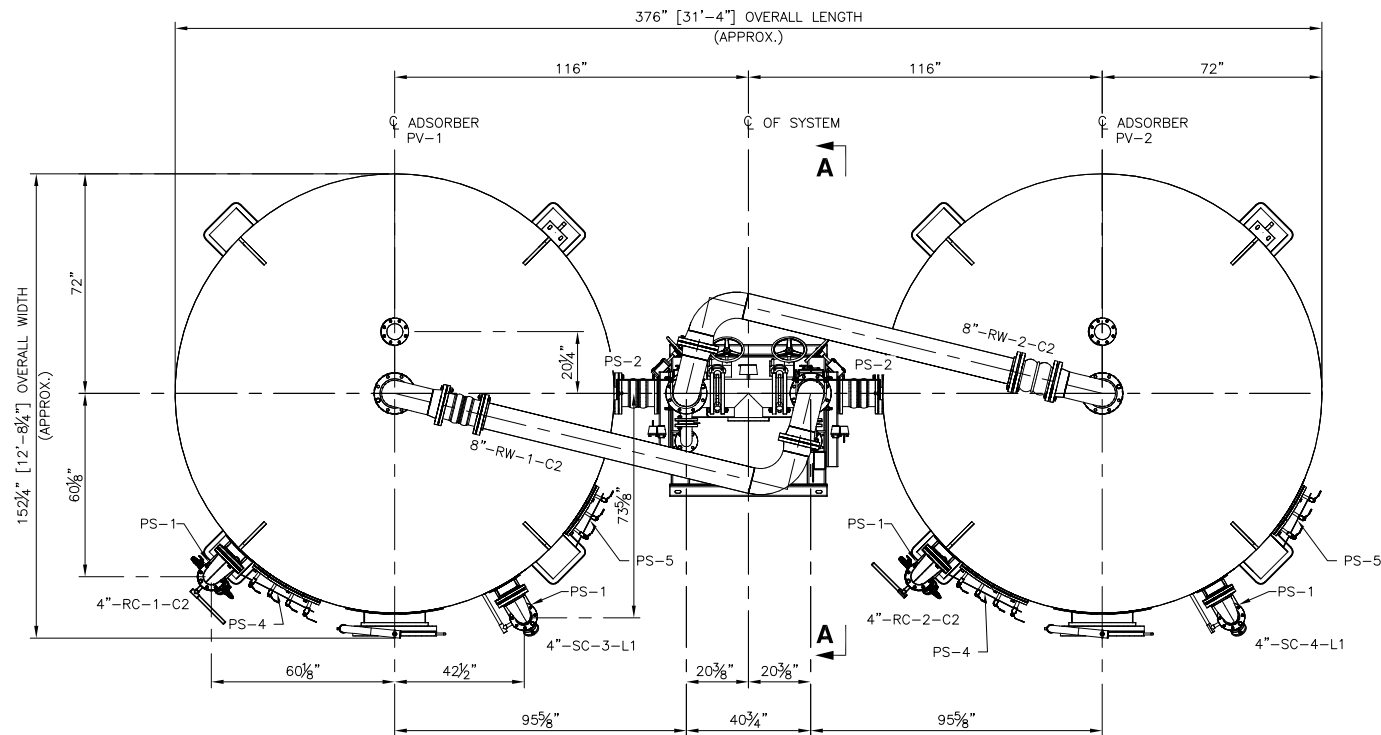


SECTION C-C
SHEET 1

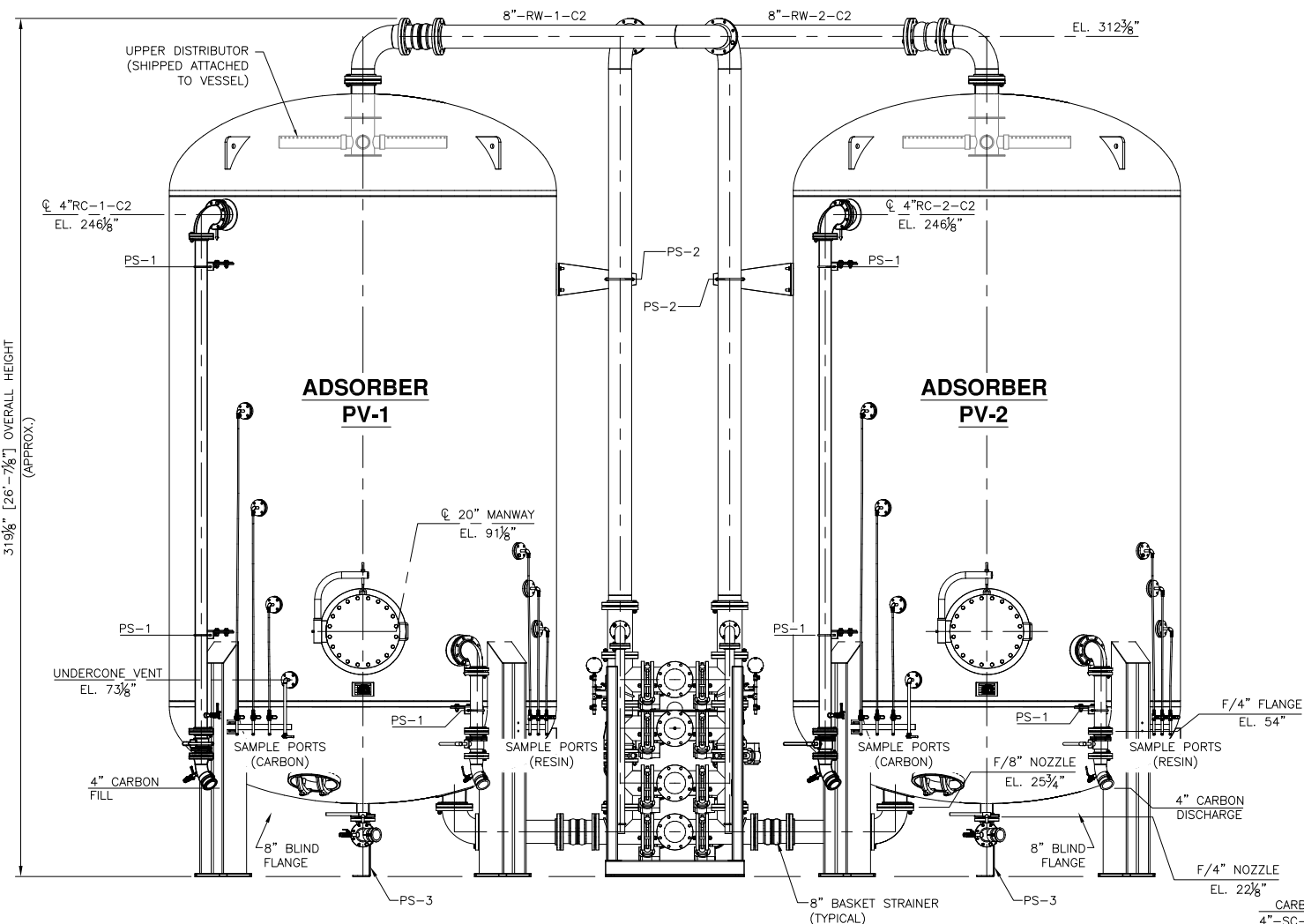
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	NAME	DATE
DRAFTER	JFS	9/13/22
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IXO.220002.NEWMARK	

B	BED ELEVATIONS, SPARE MW GASKET	RES	2/21/23
A	ISSUED FOR APPROVAL	RES	9.30/22
REV	DESCRIPTION	APP	DATE
REVISIONS			
TOLERANCES (unless otherwise specified)			
ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005
 A Kuraray Company			
CLIENT CITY OF NEWARK SOUTH WELL FIELD PALNT			
TITLE MODEL 12-40, 125 PSIG 12 FT DIA., INTERNAL CONE VESSEL ARRANGEMENT, PV-2			
DWG. Size	D	SHEET No. 2 OF 2	SCALE AS NOTED
PROJECT No.	91224268		REV. B

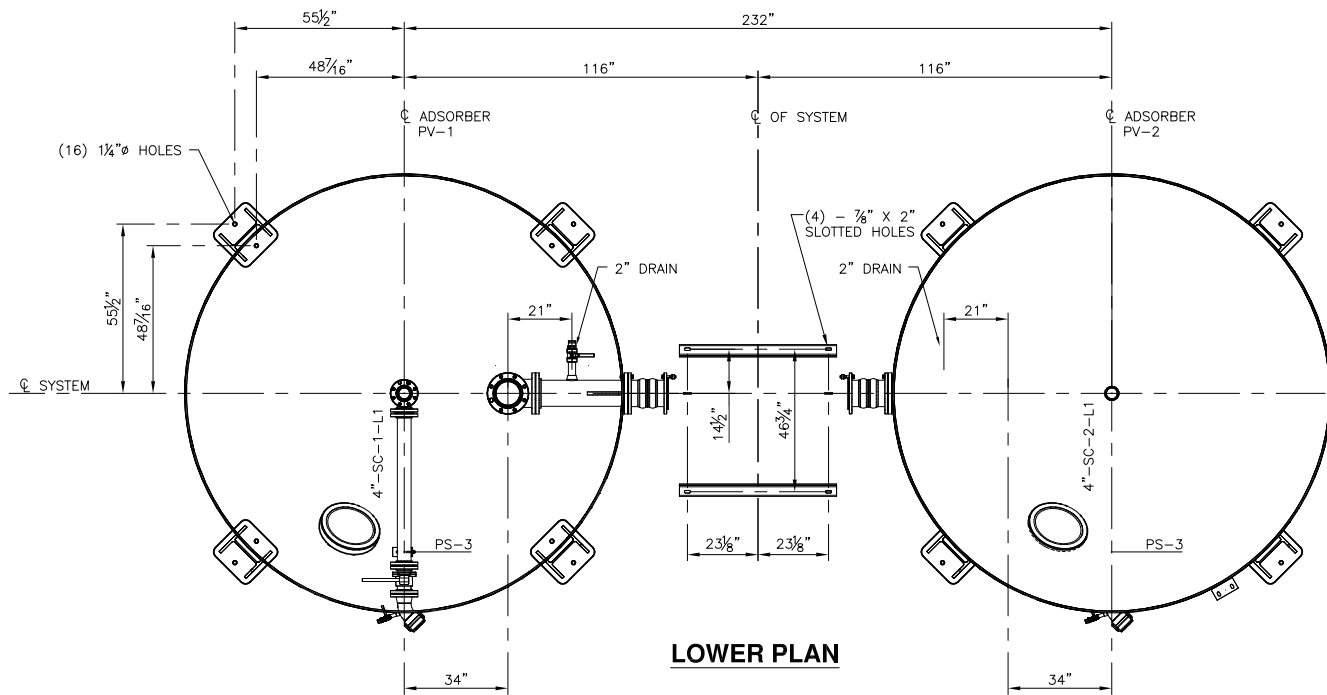
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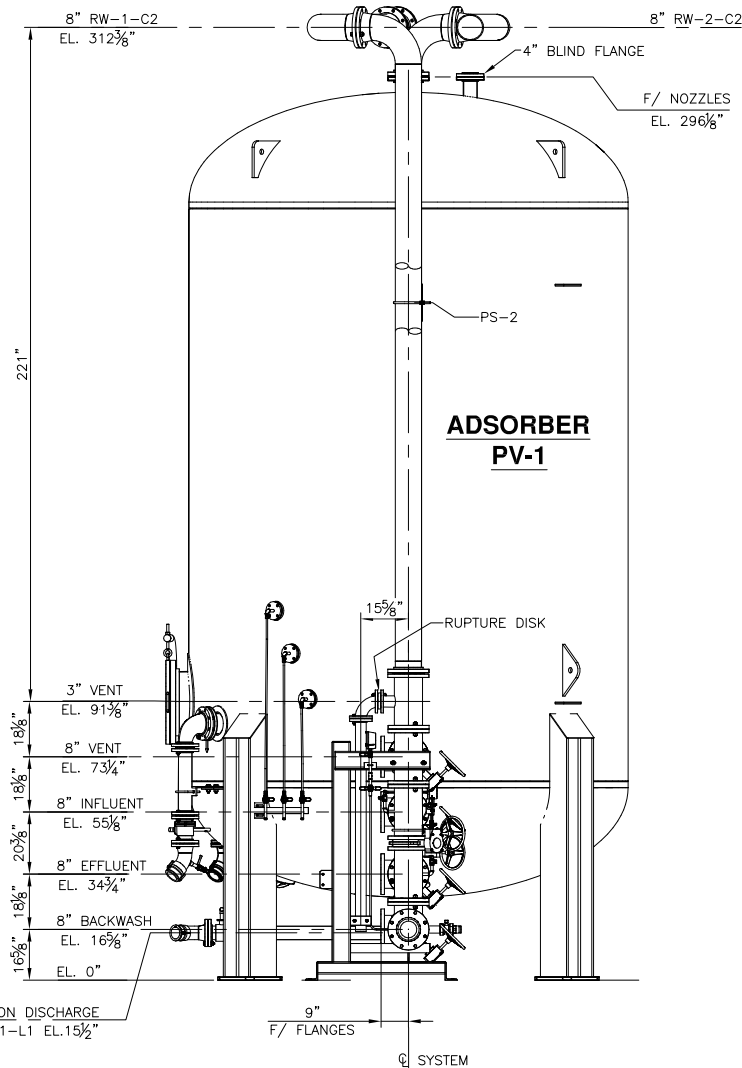
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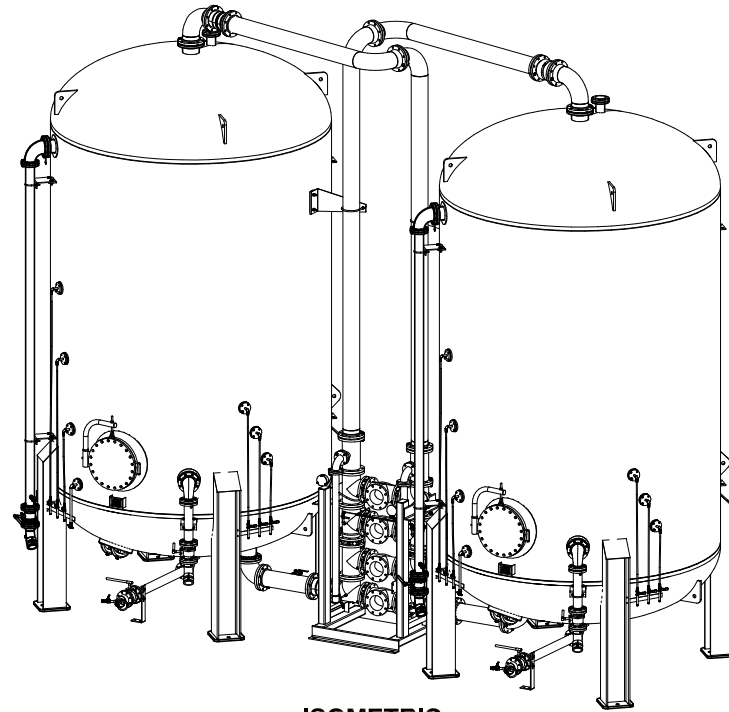
ELEVATION



LOWER PLAN



VIEW A-A



ISOMETRIC

- NOTES:
- (1) SYSTEM SHOWN, (2) REQUIRED.
 - VALVE MODULE STRUCTURAL FRAME, PIPE SUPPORTS AND FASTENERS TO BE UNPAINTED 316 SS.
 - (2) SPARE RUPTURE DISKS AND (2) SPARE MANWAY GASKETS TO BE PROVIDED FOR EACH SYSTEM.



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	NAME	DATE
DRAFTER	JFS	9/13/22
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	1X0.220002.NEWMARK	

SYSTEM DATA			
DESIGN CONDITIONS		125 PSIG @ 140° F	
DESIGN CODE		ASME SECTION VIII DIVISION1	
APPROXIMATE		WEIGHTS (LB.)	
VESSEL (EMPTY)		31,000	
CARBON (PER VESSEL)		40,000	
VESSEL (OPERATING)		191,000	
SYSTEM (EMPTY)		69,000	
SYSTEM (OPERATING)		391,000	
PAINT INFORMATION			
ITEM	MFG.	COLOR	SAMPLE
VESSEL	CARBOLINE	RAIN FOREST GREEN	
PIPING	CARBOLINE	RAIN FOREST GREEN	
SUPPORTS	SEE NOTE 2	N/A	

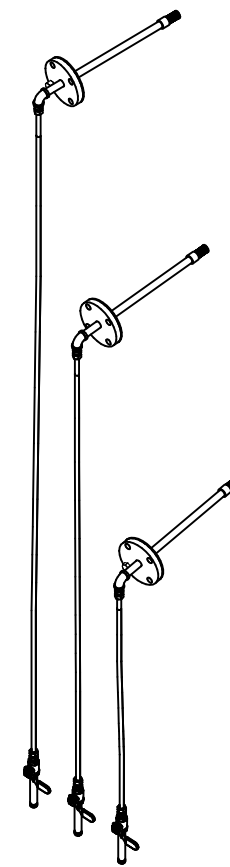
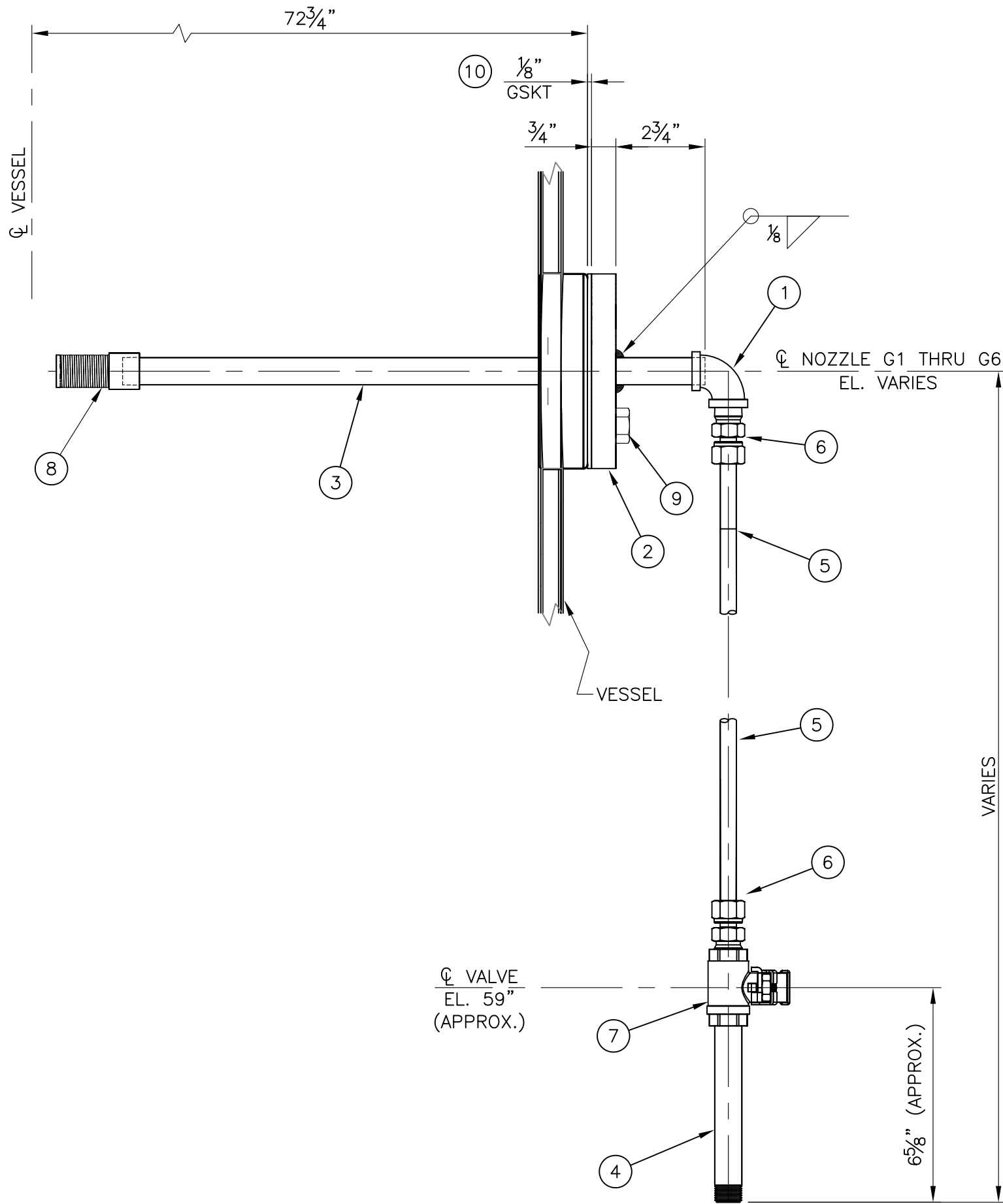
PIPE SUPPORT SCHEDULE			
#	DRAWING NO.	DESCRIPTION	QTY.
PS-1	90160401	4" CARBON FILL 4" CARBON DISCHARGE (UPPER)	6
PS-2	90130162	8" INFLUENT	2
PS-3	90130158	4" CARBON DISCHARGE	2
PS-4	90170541	SAMPLE PORT (CARBON)/VENT	2
PS-5	90220796	SAMPLE PORT (RESIN)	2

C	ROTATE 8" TIE-INS 180°	RES	4/4/23
B	ADD NOTES 2 & 3	RES	2/23/23
A	ISSUED FOR APPROVAL	RES	9/30/22
REV	DESCRIPTION	APP	DATE

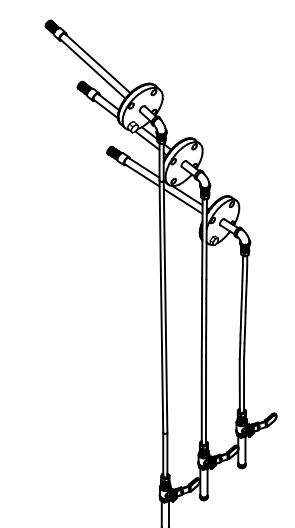
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FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CLIENT		CITY OF NEWARK SOUTH WELL FIELD PLANT	
TITLE		MODULAR ADSORBER SYSTEM MODEL 12-40 DWC, 8" PIPING GENERAL ARRANGEMENT	
DWG. Size	D	SHEET No.	1 OF 1
SCALE	NONE		
DWG. No.	91224269		
REV.	C		

V:\2022\IXO.220002.NEWARE\Drawings\Piping\NEWARK-017.dwg Jan 31, 2023 - 8:14am



CARBON SAMPLE
PIPING



RESIN SAMPLE
PIPING

ISOMETRIC

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	NAME	DATE
DRAFTER	JFS	9/23/22
DESIGNER		
CHECKER	XXX	PENDING
APPROVAL		
PROJECT No.	IXO.220002.NEWARE	

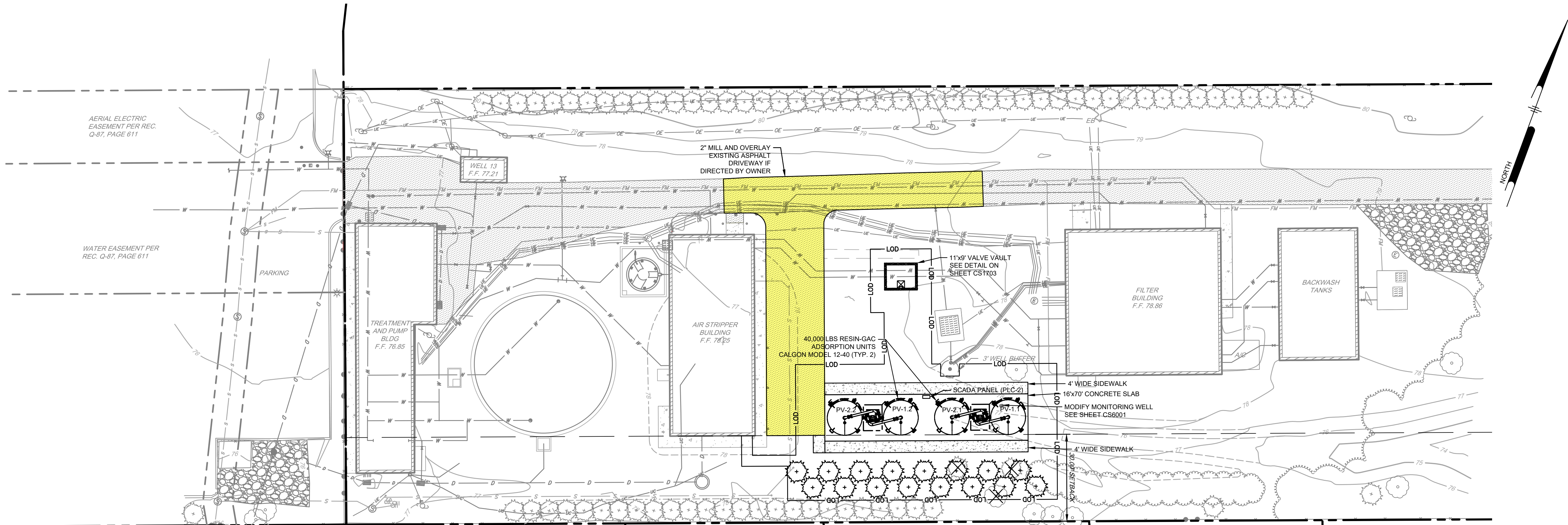
BILL OF MATERIAL			
MK	QTY.	SPEC	DESCRIPTION
1	1	S15	ELBOW, 1/2" THRD., 90°, 150#, 316 SS
2	1	S15	FLANGE, 2" PLATE, 6" O.D. X 7/8" I.D. X 3/4" THICK, 150# DRILLING, 316 SS
3	1	S15	PIPE, 1/2" X 18" LG, T.B.E., SCH. 40S, 316 SS
4	1	S15	NIPPLE, 1/2" X 6" LG, T.B.E., SCH. 40S, 316 SS
5	65'	S6	TUBING, 1/2", 316 SS (TOTAL PER SYSTEM)
6	2	S6	MALE ADAPTER, 1/2" MNPT X 1/2" TUBE
7	1	4.57	VALVE, 1/2" BALL, THRD., SS
8	1	22.29	FILTER NOZZLE, 1/2" FNPT, 316 SS, 1"ø WEDGEWIRE
9	4	F03	BOLT, 5/8" x 1 3/8", HVY. HEX
10	1	G46	GASKET, 2" FF, 1/8" THK., 150#, WHITE EPDM

MATERIAL SHOWN IS FOR (1) ASSEMBLY, (12) REQUIRED PER SYSTEM

- NOTES:
- SEE DRAWING NEWARK-001 FOR GENERAL FABRICATION NOTES.
 - SHIP ATTACHED TO VESSEL.

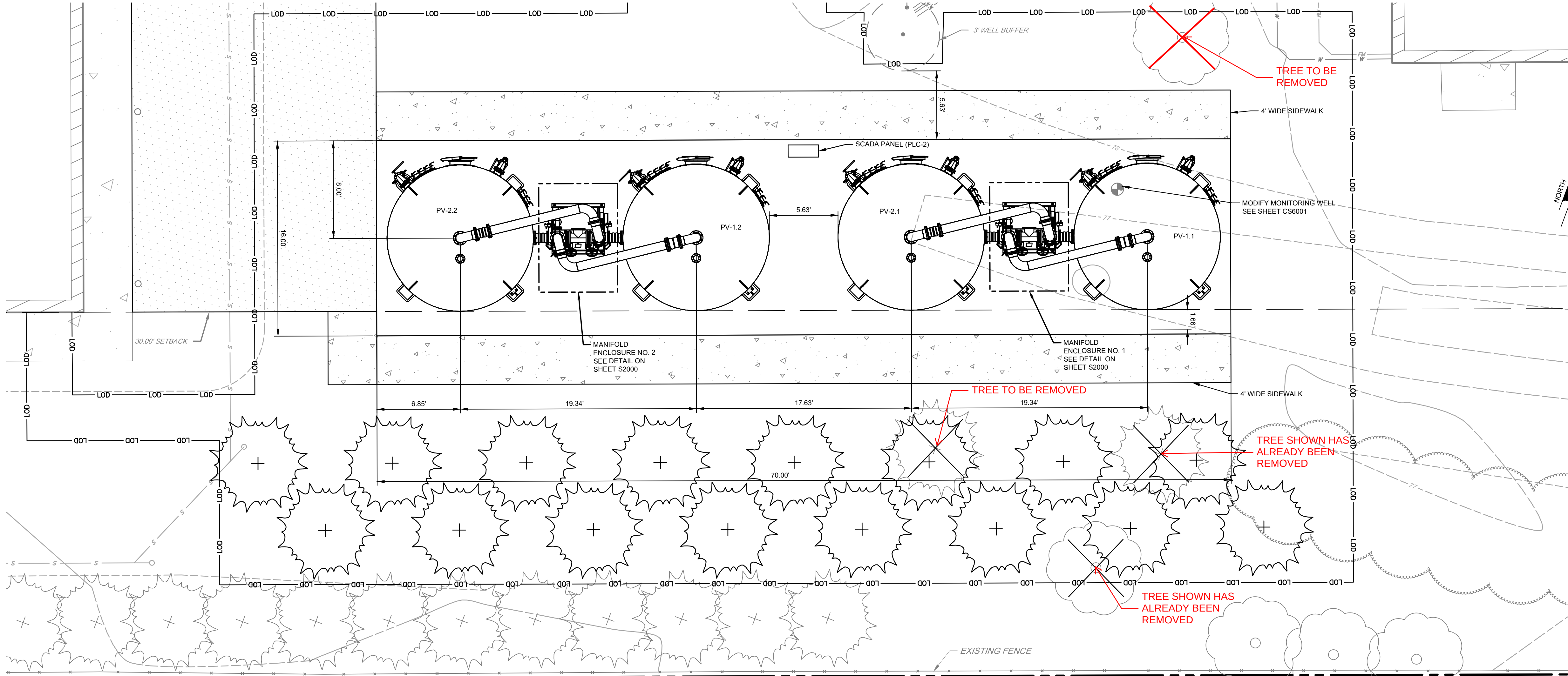
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REVISIONS			
TOLERANCES (unless otherwise specified)			
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FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005
 A Kuraray Company			
CLIENT	CITY OF NEWARK SOUTH WELL FIELD PLANT		
TITLE	MODEL 12-40 SYSTEM 8" 'C2' BACKWASHABLE SAMPLE PORT PIPING		
DWG. Size	B	SHEET No.	1 OF 1
DWG. No.	NEWARK-017		SCALE NONE
			REV. 0

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SITE & SYSTEM LAYOUT

SCALE: 1" = 20'



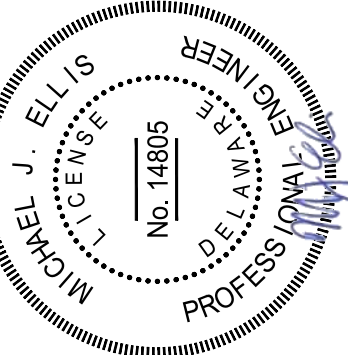
ENLARGED SITE & SYSTEM LAYOUT

SCALE: 1" = 5'



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Christiana Executive Campus
121 Continental Drive, Suite 207
Newark, DE 19713-4310
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SOUTH WELLFIELD RESIN-GAC SYSTEM

912 SOUTH CHAPEL STREET
NEWARK, DE 19713

SITE & SYSTEM LAYOUT PLAN

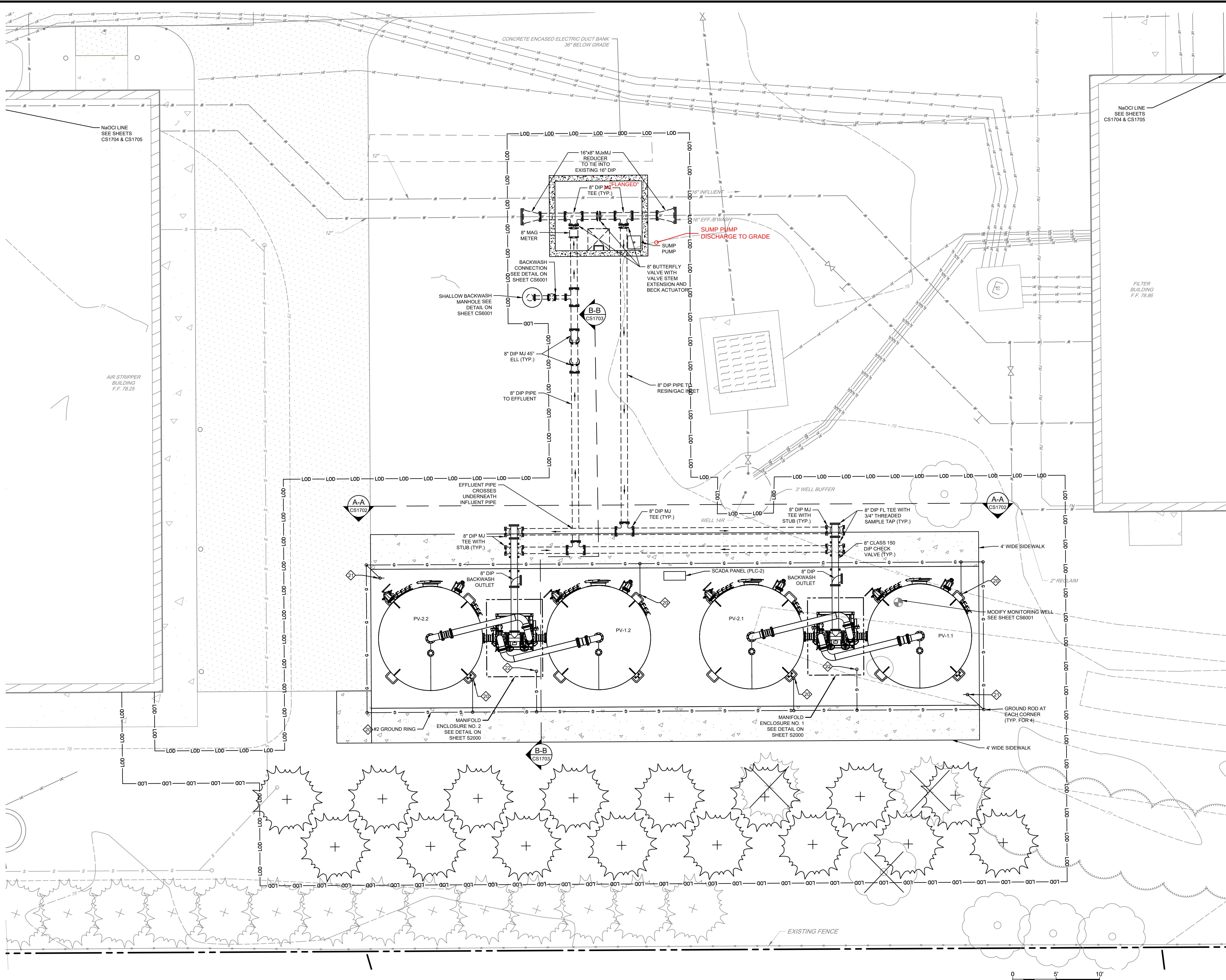
CITY OF NEWARK
220 SOUTH MAIN STREET
NEWARK, DE 19711

NO.	DATE	REVISIONS	BY
1	05/18/2023	BID PLAN SUBMISSION	ELA
2	06/15/2023	ADDENDUM 2	

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PROJECT	CNEWK22008
DATE	2023-05-05
DRAWING SCALE	AS NOTED
DRAWN BY	ELA
APPROVED BY	MJE

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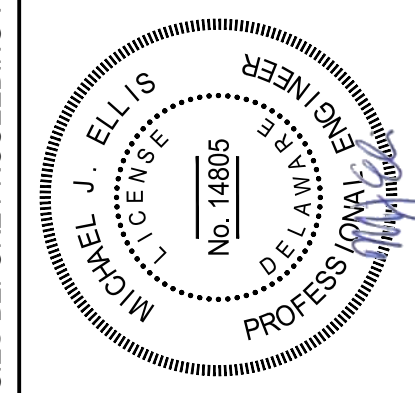
SOUTH WELLFIELD RESIN-GAC SYSTEM

912 SOUTH CHAPEL STREET
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YARD PIPING PLAN

CITY OF NEWARK
220 SOUTH MAIN STREET
NEWARK, DE 19711

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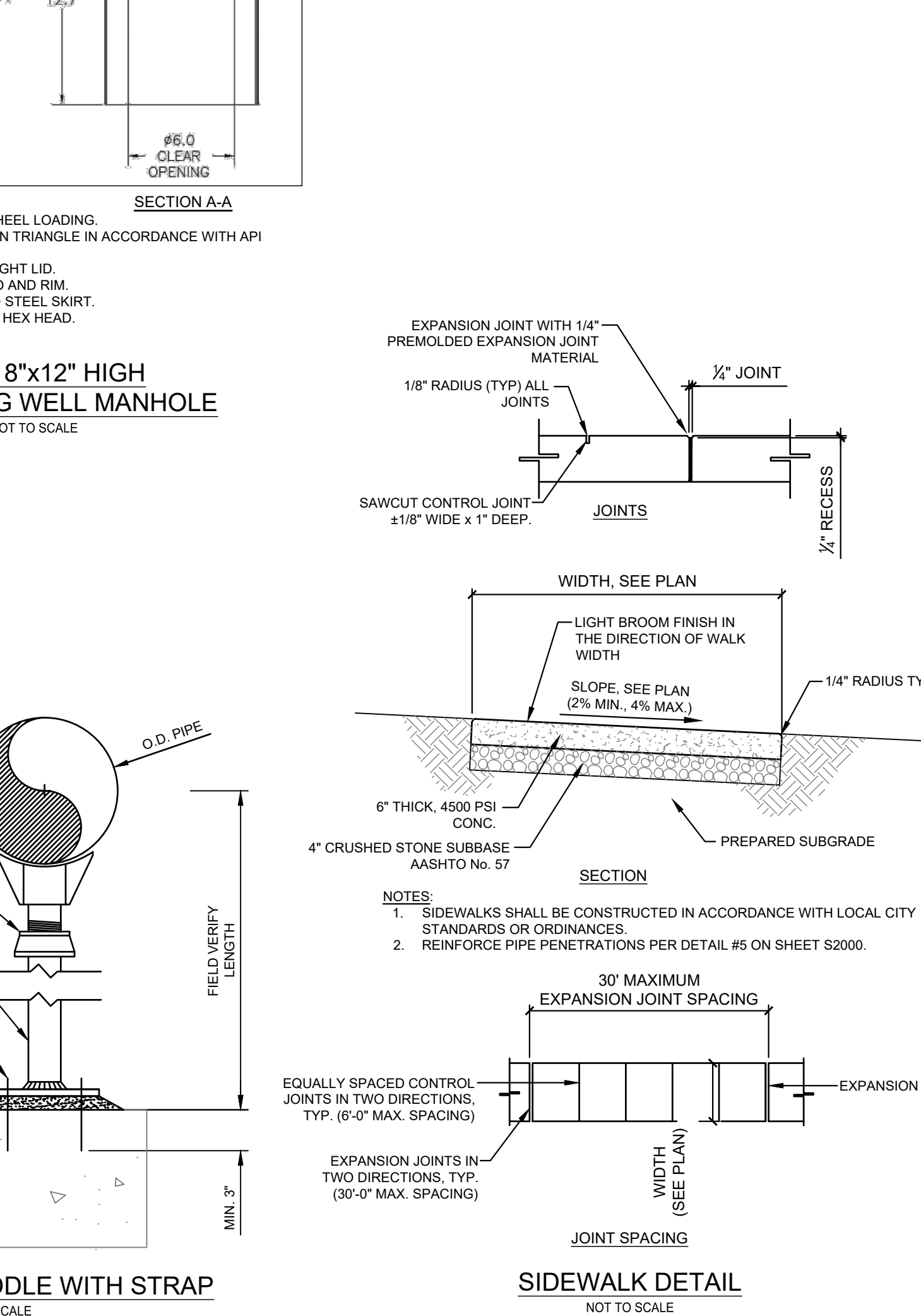
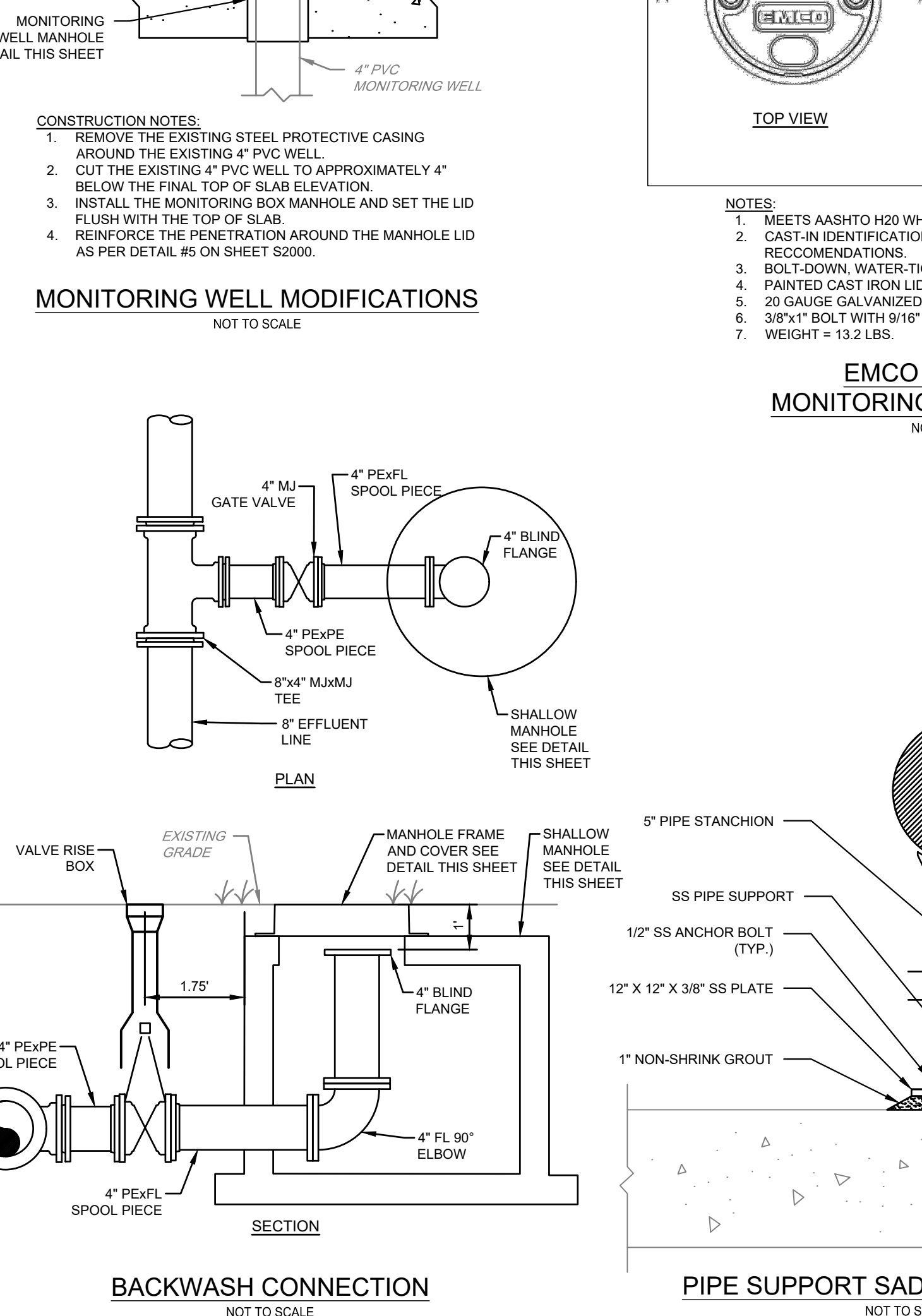
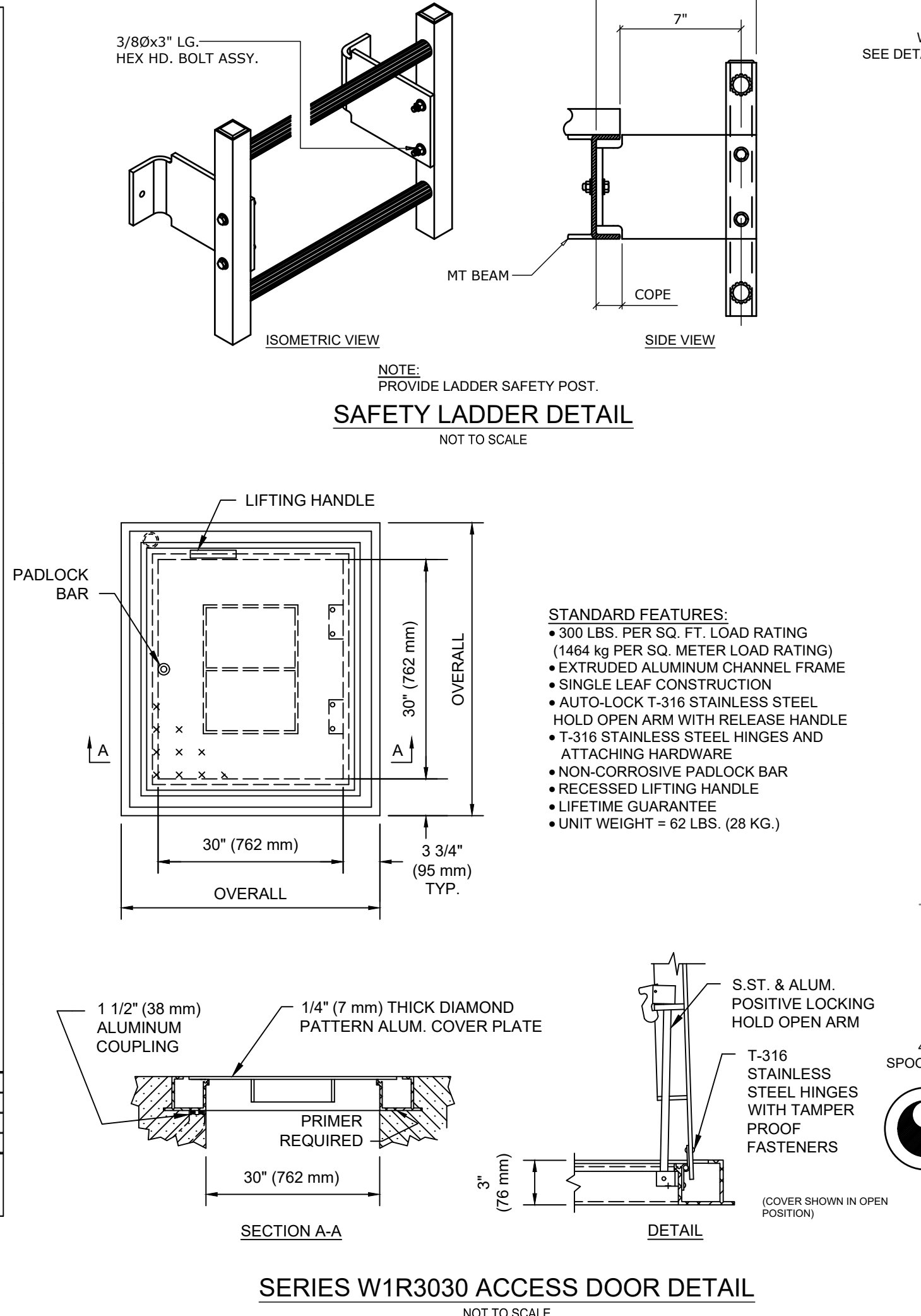
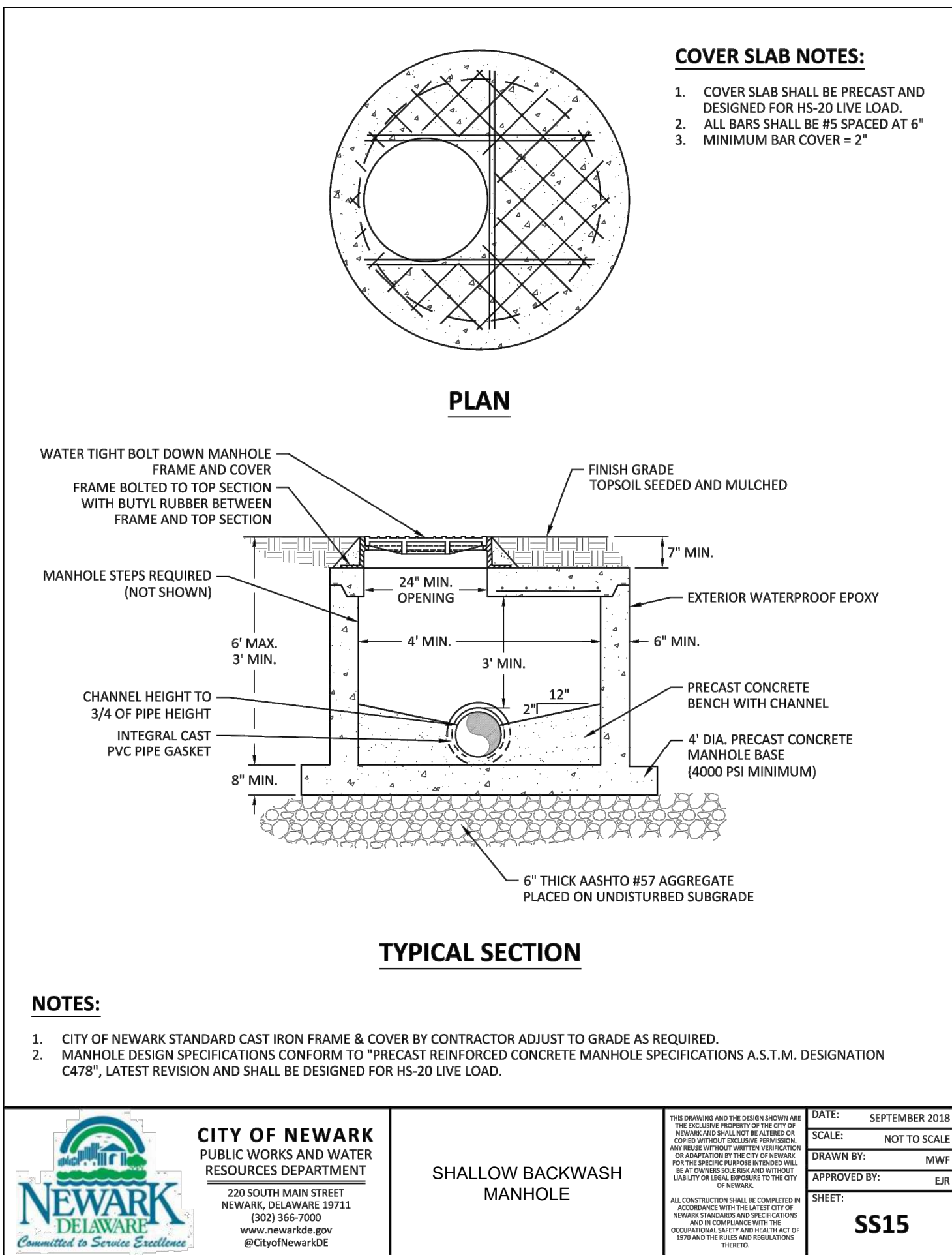
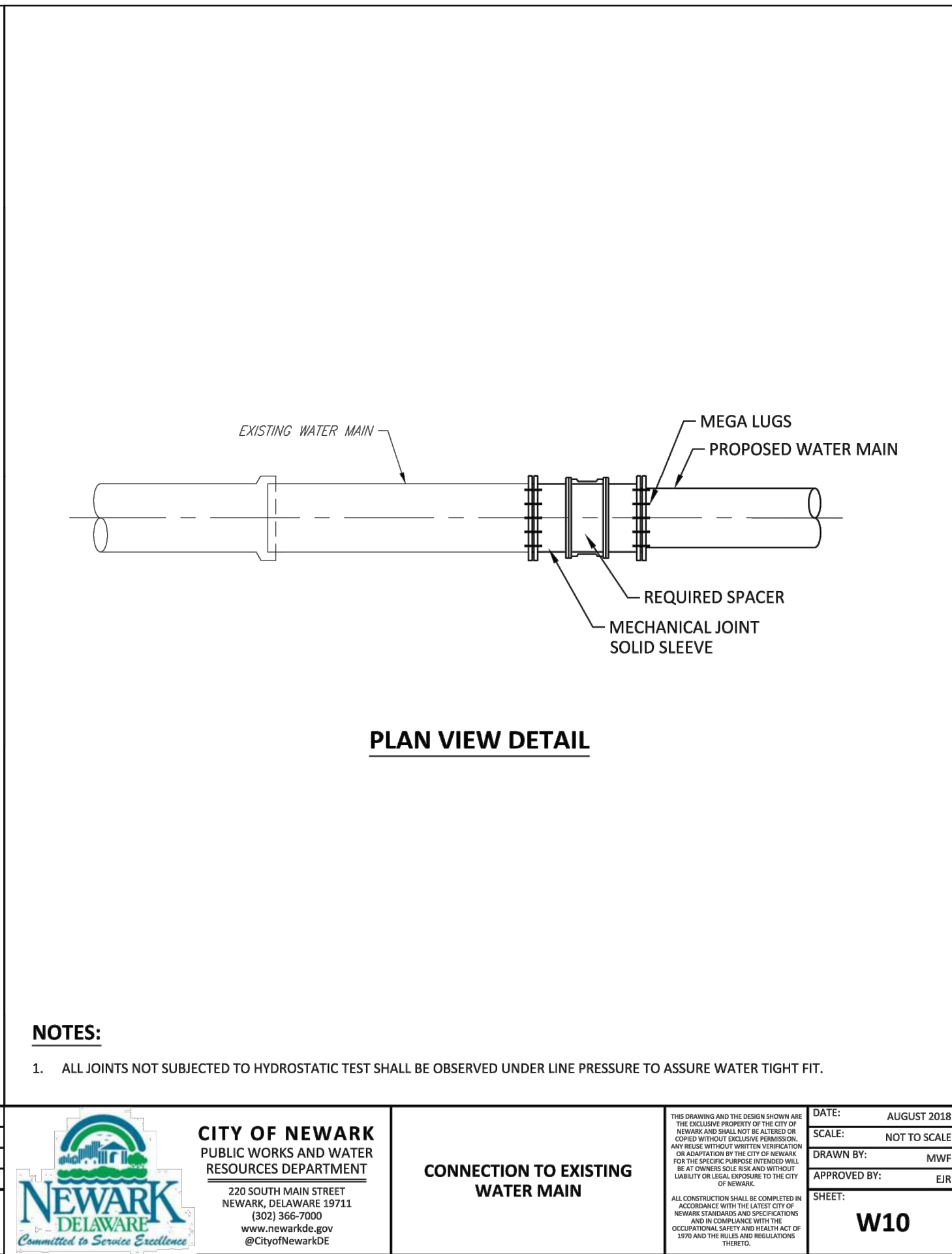
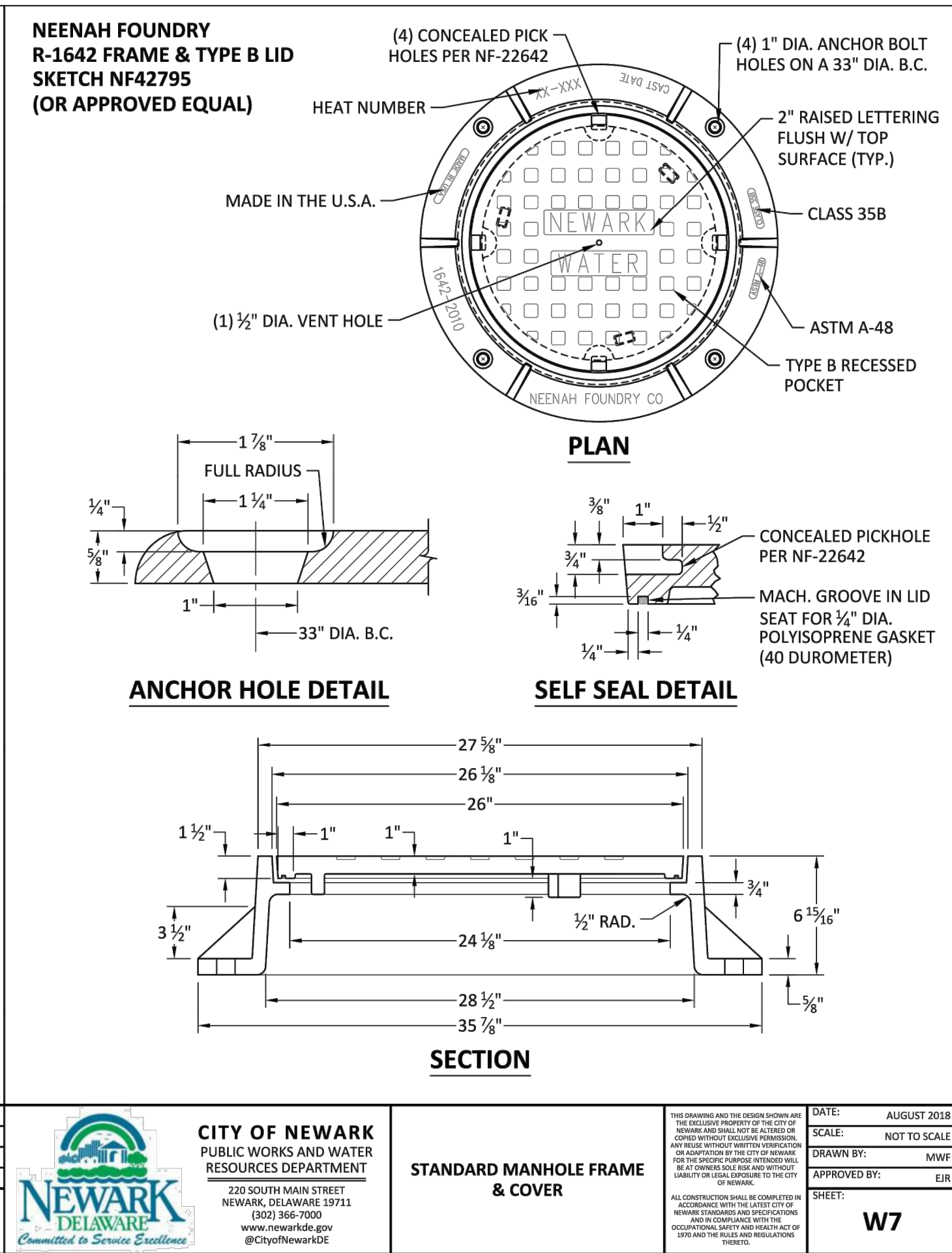
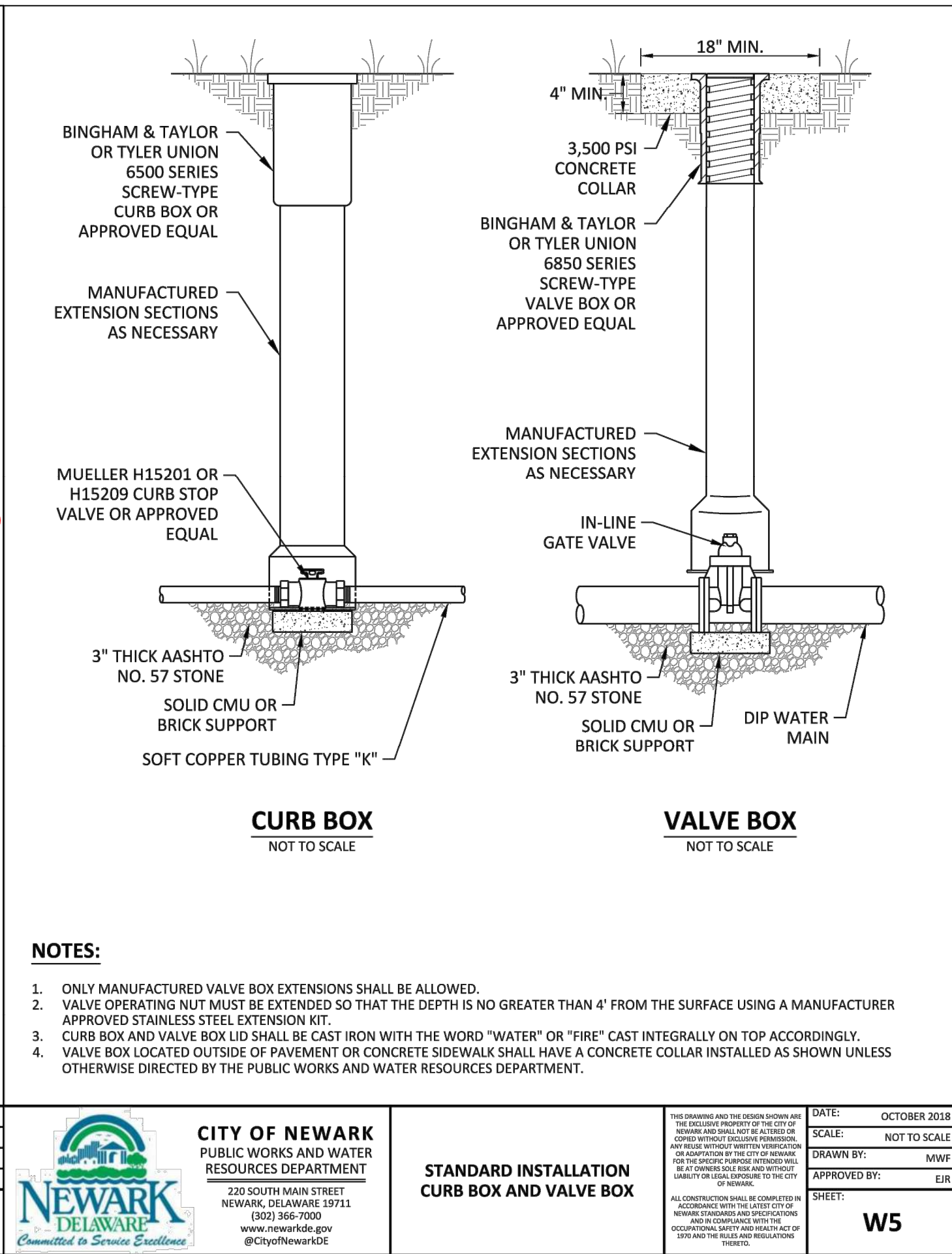
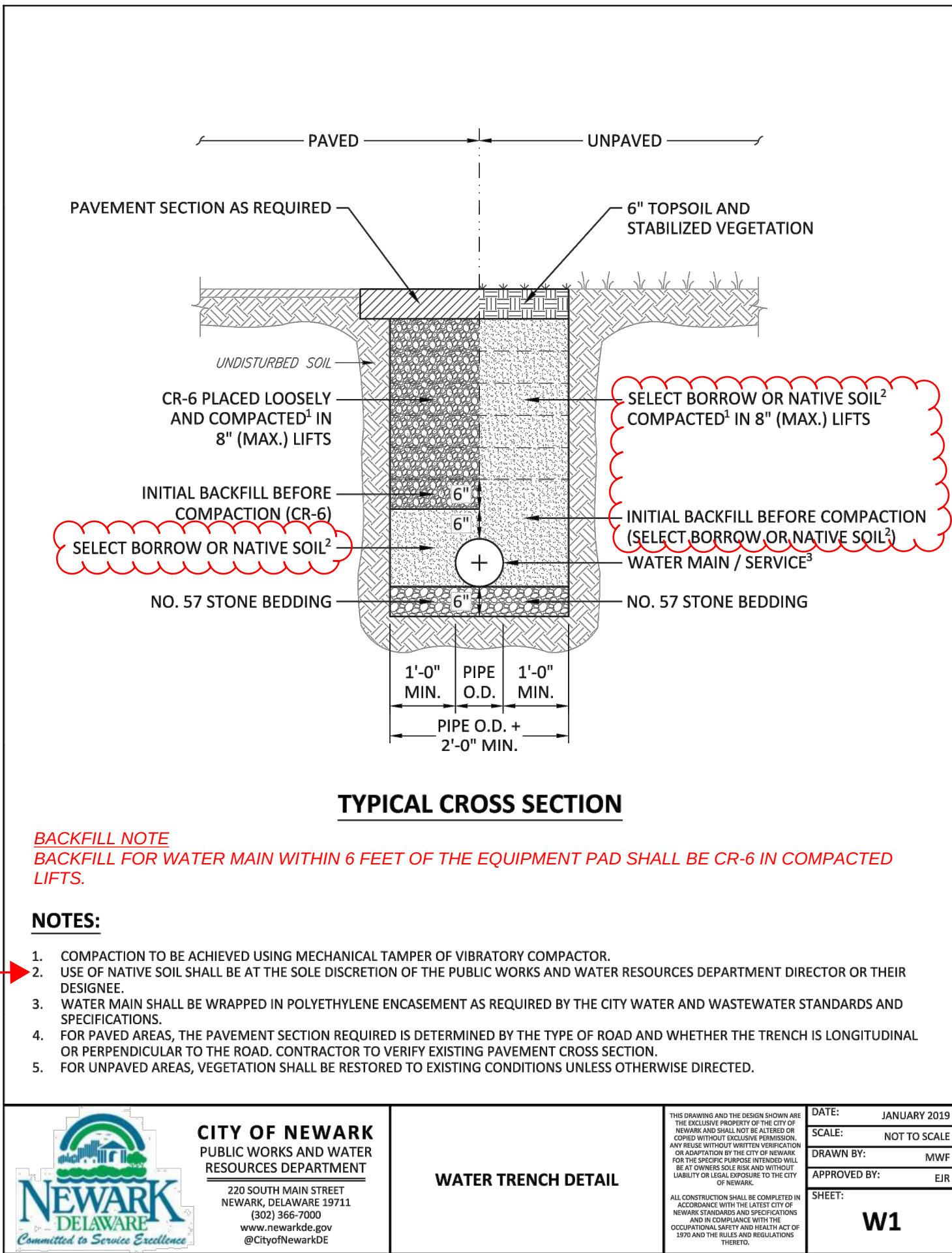
Pennon

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NO.	DATE	REVISIONS	BY
2	06/02/2023	ADDENDUM 2	ELA
1	05/19/2023	BID PLAN SUBMISSION	

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PROJECT	CNEWK22008
DATE	2023-05-05
DRAWING SCALE	1"=5'
DRAWN BY	ELA
APPROVED BY	MJE



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SOUTH WELLFIELD RESIN-GAC SYSTEM
912 SOUTH CHAPEL STREET
NEWARK, DE 19713

CONSTRUCTION DETAILS

CITY OF NEWARK
220 SOUTH MAIN STREET
NEWARK, DE 19711

NO.	DATE	REVISIONS	BY
1	05/10/2023	BID PLAN SUBMISSION	ELA
2	06/15/2023	ADDENDUM 2	ELA

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PROJECT: **CNEWK22008**

DATE: 2023-05-05

DRAWING SCALE: **AS NOTED**

DRAWN BY: **ELA**

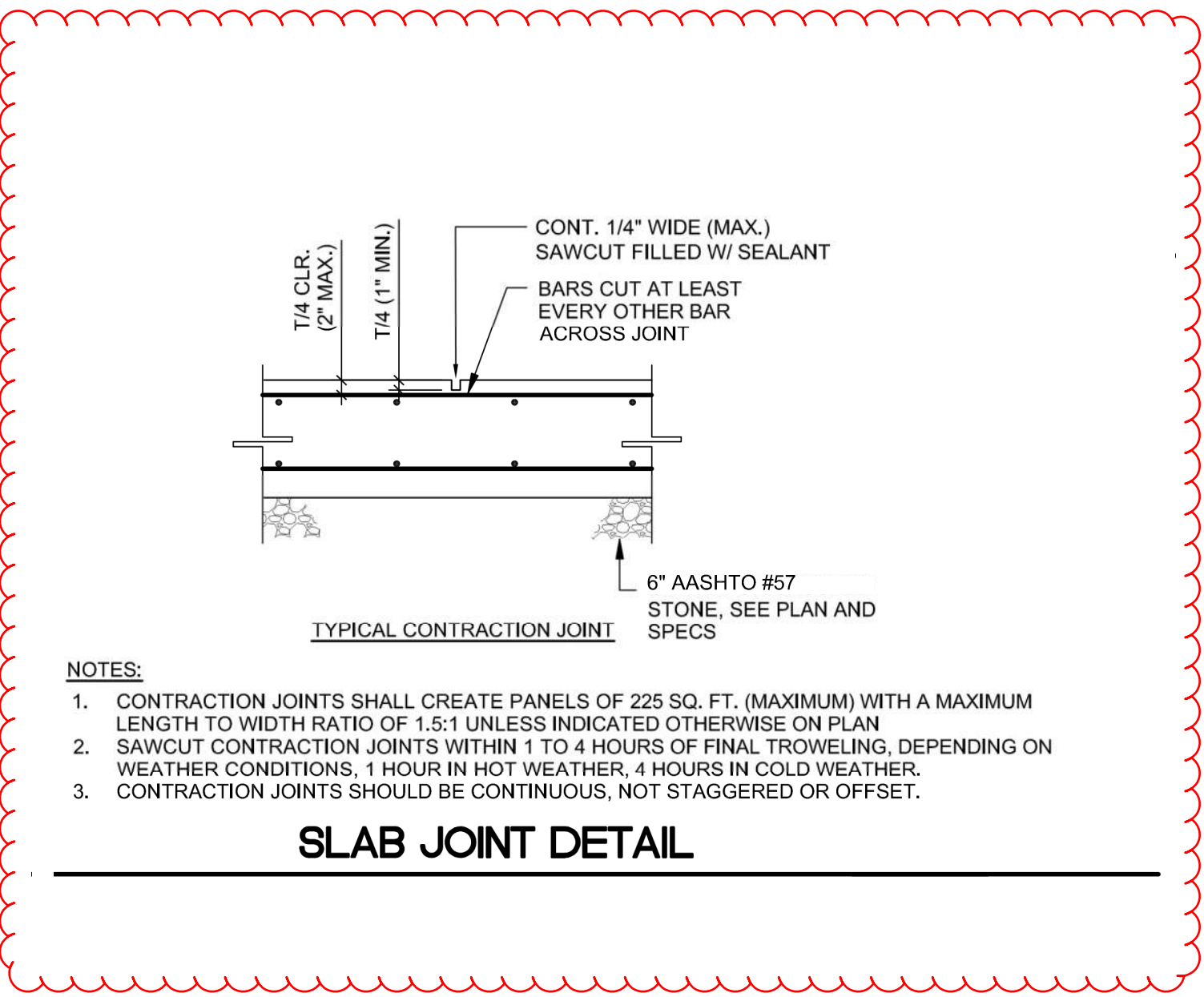
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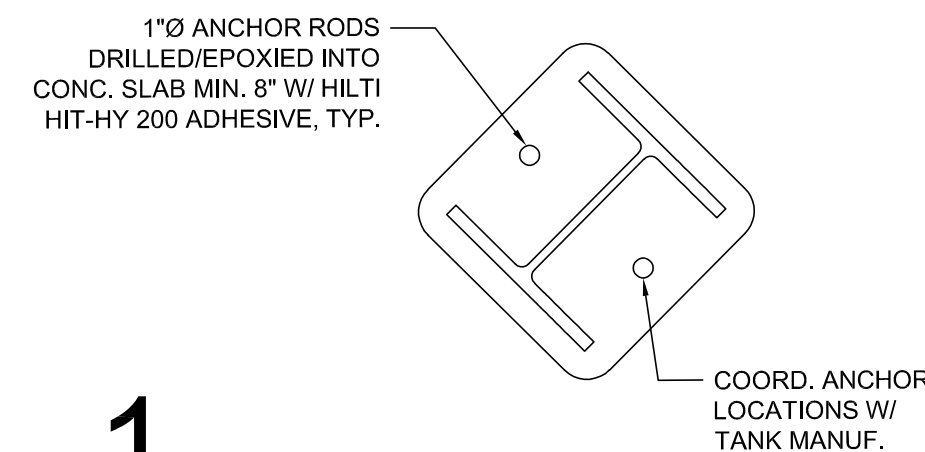
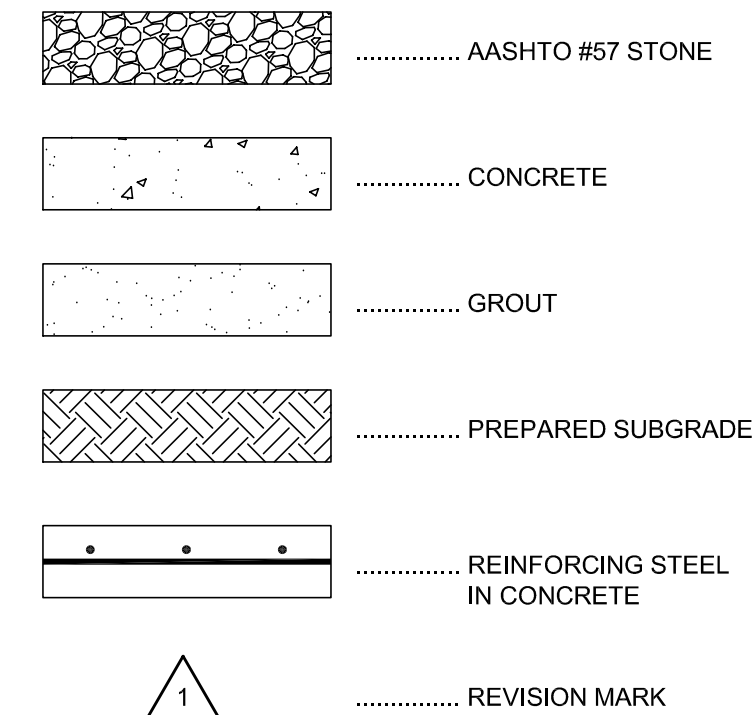
SHEET 12 OF 20

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EXISTING AIR
STRIPPER BUILDING
F.F. 78.25'



STRUCTURAL SYMBOLS



1

SCALE: 1"=1'-0"

FOUNDATION SLAB PLAN

SCALE: 1/4" = 1'-0"

NOTES:

- SEE DRAWING S0001 FOR DESIGN CRITERIA, LOADS, AND GENERAL STRUCTURAL NOTES.
- COORDINATE ALL DIMENSIONS AND ELEVATIONS WITH CIVIL AND MEP DRAWINGS.
- COORDINATE EMBEDDED ITEMS AND OPENINGS WITH MEP DRAWINGS. SEE TYPICAL CONSTRUCTION DETAILS FOR ADDITIONAL INFO.
- ALL EXISTING DIMENSIONS, ELEVATIONS, AND OTHER EXISTING INFORMATION REFERENCED ON THESE DOCUMENTS SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. PENNONI DID NOT VERIFY ALL INFORMATION. THE CONTRACTOR SHALL DETERMINE THE ACTUAL FIELD CONDITIONS ARE ACCURATELY REPRESENTED. IF DIFFERENCES ARE DISCOVERED DURING CONSTRUCTION, CONTACT THE STRUCTURAL ENGINEER.
- CONTRACTOR IS RESPONSIBLE FOR LOCATING ALL EXISTING UTILITIES WITHIN THE AREA OF WORK. CONTRACTOR IS CAUTIONED THAT OTHER UTILITIES NOT SHOWN ON THESE CONTRACT DOCUMENTS MAY EXIST. CONTRACTOR IS RESPONSIBLE FOR PROTECTION OF EXISTING UTILITIES TO REMAIN.

SOUTH WELLFIELD RESIN-GAC SYSTEM

912 SOUTH CHAPEL STREET
NEWARK, DE 19713

ADSORBER SLAB PLAN AND DETAIL

CITY OF NEWARK
220 SOUTH MAIN STREET
NEWARK, DE 19711

NO.	DATE	REVISIONS	BY
1	5-15-23	BID PLAN SUBMISSION	
2	05/15/2023	ADDENDUM 2	

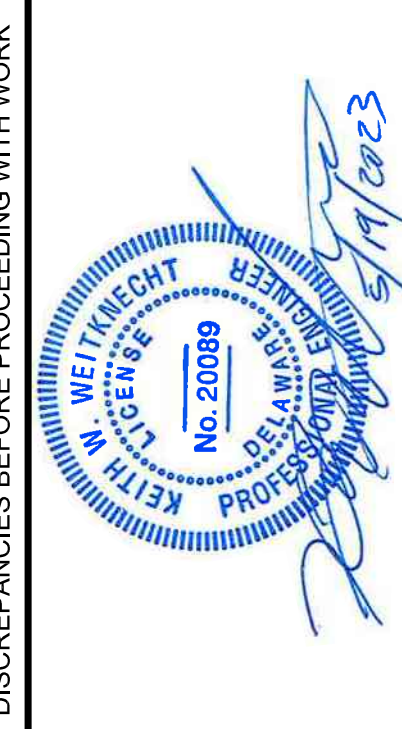
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PROJECT	CNEWK22008
DATE	2023-05-05
DRAWING SCALE	AS NOTED
DRAWN BY	RJK
APPROVED BY	TRG

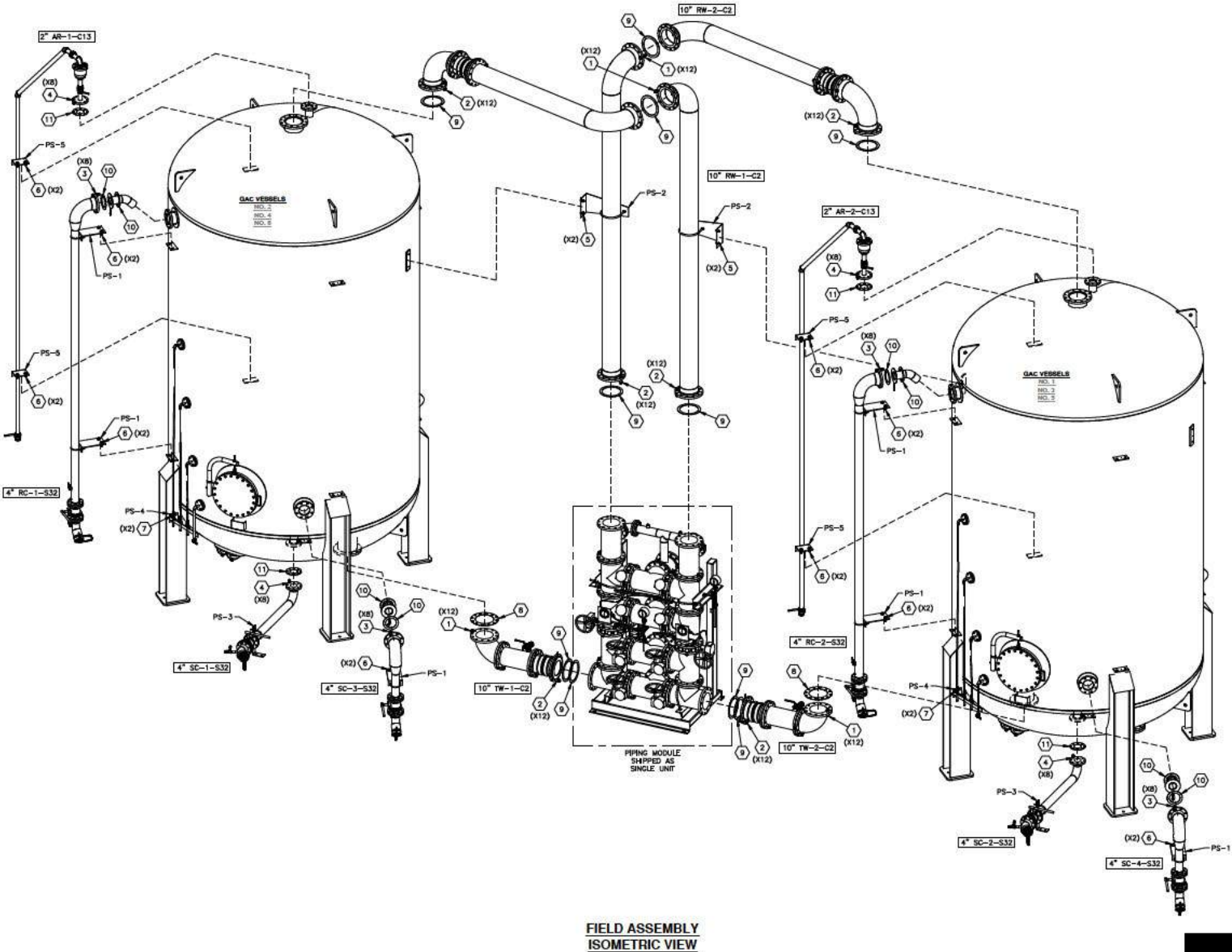
S1000

SHEET 17 OF 20

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INFORMATIONAL DRAWING ONLY - PROVIDED AS AN EXAMPLE REFERENCE



BOLT CHART		
ITEM	QTY	DESCRIPTION
1	48	BOLT SET, 3/8" x 4" LG. w/HVY. HEX NUT & (2) SAE F.W. (TYPE 18-8 SS) & BOLT INSULATOR KIT, 10"-150# FLANGE w/2# LG. SLEEVES (FOR DETAILS, SEE DWG. 90130122)
2	72	BOLT SET, 3/8" x 4" LG. w/HVY. HEX NUT & (2) SAE F.W. (TYPE 18-8 SS) & BOLT INSULATOR KIT, 10"-150# FLANGE w/2# LG. SLEEVES (FOR DETAILS, SEE DWG. 90130122)
3	32	BOLT SET, 3/8" x 4" LG. w/HVY. HEX NUT & (2) SAE F.W. (TYPE 18-8 SS) & BOLT INSULATOR KIT, 8"-150# FLANGE w/2# LG. SLEEVES (FOR DETAILS, SEE DWG. 90130122)
4	32	BOLT SET, 3/8" x 3/8" LG. w/HVY. HEX NUT & (2) SAE F.W. (TYPE 18-8 SS) & BOLT INSULATOR KIT, 4"-150# FLANGE w/2# LG. SLEEVES (FOR DETAILS, SEE DWG. 90130122)
5	4	STUD SET, 3/8" x 2# LG. w/HVY. HEX NUT & F.W. (ALL THREAD, 304SS)
6	20	BOLT SET, 3/8" x 2# LG. w/HVY. HEX NUT & (2) F.W. (304SS)
7	4	BOLT SET, 3/8" x 2" LG. w/HVY. HEX NUT & (2) F.W. (304SS)

GASKET CHART		
ITEM	QTY	DESCRIPTION
8	2	10" FULL FACE
9	10	10" RING TYPE
10	8	8" RING TYPE
11	4	4" FULL FACE

PIPE SUPPORT CHART		
ITEM	QTY	DESCRIPTION
PS-1	8	4" REACT. CARBON/4" SPENT CARBON (UPPER)
PS-2	2	8" INTLUENT
PS-3	2	4" SPENT CARBON (LOWER)
PS-4	2	3/8" LEVEL IND./W/ CONE VENT
PS-5	4	2" AIR RELIEF/VENT

NOTE:
1. (1) SYSTEM SHOWN, (3) SYSTEMS REQUIRED.

2			
1			
0	ISSUED FOR CONSTRUCTION	REV	5/23/2023
REV	DESCRIPTION	APP	DATE
REVISIONS			
TOLERANCES (unless otherwise specified)			
ANGULAR	30°/32'	DECIMAL (2 PLACES)	0.010
FRACTIONAL	1/8"	DECIMAL (3 PLACES)	0.008
DECIMAL (1 PLACES)	0.015	DECIMAL (4 PLACES)	0.0005

Calsonic Industries

3.3 WETTING (DEAERATING THE CARBON)

In a typical bed of virgin carbon, the pore volume is approximately 40% of the bed volume. Carbon which is shipped dry will contain air in these pores. Therefore, the carbon must be properly wetted prior to being placed on stream. If this is not done, the air within these pores will displace into the void spaces between the carbon particles during operation and cause high pressure drop and channeling in the adsorbers. These problems can cause premature breakthrough of contaminants. Air will not migrate out of the bed during normal downflow operation.

The time required for wetting is a function of liquid temperature and viscosity. Generally, a minimum wetting period of 24 hours is required using water at ambient temperatures, although a period of up to 72 hours is preferred for complete wetting. After wetting, backwashable adsorbers should be backwashed to remove air and segregate the carbon by size.

As an alternative, the Calgon Carbon Service trailer containing fresh carbon may be filled with water and allowed to stand for several hours. When the fresh carbon is transferred to the adsorber, the adsorber should be backwashed to eliminate any remaining air.

After the carbon has been wetted, the adsorber should be drained and then backfilled until water flows out the system vent line. The adsorber should be filled up-flow at 2 gpm/ft² maximum. For a Model 12-40 System this is 150 gpm, maximum.

If the unit must be placed on-stream before the carbon has been wetted, the adsorbers should be drained and backfilled when the pressure drop becomes prohibitive or after two days of operation, whichever occurs first.

For process applications, the same procedure is required. If the process liquid cannot be diluted with water and the carbon must be wetted with the process liquid there will be a significant heat of adsorption. In this case, Calgon Carbon should be contacted for specific instructions on the method to be used for wetting.

3.4 BACKWASHING AND BACKFLUSHING

3.4.1 BACKWASHING

Backwashing an adsorber results in expanding or fluidizing the carbon bed. This is accomplished by running contaminant-free water upflow through the carbon bed. The backwash flow rate depends upon the vessel diameter, carbon particle mesh size and the backwash water temperature (refer to the bed expansion curve in Section 8). Backwash flow rates may need to be adjusted due to seasonal temperature variations. Calgon Carbon vessels are designed with significant straight side height to permit 30% bed expansion. Before starting the backwash

operation, ensure that your vessel has appropriate straight side for the intended bed expansion; otherwise media may be lost during backwashing.

A 20% bed expansion will usually provide acceptable results, but a 30% bed expansion is optimal.

For your system, refer to Section 1.2 for the design backwash water flow rate. Note that this rate assumes a 55°F backwash water source. Use the bed expansion curve in Section 8 to determine a backwash rate if the water source is at a different temperature.

Backwashing of a carbon bed should be done after fresh carbon has been transferred into an adsorber and wetted (see Section 3.3). This is referred to as the Initial Backwash. Backwashing during operation to remove sediment from the top of the bed is referred to as an Operational Backwash.

Initial Backwash

The reasons for backwashing before placing fresh carbon on-line are to:

1. Size segregates the carbon (larger particles at bottom, smaller particles on top).
 - a. Therefore, subsequent backwashing will return the carbon particles to the same relative position in the bed.
 - b. Reduce pressure drop
2. Remove any remaining air from the bed.
3. Remove carbon fines which can lead to excessive pressure drop.

In addition, proper backwashing is a crucial step in collecting the most representative and meaningful post-start up data on compounds of interest such as metals and organic contaminants.

In municipal drinking water applications NSF/ANSI 61 establishes criteria for the release of metals (i.e. arsenic) from media used in drinking water treatment. The NSF/ANSI 61 testing protocol for GAC media is designed to mimic the critical procedural steps of a GAC adsorption filter start up and conditioning in the field. This test method consists of several steps:

1. Media conditioning: 16 hour soak
2. Backwash: 30 minutes @ 30% bed expansion
3. Media exposure I: 1 hour soak, discard water

4. Media exposure II: 1 hour soak, discard water
5. Media exposure III: 1 hour soak, analyze sample

In order for the data collected at adsorber start up and the data collected during NSF/ANSI 61 testing to be comparable, the field and lab procedures must be consistent with one another.

An analogous backwash is also recommended when an adsorber is to be restarted after an extended shutdown or when the bed has been drained.

After the wetting period, start backwashing slowly (< 5% bed expansion) to fill the vessel and submerge the bed. In incremental steps, increase the backwash water flow rate until a 20-30% bed volume expansion is obtained. Once the 20-30% carbon bed expansion is achieved, continue the backwash at this maximum rate for 20 to 30 minutes. The backwash water flow rate is then reduced by reversing the ramp up steps used to reach 20-30% expansion. Please see the below delineated steps outlining the recommended initial backwash ramp up/down procedure:

1. Flow @ 5% expansion for 2 minutes
2. Flow @ 10% expansion for 2 minutes
3. Flow @ 15% expansion for 2 minutes
4. Flow @ 20-30% expansion for 20-30 minutes
5. Flow @ 15% expansion for 2 minutes
6. Flow @ 10% expansion for 2 minutes
7. Flow @ 5% expansion for 2 minutes

Operational Backwash

Backwashing is done during operation to remove:

1. Sediment from the top of the bed.
2. Carbon fines that may be plugging the underdrain.
3. Air that is binding the bed.

Operational backwashes are normally required due to an increase in pressure drop across the carbon bed. The frequency of backwash will depend on the level of turbidity in the influent and throughput of the adsorber. The backwash time required to clean the GAC bed depends on the amount of deposited suspended solids, the nature of the suspended solids, and the depth of solids build-up.

The operational backwash procedure is essentially the same as the initial backwash procedure described above, but the time maintained at 20-30% expansion is reduced. Observation of the amount of time required to obtain visually clear effluent water at maximum backwash rate determines a sufficient backwash time. Please see the below delineated steps outlining the recommended operational backwash ramp up/down procedure:

1. Flow @ 5% expansion for 2 minutes
2. Flow @ 10% expansion for 2 minutes
3. Flow @ 15% expansion for 2 minutes
4. Flow @ 20-30% expansion for 10-20 minutes
5. Flow @ 15% expansion for 2 minutes
6. Flow @ 10% expansion for 2 minutes
7. Flow @ 5% expansion for 2 minutes

3.4.2 BACKFLUSHING

In a system that is not designed for backwashing, an operation termed backflushing can be used to remove fines from the upper portion of the bed. This operation will not remove fines from the lower portion of the bed because it does not expand the bed. Expansion of the bed allows the fines at the bottom of the bed to move to the top. However, fines do not always cause high pressure drop, and their removal is not always necessary.

The backflushing rate is 2 to 3 gpm/ft² and this is not significant enough to expand the carbon bed. For the Model 12-40 adsorber this is a flow rate from 150 gpm to 225 gpm. Flow rates of less than 225 gpm will not expand the bed; therefore, size segregation of the bed will not occur. The time required for backflushing is 30 to 45 minutes.

Normally when backwashing or backflushing, a clean external water source is used. The stream should be compatible with the system and free of suspended solids and organic contaminants which might affect adsorption. If necessary, effluent from the adsorber system may be used as the water source. In this case a tank with storage capacity for 15 minutes of backwash water (20,000 gallons) will be necessary.

When normal downflow operation is started after backwashing, the initial 5 to 15 minutes of effluent flow will be dark due to a small quantity of fines. Under normal operating conditions, this condition will clear up.

3.4.3 BACKWASHING AN ADSORBER (FIGURES 6 AND 7 IN SECTION 8)

In this mode, a clean external source is used as the source for the backwash water. Note that the lead adsorber is taken out of service while the backwashing procedure takes place. It is recommended that the entire system be taken off-line to retain all process conditions. However, for continuous flow, the lag adsorber can remain on-line while the lead bed is being backwashed.

For a system operating in parallel, only the vessel needing backwashed should be taken off-line when backwashing is required.

1. Isolate the adsorber to be backwashed. If adsorber PV1 is to be backwashed, refer to Section 3.6.4 for valve sequencing. If adsorber PV2 is to be backwashed, refer to Section 3.6.6 for sequencing. If entire system is taken off-line, make sure source is turned off (i.e., pump) and all valves at system are closed.
2. Open the vent valve (V5 for adsorber PV1, V6 for adsorber PV2).
3. Open the backwash water inlet valve (V8 for adsorber PV1, V7 for adsorber PV2) and start the backwash pump. Backwash flow should be increased to design flow gradually, avoiding water hammer.

The backwash water enters the vessel through the effluent line and flows up through the underdrain and the carbon bed. The backwash water discharge from the vent line should be observed for clarity to determine the duration of backwashing. Backwashing for high pressure drop should take approximately 10 minutes. If excessive sediment and turbidity exists in the untreated water, the backwashing times may have to be increased to 15 minutes. A fresh carbon fill should be backwashed to classify the carbon. The time required for this step is approximately 15 minutes or until the backwash discharge is free of fines.



SECTION 4

CARBON TRANSFER PROCEDURE

SECTION 4

CARBON TRANSFER PROCEDURE

4.1 STANDARD TRAILER

The procedures that are detailed in this section of the manual are for Calgon Carbon's standard carbon trailer. Carbon may be delivered in any of two types of trailers; the standard (single compartment) trailer, or the multi compartment trailer.

The multi compartment trailer (Figure 9 in Section 8) is built to hold 10,000 pounds of carbon in each end section and 20,000 pounds in its center section. The multi compartment trailer arrives at the site with fresh carbon in the end sections. First, spent carbon is transferred to the center section of the trailer and then the fresh carbon is transferred from the end compartments to the adsorber.

In cold weather conditions, steam may be used to thaw the trailer and transfer lines if necessary. Contact Calgon Carbon for trailer steaming procedures if required.

4.2 SITE REQUIREMENTS

A flat paved area is needed to support the Calgon Carbon service trailer which may weigh up to 100,000 pounds. The overhead clearance required for the adsorption system is 13 to 14 feet. Diagrams of the trailers with on-board piping are shown in Figures 8 and 9 in Section 8.

The utility and piping requirements to connect to the adsorber and trailer are as follows:

ADSORBER

Plant Air Line	3/4" Universal air connection 100 scfm at 30 psig min. (Attaches to 3/4" flush connection on carbon fill line above carbon inlet valve)
Plant Water Line	100 gpm (max) at 30 psig min. (Attach at drain connection using a 2" female Kamlock, or through backwash inlet using an 8" 150 lb. flanged connection)

Trailer (See Figure 8 in Section 8)

Plant Air Line	3/4" Universal air connection (for both industrial and food grade trailer) 100 scfm regulated to 15 psig max.
Plant Water Line	4" Kamlock connection (female for industrial trailer, male for food grade trailer) 100 gpm regulated to 15 psig max. (Connect to Trailer Carbon Fill or Discharge Line)

4.3 SPENT CARBON TRANSFER TO EMPTY TRAILERS

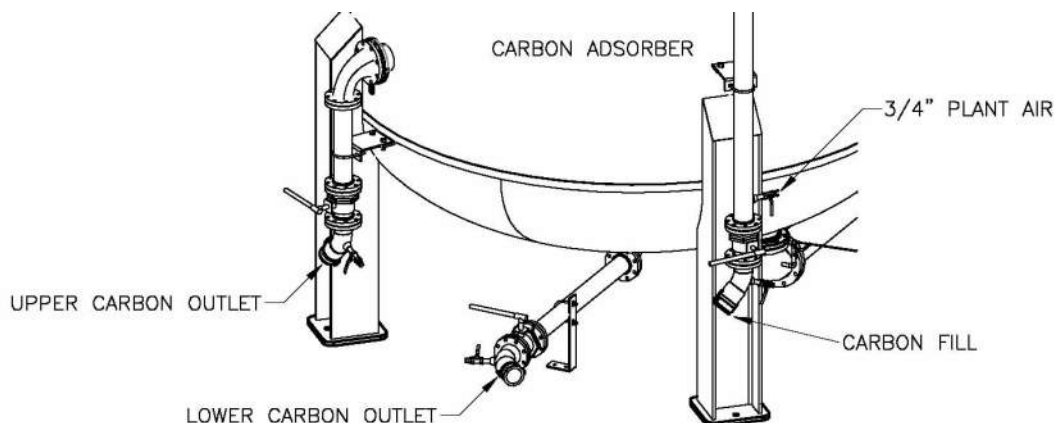


Figure 1

Spent carbon transfer from the adsorber to the trailer is accomplished by pressurizing the adsorber with plant air. When the transfer is complete, the spent carbon in the trailer is drained of water. Prior to disconnecting any lines, the air supply must be shut off, and the adsorber and all transfer lines must be vented.

4.3.1 Spent Carbon Transfer

A. Prepare for Spent Carbon Transfer:

1. Close all adsorber valves.
2. Connect the upper carbon outlet line to the trailer carbon fill line using 4" flexible hose.
3. Open the center manway of the trailer or trailer vent valve T1 for venting.

4. Open valve T2 in the trailer carbon fill line.
5. Check that the adsorber is full of water.
6. To aid the initial phase of transferring spent carbon, fill the transfer line with water. To do this, use a 3/4" water hose to fill the transfer line with water at the adsorber carbon outlet valve's flush-out connection.
7. Connect the plant air line to the 3/4" Chicago connection on the adsorber carbon fill line.
8. Connect the trailer carbon discharge/drain line to the drain, provided by the plant, by means of a 4" flexible hose.

B. Transfer Spent Carbon to Trailer 1

1. Open the 3/4" air line valve slowly and pressurize the adsorber to 25 to 30 psig.
2. Open the 4" upper adsorber carbon outlet valve (V16 for adsorber PV1, V15 for adsorber PV2) and transfer the spent carbon to the trailer.
3. As the trailer starts to fill with carbon slurry, open the trailer septa valves T8, T9, and T10 to drain off excess motive water.

The transfer should take 20 to 30 minutes. The transfer will end with a loss of pressure in the adsorber and the sound of air in the transfer line.

C. End Transfer to Trailer 1

1. Close the plant air line valve.
2. Vent the tank and lines through the trailer vent valve T1.
3. Open the adsorber vent valve (V5 or V6) to further aid the venting.
4. Close the upper adsorber carbon outlet valve (V16 for adsorber PV1, V15 for adsorber PV2).

5. Using a 3/4" water hose at the adsorber carbon discharge line flush-out connection, flush out the transfer line for a few minutes to remove all traces of carbon. Bleed the water hose and remove it.

4.3.2 Drain Water from Trailer

A. Prepare for Draining Water

1. Close all valves on the trailer. Close the trailer manway.
2. Connect the plant air line to the 3/4" connection on trailer carbon fill line using the air line hose.
3. Connect the trailer carbon discharge/drain line to the drain, provided by the plant/customer, by means of a 4" flexible hose, if not already connected.

B. Draining Trailer

1. Pressurize the trailer to 15 psig by slowly opening plant air line valve T4 on the trailer.
2. Open 2" trailer septa valves T8, T9, and T10.

By pressurizing the trailer, water will be drained in less time than if drained by gravity.

C. End Draining

1. When the carbon is completely drained, close the air line valve T4 on the trailer.
2. Vent trailer slowly through trailer vent valve T1.
3. When venting is complete, close all valves on the trailer and disconnect all hoses.

The trailer is now full of drained spent carbon and is ready for return to Calgon Carbon for reactivation.

4.3.3 Repeat Process for Second Trailer

- A. Repeat steps 4.3.1 for second trailer using the lower carbon outlet line connections and valve.**
- B. Repeat steps 4.3.2 for second trailer.**

4.4 FRESH CARBON TRANSFER FROM MULTICOMPARTMENT TRAILER

Fresh carbon is transferred in a slurry using plant air pressure. The trailer is first filled with water to create the slurry. The carbon slurry hose on the trailer is connected to the adsorber fill line and the trailer carbon discharge line. After putting a water cushion in the adsorber, the trailer is pressurized, and the carbon slurry is transferred to the empty adsorber. Prior to disconnecting any lines, the air supply must be shut off, and the trailer and all transfer lines must be vented.

Under no circumstances should the standard and triple compartment trailers be connected to a pressure source exceeding 15 psig.

4.4.1 Fill the Trailer with Water

If the carbon is wetted prior to delivery, about 4000 gallons of water will be required. If the carbon is dry, about 5000 gallons of water will be required. The trailer may be filled either upflow or downflow.

A. Filling Operation

1. Connect water line to the trailer (carbon fill line if filling downflow, carbon discharge line if filling upflow) using a 4" flexible hose.
2. Open one top manway to vent trailer during filling.
3. Open trailer vent line valve T1.
4. Open trailer water line valve (valve T2 if filling downflow, valves T8, T9, and/or T10 if filling upflow).
5. Open plant water line valve slowly and fill the trailer.

The trailer will be filled with approximately 4000 to 5000 gallons of water. The trailer filling shall be visually determined by observing the water level through the manway or by metering the desired amount.

B. End Filling Operation

1. Close plant water line valve.
2. Close trailer water line valve (T2 for downflow, T8, T9, and T10 for upflow), manways, and trailer vent valve T1.
3. Disconnect hose.

4.4.2 Transfer Carbon to Adsorber

A. Prepare for Transfer

Place about 3000 gallons of water in the adsorber. This water cushion helps to protect the underdrain system and vessel lining. If the amount of water cannot be measured, fill the vessel until water flows from the air bleed nozzle located at the point where the internal cone meets the vessel sidewall. After water flows from this point, continue to fill the vessel for several minutes to allow the water cushion to rise several inches above the internal cone.

1. Connect the adsorber fill line to the trailer carbon discharge/drain line using 4" flexible hose.
2. Connect the 3/4" plant air line to the trailer carbon fill line using the air line hose.
3. Close all valves on the adsorber.
4. Open the adsorber vent valve (V5 or V6).
5. To aid the initial phase of transferring fresh carbon, fill the transfer line with water. To do this, use a 3/4" water hose to fill the transfer line with water, at the carbon inlet valve's flush-out connection.

B. Transfer Fresh Carbon

1. Pressurize the trailer to 15 psig by slowly opening the plant air line valve and then slowly opening valve T4 in the trailer carbon fill line.
2. Open the adsorber fill line valve (V16 for adsorber PV1, V15 for adsorber PV2).

3. The Calgon Carbon trailer driver will open the trailer carbon outlet valves T5, T6, and T7 to empty the respective hoppers.
4. If a water cushion is utilized, open an adsorber drain valve shortly after starting the transfer. This is done to reduce the amount of water that overflows at the end of the transfer. The disposal of the excess motive water is provided by the customer.

C. End Transfer

1. Close the plant air valve and vent the trailer through the adsorber vent valve.
2. Close the adsorber drain valve if it was utilized during the transfer.
3. Slowly open trailer vent valve T1 for additional venting.
4. When completely vented, close the adsorber fill line valve (V16 for adsorber PV1, V15 for adsorber PV2), disconnect the hoses, and close the trailer valves.
5. Refer to Sections 3.3 and 3.4.2 for instructions on wetting and backwashing/backflushing the adsorber.
6. After the adsorber has been backwashed/backflushed, shut off the plant water and close the vent valve on the adsorber.



SECTION 4

RESIN TRANSFER PROCEDURE

SECTION 4

4.1 RESIN TRANSFER PROCEDURE -- STANDARD TRAILER

The procedures that are detailed in this section of the manual are for Calgon Carbon's standard resin trailer. Resin may be delivered in any of two types of trailers; the standard (single compartment) trailer, or the multi compartment trailer.

The multi compartment trailer (Figure 9 in Section 3) is built to hold 10,000 pounds of resin in each end section and 20,000 pounds in its center section. The multi compartment trailer arrives at the site with fresh resin in the end sections. First, spent resin is transferred to the center section of the trailer and then the fresh resin is transferred from the end compartments to the exchanger.

In cold weather conditions, steam may be used to thaw the trailer and transfer lines if necessary. Contact Calgon Carbon for trailer steaming procedures if required.

4.2 SITE REQUIREMENTS

A flat paved area is needed to support the Calgon Carbon service trailer which may weigh up to 100,000 pounds. The overhead clearance required for the adsorption system is 13 to 14 feet. Diagrams of the trailers with on-board piping are shown in Figures 8 and 9 in Section 3.

The utility and piping requirements to connect to the exchanger and trailer are as follows:

EXCHANGER

Plant Air Line	3/4" Universal air connection 100 scfm at 30 psig min. (Attaches to 3/4" flush connection on resin fill line above resin inlet valve)
Plant Water Line	100 gpm (max) at 30 psig min. (Attach at drain connection using a 2" female Kamlock, or through backwash inlet using an 8" 150 lb. flanged connection)

Trailer (See Figure 8 in Section 3)

Plant Air Line	3/4" Universal air connection (for both industrial and food grade trailer) 100 scfm regulated to 15 psig max.
Plant Water Line	4" Kamlock connection (female for industrial trailer, male for food grade trailer) 100 gpm regulated to 15 psig max. (Connect to Trailer Resin Fill or Discharge Line)

4.3 SPENT RESIN TRANSFER TO TRAILER

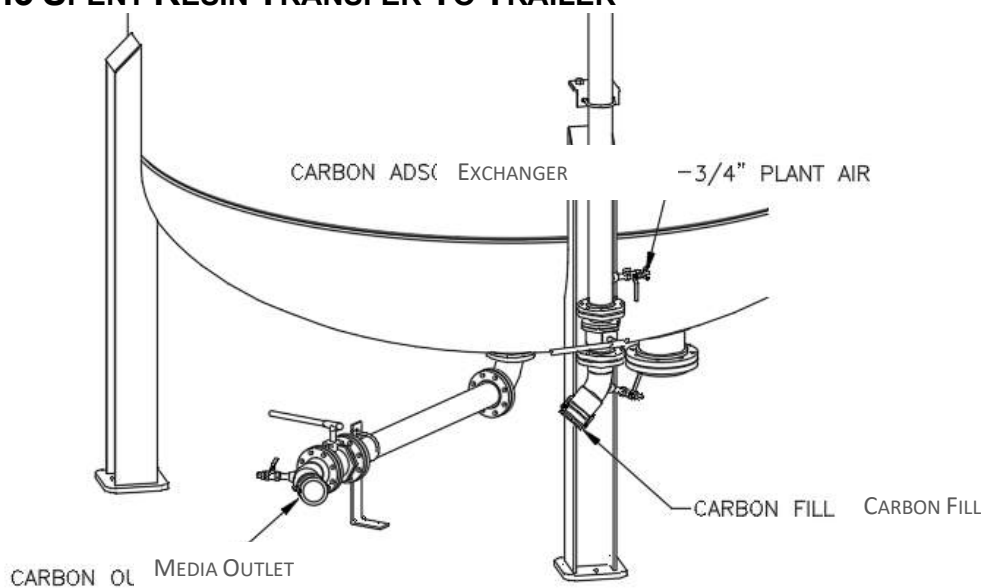


Figure 1

Spent resin transfer from the exchanger to the trailer is accomplished by pressurizing the exchanger with plant air. When the transfer is complete, the spent resin in the trailer is drained of water. Prior to disconnecting any lines, the air supply must be shut off, and the exchanger and all transfer lines must be vented.

4.3.1 Spent Resin Transfer

A. Prepare for Spent Resin Transfer:

1. Close all exchanger valves.
2. Connect the exchanger resin outlet line to the trailer resin fill line using 4" flexible hose.
3. Open the center manway of the trailer or trailer vent valve T1 for venting.
4. Open valve T2 in the trailer resin fill line.
5. Check that the exchanger is full of water.
6. To aid the initial phase of transferring spent resin, fill the transfer line with water. To do this, use a 3/4" water hose to fill the transfer line with water at the exchanger resin outlet valve's flush-out connection.

B. Transfer Spent Resin

1. Open the 3/4" air line valve slowly and pressurize the exchanger to 25 to 30 psig.
2. Open the 4" exchanger resin outlet valve (V14 for exchanger PV1A & 2A, V13 for exchanger PV1B & 2B) and transfer the spent resin to the trailer.
3. As the trailer starts to fill with resin slurry, open the trailer septa valves T8, T9, and T10 to drain off excess motive water.

The transfer should take 20 to 30 minutes. The transfer will end with a loss of pressure in the exchanger and the sound of air in the transfer line.

A small heel of resin may remain in the exchanger. This material will have to be removed. Close the resin outlet valve on the exchanger and add plant water to the exchanger for 2-3 minutes (through the drain connection or backwash inlet). Leave the 3/4" air line open. When the exchanger pressure reaches 25 psig, open the exchanger resin outlet valve (V14 for exchanger PV1A & 2A, V13 for exchanger PV1B & 2B) and transfer the remaining amount of resin into the trailer.

C. End Transfer

1. Close the plant air line valve.
2. Vent the tank and lines through the trailer vent valve T1.

3. Open the exchanger vent valve (V5 or V6) to further aid the venting.
4. Close the exchanger resin outlet valve (V14 for exchanger PV1A & 2A, V13 for exchanger PV1B & 2B).
5. Using a 3/4" water hose at the exchanger resin discharge line flush-out connection, flush out the transfer line for a few minutes to remove all traces of resin. Bleed the water hose and remove it.

4.3.2 Drain Water from Trailer

A. Prepare for Draining Water

1. Close all valves on the trailer. Close the trailer manway.
2. Connect the plant air line to the 3/4" connection on trailer resin fill line using the air line hose.
3. Connect the trailer resin discharge/drain line to the drain line in the trench by means of a 4" flexible hose.

B. Draining Trailer

1. Pressurize the trailer to 15 psig by slowly opening plant air line valve T4 on the trailer.
2. Open 2" trailer septa valves T8, T9, and T10.

By pressurizing the trailer, water will be drained in less time than if drained by gravity.

C. End Draining

1. When the resin is completely drained, close the air line valve T4 on the trailer.
2. Vent trailer slowly through trailer vent valve T1.
3. When venting is complete, close all valves on the trailer and disconnect all hoses.

The trailer is now full of drained spent resin and is ready for return to Calgon Carbon for reactivation.

4.4 FRESH RESIN TRANSFER FROM TRAILER

Fresh resin is transferred in a slurry using plant air pressure. The trailer is first filled with water to create the slurry. The resin slurry hose on the trailer is connected to the exchanger fill line and the trailer resin discharge line. After putting a water cushion in the exchanger, the trailer is pressurized and the resin slurry is transferred to the empty exchanger. Prior to disconnecting any lines, the air supply must be shut off, and the trailer and all transfer lines must be vented.

Under no circumstances should the standard and triple compartment trailers be connected to a pressure source exceeding 15 psig.

4.4.1 Fill the Trailer with Water

If the resin is wetted prior to delivery, about 4000 gallons of water will be required. If the resin is dry, about 5000 gallons of water will be required. The trailer may be filled either upflow or downflow.

A. Filling Operation

1. Connect water line to the trailer (resin fill line if filling downflow, resin discharge line if filling upflow) using a 4" flexible hose.
2. Open one top manway to vent trailer during filling.
3. Open trailer vent line valve T1.
4. Open trailer water line valve (valve T2 if filling downflow, valves T8, T9, and/or T10 if filling upflow).
5. Open plant water line valve slowly and fill the trailer.

The trailer will be filled with approximately 4000 to 5000 gallons of water. The trailer filling shall be visually determined by observing the water level through the manway or by metering the desired amount.

B. End Filling Operation

1. Close plant water line valve.
2. Close trailer water line valve (T2 for downflow, T8, T9, and T10 for upflow), manways, and trailer vent valve T1.
3. Disconnect hose.

4.4.2 Transfer Resin to Exchanger

A. Prepare for Transfer

Place about 3000 gallons of water in the exchanger. This water cushion helps to protect the underdrain system and vessel lining. If the amount of water cannot be measured, fill the vessel until water flows from the air bleed nozzle located at the point where the internal cone meets the vessel sidewall. After water flows from this point, continue to fill the vessel for several minutes to allow the water cushion to rise several inches above the internal cone.

1. Connect the exchanger fill line to the trailer resin discharge/drain line using 4" flexible hose.
2. Connect the 3/4" plant air line to the trailer resin fill line using the air line hose.
3. Close all valves on the exchanger.
4. Open the exchanger vent valve (V5 or V6).
5. To aid the initial phase of transferring fresh resin, fill the transfer line with water. To do this, use a 3/4" water hose to fill the transfer line with water, at the resin inlet valve's flush-out connection.

B. Transfer Fresh Resin

1. Pressurize the trailer to 15 psig by slowly opening the plant air line valve and then slowly opening valve T4 in the trailer resin fill line.
2. Open the exchanger fill line valve (V16 for exchanger PV1A & 2A, V15 for exchanger PV1B & 2B).
3. The Calgon Carbon trailer driver will open the trailer resin outlet valves T5, T6, and T7 to empty the respective hoppers.
4. If a water cushion is utilized, open an exchanger drain valve shortly after starting the transfer. This is done to reduce the amount of water that overflows at the end of the transfer. The disposal of the excess motive water is provided by the customer.

C. End Transfer

1. Close the plant air valve and vent the trailer through the exchanger vent valve.
2. Close the exchanger drain valve if it was utilized during the transfer.
3. Slowly open trailer vent valve T1 for additional venting.

-
4. When completely vented, close the exchanger fill line valve (V16 for exchanger PV1A & 2A, V15 for exchanger PV1B & 2B), disconnect the hoses, and close the trailer valves.
 5. Refer to Sections 3 for instructions on wetting and backwashing/backflushing the exchanger.
 6. After the exchanger has been backwashed/backflushed, shut off the plant water and close the vent valve on the exchanger.



SUBMITTAL MANUAL
(2) MODEL 12-40 DWC
GRANULAR ACTIVATED CARBON
ADSORPTION SYSTEMS

FOR

CITY OF NEWARK
NEWARK, DE

SOLD TO: CITY OF NEWARK

APRIL, 2023

CALGON CARBON PROJECT NUMBER:
CUSTOMER PURCHASE ORDER NUMBER:

IXO.220002.NEWARK
20221012
REV. 2

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OTHER THAN SPECIFICALLY PERMITTED IN WRITING BY CALGON CARBON CORPORATION.

SAFETY DEPENDS ON YOU

Calgon Carbon Corporation's equipment is designed and built with safety in mind. However, proper installation and operation can increase your overall safety.

DO NOT INSTALL, OPERATE OR REPAIR THIS EQUIPMENT WITHOUT READING THIS MANUAL AND THE SAFETY PRECAUTIONS CONTAINED THROUGHOUT.

BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.

SAFETY HIGHLIGHTS

READ AND UNDERSTAND THE FOLLOWING SAFETY HIGHLIGHTS.

WARNING

This statement appears where the information must be followed exactly to avoid serious personal injury or loss of life

CAUTION

This statement appears where the information must be followed exactly to avoid minor personal injury or damage to equipment.

QUESTIONS, TROUBLESHOOTING, SPARE PARTS

Call Calgon Carbon Corporation at 1-800-422-7266

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SECTION 1

CARBON / MEDIA

FILTRASORB® 400

Granular Activated Carbon

Applications



FILTRASORB 400 activated carbon can be used in a variety of liquid phase applications for the removal of dissolved organic compounds. FILTRASORB 400 has been successfully applied for over 40 years in applications such as drinking and process water purification, wastewater treatment, and food, pharmaceutical, and industrial purification.

Description

FILTRASORB 400 is a granular activated carbon for the removal of dissolved organic compounds from water and wastewater as well as industrial and food processing streams. These contaminants include taste and odor compounds, organic color, total organic carbon (TOC), industrial organic compounds such as TCE and PCE, and PFAS.

This activated carbon is made from select grades of bituminous coal through a process known as reagglomeration to produce a high activity, durable, granular product capable of withstanding the abrasion associated with repeated backwashing, hydraulic transport, and reactivation for reuse. Activation is carefully controlled to produce a significant volume of both low and high energy pores for effective adsorption of a broad range of high and low molecular weight organic contaminants.

FILTRASORB 400 is formulated to comply with all the applicable provisions of the AWWA Standard for Granular Activated Carbon (B604) and Food Chemicals Codex. This product may also be certified to the requirements of NSF/ANSI 61 for use in municipal water treatment facilities. Only products bearing the NSF Mark are certified to the NSF/ANSI 61 - Drinking Water System Components - Health Effects standard. Certified Products will bear the NSF Mark on packaging or documentation shipped with the product.

Features / Benefits

- Produced from a pulverized blend of high quality bituminous coals resulting in a consistent, high quality product.
- Carbon granules are uniformly activated through the whole granule, not just the outside, resulting in excellent adsorption properties and constant adsorption kinetics.
- The reagglomerated structure ensures proper wetting while also eliminating floating material.
- High mechanical strength relative to other raw materials, thereby reducing the generation of fines during backwashing and hydraulic transport.
- Carbon bed segregation is retained after repeated backwashing, ensuring the adsorption profile remains unchanged and therefore maximizing the bed life.
- Reagglomerated with a high abrasion resistance, which provides excellent reactivation performance.
- High density carbon resulting in a greater adsorption capacity per unit volume.

Specifications¹

FILTRASORB 400

Iodine Number, mg/g	1000 (min)
Moisture by Weight	2% (max)
Effective Size	0.55–0.75 mm
Uniformity Coefficient	1.9 (max)
Abrasion Number	75 (min)
Screen Size by Weight, US Sieve Series	
On 12 mesh	5% (max)
Through 40 mesh	4% (max)

¹Calgon Carbon test method

Typical Properties*

FILTRASORB 400

Apparent Density (tamped)	0.54 g/cc
Water Extractables	<1%
Non-Wettability	<1%

*For general information only, not to be used as purchase specifications.

Safety Message

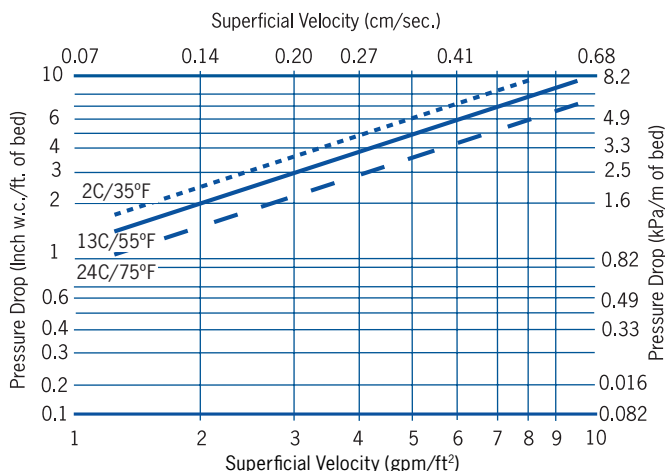
Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

1.800.4CARBON calgoncarbon.com

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 DS-FILTRA40018-EIN-E1

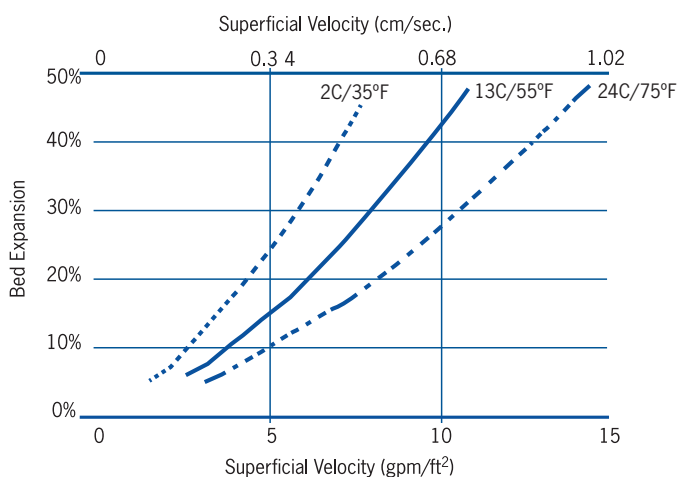
Typical Pressure Drop

Based on a backwashed and segregated bed



Typical Bed Expansion During Backwash

Based on a backwashed and segregated bed



Conditioning and Backwashing

Backwashing and conditioning fresh GAC before placing into operation is critical to GAC performance. The reasons for backwashing before placing fresh media online are to: (1) size segregate the media so subsequent backwashing will return the media to the same relative position in the bed, (2) remove any remaining air from the bed, and (3) remove media fines which can lead to excessive pressure drop and flow restriction. In addition, proper backwashing is a crucial step to collecting the most representative and meaningful post-start up data on compounds of interest, such as metals listed in the NSF/ANSI 61 standard.

Below are the recommended steps for proper conditioning and backwashing of GAC based on Filtrasorb 400 GAC being backwashed at 55°F:

1. Fully submerge GAC bed in clean, contaminant free water for at least 16 hours (overnight)
2. Open backwash inlet and begin up-flow at 3 gpm/ft² for 2 minutes
3. Increase flow to 5 gpm/ft² and maintain for 2 minutes
4. Increase flow to 7 gpm/ft² and maintain for 2 minutes
5. Increase flow to 8.5 gpm/ft² and maintain for 30 minutes*
6. Decrease flow to 7 gpm/ft² and maintain for 2 minutes
7. Decrease flow to 5 gpm/ft² and maintain for 2 minutes
8. Decrease flow to 3 gpm/ft² and maintain for 2 minutes
9. Close backwash inlet and stop flow

*Duration representative of initial backwash conditions. Required duration during operational backwashes can be shorter but will vary by utility, solids load, and GAC throughput. Contact Calgon Carbon for more information"

Design Considerations

FILTRASORB 400 activated carbon is typically applied in down-flow packed-bed operations using either pressure or gravity systems. Design considerations for a treatment system is based on the user's operating conditions, the treatment objectives desired, and the chemical nature of the compound(s) being adsorbed.

Safety Message

Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

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DS-FILTRA40018-EIN-E1

SECTION 1: Identification of the Substance/Mixture and of the Company/Undertaking

1.1. Product identifier

Product name : FILTRASORB 400
Product form : Substance
CAS No : 7440-44-0
Product code : 12030
Synonyms : Activated carbon; Steam activated carbon

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Adsorbent

1.3. Details of the supplier of the safety data sheet

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA 15230
412-787-6700

1.4. Emergency telephone number

Emergency number : CHEMTREC (24 HRS): 1-800-424-9300

SECTION 2: Hazards Identification

2.1. Classification of the substance or mixture

GHS-US classification

Combustible Dust

Not classified as a simple asphyxiant. Product does not displace oxygen in the ambient atmosphere, but slowly adsorbs oxygen from a confined space when wet. Under conditions of anticipated and recommended use, product does not pose an asphyxiation hazard.

2.2. Label elements

GHS-US labeling

Signal word (GHS-US) : **Warning**
Hazard statements (GHS-US) : May form combustible dust concentrations in air.

2.3. Other hazards

Other hazards not contributing to the classification : Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/Information on Ingredients

3.1. Substance

Name	Product identifier	%
Activated carbon	(CAS No) 7440-44-0	< 100

3.2. Mixture

Not applicable

SECTION 4: First Aid Measures

4.1. Description of first aid measures

First-aid measures general : If exposed or concerned, get medical attention/advice. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before re-use. Never give anything to an unconscious person.

First-aid measures after inhalation : IF INHALED: Remove to fresh air and keep at rest in a comfortable position for breathing.

First-aid measures after skin contact : IF ON SKIN (or clothing): Remove affected clothing and wash all exposed skin with water for at least 15 minutes.

First-aid measures after eye contact : IF IN EYES: Immediately flush with plenty of water for at least 15 minutes. Remove contact lenses if present and easy to do so. Continue rinsing.

FILTRASORB 400

Product Code: 12030

Safety Data Sheet

First-aid measures after ingestion : IF SWALLOWED: Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center or medical professional. Get medical attention if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : Not expected to present a significant hazard under anticipated conditions of normal use. Dust may cause irritation to the respiratory system.

Symptoms/injuries after skin contact : Dust may cause irritation.

Symptoms/injuries after eye contact : Dust may cause irritation and redness.

Symptoms/injuries after ingestion : Not expected to present a significant hazard under anticipated conditions of normal use.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available.

SECTION 5: Firefighting Measures

5.1. Extinguishing media

Suitable extinguishing media : Water spray. Carbon dioxide. Dry chemical. Foam. Sand.

Unsuitable extinguishing media : None known.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Dust may be combustible under specific conditions. May be ignited by heat, sparks or flames.

Explosion hazard : Dust may form explosive mixture in air.

Reactivity : No dangerous reactions known under normal conditions of use. Carbon oxides may be emitted upon combustion of material.

5.3. Advice for firefighters

Firefighting instructions : Wear NIOSH-approved self-contained breathing apparatus suitable for the surrounding fire. Use water spray or fog for cooling exposed containers. Evacuate area.

SECTION 6: Accidental Release Measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Evacuate area. Keep upwind. Ventilate area. Spill should be handled by trained clean-up crews properly equipped with respiratory equipment and full chemical protective gear (see Section 8).

6.1.1. For non-emergency personnel

No additional information available.

6.1.2. For emergency responders

No additional information available.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Avoid release to the environment. Product is not soluble, but can cause particulate emission if discharged into waterways. Dike all entrances to sewers and drains to avoid introducing material to waterways. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment : Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust.

Methods for cleaning up : Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust. Dispose of material in compliance with local, state, and federal regulations.

6.4. Reference to other sections

No additional information available.

SECTION 7: Handling and Storage

7.1. Precautions for safe handling

Precautions for safe handling : Avoid dust formation. Avoid contact with skin, eyes and clothing. Do not handle until all safety precautions have been read and understood. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Keep away from sources of ignition - No smoking.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container tightly closed in a cool, dry, and well-ventilated place. Keep away from ignition sources.

FILTRASORB 400

Product Code: 12030

Safety Data Sheet

SECTION 8: Exposure Controls/Personal Protection

8.1. Control parameters

Activated carbon (7440-44-0)*

OSHA PEL (TWA) (mg/m ³)	≤ 5 (Respirable Fraction) ≤ 15 (Total Dust)
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*Exposure limits are for inert or nuisance dust. No specific exposure limits have been established for this activated carbon product by OSHA or ACGIH.

8.2. Exposure controls

Appropriate engineering controls

: Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof equipment with flammable materials. Ensure adequate ventilation, especially in confined areas. Wet activated carbon can deplete oxygen from air in enclosed spaces. If use in an enclosed space is required, procedures for work in an oxygen deficient environment should be followed.

Personal protective equipment

: Gloves. Safety glasses. Protective clothing. Under insufficient ventilation conditions wear respiratory protection.



Hand protection

: Gloves should be classified under Standard EN 374 or ASTM F1296. Suggested glove materials are: Neoprene, Nitrile/butadiene rubber, Polyethylene, Ethyl vinyl alcohol laminate, PVC or vinyl. Suitable gloves for this specific application can be recommended by the glove supplier.

Eye protection

: Use eye protection suitable to the environment. Avoid direct contact with eyes.

Skin and body protection

: Wear long sleeves, and chemically impervious PPE/coveralls to minimize bodily exposure.

Respiratory protection

: Use NIOSH-approved dust/particulate respirator. Where vapor, mist, or dust exceed PELs or other applicable OELs, use NIOSH-approved respiratory protective equipment.

SECTION 9: Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical state	: Solid
Appearance	: Granular, powder, or pelletized substance
Color	: Black
Odor	: Odorless
Odor threshold	: No data available
pH	: No data available
Relative evaporation rate (butylacetate=1)	: Not applicable
Melting point	: Not applicable
Freezing point	: Not applicable
Boiling point	: Not applicable
Flash point	: No data available
Auto-ignition temperature	: > 325 °C
Decomposition temperature	: No data available
Flammability (solid, gas)	: > 325 °C
Vapor pressure	: Not applicable
Relative vapor density at 20 °C	: Not applicable
Apparent density	: 0.3 - 0.75 g/cc
Solubility	: Insoluble
Log Pow	: Not applicable
Log Kow	: Not applicable
Viscosity, kinematic	: Not applicable
Viscosity, dynamic	: Not applicable
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: No data available

9.2. Other information

No additional information available.

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Safety Data Sheet

SECTION 10: Stability and Reactivity

10.1. Reactivity

No dangerous reactions known under normal conditions of use.

10.2. Chemical stability

Stable under use and storage conditions as recommended in section 7.

10.3. Possibility of hazardous reactions

None known.

10.4. Conditions to avoid

Avoid dust formation. Heat. Ignition sources. Exposure to high concentrations of organic compounds may cause bed temperature to rise.

10.5. Incompatible materials

Alkali metals. Strong oxidizing agents.

10.6. Hazardous decomposition products

Carbon monoxide (CO), carbon dioxide (CO₂).

SECTION 11: Toxicological Information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Activated carbon (7440-44-0)	
LD ₅₀ oral rat	> 2000 mg/kg

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Not classified

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Silica: crystalline, quartz (14808-60-7)	
IARC group	1 - Carcinogenic to humans
The International Agency for Research on Cancer (IARC) has classified "silica dust, crystalline, in the form of quartz or cristobalite" as carcinogenic to humans (group 1). However these warnings refer to crystalline silica dusts and do not apply to solid activated carbon containing crystalline silica as a naturally occurring, bound impurity. As such, we have not classified this product as a carcinogen in accordance with the US OSHA Hazard Communication Standard (29 CFR §1910.1200) but recommend that users avoid inhalation of product in a dust form.	

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Symptoms/injuries after inhalation : Not expected to present a significant hazard under anticipated conditions of normal use.

Symptoms/injuries after skin contact : Dust may cause irritation of the skin.

Symptoms/injuries after eye contact : Dust may cause irritation and redness.

Symptoms/injuries after ingestion : Not expected to present a significant hazard under anticipated conditions of normal use.

SECTION 12: Ecological Information

12.1. Toxicity

No additional information available.

12.2. Persistence and degradability

No additional information available.

12.3. Bioaccumulative potential

No additional information available.

12.4. Mobility in soil

No additional information available.

FILTRASORB 400

Product Code: 12030

Safety Data Sheet

12.5. Other adverse effects

No additional information available.

SECTION 13: Disposal Considerations

13.1. Waste treatment methods

- Waste treatment and disposal methods : Vacuum or shovel material into a closed container. Dispose in a safe manner in accordance with local/national regulations. Do not allow the product to be released into the environment.
- Additional information : Activated carbon is an adsorbent media; hazard classification is generally determined by the adsorbate. Consult U.S. EPA guidelines listed in 40 CFR 261.3 for more information on hazardous waste disposal.

SECTION 14: Transport Information

14.1. In accordance with DOT

Not classified as hazardous for domestic land transport.

- UN-No.(DOT) : None on finished product
- DOT NA no. : None on finished product
- Proper Shipping Name (DOT) : Not regulated
- Department of Transportation (DOT) Hazard Classes : None on finished product
- Hazard labels (DOT) : None on finished product
- Packing group (DOT) : None on finished product
- DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : None on finished product

14.2. Transport by sea

Not classified as hazardous for water transport.

- IMO / IMDG
- UN/NA Identification Number : None on finished product
- UN- Proper Shipping Name : Not regulated
- Transport Hazard Class : None on finished product

14.3. Air transport

Not classified as hazardous for air transport.

- ICAO / IATA
- UN/NA No : None on finished product
- UN- Proper Shipping Name : Not regulated
- Transport Hazard Class : None on finished product
- Packing Group : None on finished product
- Marine Pollutant : None on finished product

14.4. Additional information

- Other information : Under the UN classification for activated carbon, all activated carbons have been identified as a class 4.2 product. However, this product type or an equivalent has been tested according to the United Nations Transport of Dangerous Goods, Manual of Tests and Criteria, Part III, Test N.4 - Test Method for Self Heating Substances and it has been specifically determined that this product type or an equivalent does not meet the definition of a self-heating substance (class 4.2). This information is applicable to the steam activated carbon product described in this document.

SECTION 15: Regulatory Information

15.1. US Federal regulations

FILTRASORB 400

All chemical substances in this product are listed as "Active" in the EPA (Environmental Protection Agency) "TSCA Inventory Notification (Active-Inactive) Requirements Rule" ("the Final Rule"). as of February 2019 or are otherwise exempt.

SARA Section 311/312 Hazard Classes	Physical hazard - Combustible dust
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FILTRASORB 400

Product Code: 12030

Safety Data Sheet

Cobalt (7440-48-4)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

Listed on United States SARA Section 313

SARA Section 313 - Emission Reporting

0.1 %

15.2. International regulations

No additional information available.

15.3. US State regulations

California Proposition 65

WARNING: This product can expose you to chemicals including Silica: crystalline, quartz, which are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Component	Carcinogenicity	Developmental toxicity	Reproductive toxicity male	Reproductive toxicity female	No significant risk level (NSRL)	Maximum allowable dose level (MADL)
Silica: crystalline, quartz (14808-60-7)	X					
Titanium dioxide (13463-67-7)	X				Not available	
Cobalt (7440-48-4)	X					

Component	State or local regulations
Aluminum oxide (1344-28-1)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Massachusetts - Right To Know List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List
Calcium sulfate (7778-18-9)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Massachusetts - Right To Know List
Silica: crystalline, quartz (14808-60-7)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Massachusetts - Right To Know List
Titanium dioxide (13463-67-7)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Massachusetts - Right To Know List
Cobalt (7440-48-4)	U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Massachusetts - Right To Know List

SECTION 16: Other Information

Indication of changes : Revision 4.0

Revision Date : 10/20/2020

Other information : Author: ADK

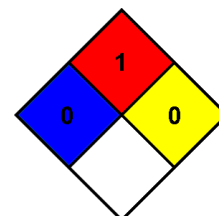
For internal use only : PR #1

Prepared according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

NFPA fire hazard : 1 - Must be preheated before ignition can occur.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 0

Flammability : 1

Physical : 0

FILTRASORB 400

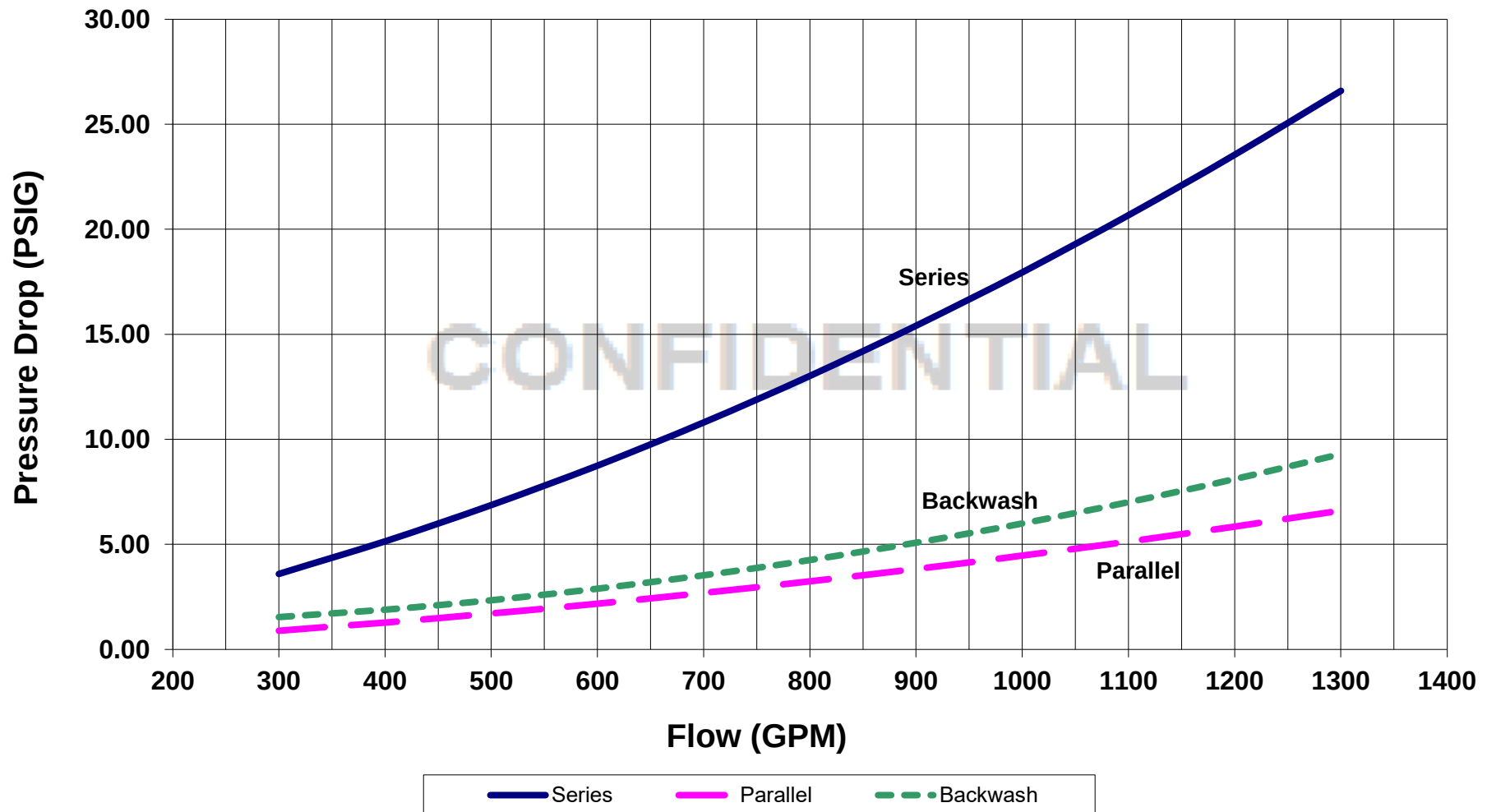
Product Code: 12030

Safety Data Sheet

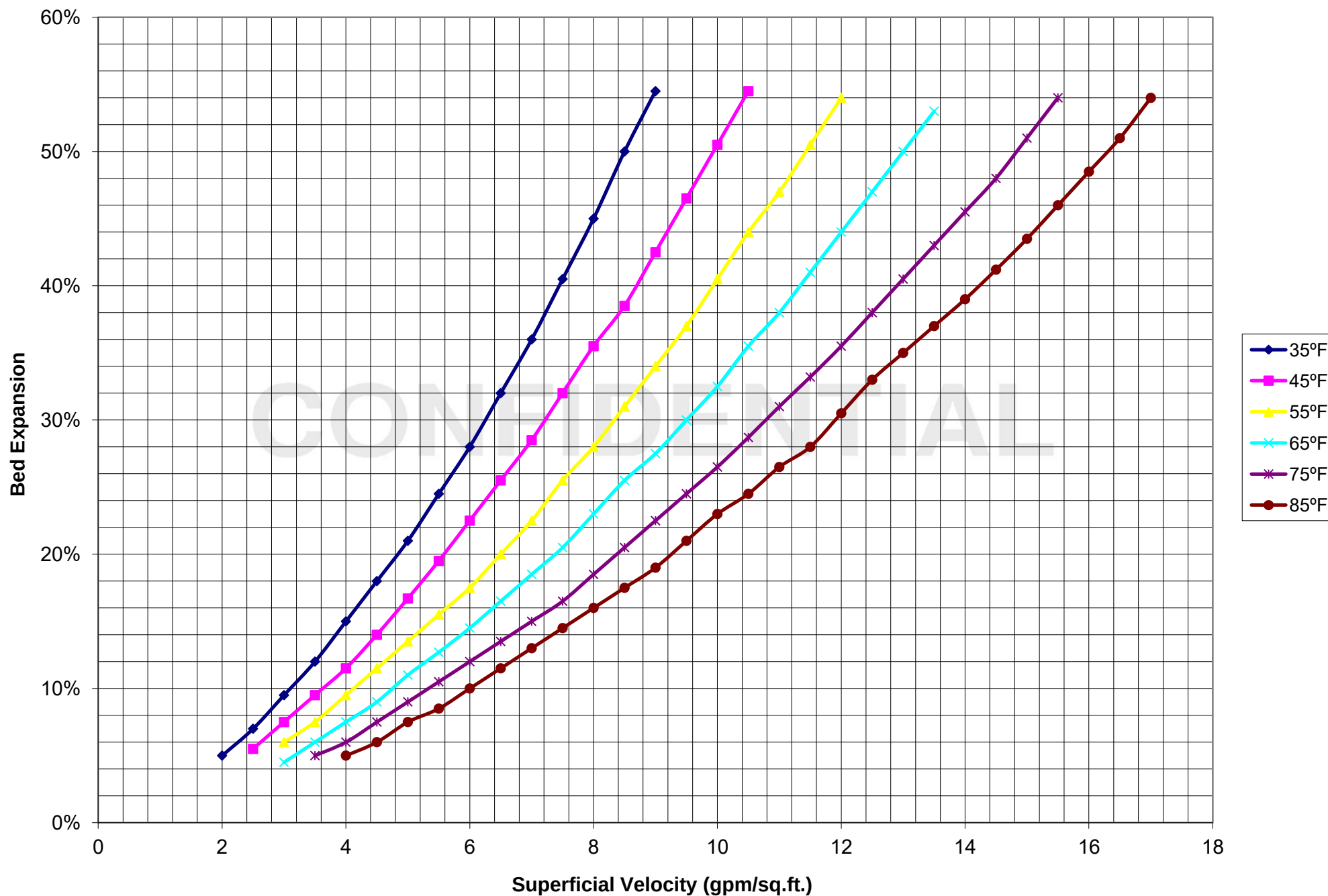
Personal Protection :

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product. The information in this document applies to this specific material as supplied. It may not be valid if product is used in combination with other materials. It is the user's responsibility to determine the suitability and completeness of this information for their particular use. While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Calgon Carbon Corporation makes no warranty with respect to the same, and disclaims all liability for reliance thereon.

Pressure Drop Curve
Model 12-40, 40,000 # F-400 Carbon, 8in piping,
60 deg. F., 120 spec. 22.113 septas



F400 Bed Expansion Curve Backwashed & Segregated



SALES SPECIFICATION SHEET

CALRES 2301

Strong Base Anion Exchange Resin

Test	Specification		Calgon Carbon Test Method
	Min	Max	
TOTAL CAPACITY (ANION), eq/l	0.51	-	GB/T 5760-2000
WATER RETENTION CAPACITY, wt%	48	60	GB/T 5757-86
WHOLE BEAD COUNT, %	95	-	ASTM D2862
16 US MESH [1.18 mm], wt%	-	3	
< 45 US MESH [0.355 mm], wt%	-	5	

Structure: Macroporous

Functional Group: N-Tri-Butyl Amine

Ionic Form: Chloride

This product complies with NSF 61 (WQA Gold Seal)

Calgon Carbon Corporation's products are continuously being improved and changes may have taken place since this publication went to press. -10/30/2019



+1 800 422 7266 calgoncarbon.com

CalgonCarbon
A Kuraray Company

SECTION 1: Identification of the Substance/Mixture and of the Company/Undertaking

1.1. Product identifier

Product name : CALRES 2301
Product form : Mixture
Product code : 1077516

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Ion exchange and/or adsorption processes

1.3. Details of the supplier of the safety data sheet

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA 15230
412-787-6700

1.4. Emergency telephone number

Emergency number : CHEMTREC (24 HRS): 1-800-424-9300; INTERNATIONAL: 1-703-527-3887

SECTION 2: Hazards Identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

GHS-US labeling

No labelling applicable.

2.3. Other hazards

No additional information available.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/Information on Ingredients

3.1. Substance

Not applicable

3.2. Mixture

Name	Product identifier	%
Styrene, divinylbenzene polymer, chloromethylated, tributylamine-functionalized	116565-72-1	43-53
Dimethylamine functionalize chloromethylated copolymer of styrene and divinylbenzene	69011-17-2	38-50

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : If exposed or concerned, get medical attention/advice. Show this safety data sheet to the doctor in attendance. Wash contaminated clothing before re-use. Never give anything to an unconscious person.

First-aid measures after inhalation : IF INHALED: Remove to fresh air and keep at rest in a comfortable position for breathing.

First-aid measures after skin contact : IF ON SKIN (or clothing): Remove affected clothing and wash all exposed skin with water for at least 15 minutes.

First-aid measures after eye contact : IF IN EYES: Immediately flush with plenty of water for at least 15 minutes. Remove contact lenses if present and easy to do so. Continue rinsing.

First-aid measures after ingestion : IF SWALLOWED: Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center or medical professional. Get medical attention if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

Symptoms/injuries after inhalation : May cause respiratory irritation.

Symptoms/injuries after skin contact : May cause skin irritation.

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Symptoms/injuries after eye contact : Direct contact with the eyes is likely to be irritating.
Symptoms/injuries after ingestion : May cause gastrointestinal irritation.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available.

SECTION 5: Firefighting Measures

5.1. Extinguishing media

Suitable extinguishing media : Water spray. Carbon dioxide. Dry chemical.

5.2. Special hazards arising from the substance or mixture

Fire hazard : This material will not burn until the water has evaporated. Residue can burn.
Explosion hazard : Product is not explosive.
Reactivity : No dangerous reactions known under normal conditions of use. Carbon oxides, nitrogen oxides, organic amines, ammonia, hydrogen chloride, methyl chloride, phenol, hydrocarbons, and benzenes may be emitted upon combustion of material.

5.3. Advice for firefighters

Firefighting instructions : Wear NIOSH-approved self-contained breathing apparatus suitable for the surrounding fire. Use water spray or fog for cooling exposed containers. Evacuate area.

SECTION 6: Accidental Release Measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Evacuate area. Ventilate area. Keep upwind. Spill should be handled by trained clean-up crews properly equipped with respiratory equipment and full chemical protective gear (see Section 8). Beads can cause serious slipping hazard on hard smooth surface.

6.1.1. For non-emergency personnel

No additional information available.

6.1.2. For emergency responders

No additional information available.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Avoid release to the environment. Product is not soluble, but can cause particulate emission if discharged into waterways. Dike all entrances to sewers and drains to avoid introducing material to waterways. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment : Sweep or shovel spills into appropriate container for disposal.
Methods for cleaning up : Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust. Dispose of material in compliance with local, state, and federal regulations.

6.4. Reference to other sections

No additional information available.

SECTION 7: Handling and Storage

7.1. Precautions for safe handling

Precautions for safe handling : Avoid contact with skin, eyes and clothing. Do not handle until all safety precautions have been read and understood. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Keep away from sources of ignition - No smoking. Handling this product may result in electrostatic accumulation. Leave room for expansion as dry resin swells upon wetting and/or changing ionic form. Equipment construction material should be compatible with feed, regenerant, ionic form and effluent of the ion exchange process.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store in a dry, cool and well-ventilated place. Keep container closed when not in use.
Maximum storage period : 36 months
Storage temperature : 0 - 50 °C (preferred temperature is in lower half of range)

SECTION 8: Exposure Controls/Personal Protection

8.1. Control parameters

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8.2. Exposure controls

Appropriate engineering controls

: Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof equipment with flammable materials. Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

: Gloves. Protective goggles.



Hand protection

: Use gloves chemically resistant to this material when prolonged or repeated contact could occur. Suggested glove materials are: Neoprene, Nitrile/butadiene rubber, Polyethylene, Ethyl vinyl alcohol laminate, PVC or vinyl.

Eye protection

: Use eye protection suitable to the environment. Avoid direct contact with eyes.

Skin and body protection

: Wear long sleeves, and chemically impervious PPE/coveralls to minimize bodily exposure.

Respiratory protection

: Use NIOSH-approved dust/particulate respirator. Where vapor, mist, or dust exceed PELs or other applicable OELs, use NIOSH-approved respiratory protective equipment.

SECTION 9: Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical state	: Solid
Appearance	: Beads
Molecular mass	: 99,999 kg/mol (calculated)
Color	: White, yellow or tan
Odor	: No data available
Odor Threshold	: No data available
pH	: Neutral
Relative evaporation rate (water=1)	: 1
Melting point	: Decomposes at elevated temperature
Freezing point	: Not applicable
Boiling point	: Not applicable
Flash point	: Not applicable
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: Not applicable
Relative vapour density at 20 °C	: Not applicable
Relative density	: 1.1 (calculated)
Density	: 0.7 g/cm ³ (calculated)
Solubility	: Insoluble in water Water: 0 %
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: Not applicable
Viscosity, dynamic	: Not applicable
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: Not applicable

9.2. Other information

No additional information available.

SECTION 10: Stability and Reactivity

10.1. Reactivity

No dangerous reactions known under normal conditions of use.

10.2. Chemical stability

Stable under use and storage conditions as recommended in section 7.

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Product Code: 1077516

Safety Data Sheet

10.3. Possibility of hazardous reactions

None known.

10.4. Conditions to avoid

Elevated temperature (> 400 °F) .

10.5. Incompatible materials

Avoid contact with oxidizing materials. Oxidizing agents such as nitric acid attack organic exchange resins under certain conditions. Before using strong oxidizing agents, consult sources knowledgeable in handling such materials. The severity of the reaction with oxidizing materials can vary from slight degradation to an explosive reaction.

10.6. Hazardous decomposition products

Carbon monoxide (CO), carbon dioxide (CO₂). Nitrogen oxides. Organic amines. Ammonia. Hydrogen chloride. Methyl chloride. Phenol. Hydrocarbons. Benzenes.

SECTION 11: Toxicological Information

11.1. Information on toxicological effects

Acute toxicity	: Oral: Very low. Typical LD ₅₀ (rat) >5,000 mg/kg
Skin corrosion/irritation	: Not classified
Serious eye damage/irritation	: Not classified
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: Not classified
Specific target organ toxicity (repeated exposure)	: Not classified
Aspiration hazard	: Not classified
Symptoms/injuries after inhalation	: May cause respiratory irritation.
Symptoms/injuries after skin contact	: May cause skin irritation.
Symptoms/injuries after eye contact	: Direct contact with the eyes is likely to be irritating.
Symptoms/injuries after ingestion	: May cause gastrointestinal irritation.

SECTION 12: Ecological Information

12.1. Toxicity

Ecology - general : No information available. Not expected to be acutely toxic, but material in pellet or bead form may mechanically cause adverse effects if ingested by waterfowl or aquatic life.

12.2. Persistence and degradability

No additional information available.

12.3. Bioaccumulative potential

Profile 80	
Bioaccumulative potential	Based on its structural properties, the polymer is not biologically available. Accumulation in organisms is not to be expected.

12.4. Mobility in soil

No additional information available.

12.5. Other adverse effects

Other adverse effects : No data available.

SECTION 13: Disposal Considerations

13.1. Waste treatment methods

Waste treatment and disposal methods : Vacuum or shovel material into a closed container. Dispose in a safe manner in accordance with local/national regulations. Do not allow the product to be released into the environment.

SECTION 14: Transport Information

14.1. In accordance with DOT

Not classified as hazardous for domestic land transport

CALRES 2301

Product Code: 1077516

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UN-No.(DOT)	: None on finished product
DOT NA no.	: None on finished product
Proper Shipping Name (DOT)	: Not regulated
Department of Transportation (DOT) Hazard Classes	: None on finished product
Hazard labels (DOT)	: None on finished product
Packing group (DOT)	: None on finished product
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	: None on finished product

14.2. Transport by sea

Not classified as hazardous for water transport

IMO / IMDG

UN/NA Identification Number	: None on finished product
UN- Proper Shipping Name	: Not regulated
Transport Hazard Class	: None on finished product

14.3. Air transport

Not classified as hazardous for air transport

ICAO / IATA

UN/NA No	: None on finished product
UN- Proper Shipping Name	: Not regulated
Transport Hazard Class	: None on finished product
Packing Group	: None on finished product
Marine Pollutant	: None on finished product

SECTION 15: Regulatory Information

15.1. US Federal regulations

CALRES 2301

All chemical substances in this product are listed as "Active" in the EPA (Environmental Protection Agency) "TSCA Inventory Notification (Active-Inactive) Requirements Rule" ("the Final Rule"). as of February 2019 or are otherwise exempt.

SARA Section 311/312 Hazard Classes	None
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15.2. International regulations

No additional information available.

15.3. US State regulations

California Proposition 65

This product does not contain any substances known to the state of California to cause cancer and/or reproductive harm.

Component	State or Local Regulations
Styrene, divinylbenzene polymer, chloromethylated, tributylamine-functionalized	U.S. - Massachusetts - Right To Know List U.S. - Massachusetts - Right To Know List - Extraordinary Hazardous Substances U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances U.S. - Pennsylvania - RTK (Right to Know) List
Dimethylamine functionalized chloromethylated copolymer of styrene and divinylbenzene	U.S. - Massachusetts - Right To Know List U.S. - Massachusetts - Right To Know List - Extraordinary Hazardous Substances U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) - Special Hazardous Substances U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other Information

Indication of changes	: Revision 2.0: Minor updates needed.
Revision Date	: 06/22/2020
Other information	: Author: ADK/RAK
For internal use only	: PR #80

CALRES 2301

Product Code: 1077516

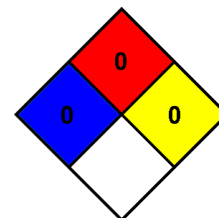
Safety Data Sheet

Prepared according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

NFPA health hazard : 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 0

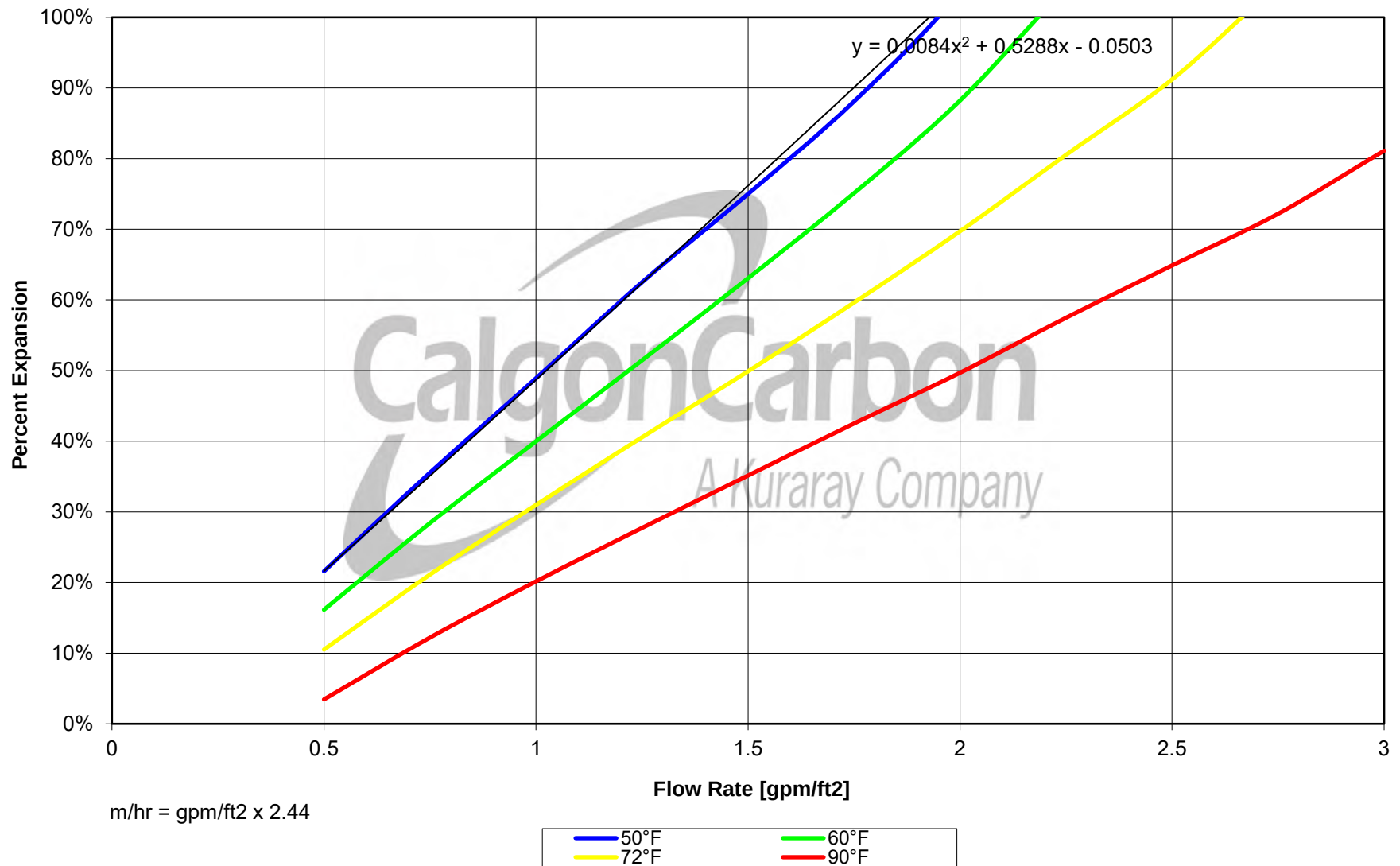
Flammability : 0

Physical : 0

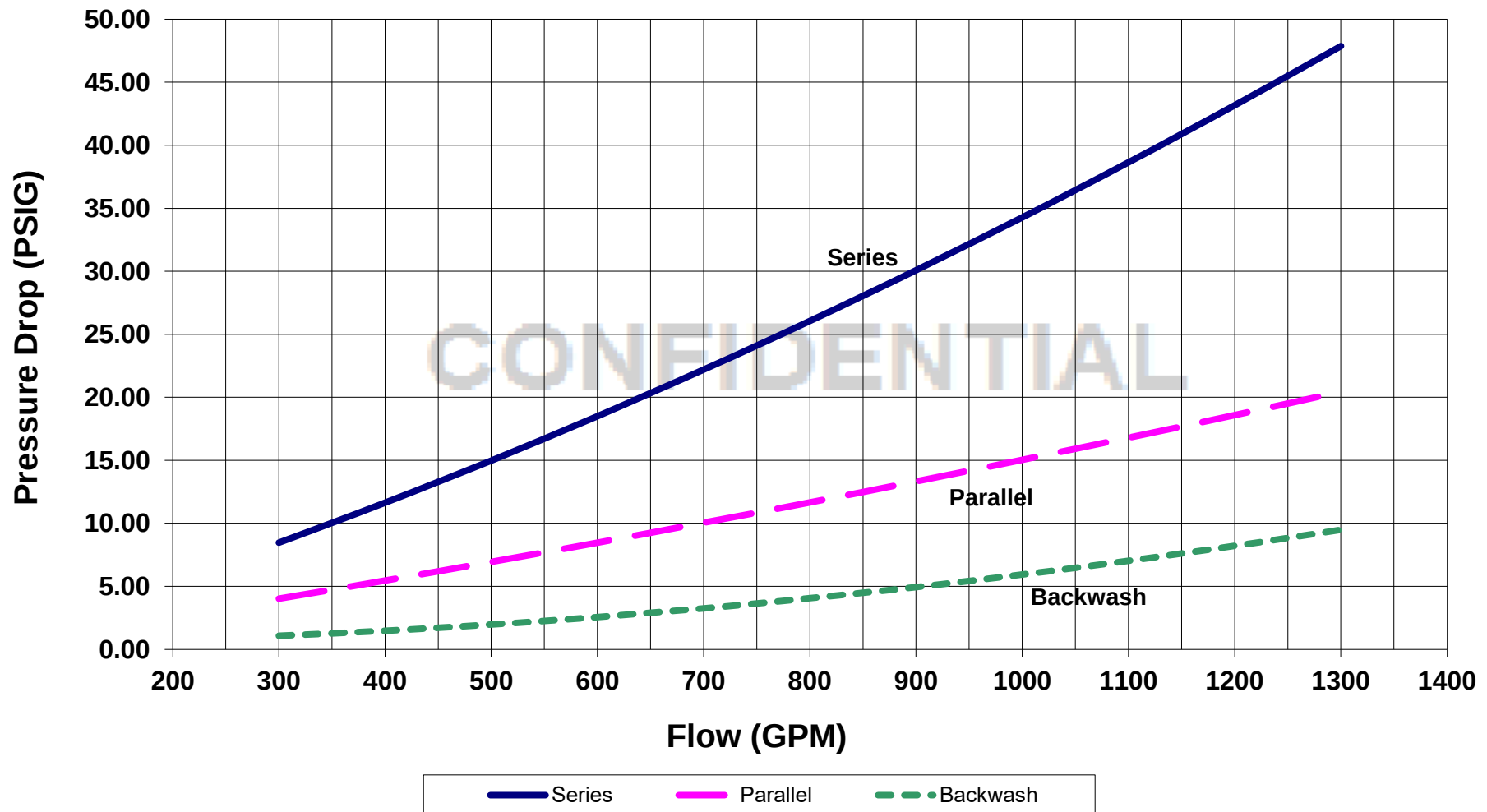
Personal Protection :

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product. The information in this document applies to this specific material as supplied. It may not be valid if product is used in combination with other materials. It is the user's responsibility to determine the suitability and completeness of this information for their particular use. While the information and recommendations set forth herein are believed to be accurate as of the date hereof, Calgon Carbon Corporation makes no warranty with respect to the same, and disclaims all liability for reliance thereon.

Resin Bed Expansion Curves



Pressure Drop Curve
Model 12-40, 535 Cu. Ft. Cal Res 2301 Resin,
8in Piping, 60 deg. F., 120 spec. 22.110 septas





Carbon Enterprises, Inc.

"ONE COMPANY FOR ALL YOUR FILTER MEDIA"**Anthracite 0.60 - 0.80**

Typical Lab Analysis

SIEVE	Particle Size	% Passing
#6	3.35mm	100
#8	2.36mm	99.7
#10	2.00mm	99.3
#12	1.70mm	98.4
#14	1.40mm	96.8
#16	1.18mm	94.1
#18	1.00mm	78.6
#20	0.85mm	23.8
#25		5.5

Test	Result	Specification
Effective Size (mm)	0.78	0.60-0.80
Uniformity Coefficient	1.2	1.6
MOH Hardness	2.85	2.7 min.
Specific Gravity	1.6	1.6 min.
Acid Solubility	0.87%	5.00%
Caustic Solubility	1.46	2.00

Safety Data Sheet

Product Identity: Anthracite

1/1/2016

Section I - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Trade name Anthracite filter media
Company CEI Anthracite (manufacturer)
603 S Church Street
Hazleton, PA 18201
570-459-7005

Section II - COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Anthracite Carbon
CAS Number 8029-10-5 100%
OHSA PEL 2mb/M3

Section III - HAZARD(S) IDENTIFICATION

Prolonged inhalation of substantial quantities of dust may cause irritation
Prolonged ingestion of substantial quantities of dust may cause irritation
Contact with eyes/mucous membranes may cause temporary irritation
Contact with the skin may cause temporary irritation.

Section IV - FIRST AID MEASURES

Skin contact Remove particles and flush with water
Eye contact Flush eye with water and remove all particles. Consult a physician if the problem persists.
Ingestion Give water and seek medical advise if the problem persists.
Inhalation Remove subject into fresh air and seek medical advise.

Section V - FIRE FIGHTING MEASURES

Suitable extinguishing media Use water spray or foam extinguishers.
Fire fighting procedure Wear self contained breathing apparatus and full protection.

Section VI - ACCIDENTAL RELEASE MEASURES

Personal Precaution Non-hazardous
Environmental Precaution Non-hazardous
Clean up Method Take up mechanically

Section VII - HANDLING AND STORAGE

Precautions for Handling No special instructions
Measures to protect against Do not store near a heat source
Fire/Explosion Non explosive
Storage Store in a dry place

Section VIII - EXPOSURE CONTROLS AND PERSONAL PROTECTION

Respiratory Protection Not required for normal operations. Recommended for high volume applications if dust is present.
Hand Protection Protective gloves are recommended.
Body Protection Wearing of overalls is recommended.
Eye Protection Eye protection is recommended.

Hygiene Measures High standard of personal hygiene must be encouraged.

Section IX - PHYSICAL AND CHEMICAL PROPERTIES

Appearance Granular/Solid
Color Black
Odor None
Specific Gravity 1.6 $\pm$ 0.05
Bulk Density 50 pounds per cubic foot

Section X - STABILITY AND REACTIVITY

The material is stable under normal conditions.

Materials to Avoid None

Section XI - TOXICOLOGICAL INFORMATION

The material is stable under normal conditions.

Toxicological Tests Acute Toxicity N/A
Additional Information N/A

Experiences Relevant Observations None

Section XII - ECOLOGICAL INFORMATION

Information on Elimination None
Behavior in the Environment Material is resistant to bio-degradation
Mobility and Bio-accumulative potential None
Aquatic Toxicity N/A

Section XIII - DISPOSAL CONSIDERATIONS

Dispose to an authorized landfill site.

Dispose in accordance with all Federal and Local regulations.

Section XIV - TRANSPORT INFORMATION

Road / Rail ARD / RID Not dangerous
Inland Sea AND/ADNR Not dangerous
Air Transport ICAO / IATA Not dangerous

Section XV - REGULATORY INFORMATION

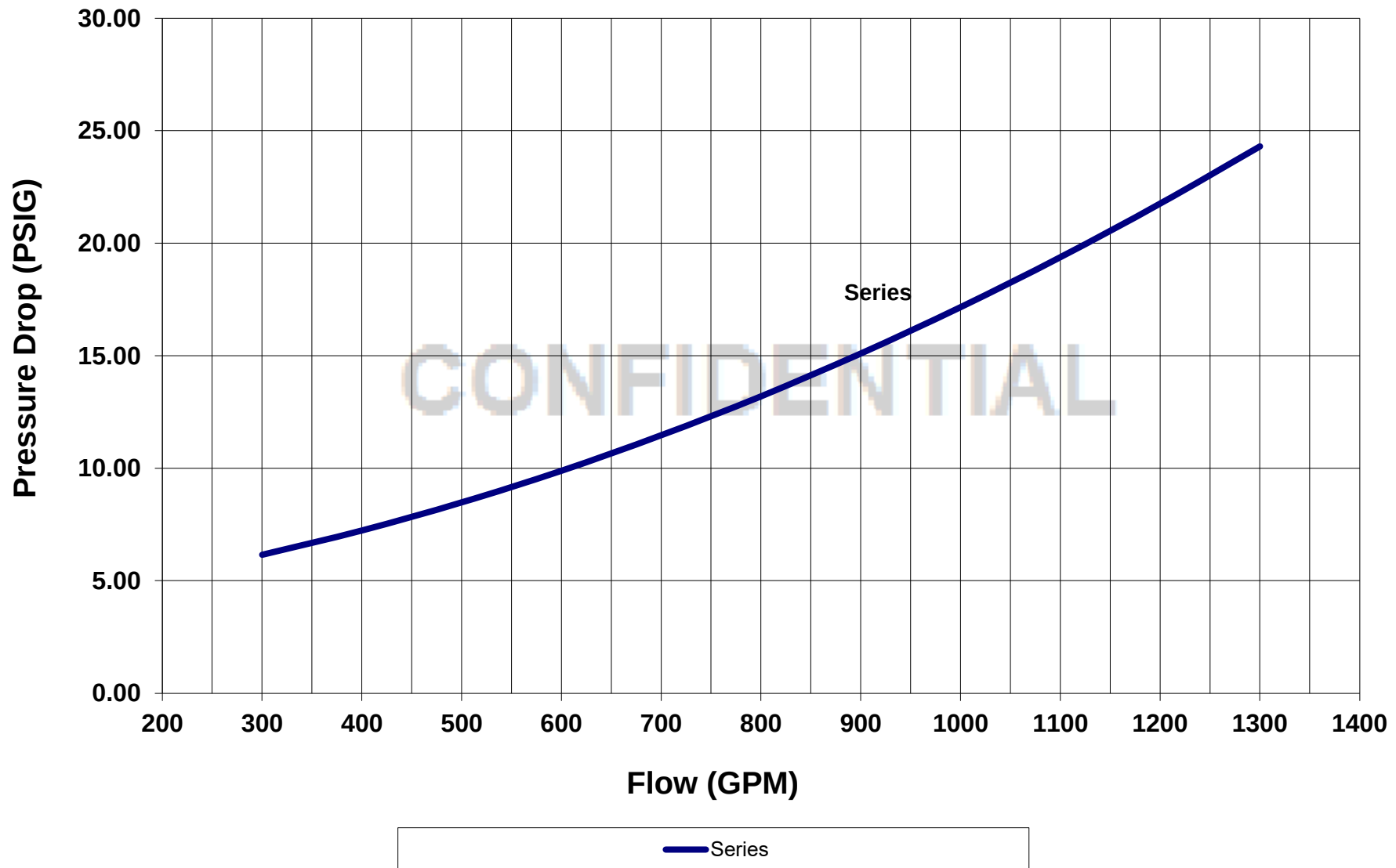
Labeling Not classified as hazardous

Section XVI - OTHER INFORMATION

All the information provided herein is based upon our present knowledge and experience and describes our product with regard to its safety requirements. Users should satisfy themselves that the information provided complies with their National Regulations. This is not to be considered as an assurance of the properties or a description of the quality of the product. CEI assumes no liability arising out of the use of this product by others.

END OF MATERIAL SAFETY DATA SHEET

Pressure Drop Curve
Model 12-40 Hybrid System, 40,000 # F-400 Carbon,
& 535 Cu. Ft. Cal Res 2301 Resin, 8in Process Piping
60 deg. F., 120 spec. 22.110 septas





SECTION 2

SPECIFICATIONS & CATALOG CUTSHEETS

	MATERIAL SPECIFICATION BUTTERFLY VALVES	SPEC NO: 3.54
	DWC WAFER STYLE CAST IRON BUTTERFLY VALVE	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	One-piece ductile iron wafer style body, EPDM food grade seat material, One piece 416 stainless steel stem, Stainless steel or aluminum bronze disc material.
ACTUTATOR:	Lever operator for valve sizes 2" through 6", weatherproof worm gear wheel operator for sizes 8" through 12".
TESTING:	Valves shall comply with Section 5: Inspection Testing and Rejection of AWWA specification C-504-87.
RATING:	200 psig @ 180 Deg. F. for Apollo, Centerline & Flow Line 175 psig @ 180 Deg. F. for Bray
CONSTRUCTION:	Shaft: 1 piece, through shaft construction.
CONNECTION:	Compatible with ANSI 125# and 150# flanges. Gasket not required.
MANUFACTURER:	Apollo, Bray, Centerline, Flow Line
SIZES:	2" through 12"
MODELS:	Apollo Series 141, Bray Series 30, Centerline Series 200, Flow Line Series 70
SERVICE CONDITIONS:	Potable water at ambient temperature
NOTES:	Centering lugs preferred to facilitate installation

Issue Date	Revision Date	Approved By	Approval Date
July 18, 2022		Robert Sprowls	July 18, 2022

PROPRIETARY AND CONFIDENTIAL

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brands you trust.

TECHNICAL DATASHEET
CENTER LINE® - Resilient Seated Butterfly Valves
Now All Ductile Iron Body Standard on Series 200



Series 200 Overview

- Available in sizes 2" to 72".
- Available in Wafer and Lug style bodies (2" to 30").
- Double flange bodies available in sizes 28" to 72".
- Wafer bodies feature four (4) alignment holes.
- Pressure ratings for tight shutoff at temperatures up to the maximum limit of the seat material:
 - 2" to 12" - 200 psi.
 - 14" to 72" - 150 psi.
- Ideal for on-off or throttling services.
- Available with handles (2" to 12"), manual gear actuators (2" to 72"), and electric or pneumatic actuators (2" to 72").
- Refer to Crane automation bulletin for details for pneumatic and electric actuators.
- Designed to comply with MSS SP-67 and MSS SP-25.
- Compatible with ASME B16.1 and ASME B16.5 flanges (2" to 24") and ASME B16.47 Series A (MSS SP-44) flanges (28" to 72").
- Valves 2" to 20" meet the intent and have passed the AWWA C504-87, Section 5 proof of design tests.
- Type approval certification from ABS & USCG Category A for marine applications (2" to 24").
- Bi-directional dead-end service capability to 200 psi (2" to 12") and 150 psi (14" - 24") is standard on lug style valves.
- Operators mounted perpendicular to the pipeline.
- For bolting information, consult the Center Line Installation and Maintenance Manual.
- Vacuum Service Rating: zero leakage at 24" of mercury.
- Commercial cleaning available for Oxygen level 2 applications.
- CE/PED Certification available for sizes 2" to 24".

Valve Seating Torques (In-Lbs.) 2" to 30"

Valve Size	Standard Disc Differential Pressure								Undercut Differential Pressure	
	50 PSI ΔP Bushing		100 PSI ΔP Bushing		150 PSI ΔP Bushing		200 PSI ΔP Bushing		75 PSI ΔP Bushing	
	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE	Bronze	PTFE
2"	106	100	117	106	129	111	140	117	-	-
2 1/2"	152	150	166	163	181	176	195	189	-	-
3"	213	207	230	220	248	232	265	244	-	-
4"	321	290	386	323	450	357	515	390	-	-
5"	481	423	598	481	715	540	832	598	-	-
6"	692	599	878	691	1,063	783	1,248	875	-	-
8"	1,326	1,060	1,716	1,183	2,106	1,307	2,496	1,430	1,124	819
10"	2,239	1,671	3,010	1,872	3,780	2,074	4,550	2,275	1,363	909
12"	3,959	2,568	4,953	2,795	5,948	3,023	6,942	3,250	2,457	1,445
14"	4,881	2,640	6,226	3,070	7,570	3,500	-	-	4,400	2,300
16"	7,020	4,260	8,580	4,880	10,140	5,500	-	-	5,900	3,600
18"	10,105	6,287	12,202	7,243	14,300	8,200	-	-	8,300	5,500
20"	13,923	8,360	16,582	9,180	19,240	10,000	-	-	11,100	6,700
24"	23,617	15,427	26,953	16,813	30,290	18,200	-	-	17,300	12,100
30"	39,721	27,313	43,391	29,407	47,060	31,500	-	-	27,300	21,100

Valve Seating Torques (in-lbs), 28" to 72" Double Flanged

Valve Size	Standard Disc Differential Pressure		
	50 psi ΔP Wet	100 psi ΔP Wet	150 psi ΔP Wet
28"	34,030	38,180	41,502
30"	39,110	43,880	47,698
32"	50,040	56,145	61,028
36"	61,660	69,175	75,190
40"	81,720	91,690	99,660
42"	124,360	139,530	151,660
48"	171,320	192,210	208,925
42"	184,270	206,740	224,720
54"	204,672	229,630	249,600
60"	308,460	346,080	376,170
64"	377,400	423,430	460,250
66"	420,950	472,290	513,360
72"	505,150	566,750	616,030

All torques shown in these charts were derived from test data using water at 60°F. For torques using dry gases, multiply these numbers by 2.0. For torques involving other media, please consult the factory.

There is no safety factor included in the numbers shown on these charts. For actuator sizing, Crane recommends that these values be multiplied by 1.2 for single valve applications, or 2.0 for 3-way ("tee") applications.

Under certain conditions, hydrodynamic torque can meet or exceed seating and unseating torques. When designing valve systems, hydrodynamic torque must be considered to help assure correct selection for the application.

Series 200 Temperature Ratings and C_v Values

Seat Temperature Ratings

Seat Material	Temperature Ratings, °F
Buna-N	+10 to 180
EPDM (2" to 16")	-30 to 275
EPDM (18" & Above)	-30 to 225
Viton®	10 to 400

Although elastomers have an effective operating temperature range, when used in valves, these ranges may have to be modified. The temperature ranges shown in the table have been adjusted accordingly.

For Low Temperature: While the seat materials selected for use in Center Line butterfly valves are capable of withstanding lower temperatures without damage, the durometer of the elastomer is changed. This "hardening" of the seat may increase the operating torque beyond the structural limits of the stem and/or the disc to stem configuration.

For High Temperature: When using Viton®, the operating pressure of the valve is reduced above 275°F.

Field Replacement: Replacing seats in sizes 14" and above requires factory service.

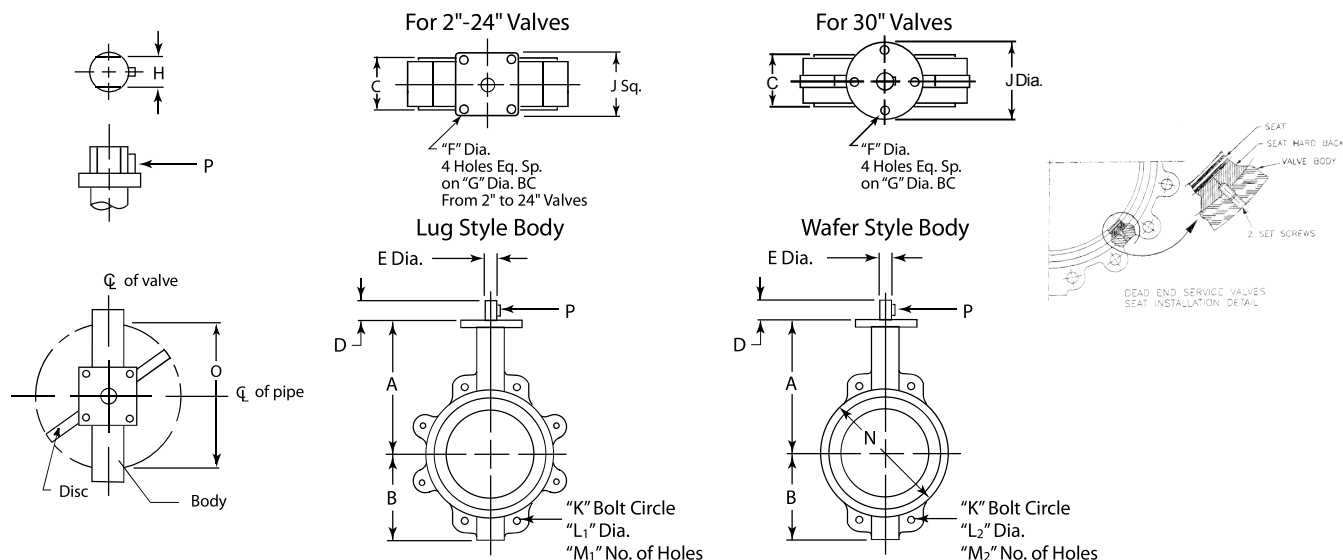
C_v Values – Valve Sizing Coefficients (US-GPM @ 1 psi ΔP), 2" to 30" Wafer and Lug Style Valves

Size	Degrees Open								
	10°	20°	30°	40°	50°	60°	70°	80°	90°
2"	0.06	3	7	15	27	44	70	105	115
2-1/2"	0.10	6	12	25	45	75	119	178	196
3"	0.20	9	18	39	70	116	183	275	302
4"	0.30	17	36	78	139	230	364	546	600
5"	0.50	29	61	133	237	392	620	930	1,022
6"	0.80	45	95	205	366	605	958	1,437	1,579
8"	2	89	188	408	727	1,202	1,903	2,854	3,136
10"	3	151	320	694	1,237	2,047	3,240	4,859	5,340
12"	4	234	495	1,072	1,911	3,162	5,005	7,507	8,250
14"	6	338	715	1,549	2,761	4,568	7,230	10,844	11,917
16"	8	464	983	2,130	3,797	6,282	9,942	14,913	16,388
18"	11	615	1,302	2,822	5,028	8,320	13,168	19,752	21,705
20"	14	791	1,647	3,628	6,465	10,598	16,931	25,396	27,908
24"	22	1,222	2,587	5,605	9,989	16,528	26,157	39,236	43,116
30"	37	2,080	4,406	9,546	17,010	28,147	44,545	66,818	73,426

C_v Values – Valve Sizing Coefficients (US-GPM @ 1 psi ΔP), 28" to 72" Double-Flanged Valves

Size	Degrees Open								
	10°	20°	30°	40°	50°	60°	70°	80°	90°
28"	35	1,743	3,479	6,349	12,385	23,176	35,987	52,685	57,456
30"	36	1,982	4,253	9,069	16,165	26,964	42,832	63,482	70,356
32"	44	2,295	4,637	10,763	18,073	30,120	48,394	69,115	81,245
36"	255	2,919	6,456	12,150	19,242	31,880	50,030	76,383	84,153
40"	283	3,984	7,959	14,895	23,059	34,636	52,806	81,490	116,275
42"	350	4,589	8,629	16,397	26,137	41,952	68,584	101,800	132,859
48"	449	5,210	11,420	21,383	29,143	49,380	88,505	134,833	146,688
52"	900	4,100	9,210	15,110	24,200	38,960	62,580	96,833	118,090
54"	1,299	5,904	13,158	21,594	34,583	55,671	89,411	138,334	168,700
60"	1,480	6,400	14,500	24,500	39,400	63,200	102,000	154,000	190,000
64"	1,518	6,938	15,979	27,797	40,399	64,573	104,725	162,868	203,290
66"	1,650	7,110	16,100	27,300	43,800	70,200	113,000	171,000	211,000
72"	1,900	8,220	13,600	31,500	50,700	81,200	131,000	198,000	244,000

Series 200 Dimensions



Dimensions 2" - 30" Wafer and Lug

For installation and maintenance instructions, please refer to the IOM manual available at www.cranecpe.com

Valve Size	A	B	C	D	E	F	G	H	J	K	L ₁	L ₂	M ₁	M ₂	N	O	P
2" in	6.38	3.19	1.88	1.25	0.50	0.38	2.76	0.39	2.75	4.75	5/8-11UNC	0.69	4	4	4.00	1.26	Woodruff #3
50 mm	161.93	80.96	47.63	31.75	12.70	9.53	70	10	69.85	120.65		17.46			101.60	32.00	
2-1/2" in	6.88	3.50	2.00	1.25	0.50	0.38	2.76	0.39	2.75	5.50	5/8-11UNC	0.69	4	4	4.75	1.83	Woodruff #3
65 mm	174.63	88.90	50.80	31.75	12.70	9.53	70	10	69.85	139.70		17.46			120.65	46.50	
3" in	7.12	3.75	2.00	1.25	0.50	0.38	2.76	0.39	2.75	6.00	5/8-11UNC	0.69	4	4	5.00	2.54	Woodruff #3
80 mm	180.98	95.25	50.80	31.75	12.70	9.53	70	10	69.85	152.40		17.46			127.00	64.50	
4" in	7.88	4.50	2.12	1.25	0.62	0.38	2.76	0.47	2.75	7.50	5/8-11UNC	0.69	8	4	6.25	3.54	Woodruff #9
100 mm	200.03	114.30	53.98	31.75	15.88	9.53	70	12	69.85	190.50		17.46			158.75	89.90	
5" in	8.38	5.00	2.38	1.25	0.75	0.38	2.76	0.55	2.75	8.50	3/4-10UNC	0.81	8	4	7.50	4.36	Woodruff #9
125 mm	212.73	127.00	60.33	31.75	19.05	9.53	70	14	69.85	215.90		20.64			190.50	110.70	
6" in	8.88	5.50	2.38	1.25	0.75	0.38	2.76	0.55	2.75	9.50	3/4-10UNC	0.81	8	4	8.38	5.72	Woodruff #9
150 mm	225.43	139.70	60.33	31.75	19.05	9.53	70	14	69.85	241.30		20.64			212.73	145.30	
8" in	10.25	6.88	2.50	1.75	0.88	0.44	4.02	0.67	3.75	11.75	3/4-10UNC	0.81	8	4	10.62	7.60	Woodruff #9
200 mm	260.35	174.63	63.50	44.45	22.23	11.11	102	17	95.33	298.45		20.64			269.88	193.00	
10" in	11.50	8.00	2.75	1.75	1.12	0.44	4.02	0.87	3.75	14.25	7/8-9UNC	0.94	12	4	12.88	9.50	Woodruff #15
250 mm	292.10	203.20	69.85	44.45	28.58	11.11	102	22	95.33	361.95		23.81			327.03	241.30	
12" in	13.25	9.62	3.12	1.75	1.25	0.44	4.02	0.95	3.75	17.00	7/8-9UNC	0.94	12	4	15.88	11.45	Woodruff #15
300 mm	336.55	244.48	79.38	44.45	31.75	11.11	102	24	95.33	431.80		23.81			403.23	290.80	
14" in	14.50	10.50	3.12	1.75	1.25	0.44	4.02	0.95	3.75	18.75	1-8UNC	1.06	12	4	17.12	12.78	Woodruff #15
350 mm	368.30	266.70	79.38	44.45	31.75	11.11	102	24	95.33	476.25		26.99			434.98	324.60	
16" in	15.75	12.88	3.50	2.00	1.31	0.88	6.50	1.06	6.50	21.25	1-8UNC	1.06	16	4	19.25	14.97	0.31" Sq x 1.75"
400 mm	400.05	327.02	88.90	50.80	33.34	22.23	165	27	165.10	539.75		26.99			488.95	380.20	
18" in	16.62	13.62	4.25	2.00	1.50	0.88	6.50	1.06	6.50	22.75	1-1/8-7UNC	1.25	16	4	21.25	16.83	0.38" Sq x 1.50"
450 mm	422.28	346.08	107.95	50.80	38.10	22.23	165	27	165.10	577.85		31.75			539.75	427.50	
20" in	18.88	15.12	5.38	2.75	1.62	0.88	6.50	1.26	6.50	25.00	1-1/8-7UNC	1.25	20	4	23.62	18.67	0.38" Sq x 1.75"
500 mm	479.43	384.18	136.53	63.50	41.28	22.23	165	32	165.10	635.00		31.75			650.88	474.20	
24" in	22.12	18.38	6.12	2.75	2.00	0.88	6.50	1.42	6.50	29.50	1-1/4-7UNC	1.38	20	4	27.88	22.62	0.50" Sq x 2.25"
600 mm	561.98	466.73	155.58	69.85	50.80	22.23	165	36	165.10	749.30		34.93			708.03	574.50	
30" in	25.50	24.75	6.75	3.25	2.50	0.88	8.50	N/A	11.25	36.00	1-1/4-7UNC	1.25	28	4	34.38	28.60	0.62" Sq x 2.62"
750 mm	647.70	628.65	171.45	82.55	63.50	22.23	215.9		285.75	914.40		31.75			873.13	726.40	

L1 and M1 refer to Lug style valves, L2 and M2 refer to Wafer Style. "C" dimension is listed with elastomer in the relaxed condition. Approximately 1/8" total compression is required for proper sealing with pipe flanges. Valves are designed for installation between ASME B16.1 Class 125 (Iron) and B16.5 Class 150 (Steel) flanges. Gaskets are not needed, and should not be used since the seat face seals against the mating flange. If the valve is to be installed in between any other flanges, consult your Center Line agent or the factory for additional information. Center Line recommends that a blind flange be used on end of line applications.

"O" dimension is the valve clearance dimension.

Series 200 Dimensions

Weights: 2" to 72" (Bare Stem)

		2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"	14"	16"	18"	20"	24"	28"	30"	32"	36"	40"	42"
Wafer	lbs	6	7	10	13	18	20	32	42	70	95	117	165	275	440	-	740	-	-	-	-
	kg	2.7	3.2	4.5	5.9	8.2	9.1	14.5	19.1	31.7	43.1	53.1	74.8	124.7	199.6	-	335.7	-	-	-	-
Lug	lbs	7	8	14	26	28	31	49	72	105	155	195	230	396	610	-	1,050	-	-	-	-
	kg	3.2	3.6	6.4	11.8	12.7	14.1	22.2	32.7	47.6	70.3	88.5	104.3	179.6	276.7	-	476.3	-	-	-	-
Flanged	lbs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,175	1,219	1,528	1,954	2,145	2,500
	kg	-	-	-	-	-	-	-	-	-	-	-	-	-	-	533	553	693	886	973	1,134

		48"	54"	60"	66"	72"
Wafer	lbs	-	-	-	-	-
	kg	-	-	-	-	-
Lug	lbs	-	-	-	-	-
	kg	-	-	-	-	-
Flanged	lbs	3,720	5,446	5,868	7,850	10,584
	kg	1,687	2,470	2,661	3,560	4,800

Weights: 28" - 48" Double Flanged (Gear Actuated)

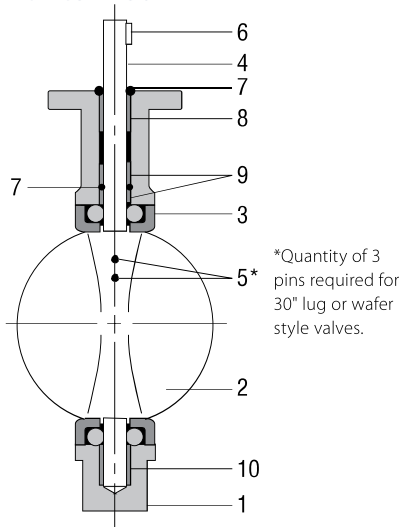
	28"	30"	32"	36"	40"	42"	48"
lbs	1327	1372	1680	2130	2509	2864	4084
kg	602	622	762	966	1138	1299	1852

Weights: 54" - 72" Double Flanged (Gear Actuated)

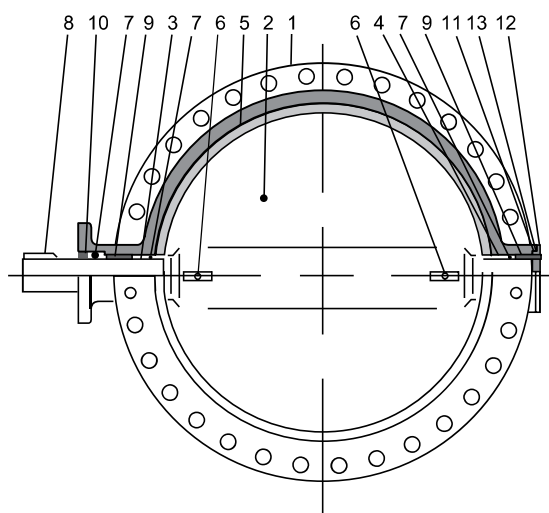
	54"	60"	66"	72"
lbs	5810	6617	8600	11797
kg	2635	3001	3900	5350

Series 200 Materials of Construction

Sizes 2"-30"



Sizes 28"-48"



Bill of Materials 2" - 30"

Item	Description	Materials	Optional Materials
1	Body	Ductile Iron, A536 Grade 65-45-12 *	Ductile Iron, A395 Gr. 60-40-18
2	Disc	Ductile Iron, A536 Grade 65-45-12 **	Aluminum-Bronze, B148 Grade C954; 316 Stainless Steel, A351 Grade CF8M; Monel®, A494 Grade M30C
3	Seat	Buna-N or EPDM	Viton®
4	Shaft	416 Stainless Steel, A582 Type 416	316 Stainless Steel, A276/A479 Type 316; Monel®, B164 Type 400, Class B; 17-4PH Stainless Steel, A564 Type 630, Condition H1150
5	Taper Pins	416 Stainless Steel, A582 Type 416	316 Stainless Steel, A276/A479 Type 316; Monel®, B164 Type 400, Class B; 17-4PH Stainless Steel, A564 Type 630, Condition H1150
6	Key	Carbon Steel, AISI C1018	No Option Available
7	O-Ring	Buna-N	Viton®
8	Bushing	PTFE	Luberized Bronze
9	Bushing	PTFE	Luberized Bronze
10	Bushing	PTFE	Luberized Bronze

Monel® is a registered trademark of Special Metals Corporation™

Viton® is a registered trademark of DuPont™

Bill of Materials, 28" to 72"

Item	Description	Materials	Optional Materials
1	Body	Ductile Iron, A536 Grade 65-45-12 *	Ductile Iron, A395 Gr. 60-40-18
2	Disc	Ductile Iron, A536 Grade 65-45-12 **	Aluminum-Bronze, B148 Grade C954; 316 Stainless Steel, A351 Grade CF8M
3	Upper Shaft	416 Stainless Steel, A582 Type 416	316 Stainless Steel (standard with 316 Stainless Steel disc), A276/A479 Type 316
4	Lower Shaft	416 Stainless Steel, A582 Type 416	316 Stainless Steel (standard with 316 Stainless Steel disc), A276/A479 Type 316
5	Seat	Buna-N or EPDM	Viton®
6	Taper Pin	416 Stainless Steel, A582 Type 416	316 Stainless Steel, A276/A479 Type 316
7	O-Ring	Buna-N	No Option Available
8	Key	Carbon Steel, AISI C1018	No Option Available
9	Bushing	PTFE	Luberized Bronze
10	Bushing	PTFE	Luberized Bronze
11	Thrust Washer	PTFE	Luberized Bronze
12	End Plate	Ductile Iron, A536 Grade 65-45-12 *	No Option Available
13	O-Ring	Buna-N	No Option Available

* Ductile iron bodies are available with an optional epoxy coating.

** Ductile iron discs are standard with an epoxy coating.

Series 200 Figure Number System

Series 200 1 0 1 8 2 A 3 G 4 0 5 6 6 1 7 0 8 5 9 5 — 10

1. Size	Code	5. Disc	Code	9. Actuator	Code
2"	02	316 SS (CF8M)	4	Handle (10 positions)	2
2½"	25	Ductile Iron (2" - 72")	5	Infinite/Lockable (2"-6")	3
3"	03	Aluminum-Bronze (2" - 72")	6	Infinite (8")	4
to	- - -	Monel® 400 (M30-C) (2" - 30")	7	Gear Operator	5
72"	72			Pneumatic Double Acting	6
				Pneumatic SR Fail Close (FCW)	7
				Pneumatic SR Fail Open (FCCW)	8
				Electric	9
				Gear Operator with Memory Stop	G
				Buried Gear / 2" Square Drive Nut	C
				Gear Operator with Chain Wheel	U
				None	X
2. Series/Style	Code	6. Shaft	Code	10. Special Features	Code
Wafer (2"-30")	A	416 SS	1		
Lug/Deadend (2"-30")	C	316 SS ¹	4	CE Marked - Non-Impact Tested	P
Flange (28"-72")	D	Monel® 400 (2" - 30")	7		
		17-4PH Cond. H1150 SS (2" - 30")	9		
		¹ Standard with 316 SS disc only.			
3. Body	Code	7. Bushing	Code		
Epoxy Coated DI (A536) (2" - 12")	V	Bronze ²	0		
Ductile Iron (A536) (14" - 72")	2	PTFE	3		
Ductile Iron (A395) (2" - 30")	G				
		² Standard on 52" - 72" valve sizes			
4. Pressure	Code	8. Seat / Liner	Code		
200 PSI (2"-12")	0	Buna-N	1		
75 PSI Undercut (8" - 30")	3	EPDM	5		
150 PSI (14" - 72")	6	Viton® (400°F)	6		

Note: For ASTM material designations, see Bill-of-Materials on page 7

	MATERIAL SPECIFICATION BALL VALVES	SPEC NO: 4.96
	DWC FULL PORT BRASS OR BRONZE THREADED BALL VALVE	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Brass full bore ball valve with blow-out proof stem and seat retainer designed to permit valve to be dead ended in either flow direction. Brass body and stem, chrome plated brass ball, PTFE seat and seals.
ACTUATOR:	Lever operated. Valve has lockable feature to lock the valve in either the open or shut position.
RATING:	600 PSIG @ 100 DEG. F.
CONNECTION:	Threaded ends. Screwed body inserts or tail pieced are not acceptable.
MANUFACTURER:	Hammond / Milwaukee Valve Company
SIZES:	1/4" through 2"
MODELS:	Hammond Model UP8901 / Milwaukee UPBA-475B
SERVICE CONDITIONS:	Potable water at ambient temperature

Issue Date	Revision Date	Approved By	Approval Date
July 19, 2022		Robert Sprowls	July 19, 2022

PROPRIETARY AND CONFIDENTIAL

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Brass Ball Valve For Potable Water

Two-Piece • Full-Port

600 PSIG WOG

Threaded Ends

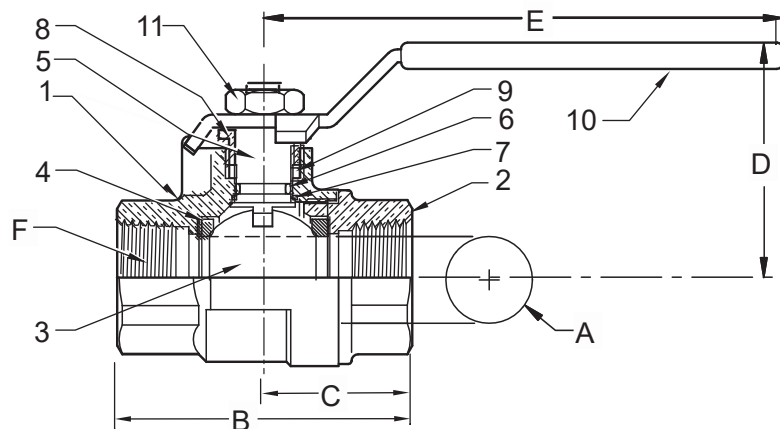
UP8901* 1/4"-3"

Dimensions and workmanship conform to MSS SP-110

ASME A112.4.14

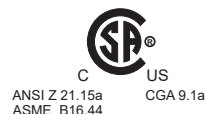
*Also Available UP8901-07

Designed in accordance with the requirements of California AB 1953, Vermont S 152 and Senate Bill S3874



MATERIAL LIST

ITEM	PART	MATERIALS	ASTM SPEC.
1	Body	Brass, Forged	B283 C27450
2	Tailpiece	Brass, Forged	B283 C27450
3	Ball	Brass w/Chrome	C27450
4	Ball Seal	PTFE	Commercial
5	Stem	Brass	C27450
6	O-Ring	Buna-N	D2006
7	Thrust Washer	PTFE	Commercial
8	Gland Nut	Brass	B16
9	Packing	PTFE	Commercial
10	Handle	Zinc Plated Steel	Commercial
11	Handle Nut	Zinc Plated Steel	Commercial



DIMENSIONS

Valve Size	UNITS	1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"
A	INCHES	0.39	0.39	0.51	0.76	1.00	1.26	1.50	2.00	2.48	2.95
	mm	9.9	9.9	12.7	19.3	25	32.0	38.1	51.0	63	74.9
B	INCHES	1.87	1.87	2.25	2.62	3.06	3.5	3.75	4.38	5.16	6
	mm	47	47	57	67	78	89	95	111	131.1	152.4
C	INCHES	0.95	0.95	1.12	1.31	1.91	2.21	1.87	2.19	2.58	3
	mm	24	24	61	33	49	56	47	56	65.5	76.2
D	INCHES	1.42	1.42	1.46	1.93	2.1	2.33	2.52	2.96	3.94	4.37
	mm	36	36	37	49	53	59	64	75	100.1	111
E	INCHES	3.14	3.14	3.14	4.35	4.35	5.00	5.00	6.90	7.87	7.87
	mm	80	80	80	110	110	127	127	175	199.9	199.9
F	THREAD SIZE	1/4" NPT	3/8" NPT	1/2" NPT	3/4" NPT	1" NPT	1-1/4" NPT	1-1/2" NPT	2" NPT	2-1/2" NPT	3" NPT
Cv		12	12	18	40	72	112	161	287	307	323
TORQUE	in-lb	16	16	19	58	69	89	124	210	445	563
	N.m	1.8	1.8	2.1	6.5	7.8	10	14	24	50	64
WEIGHT	lbs	0.33	0.34	0.47	0.89	1.24	1.66	2.34	4.94	7.4	10.47
	Kg	0.149	0.155	0.213	0.403	0.565	0.755	1.064	2.245	3.35	4.75

Hammond Valve
16550 W. Stratton Drive
New Berlin, WI 53151
Phone: 262-432-2702
Fax: 262-432-2703

Rev 11

*Same design as Milwaukee UPBA-475B.

Note: Lead free refers to the wetted surface of the pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$. Source: California Health and Safety Code (116875).

The information presented on this sheet is correct at the time of publication. Hammond Valve reserves the right to change design, and/or material specifications without notice. For the Installation, Operation and Maintenance Manual (IOM) see the engineering section on our website. For the most current information access www.hammondvalve.com
Hammond Valve is a registered trade mark of Milwaukee Valve Company.





INSTALLATION -BALL VALVE ,THREADED END

- 1) Thoroughly clean and prepare the piping system before valve installation.
- 2) Remove the valve end caps if present, and inspect the valve ports and seating surfaces for cleanliness just prior to installation.
- 3) Support the valve to prevent unnecessary stresses induced by connecting pipe.
- 4) Be sure the rating of the valve is compatible with the intended service conditions.
- 5) Operate the valve from the full open to closed position.
- 6) PTFE thread sealant is recommended when making up connections. Consult the sealant manufacturer's instructions for proper use. Install on pipe and not on the valve.
- 7) Care should be used to not over tighten the valve onto the pipe, as it is possible to distort the internal parts of the valve.
- 8) Because bronze is a softer metal than steel, always put the pipe in a vise and turn the valve onto the pipe end. Always use a smooth-jawed wrench on the valve end on the same side of the valve to which the pipe or fitting is being installed to prevent distortion of the internal parts of the valve or transmission of torque and stress into the body joint. Pipe Wrenches should be used on a pipe and fittings only.
- 9) Take precaution also to prevent loosening body to tailpiece connection by reverse rotation during installment/alignment. Such loosening could comprise body to tailpiece sealing.
- 10) Verify the tightness of the packing nut after installation.

OPERATION

- 1) Ball valves are designed to be opened by rotating the lever handle in a counterclockwise direction, and closing in a clockwise direction. The handle indicates the ball port direction.
- 2) Under certain conditions, throttling flow in the near-closed position can destroy the valve seats. Consult factory for throttling service.

INSPECTION & MAINTENANCE

- 1) Periodic inspection and preventative maintenance is not required other than adjustment of stem packing, and cycling of the valve from open to closed position.
- 2) If a valve develops a packing leak, adjust the packing nut to increase the pressure on the stem packing. The packing nut should be turned in a clockwise direction approximately ¼ turn, or until the leakage stops. **Do not repack valves under pressure.**
- 3) Repair or replacement of two piece ball valves internal parts is not recommended. Damage can occur to the body and tailpiece during disassembly that would make the valve inoperable.

REPAIR PARTS Not available for ULTRA-PURE valves.

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION BALL VALVES	SPEC NO: 4.94
	DWC FULL PORT STAINLESS STEEL FLANGED BALL VALVE	

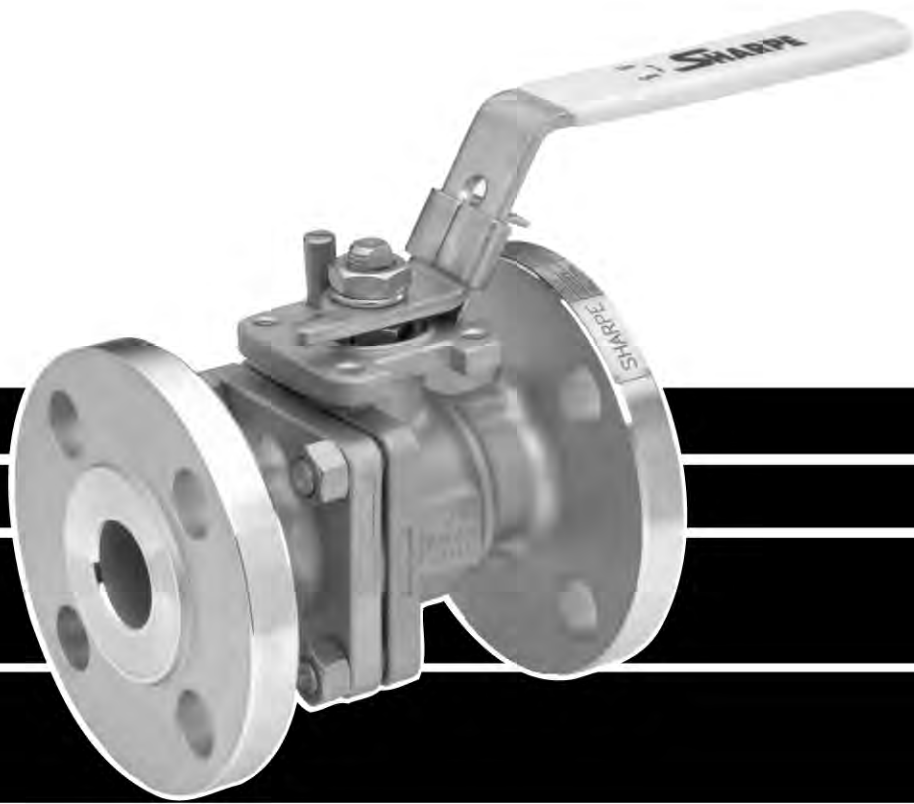
SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Stainless steel full bore ball valve 1/2" thru 4" size (reduced port for 6" & 8" acceptable) with blow-out proof stem and seat retainer designed to permit valve to be dead ended in either flow direction. Type 316 stainless steel body, ball and stem, TFE seats and seals. No asbestos allowed.
ACTUATOR:	Gear Operator for 6" and 8" size valves. Lever operated 4" and smaller. Valve has lockable feature to lock the valve in either the open or shut position.
RATING:	275 PSIG @ 100 DEG. F. or 110 PSIG @ 353 DEG. F.
CONNECTION:	150# ANSI B16.5 flanged ends, raised face, 1/2" thru 4" size Face-to-face dimensions to conform to ANSI B16.10 for steel gate valves. Screwed body inserts not acceptable.
MANUFACTURER:	Sharpe
SIZES:	1/2" through 8"
MODELS:	Sharpe Series 50
SERVICE CONDITIONS:	Carbon/water slurry at ambient temperature

Issue Date	Revision Date	Approved By	Approval Date
July 18, 2022		Robert Sprowls	July 18, 2022

PROPRIETARY AND CONFIDENTIAL

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SHARPE[®] VALVES



**FLANGED FULL PORT
BALL VALVE
SERIES 50 / CLASS 150**

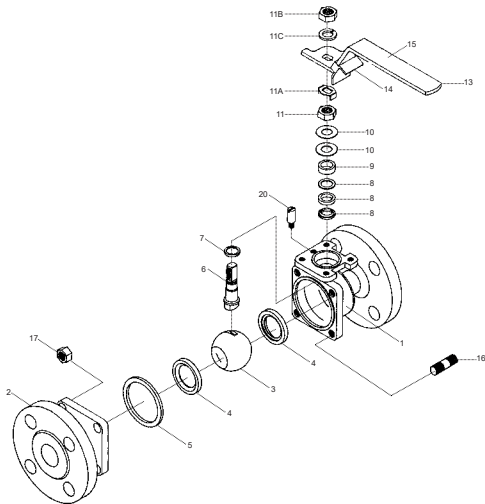
SERIES 50

VALVE PARTS AND IDENTIFICATION

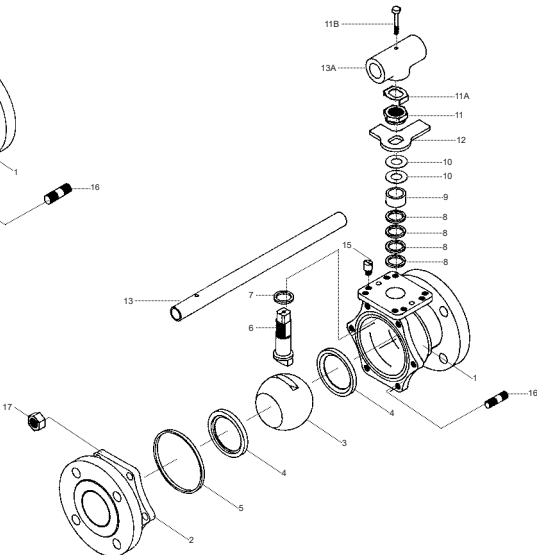
CLASS 150

BLOW OUT PROOF STEM

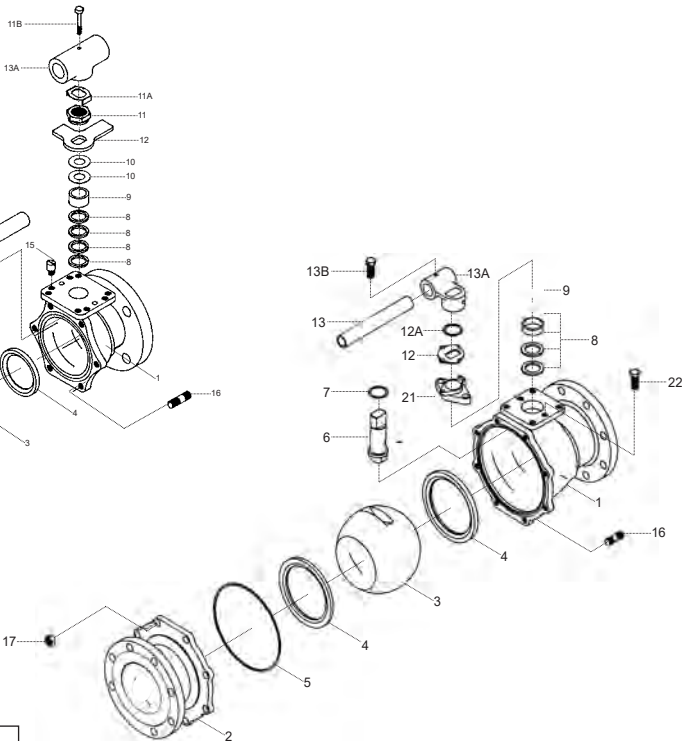
LOCKING DEVICE



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

APPLICABLE STANDARDS

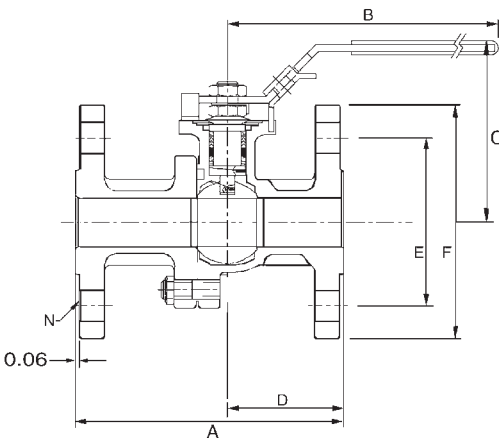
Wall Thickness	ASME B 16.34
Face to Face Dimensions	ASME B 16.10
Flange Dimensions	ASME B 16.5
Pressure Tests	ASME B 16.34 API 598 (Optional)
Basic Design	ASME B16.34

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

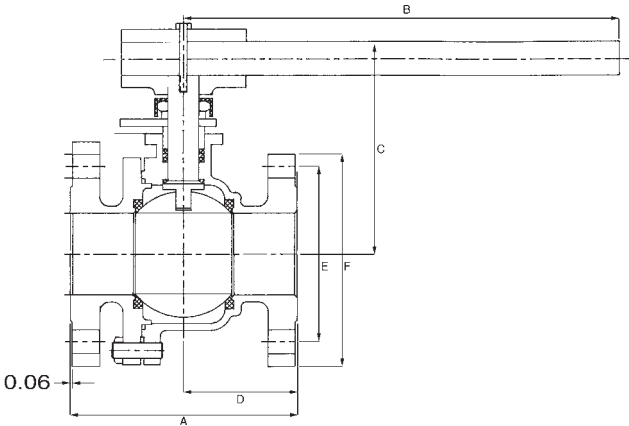
SERIES 50

DIMENSIONS

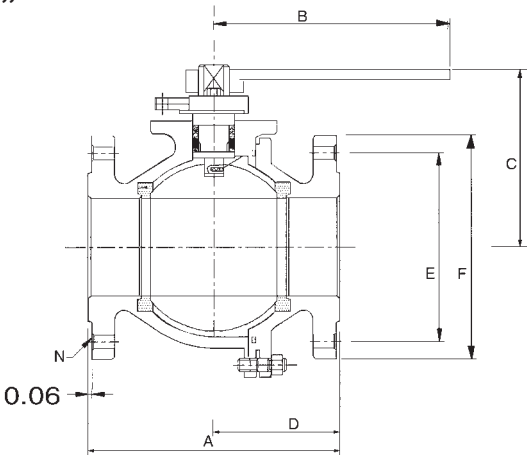
1/2" - 2"



→ 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

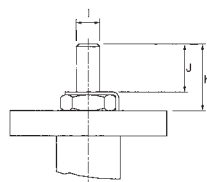
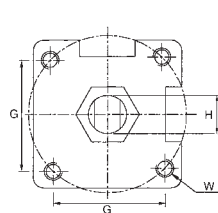
WEIGHT (lbs.)

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

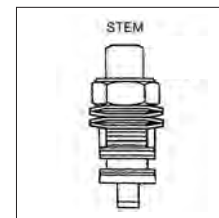
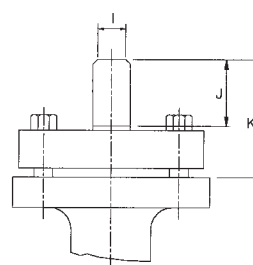
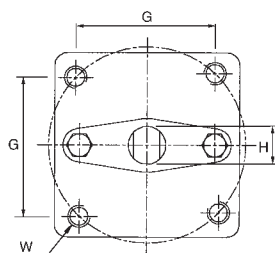
SIZE	A	B	C	D	E	F	N	G	H	I	J	K	W
1/2"	4.25	4.75	3.60	1.80	2.38	3.50	4	1.39	3/8-24 UNF	.22	.28	.63	M5
3/4"	4.62	4.75	3.75	2.00	2.75	3.85	4	1.39	3/8-24 UNF	.22	.28	.63	M5
1"	5.00	6.22	3.75	2.12	3.13	4.25	4	1.39	7/16-20 UNF	.30	.30	.90	M6
1-1/2"	6.50	9.00	4.50	2.76	3.56	5.00	4	1.94	9/16-18 UNF	.35	.42	1.18	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.

1/2" - 4"

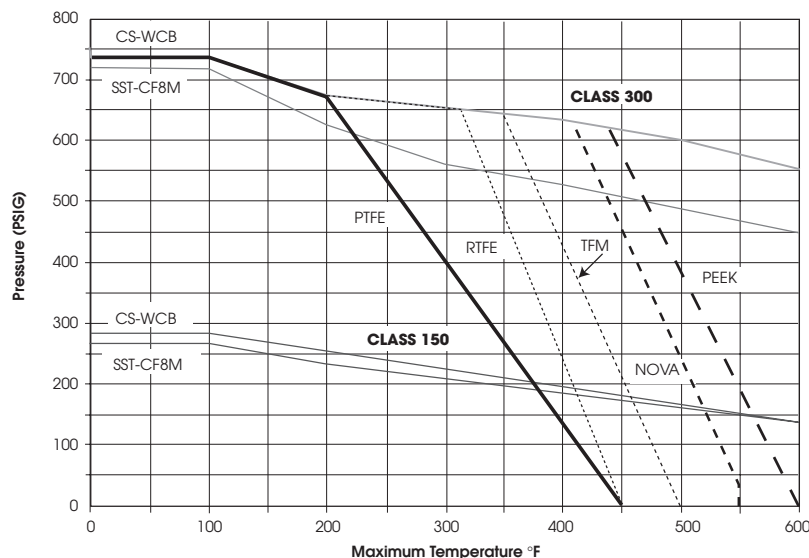


6" - 8"



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

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.

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION BALL VALVES	SPEC NO: 4.95
	DWC REGULAR PORT STAINLESS STEEL THREADED BALL VALVE	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Stainless steel regular bore ball valve with blow-out proof stem and seat retainer designed to permit valve to be dead ended in either flow direction. Type 316 stainless steel body, ball and stem, TFE seats and seals.
ACTUATOR:	Lever operated. Valve has lockable feature to lock the valve in either the open or shut position.
RATING:	1,000 PSIG @ 250 DEG. F. or 250 PSIG @ 400 DEG. F.
CONNECTION:	Threaded ends. Screwed body inserts or tail pieced are not acceptable.
MANUFACTURER:	Sharpe
SIZES:	1/4" through 2"
MODELS:	Sharpe Series 50M76
SERVICE CONDITIONS:	Potable water at ambient temperature

Issue Date	Revision Date	Approved By	Approval Date
July 18, 2022		Robert Sprowls	July 18, 2022

PROPRIETARY AND CONFIDENTIAL

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Series 50M76

2-Piece Ball Valve

SHARPE®

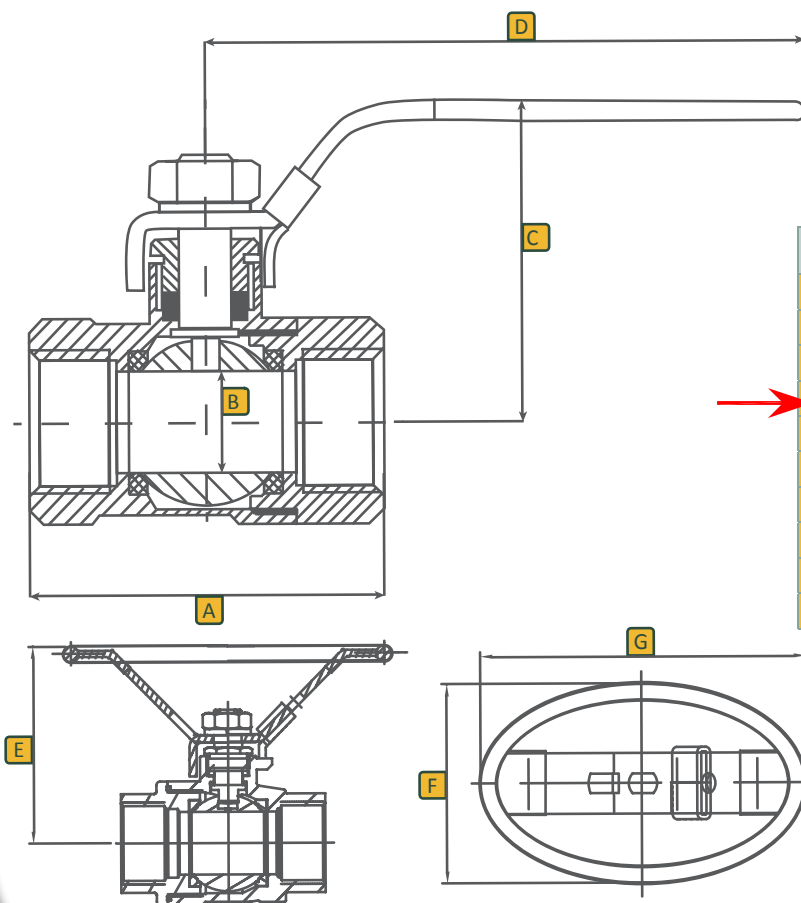
Valves, Automation & Controls

Features

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



Dimensions

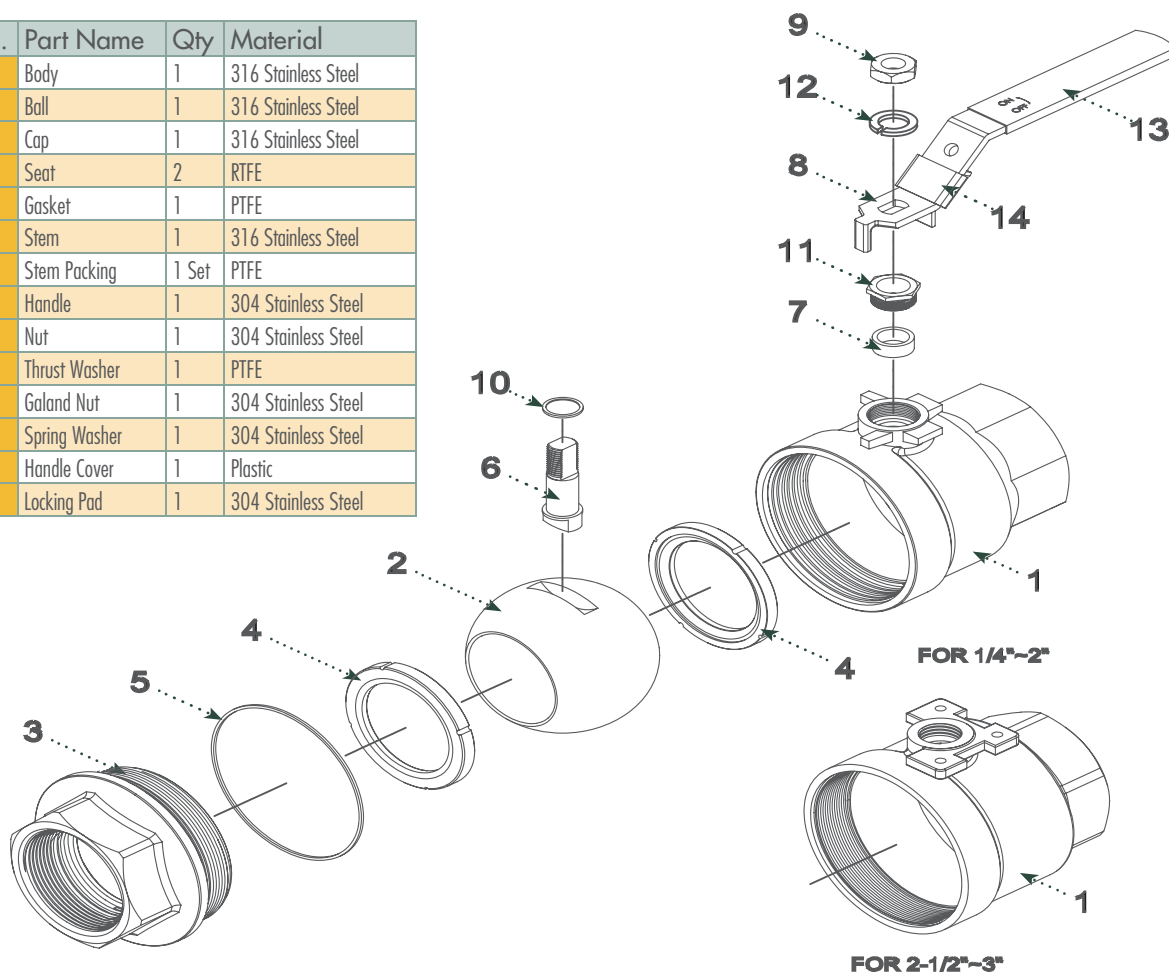


Dimensions (Inches)

Size	A	B	C	D	E	F	G
1/4	2.00	0.43	1.81	4.00	1.06	2.16	3.39
3/8	2.00	0.43	1.81	4.00	1.06	2.16	3.39
1/2	2.36	0.50	1.89	4.00	1.06	2.16	3.39
3/4	2.75	0.80	2.04	5.00	1.34	2.76	4.33
1	3.25	1.00	2.44	5.75	1.53	3.18	5.26
1-1/4	3.80	1.25	2.56	5.75	1.53	3.18	5.26
1-1/2	4.33	1.50	2.96	7.50	1.97	4.13	6.30
2	5.27	2.00	3.25	7.50	1.97	4.13	6.30
2-1/2	6.58	2.50	5.00	9.73	-	-	-
3	7.55	3.00	5.40	9.73	-	-	-

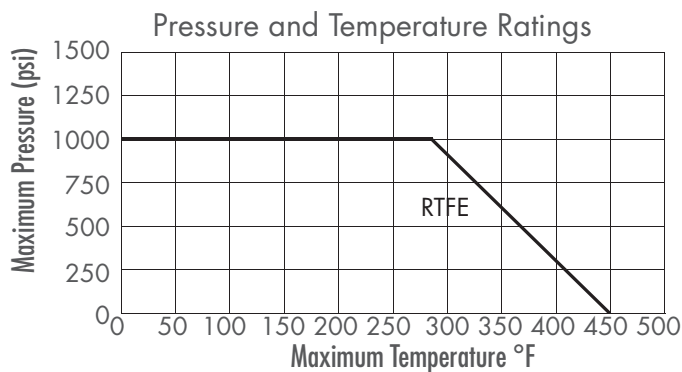
Parts & Materials

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	Gland 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-Lbs
1/4	6	0.5
3/8	6	0.5
1/2	24	0.7
3/4	35	1.1
1	47	2.0
1-1/4	81	3.0
1-1/2	105	4.8
2	241	8.0
2-1/2	319	14.0
3	580	20.0



Ordering

Fig: 1/2 - 50M76

Description: 1/2" - Series 50M76

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

	MATERIAL SPECIFICATION STRAINERS	SPEC NO: 22.29
	SAMPLE PORT SEPTUM, TYPE 316 STAINLESS STEEL	

SAP PART NUMBER:	1058440
CCC DRAWING NUMBER:	90100025
MATERIAL:	Sample port septum, Type 316 stainless steel, 0.060" wedge wire with 0.008" slot opening, Septum to be 1" O.D. x 1 1/2" long with 1/2" threaded half-coupling one end and 1/8" thk. cap other end, Overall Length= 2 9/16"
MANUFACTURER:	Orthos or equal

Issue Date:

Revision Date: 10/22/2010

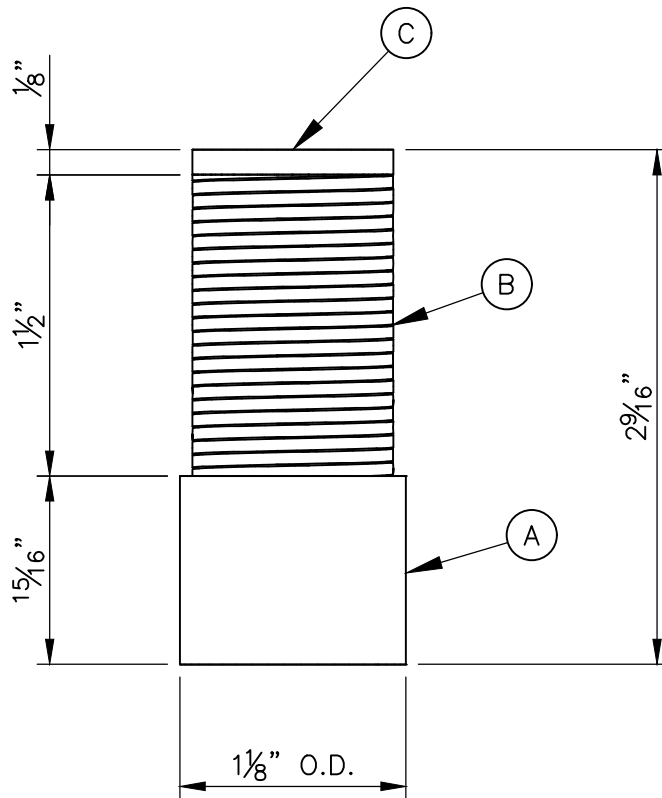
Approved by Joseph P. McMahon on 10/22/2010

PROPRIETARY AND CONFIDENTIAL

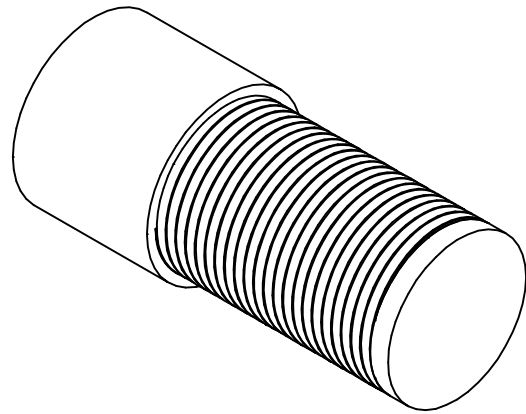
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BILL OF MATERIAL

ITEM	QUANTITY	SAP#	DESCRIPTION	MATERIAL
A	1		1/2" HALF COUPLING, 3000#, THREADED	316L SS
B	1		WEDGE WIRE, 1" O.D. X 1 1/2" LG., 0.060" WIRE W/0.008" SLOT	316L SS
C	1		CAP, 1" O.D. X 1/8" THK.	316L SS



PLAN



ISO

SAP NUMBER: 1058440

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	NAME	DATE
DRAFTER	RES	10-21-2010
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	STANDARD	



CLIENT			
TITLE 1/2" SAMPLE PORT SEPTA DETAIL CCC SPEC. 22.29			
DWG. Size	A	SHEET No.	1 OF 1
SCALE		NONE	
DWG. No.	90100025		REV. 0

2			
1			
0	ISSUED FOR FABRICATION	RES	10/21/10
REV	DESCRIPTION	APP	DATE
REVISIONS			

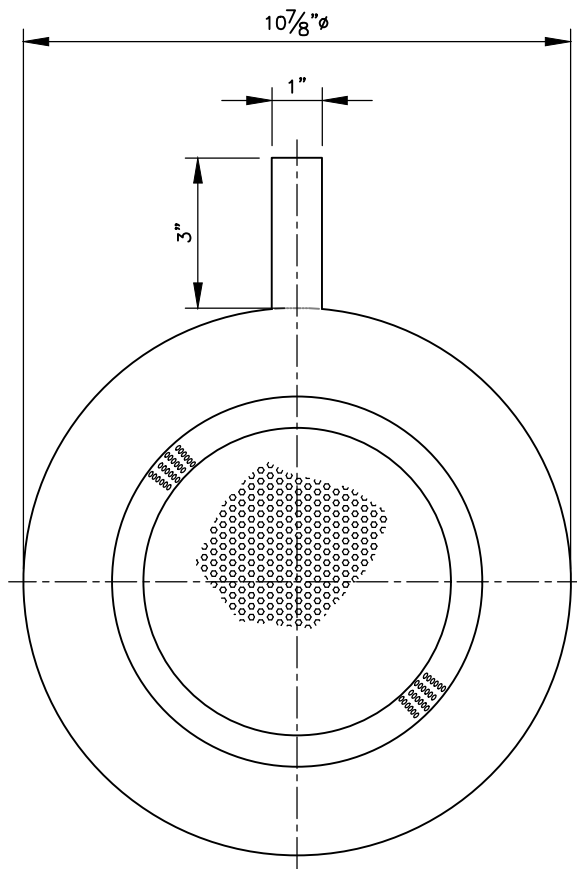
 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION STRAINERS	SPEC NO: 22.54
	BASKET STRAINER, TYPE 316 STAINLESS STEEL	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Perforated basket strainer (Media Retention) for 150 lb. Raised Face Flanges, type 316 stainless steel construction. Basket is to be Fabricated from 14 Gage 316 stainless steel with 1/8" holes drilled on 3/16" centers and covered with 40 mesh 316 stainless steel screen, this will then be covered by a 4 mesh 316 stainless steel support screen (0.063" wire diameter).
RATING:	Support Screen is to be designed for 125 PSIG if plugged in forward or reverse flow.
MANUFACTURER:	Mack Iron Works Company, Filter Solutions Inc.
SIZES:	2" thru 12"
MODELS:	Mack Iron Works Company Style PBL, Filter Solutions Inc. Style PBL

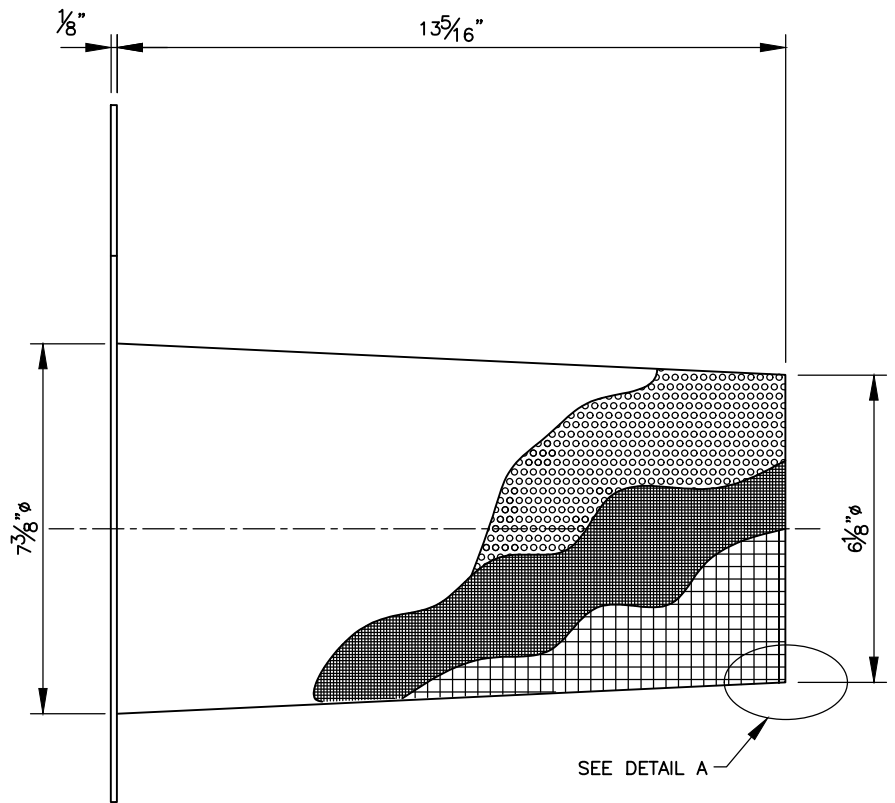
Issue Date	Revision Date	Approved By	Approval Date
September 29, 2022		Robert Sprowls	September 29, 2022

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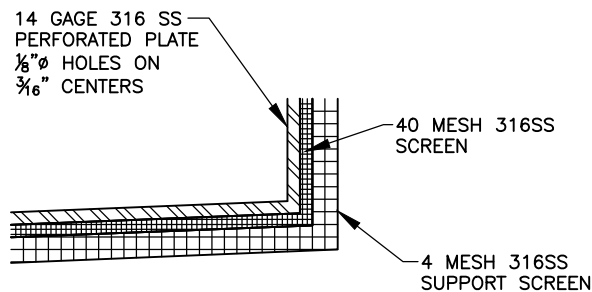
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FRONT



SIDE



DETAIL A

SAP NUMBER: 1043510

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	NAME	DATE
DRAFTER	BKM	8/29/06
DESIGNER		
CHECKER	RES	4/3/07
APPROVAL		
PROJECT No.	STANDARD	



CLIENT		STANDARD	
TITLE		8" STRAINER, 316L SS CCC SPEC 22.53 DETAILS	
DWG. Size	A	SHEET No.	1 OF 1
SCALE		NONE	
DWG. No.	90060220		REV. 1

REV	DESCRIPTION	APP	DATE
2			
1	ADD SAP NUMBER	RES	2/22/2018
0	ISSUED FOR FABRICATION	RES	4/3/07
REVISIONS			

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION STRAINERS	SPEC NO: 22.113
	FILTER NOZZLE, 316 STAINLESS STEEL, ANSI/NSF-61	

SAP PART NUMBER:	1081827
CCC DRAWING NUMBER:	90190642
MATERIAL:	Filter nozzle, 316 stainless steel construction. 2.0" O.D. x 2-1/4" long wedge-wire basket with 0.008" slot spacing, No.60 profile wire with a minimum of twenty-four (24) No.60 support rods with 22 gauge formed cap top & bottom; 1"-8 UNC thread on 3/4" Sch. 80 pipe X 2" long. Comes with 316 S.S. nut, flat and lock washer and two ANSI/NSF-61 gaskets 2" O.D. X 1 1/4" I.D. X 1/8" thick. Total overall length 4 1/2"
MANUFACTURER:	Federal Screen Products, or equal.
SEPTA SLOT SIZE:	0.008
SEPTA LENGTH:	4 1/2"
SEPTA DIAMETER:	2"
SEPTA CONNECTION TYPE:	1" Male UNC Thread

Issue Date: 12/13/2016

Revision Date: 07/01/2019

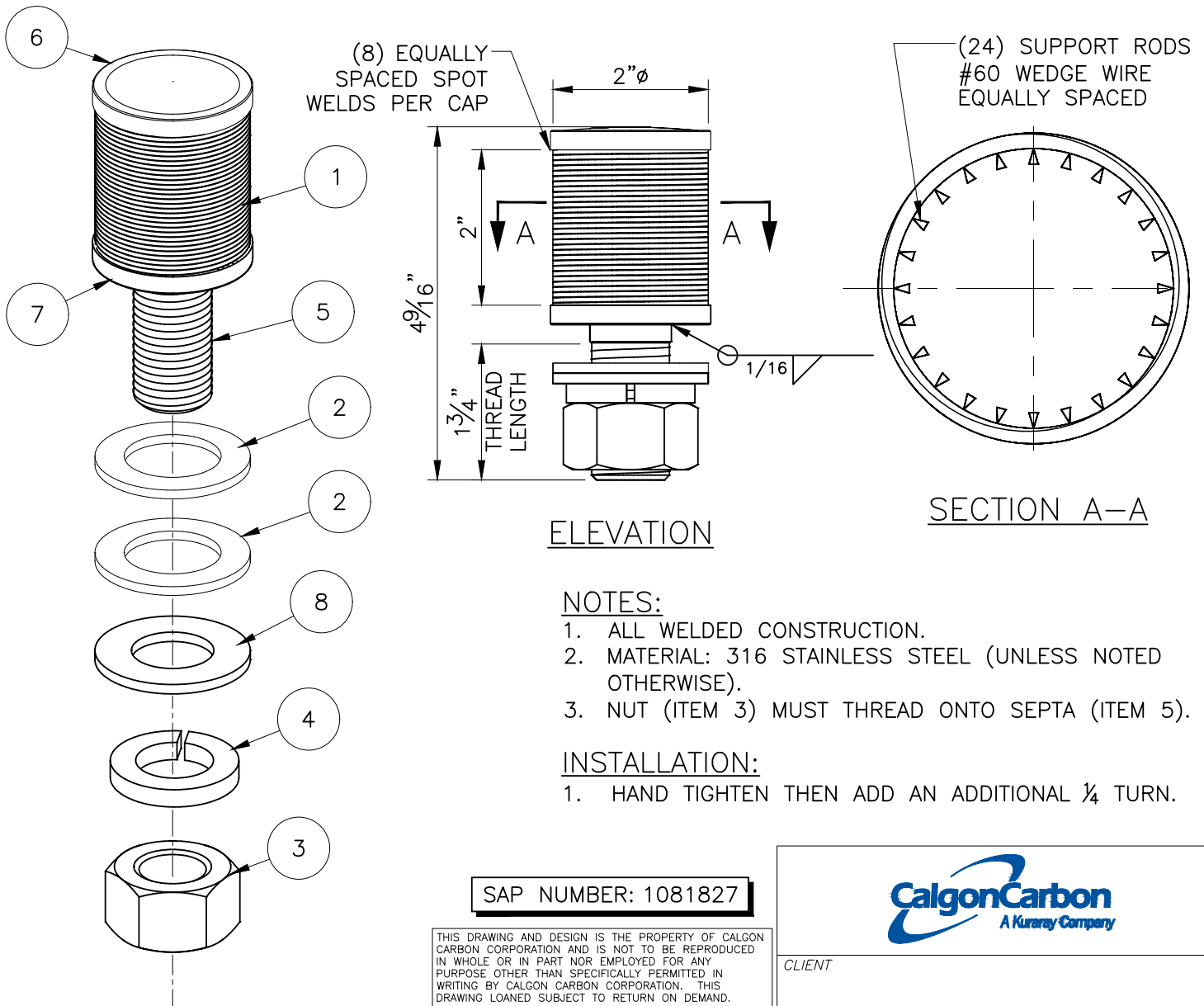
Approved by Joseph P. McMahon on 03/30/2017

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BILL OF MATERIAL

ITEM	QTY	DESCRIPTION
1	1	2" O.D. x 2 1/4" LONG WEDGE-WIRE BASKET WITH 0.008" SLOT SPACING, No. 60 PROFILE WIRE WITH (24) No. 60 SUPPORT RODS, 316 STAINLESS STEEL
2	2	GASKET, 2" O.D. x 1-1/8" I.D. x 1/8" THK., ANSI/NSF-61
3	1	HEX NUT, 1-8UNC, 316 STAINLESS STEEL
4	1	LOCK WASHER, 1"Ø, STANDARD HELICAL SPRING, 316 STAINLESS STEEL
5	1	PIPE, 3/4"Ø x 2" LG, SCH 80S W/1"-8UNC x 1-3/4" LONG THREAD, 316 STAINLESS STEEL
6	1	FORMED CAP, 20 GA., 2" I.D., 316 STAINLESS STEEL
7	1	FORMED CAP, 20 GA., 2" I.D., W/ 3/4" HOLE, 316 STAINLESS STEEL
8	1	WASHER, 1"Ø, PLAIN, TYPE A, SERIES N, 316 STAINLESS STEEL.



ELEVATION

SECTION A-A

NOTES:

1. ALL WELDED CONSTRUCTION.
2. MATERIAL: 316 STAINLESS STEEL (UNLESS NOTED OTHERWISE).
3. NUT (ITEM 3) MUST THREAD ONTO SEPTA (ITEM 5).

INSTALLATION:

1. HAND TIGHTEN THEN ADD AN ADDITIONAL 1/4 TURN.

SAP NUMBER: 1081827

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	NAME	DATE
DRAFTER	SPROWLS	07-01-2019
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	STANDARD	



CLIENT	
TITLE	SEPTA (SPEC 22.113) 316 STAINLESS STEEL, ANSI/NSF-61 DETAILS
DWG. Size	A
SHEET No.	1 OF 1
SCALE	NONE
DWG. No.	90190642
REV.	0

REV	DESCRIPTION	APP	DATE
0	ISSUED FOR FABRICATION	RES	7/1/19
REVISIONS			

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION EXPANSION JOINTS	SPEC NO: 24.25
	DWC RUBBER EXPANSION JOINT, DOUBLE ARCH TYPE	

SAP PART NUMBER:		
CCC DRAWING NUMBER:		
MATERIAL:	Rubber expansion joint, double arch type, EPDM cover and tube. Joint allows axial compression and extension, lateral deflection and minimum 13 degrees angular misalignment. Steel backing flanges to be galvanized or zinc plated, 150 # drilling. No gaskets required. Control rod assemblies are required when surge or test pressure exceed 163 psi.	
DIMENSIONS	Size	Face to Face
	1" thru 6"	10"
	8"	13"
	10" thru 12"	14"
RATING:	190 psi @ 170 DEG. F.	
MANUFACTURER:	Proco Products, Inc., General Rubber, Unisource Mfg.	
SIZES:	1" thru 12"	
MODELS:	Proco Products, Inc., Model 242/EE, General Rubber Style 1102, Unisource Style 302	

Issue Date	Revision Date	Approved By	Approval Date
September 28, 2022		Robert Sprows	September 28, 2022

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The image features a stack of several industrial expansion joints, each with a different colored elastomer (white, black, blue, orange, green, dark blue) and a metal flange. At the bottom, there is a detailed view of a spherical joint assembly, which includes a horizontal pipe section and a spherical body with multiple bolted connections.

PROCO

The Expansion Joint and Check Valve People

MOLDED SPHERICAL JOINTS STYLE 240/242

Proco Style 240/242 Molded Spherical Joints

Proco Style 240/242 Spherical Molded Expansion Joints are designed for piping systems to absorb pipe movements, relieve stress, reduce system noise/vibration, compensate for misalignment/offset and to protect rotating mechanical equipment against start-up surge forces.

The molded style 240 single sphere and 242 twin sphere designed bellows are inherently stronger than the conventional hand-built style spool arch type. Internal pressure within a "sphere" is exerted in all directions, distributing forces evenly over a larger area. The spherical design "flowing arch" reduces turbulence and sediment buildup.

Features and Benefits:

Absorbs Directional Movement

Thermal movements appear in any rigid pipe system due to temperature changes. The Style 240 and Style 242 spherical arch expansion joints allow for axial compression or axial extension, lateral deflection as well as angular movement. (Note: Rated movements in this publication are based on one plane movements. Multiple movement conditions are based on a multiple movement calculation. Contact Proco for information when designing multiple pipe movements.)

Easy Installation with Rotating Metallic Flanges

The floating metallic flanges freely rotate on the bellows, compensating for mating flange misalignment, thus speeding up installation time. Gaskets are not required with the Style 240 or Style 242, provided the expansion joints are mated against a flat face flange as required in the installation instructions.

Flange Materials/Drilling

The Proco Style 240 and Style 242 molded expansion joints are furnished complete with plated carbon steel flanges for corrosion protection. 304 or 316 stainless steel flanges are available upon request as well as ANSI 250/300 lb., BS-10, DIN PN10 & PN16 and JIS-10K drilling.

Absorbs Vibration, Noise and Shock

The Proco Style 240 and Style 242 molded expansion joints effectively dampen and insulate downstream piping against the transmission of noise and vibration generated by mechanical equipment. Noise and vibration caused by equipment can cause stress in pipe, pipe guides, anchors and other equipment downstream. Water hammer and pumping impulses can also cause strain, stress or shock to a piping system. Install the Style 240 or Style 242 molded expansion joints to help compensate for these system pressure spikes.

Wide Service Range with Low Cost

Engineered to operate up to 300 PSIG or 265°F, the Proco Style 240 and Style 242 can be specified for a wide range of piping requirements. Compared to conventional hand-built spool type joints, you will invest less money when specifying the mass-produced, consistent high quality, molded single or twin sphere expansion joints.

Material Identification

All Style 240 or Style 242 molded expansion joints have branded elastomer designations. Neoprene Tube/Neoprene Cover (NN) and Nitrile Tube/Neoprene Cover (NP) elastomer designated joints meet the Coast Guard Requirements and conform to ASTM F1123-87. 240C/NP-9 joints have ABS certification.

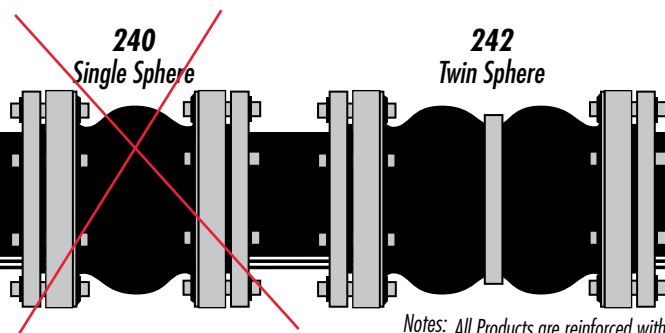
Large Inventory

Proco Products, Inc. maintains one of the largest inventories of rubber expansion joints in the world. Please contact us for price and availability.

Table 1: Available Styles • Materials

For Specific Elastomer Recommendations, See: PROCO "Chemical To Elastomer Guide"								
240-A	240-C	240-AV,D,E,M	242-A,B,C	PROCO Material Code	Cover Elastomer ¹	Tube Elastomer ²	Maximum Operating Temp. °F	Identifying Color Band/Label
		X	X	/BB ³	Chlorobutyl	Chlorobutyl	250°	Black
		X	X	/EE ³	EPDM	EPDM	250°	Red
X	X			/EE ^{3,4}	EPDM	FDA-EPDM	250°	Red
		X		/EQ ³	EPDM	FDA-EPDM	250°	Red
X	X			/EE-9 ^{3,5}	EPDM	EPDM	265°	DBL Red
	X			/ET-9 ^{3,6}	EPDM	PTFE	265°	Red
	X			/HH	CSM	CSM	212°	Green
		X	X	/NH	Neoprene	CSM	212°	Green
	X			/NJ	Neoprene	FDA-Nitrile	212°	White
	X	X	X	/NN	Neoprene	Neoprene	225°	Blue
	X			/NT ⁶	Neoprene	PTFE	225°	Blue
X	X	X	X	/NP	Neoprene	Nitrile	212°	Yellow
X	X			/NP-9 ⁷	Neoprene	Nitrile-ABS	212°	DBL Yellow

Protecting Piping and Equipment Systems from Stress/Motion



Notes: All Products are reinforced with Nylon Tire Cord, except 240-A and 240-C which are reinforced with Polyester.

1. All NN & NP elastomer designated joints meet the Coast Guard Requirements and conform to ASTM F 1123-87 and are marked accordingly.
2. Branding Label will be marked as "Food Grade".
3. BB, EE or EE-9 are good for 300°F blower service at 20 PSI or less.

4. 240-A & 240-C expansion joints have black EPDM tube, but are FDA compliant.

5. EE-9 joints are peroxide cured.
6. Products with PTFE loose liner are not intended for vacuum service.
7. NP-9 joints have ABS certification.
8. All elastomers above are not intended for steam service.

Information subject to change without notice.

Style 242 Twin Sphere Performance Data

Table 3: Sizes • Movements • Pressures • Flange Standards • Weights

NOMINAL Pipe Size I.D.	Neutral Length	PROCO Style Number ¹	242 Movement Capability: From Neutral Position ²					Pressure ⁴		Standard Flange Drilling Dimensions ⁸					Weight in lbs	
			Axial Compression Inches	Axial Extension Inches	Lateral Deflection Inches	Angular Deflection Degrees	Thrust Factor ³	Positive PSIG ⁵	Vacuum ⁶ Inches of Hg	Flange O.D. Inches	Bolt Circle Inches	Number of Holes	Size of Holes Inches	Bolt Hole ⁷ Thread	Exp. Joint & Flanges	Control Unit Set (2 Rod)
1 (25)	10.00	242-C	2.000	1.188	1.750	45	4.43	225	26	4.25	3.13	4	0.625	—	5.2	3.6
1.25 (32)	7.0	242-A						225					0.625	1/2-13 UNC	5.3	3.5
	7.0	242-HA	2.000	1.188	1.750	45	6.34	300	26	4.63	3.5	4	0.625	—	6.5	3.5
	10.00	242-C						225					0.625	—	6.2	3.6
1.5 (40)	6.00	242-B						225					0.625	—	6.1	4.6
	6.00	242-HB						300					0.625	—	7.6	4.6
	7.00	242-A	2.000	1.188	1.750	45	6.49	225	26	5.0	3.88	4	0.625	1/2-13 UNC	6.8	4.8
	7.00	242-HA						300					0.625	—	8.3	4.8
	10.00	242-C						225					0.625	—	7.7	5.1
2 (50)	6.00	242-B						225		6.0	4.75	4	0.750	—	9.0	6.6
	7.00	242-A						225		6.0	4.75	4	0.750	—	9.0	7.0
	10.00	242-C	2.000	1.188	1.750	45	7.07	235	26	6.0	4.75	4	0.750	5/8-11 UNC	10.2	7.3
	6.00	Q-242-HB						300		6.0	4.75	4	0.750	—	10.5	6.6
	7.00	Q-242-HA						300		6.5	5.00	8	0.750	—	10.5	7.0
2.5 (65)	6.00	242-B						225					0.750	—	12.9	7.6
	7.00	242-A						225					0.750	—	13.3	8.0
	10.00	242-C	2.000	1.188	1.750	43	11.05	225	26	7.0	5.5	4	0.750	5/8-11 UNC	14.5	8.4
	6.00	Q-242-HB						300					0.750	—	15.3	7.6
	7.00	Q-242-HA						300					0.750	—	15.8	8.0
3 (80)	7.00	242-A						225		7.5	6.0	4	0.750	5/8-11 UNC	14.3	8.6
	9.00	242-B						225		7.5	6.0	4	0.750	—	15.2	9.0
	10.00	242-C	2.000	1.188	1.750	38	13.36	225	26	7.5	6.0	4	0.750	—	15.8	9.1
	12.00	242-C						300		7.5	6.0	4	0.750	—	16.0	9.9
	7.00	Q-242-HA						300		8.25	6.62	8	0.875	—	18.2	8.6
3.5 (90)	10.00	242-C	2.000	1.188	1.750	34	18.67	225	26	8.5	7.0	8	0.750	—	20.6	8.1
4 (100)	9.00	242-A						225		9.0	7.5	8	0.750	5/8-11 UNC	20.3	8.0
	10.00	242-C	2.000	1.375	1.562	34	22.69	225	26	9.0	7.5	8	0.750	—	21.3	8.2
	12.00	242-C						225		9.0	7.5	8	0.750	—	22.0	8.2
	9.00	Q-242-HA						300		10.0	7.88	8	0.750	3/4-10 UNC	26.4	8.0
5 (125)	9.00	242-A						225		10.0	8.5	8	0.875	—	24.5	8.3
	10.00	242-C	2.000	1.375	1.562	29	30.02	225	26	10.0	8.5	8	0.875	—	25.5	9.1
	12.00	242-C						225		10.0	8.5	8	0.875	—	26.0	9.1
	9.00	Q-242-HA						300		11.0	9.25	8	0.875	—	31.4	8.3
6 (150)	9.00	242-A						225		11.0	9.5	8	0.875	3/4-10 UNC	29.5	11.7
	10.00	242-C	2.000	1.375	1.562	25	41.28	225	26	11.0	9.5	8	0.875	—	30.5	11.9
	12.00	242-C						225		11.0	9.5	8	0.875	—	31.0	12.0
	14.00	242-C						225		11.0	9.5	8	0.875	—	32.0	12.0
	9.00	Q-242-HA						300		12.5	10.62	12	0.875	—	38.6	11.7
8 (200)	9.00	242-B						225		13.5	11.75	8	0.875	—	42.3	14.5
	10.00	242-C						225		13.5	11.75	8	0.875	—	43.4	15.0
	12.00	242-C						225		13.5	11.75	8	0.875	—	44.0	15.2
	13.00	242-A	2.375	1.375	1.375	19	63.62	225	26	13.5	11.75	8	0.875	—	43.8	15.4
	14.00	242-C						225		13.5	11.75	8	0.875	3/4-10 UNC	46.0	16.0
	9.00	Q-242-HB						300		15.0	13.0	12	1.000	—	55.4	14.5
	13.00	Q-242-HA						300		15.0	13.0	12	1.000	—	57.5	15.4

See Notes Page 6

Style 242 Twin Sphere Performance Data

Table 3: Sizes • Movements • Pressures • Flange Standards • Weights

NOMINAL Pipe Size I.D.	Neutral Length	PROCO Style Number ¹	242 Movement Capability: From Neutral Position ²					Pressure ⁴		Standard Flange Drilling Dimensions ⁸					Weights in lbs	
			Axial Compression Inches	Axial Extension Inches	Lateral Deflection Inches	Angular Deflection Degrees	Thrust Factor ³	Positive PSIG ⁵	Vacuum ⁶ Inches of Hg	Flange O.D. Inches	Bolt Circle Inches	Number of Holes	Size of Holes Inches	Bolt Hole ⁷ Thread	Exp. Joint & Flanges	Control Unit Set (2 Rod)
10 (250)	12.00	242-B						225		16.0	14.25	12	1.000	—	64.1	23.5
	13.00	242-A						225		16.0	14.25	12	1.000	—	65.5	24.5
	14.00	242-C	2.375	1.375	1.375	15	103.87	225	26	16.0	14.25	12	1.000	7/8-9 UNC	66.7	24.5
	12.00	Q-242-HB						275		17.5	15.25	16	1.125	—	86.5	23.5
	13.00	Q-242-HA						275		17.5	15.25	16	1.125	—	88.4	24.5
12 (300)	12.00	242-B						225		19.0	17.00	12	1.000	—	94.0	30.0
	13.00	242-A						225		19.0	17.00	12	1.000	—	95.0	31.0
	14.00	242-C	2.375	1.375	1.375	13	137.89	225	26	19.0	17.00	12	1.000	7/8-9 UNC	99.1	31.0
	12.00	Q-242-HB						275		20.5	17.75	16	1.250	—	110.0	30.0
	13.00	Q-242-HA						275		20.5	17.75	16	1.250	—	110.0	31.0
14 (350)	13.75	242-A	1.750	1.118	1.118	9	182.65	150	26	19.0	18.75	12	1.125	—	112.0	32.0
16 (400)	12.00	242-C						125					1.125	—	124.0	28.8
	12.00	242-HC	1.750	1.118	1.118	8	240.53	175	26	23.5	21.25	16	1.125	—	160.0	28.8
	13.75	242-A						125					1.125	—	132.0	30.8
	13.75	242-HA						175					1.125	—	170.2	30.8
18 (450)	12.00	242-C						125					1.250	—	138.0	35.1
	13.75	242-A	1.750	1.118	1.118	7	298.65	125	26	25.0	22.75	16	1.250	—	146.0	36.1
	13.75	242-HA						175					1.250	—	181.2	36.1
20 (500)	12.00	242-C						125					1.250	—	172.0	35.0
	13.75	242-A	1.750	1.118	1.118	7	363.05	125	26	27.5	25.0	20	1.250	—	182.0	35.5
	13.75	242-HA						175					1.250	—	182.0	35.5
24 (600)	12.00	242-C						110					1.375	—	190.0	47.0
	13.75	242-A	1.750	1.118	1.118	5	510.70	110	26	32.5	29.5	20	1.375	—	220.0	48.0
	13.75	242-HA						160					1.375	—	266.2	48.0
30 (750)	12.00	242-C	1.750	1.118	1.118	4	779.31	110	26	38.75	36.0	28	1.375	—	270.0	82.0

NOTES:

Standard Proco Style 242-A Expansion Joints shown in Bold Type are considered Standards and are inventoried in large quantities.

1. "HW" denotes Heavy Weight Construction. For sizes 2" I.D. thru 12" I.D., Proco will only offer these items with 300 lb. drilling and are denoted by Q-242-HW. All Q-240-HW units will only be sold with control units.

2. Movements shown in the above tables are non-concurrent.

3. Calculation of Thrust (Thrust Factor). When expansion joints are installed in the pipeline, the static portion of the thrust is calculated as a product of the area of the I.D. of the arch of the expansion joint times the maximum pressure (design, test or surge) that will occur in the line. The result is a force expressed in pounds.

Take design, surge or test pressure X thrust factor to calculate end thrust.

4. Pressure rating is based on 170°F operating temperature. The pressure rating is reduced at higher temperatures.

5. Pressures shown at maximum "operating pressure". Test pressure is 1.5 times "operating pressure". Burst pressure is 4 times "operating pressure". If factory hydro-test is required, an additional joint per size must be purchased and tested. Once hydro-tested this joint may not be sent to field for installation as the beaded end will have taken a (compressed) set and can not be reused.

6. Vacuum rating is based on neutral installed length, without external load. Products should not be installed in extension for vacuum applications. Flattening of the arch in extended mode will cause the arch to collapse.

7. Style 242A/NN (neoprene elastomer only) expansion joints 1.0" I.D. thru 12" I.D. are available with tapped (threaded) holes and must be specified at time of order.

8. In addition to standard 150 lb. drilled flanges, Proco can provide expansion joints listed above in 300 lb. drilling, BS-10 (British) drilling, Metric PN10 and PN16 drilling and JIS 10kg/cm drilling.

"Effective Area"

Thrust Factor=

$$T = \frac{\pi}{4} (D)^2 (P)$$

T= Thrust

P= PSI (Design, Test or Surge)

D= Arch I.D.

Style 240/242 Drilling Chart

Table 4: Flange Drilling

 NOMINAL Pipe Size Inch (mm)	American 125/150# Conforms to ANSI B16.1 and B16.5						American 250/300# Conforms to ANSI B16.1 and B16.5					British Standard 10:1962 Conforms to BS 10 Table E				
	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Drilled Hole Size	Threaded Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size	Flange Thickness	Flange O.D.	Bolt Circle	No. of Holes	Hole Size
1 (25)	0.55 (14.0)	4.25 108.0	3.13 79.4	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	4.88 124.0	3.5 88.9	4 4	0.75 19.1	0.59 15.0	4.5 114.0	3.25 82.6	4 4	0.62 15.9
1.25 (32)	0.55 (14.0)	4.63 118.0	3.5 88.9	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	5.25 133.0	3.88 98.4	4 4	0.75 19.1	0.59 15.0	4.75 121.0	3.44 87.3	4 4	0.62 15.9
1.5 (40)	0.55 (14.0)	5.0 127.0	3.88 98.4	4 4	0.62 15.9	1/2 - 13 UNC	0.63 16.0	6.12 156.0	4.50 114.3	4 4	0.88 22.2	0.59 15.0	5.25 133.0	3.88 98.4	4 4	0.62 15.9
2 (50)	0.63 (16.0)	6.0 152.0	4.75 120.7	4 4	0.75 19.1	5/8 - 11 UNC	0.71 18.0	6.50 165.0	5.00 127.0	8 8	0.75 19.1	0.63 16.0	6.0 152.0	4.5 114.3	4 4	0.75 19.1
2.5 (65)	0.71 18.0	7.0 178.0	5.5 139.7	4 4	0.75 19.1	5/8 - 11 UNC	0.71 18.0	7.5 191.0	5.88 149.2	8 8	0.88 22.2	0.71 18.0	6.5 165.0	5.0 127.0	4 4	0.75 19.1
3 (80)	0.71 18.0	7.5 191.0	6.0 152.4	4 4	0.75 19.1	5/8 - 11 UNC	0.79 20.0	8.25 210.0	6.62 168.2	8 8	0.88 22.2	0.71 18.0	7.25 184.0	5.75 146.1	4 4	0.75 19.1
3.5 (90)	0.71 18.0	8.5 216.0	7.0 177.8	8 8	0.75 19.1	5/8 - 11 UNC	0.79 20.0	9.0 229.0	7.25 184.2	8 8	0.88 22.2	0.71 18.0	8.0 203.0	6.5 165.1	8 8	0.75 19.1
4 (100)	0.71 18.0	9.0 229.0	7.5 190.5	8 8	0.75 19.1	5/8 - 11 UNC	0.79 20.0	10.0 254.0	7.88 200.0	8 8	0.88 22.2	0.71 18.0	8.5 216.0	7.0 177.8	8 8	0.75 19.1
5 (125)	0.79 20.0	10.0 254.0	8.5 215.9	8 8	0.88 22.2	3/4 - 10 UNC	0.87 22.0	11.0 279.0	9.25 235.0	8 8	0.88 22.2	0.79 20.0	10.0 254.0	8.25 209.6	8 8	0.75 19.1
6 (150)	0.87 22.0	11.0 279.0	9.5 241.3	8 8	0.88 22.2	3/4 - 10 UNC	0.87 22.2	12.5 318.0	10.62 269.9	12 12	0.88 22.2	0.87 22.2	11.0 279.0	9.25 235.0	8 8	0.88 22.2
8 (200)	0.87 22.0	13.5 343.0	11.75 298.5	8 8	0.88 22.2	3/4 - 10 UNC	0.95 24.0	15.0 381.0	13.0 330.2	12 12	1.00 25.4	0.87 22.2	13.5 343.0	11.5 292.1	8 8	0.88 22.2
10 (250)	0.95 24.0	16.0 406.0	14.25 362.0	12 12	1.00 25.4	7/8 - 9 UNC	1.02 26.0	17.5 445.0	15.25 387.4	16 16	1.13 28.6	0.95 24.0	16.0 406.0	14.0 355.6	12 12	0.88 22.2
12 (300)	0.95 24.0	19.0 483.0	17.0 431.8	12 12	1.00 25.4	7/8 - 9 UNC	1.02 26.0	20.5 521.0	17.75 450.9	16 16	1.25 31.8	0.95 24.0	18.0 457.0	16.0 406.4	12 12	1.00 25.4
14 (350)	1.02 26.0	21.0 533.0	18.75 476.3	12 12	1.13 28.6	1 - 8 UNC	1.10 28.0	23.0 584.0	20.25 514.4	20 20	1.25 31.8	1.02 26.0	20.75 527.0	18.5 469.9	12 12	1.00 25.4
16 (400)	1.10 28.0	23.5 597.0	21.25 539.8	16 16	1.13 28.6	1 - 8 UNC	1.18 30.0	25.5 648.0	22.5 571.5	20 20	1.38 34.9	1.10 28.0	22.75 578.0	20.5 520.7	12 12	1.00 25.4
18 (450)	1.18 30.0	25.0 635.0	22.75 577.9	16 16	1.25 31.8	1 1/8 - 7 UNC	1.18 30.0	28.0 711.0	24.75 628.7	24 24	1.38 34.9	1.18 30.0	25.25 641.0	23.0 584.2	16 16	1.00 25.4
20 (500)	1.18 30.0	27.5 699.0	25.0 635.0	20 20	1.25 31.8	1 1/8 - 7 UNC	1.18 30.0	30.5 775.0	27.0 685.8	24 24	1.38 34.9	1.18 30.0	27.75 705.0	25.25 641.4	16 16	1.00 25.4
24 (600)	1.18 30.0	32.0 813.0	29.5 749.3	20 20	1.38 34.9	1 1/4 - 7 UNC	1.18 30.0	36.0 914.0	32.0 812.8	24 24	1.62 41.3	1.18 30.0	32.5 826.0	29.75 755.7	16 16	1.25 31.8
30 (750)	1.26 32.0	38.75 984.0	36.0 914.4	28 28	1.38 34.9	1 1/4 - 7 UNC	1.26 32.0	43.0 1092.0	39.25 997.0	28 28	2.00 50.8	1.26 32.0	39.25 997.0	36.5 927.1	20 20	1.38 34.9

Installation Instructions for Non-Metallic Expansion Joints with Beaded End Flanges

1. Service Conditions:

Make sure the expansion joint rating for temperature, pressure, vacuum*, movements and selection of elastomeric materials match the system requirements. Contact the manufacturer if the system requirements exceed those of the expansion joint selected.

(*Vacuum service for spherical rubber connectors: Vacuum rating is based on neutral installed length. These products should not be installed “extended” on vacuum applications.)

2. Alignment:

Expansion joints are not designed to make up for piping misalignment errors. Piping misalignment should be no more than 1/8” in any direction. Misalignment of an expansion joint will reduce the rated movements and can induce severe stress of the material properties, thus causing reduced service life.

3. Anchoring:

Anchors are required wherever the piping system changes direction. Expansion joints should be located as close as possible to anchor points. If an anchoring system is not used, it is recommended that control rods be installed on the expansion joint to prevent excessive movements from occurring due to pressure thrust of the line.

4. Pipe Support:

Piping must be supported so expansion joints do not carry any pipe weight.

5. Mating Flanges:

Install the expansion joint against the mating pipe flanges and install bolts so that the bolt head is against the expansion joint flange. Flange-to-flange dimension of the expansion joint must match the breech opening*. (*A spherical rubber connector must be compressed 1/8” to 3/16” during installation in order to obtain a correct installed face-to-face dimension.)

Make sure the mating flanges are clean and are a flat-faced type. When attaching beaded end flange expansion joints to raised face flanges, the use of metal gaskets are required to prevent metal flange faces from cutting rubber bead during installation.

Never install expansion joints next to wafer type check or butterfly valves. Serious damage to the rubber flange bead can result due to lack of flange mating surface and/or bolt connection.

6. Bolting Torque:

Table 8 shows the recommended torque values for non-metallic expansion joints with beaded end type-flanges: Tighten bolts in stages by alternating around the flange. Use the recommended torque values in Table 8 to achieve a good seal. Never tighten an expansion joint to the point that there is metal-to-metal contact between the expansion joint flanges and the mating flanges. A slight bulge in the rubber beaded end should create a flush tight seal.

Note: Torque values are approximate due to mating flange surfaces, installation offsets, operating pressures and environmental conditions.

7. Storage:

Ideal storage is in a warehouse with a relatively dry, cool location. Store flanges face down on a pallet or wooden platform. Do not store other heavy items on top of the expansion joints. Ten year shelf life can be expected with ideal conditions. If storage must be outdoors, place on a wooden platform and joints should not be in contact with the ground. Cover with a tarpaulin.

8. Large Joint Handling:

Do not lift with ropes or bars through the bolt holes. If lifting through the bore, use padding or a saddle to distribute the weight. Make sure cables or forklift tines do not contact the rubber. Do not let expansion joints sit vertically on the edges of the flanges for any period of time.

9. Additional Tips:

- A. Do not insulate over a non-metallic expansion joint. This facilitates inspection of the tightness of the joint bolting.
- B. It is acceptable (but not necessary) to lubricate the expansion joint flanges with a thin film of graphite dispersed in glycerin or water to ease disassembly at a later time.
- C. Do not weld in the near vicinity of a non-metallic joint.
- D. If expansion joints are to be installed underground, or will be submerged in water, contact manufacturer for specific recommendations.
- E. If the expansion joint will be installed outdoors, make sure the cover material will withstand ozone, sunlight, etc.
- F. Check the tightness of lead-free flanges two or three weeks after installation and retighten if necessary.

Warning: Expansion joints may operate in pipelines or equipment carrying fluids and/or gasses at elevated temperature and pressures and may transport hazardous materials. Precautions should be taken to protect personnel in the event of leakage or splash. Rubber joints should not be installed in areas where inspection is impossible. Make sure proper drainage is available in the event of leakage when operating personnel are not available.

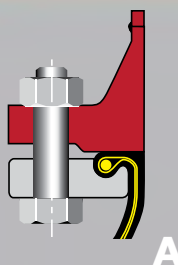
Installation Instructions for Non-Metallic Expansion Joints with Beaded End Flanges

Table 8: Bolt-Torque					
Nominal Pipe Size Expansion Joint I.D. Inch /(mm)	Step 1 FT-LBS (Nm)	Rest	Step 2 FT-LBS (Nm)	Rest	Step 3 FT-LBS (Nm)
1 (25)	18 (25)	30 Min	30 (40)	60 Min	45-60 (60-80)
1.25 (32)	18 (25)	30 Min	30 (40)	60 Min	45-60 (60-80)
1.5 (40)	18 (25)	30 Min	30 (40)	60 Min	45-60 (60-80)
2 (50)	18 (25)	30 Min	30 (40)	60 Min	45-60 (60-80)
2.5 (65)	18 (25)	30 Min	35 (50)	60 Min	50-60 (70-80)
3 (80)	25 (35)	30 Min	45 (60)	60 Min	60-75 (80-100)
3.5 (90)	25 (35)	30 Min	45 (60)	60 Min	60-75 (80-100)
4 (100)	25 (35)	30 Min	45 (60)	60 Min	60-75 (80-100)
5 (125)	25 (35)	30 Min	45 (60)	60 Min	60-75 (80-100)
6 (150)	30 (40)	30 Min	50 (70)	60 Min	60-75 (80-100)
8 (200)	30 (40)	30 Min	50 (70)	60 Min	60-75 (80-100)
10 (250)	30 (40)	30 Min	50 (70)	60 Min	75-85 (100-115)
12 (300)	30 (40)	30 Min	50 (70)	60 Min	75-85 (100-115)
14 (350)	30 (40)	30 Min	60 (80)	60 Min	75-95 (110-130)
16 (400)	30 (40)	30 Min	60 (80)	60 Min	75-95 (110-130)
18 (450)	30 (40)	30 Min	60 (80)	60 Min	90-95 (120-130)
20 (500)	30 (40)	30 Min	65 (90)	60 Min	95-185 (130-250)
24 (600)	30 (40)	30 Min	65 (90)	60 Min	95-185 (130-250)
30 (750)	30 (40)	30 Min	65 (90)	60 Min	95-220 (130-300)

Note: Bolt torque based on new bolts and nuts

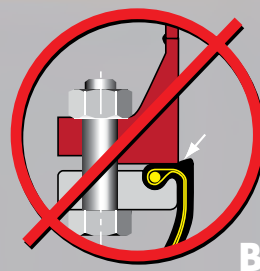
Right:

Flanges with correct ID help prevent damage to rubber.



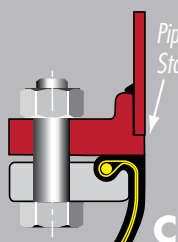
Wrong:

Insure matting flanges I.D. is flush with rubber.



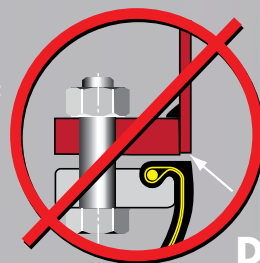
Right:

Weld neck flanges with correct ID prevent damage to rubber.



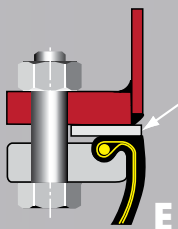
Wrong:

Uneven end of pipe can cause damage to rubber.



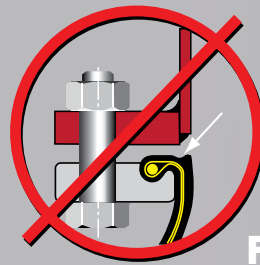
Right:

In case of B, D, F an additional metal gasket can be used to prevent damage to rubber.



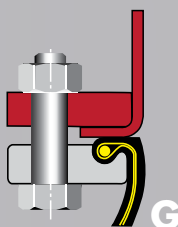
Wrong:

Inner edge of flanges damages rubber.

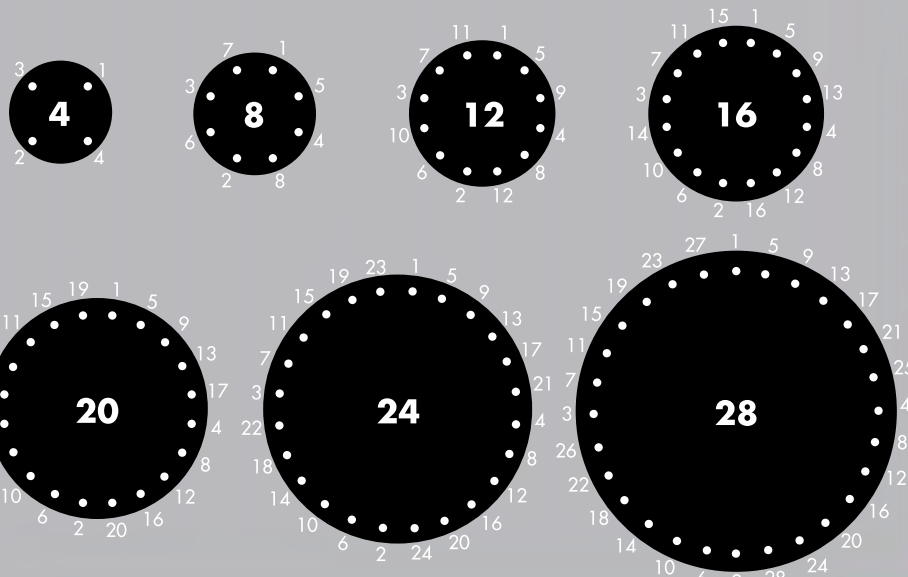


Right:

Well rounded smooth edge prevents damage to rubber.



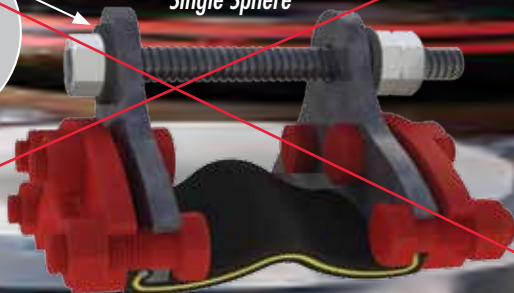
Tighten opposing nuts/bolts gradually according to the following sequence





240-ITR
Single Sphere

Optional
Spherical Washers



242-ITR
Twin Sphere

Optional
Spherical Washers



ALSO AVAILABLE FROM Proco Products, Inc.

Proco Products, Inc. can supply an Integral Tie Rod Design Joint when space prohibits use of typical rod designs.



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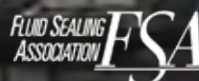
(209) 943-6088

email: sales@procoproducts.com

website: <http://www.procoproducts.com>

NATIONWIDE AND CANADA

INTERNATIONAL



REPRESENTED BY:

	MATERIAL SPECIFICATION HOSE FITTINGS	SPEC NO: 32.40
	UNIVERSAL HOSE COUPLING - MALLEABLE IRON	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Universal Hose Coupling, Malleable iron, male pipe thread on one end with other end for connecting to universal coupling.
RATING:	90 psig @ 140 DEG. F.
MANUFACTURER:	Chicago Pneumatic, or equal.
SIZES:	1/4" - C-36844Y 3/8" - C-36843Y 1/2" - C-36842Y 3/4" - C-36841Y 1" - C-36840Y NOTE: Above model number includes one standard type rubber gasket No. C-101158Y for air service. For water service use neoprene gasket No. C-101160Y.

Issue Date:

Revision Date:

Approved by Joseph P. McMahon on 10/30/98

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UNIVERSAL COUPLINGS



MALE NPT



Ductile Iron

npt size	part number	list each
3/8	UM-38	6.88
1/2	UM-2	5.72
3/4	UM-3	6.09
1	UM-4	6.83



Brass

3/8	UMB-38	—
1/2	UMB-2	—
3/4	UMB-3	—
1	UMB-4	—

316 Stainless

1/2	UMSS-2	44.71
3/4	UMSS-3	38.75
1	UMSS-4	41.73

UNIVERSALOCK™
COUPLINGS

HOSE END

Ductile Iron
(machined serrations)

hose size	part number	list each
3/8	UH-38	7.98
1/2	UH-2	4.99
5/8	UH-58	7.61
3/4	UH-3	5.15
1	UH-4	6.88

Brass
(machined serrations)

3/8	UHB-38	—
1/2	UHB-2	12.60
5/8	UHB-58	—
3/4	UHB-3	14.49
1	UHB-4	18.59

316 Stainless
(machined serrations)

1/2	UHSS-2	43.47
3/4	UHSS-3	36.71
1	UHSS-4	40.57

BLANK END



Ductile Iron

size	part number	list each
All	UB	9.82

Brass

All	UBB	—
-----	-----	---

THREE WAY



Ductile Iron

size	part number	list each
All	UTW	17.85

Brass

All	UTWB	—
-----	------	---

UNIVERSAL WASHER



Nitrile

size	part number	list each
All	UG	0.53

Never use Universal Washers
in UniversaLock Couplings

SAFETY CLIP



size	part number	list each
All	SC	0.26

TWO-BOLT
UNIVERSAL CLAMP

Ductile Iron

hose o.d. min to max	part no.	list each
3/4 to 15/16	UC-2	5.78
1 to 1-1/4	UC-3	5.83
1-1/4 to 1-17/32	UC-4	10.08

DISTRIBUTOR AUTHORIZATION

Safety is of paramount concern to everyone. Due to the volatile nature of compressed air, and in accordance with our ISO 9000 quality system, we reserve the right to restrict sales of our UniversaLock® Couplings to only those distributors authorized by Campbell Fittings.

Please contact our customer service department for more information.

HOSE END

Ductile Iron
(machined serrations)

hose size	part number	list each
1/2	ULH-2	19.10
3/4	ULH-3	19.10
1	ULH-4	19.10

MALE END



Ductile Iron

npt size	part number	list each
1/2	ULM-2	19.10
3/4	ULM-3	19.10
1	ULM-4	19.10

FEMALE END



Ductile Iron

npt size	part number	list each
1/2	ULF-2	19.10
3/4	ULF-3	19.10

UNIVERSALOCK WASHER



Nitrile

size	part number	list each
All	ULW	2.13

Never use UniversalLock Washers
in standard Universal Couplings

FEMALE NPT



Ductile Iron

npt size	part number	list each
3/8	UF-38	6.88
1/2	UF-2	6.30
3/4	UF-3	5.93
1	UF-4	7.72

Brass

3/8	UFB-38	—
1/2	UFB-2	—
3/4	UFB-3	—
1	UFB-4	—

316 Stainless

1/2	UFSS-2	44.71
3/4	UFSS-3	38.75
1	UFSS-4	41.73

 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION HOSE FITTINGS	SPEC NO: 32.60
	QUICK DISCONNECT MALE ADAPTER - ALUMINUM	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Quick disconnect male adapter, Aluminum, male NPT on one end with other end for connecting to quick disconnect female coupler.
RATING:	150 psig @ 100 DEG. F.
MANUFACTURER:	Dixon, Ever-Tite
SIZES:	1/2" thru 4"
MODELS:	Dixon "Andrews" line, type F, Ever-Tite Part F, or equal.

Issue Date: 04/16/90

Revision Date: 09/15/99

Approved by Matthew R. McGowan on 09/27/99

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Cam and Groove Information

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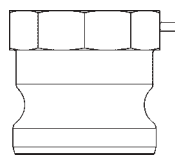
"EZ BOSS-LOCK"

No more fumbling with clamps, wire, clips or pins . .
*Just close the handles and the locking
 mechanism is engaged.*

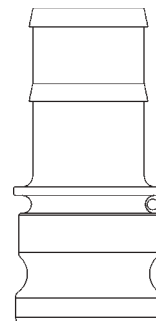
**Unlike other safety couplings . . .**

- The EZ Boss-Lock is extremely **EASY TO OPEN!!!** The release lever is under your thumb when you want to open the fitting. **ERGONOMIC.**
- The EZ Boss-Lock is resistant to accidental disconnection when being dragged. The release lever opens in the direction opposite to the cam arm, so movements that tend to open the release lever also tend to close the cam arm!!!
- The EZ Boss-Lock alerts you if it is not properly engaged. If the rotating lever is not flush with the handle, it is not properly engaged.
- The EZ Boss-Lock has no sliding pins to jam. The EZ Boss-Lock's rotating action helps keep the locking device free of debris.
- The EZ Boss-Lock has no sliding pins to pop open. The EZ Boss-Lock is designed to protect critical parts from impact and to withstand rugged use.
- The EZ Boss-Lock can be supplied with special shanks custom suited to your needs. The EZ Boss-Lock is available with Swaged and PF shank designs, for hard to couple chemical hoses.
- The EZ Boss-Lock cam arm assemblies are made of investment cast Stainless Steel with plated Carbon Steel pull rings.
- The EZ Boss-Lock is easier to insert into the hose tubes on Tank Trucks, and easier to use in restricted spaces. This is due to the smaller maximum O.D. and a more snag free exterior.
- The EZ Boss-Lock Cam Arm assemblies can be retrofitted onto Undamaged Stainless Steel Boss-Lock. This allows you to protect your investment in Stainless Steel Boss-Lock couplings while you upgrade.
- The EZ Boss-Lock is Made in the USA.

All measurements in this brochure are for reference only and are subject to change. Where dimensions are critical, please consult the factory. For products not shown or special application questions, please consult the factory.

CAM & GROOVE LINE DRAWINGS

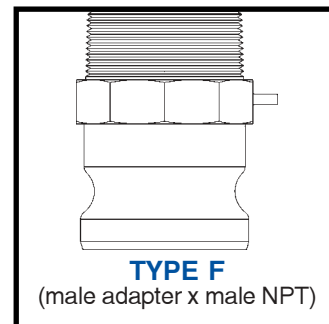
TYPE A
 (male adapter x female NPT)



TYPE E
 (male adapter x hose shank)



TYPE B
 (female coupler x male NPT)



TYPE F
 (male adapter x male NPT)



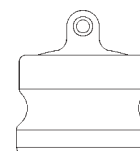
TYPE C
 (female coupler x hose shank)



TYPE DC *
 (dust cap)



TYPE D
 (female coupler x female NPT)



TYPE DP *
 (dust plug)

NOTE: Line drawings are representative of the Dixon / "Andrews" line of cam and groove.

* Dust Caps and Dust Plugs are NOT to be used in Pressure Applications for safety and environmental reasons.

WARNING:
UNDER NO CIRCUMSTANCES
should Cam and Groove couplings
be used for compressed air
or steam service!

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Dixon "Andrews" / "Boss-Lock" Type F Adapters



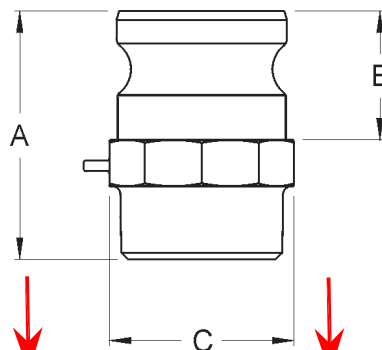
Male Adapter x Male NPT

	Aluminum	Aluminum Hard Coat	Brass	Unplated Malleable Iron	Plated Malleable Iron	Stainless Steel
Size	Part #	Part #	Part #	Part #	Part #	Part #
1/2"	50-F-AL	----	50-F-BR	----	----	50-F-SS
3/4" x 1/2"	7550-F-AL	----	7550-F-BR	----	----	7550-F-SS
3/4"	75-F-AL	----	75-F-BR	----	75-F-PM	75-F-SS
1"	100-F-AL	----	100-F-BR	----	100-F-PM	100-F-SS
1 1/4"	125-F-AL	----	125-F-BR	----	----	125-F-SS
1 1/2"	150-F-AL	150-F-ALH	150-F-BR	150-F-MI	150-F-PM	150-F-SS
2"	200-F-AL	200-F-ALH	200-F-BR	200-F-MI	200-F-PM	200-F-SS
2 1/2"	250-F-AL	----	250-F-BR	----	250-F-PM	250-F-SS
3"	300-F-AL	300-F-ALH	300-F-BR	300-F-MI	300-F-PM	300-F-SS
4"	400-F-AL	400-F-ALH	400-F-BR	400-F-MI	400-F-PM	400-F-SS
5"	500-F-AL	----	----	----	----	----
6"	600-F-AL	600-F-ALH	600-F-BR	----	600-F-PM	600-F-SS
8" AND*	800-F-AL	----	----	----	----	----
8" BL*	801-F-AL	----	----	----	----	----

* "Andrews" and "Boss-Lock" Cam and Groove Couplings **DO NOT INTERCHANGE IN THE 8" SIZE.**

- The 8" "Boss-Lock" were designed to interchange with 8" Cam & Groove Couplings manufactured by P.T. Coupling.

SAFETY
ALERT



ALUMINUM, BRASS and MALLEABLE IRON DIMENSIONS

Size	1/2"	3/4" x 1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8" AND	8" BL
A Overall Length	2 1/8	2 7/16	2 1/16	2 3/8	2 15/16	3 5/32	3 17/32	4 3/8	4 15/32	4 21/32	4 1/2	5 17/32	6 15/16	6 3/8
B Adapter Length	1	1	1	1 5/16	1 9/16	1 5/8	1 7/8	1 15/16	2	2 1/16	2 5/16	2 1/4	3 9/16	3 1/16
C Distance Across Flats	1	1 5/16	1 3/8	1 1/2	1 7/8	2 1/4	2 11/16	3 1/4	3 3/4	5	6 1/2*	8 1/32*	10 5/8*	10 5/8*

STAINLESS STEEL DIMENSIONS

Size	1/2"	3/4" x 1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8" AND	8" BL
A Overall Length	2 1/8	2 1/4	2 1/16	2 23/32	2 15/16	3 1/8	3 21/32	4 5/16	4 17/32	4 59/64	-----	4 15/16	-----	-----
B Adapter Length	1	1	1	1 5/16	1 9/16	1 5/8	1 7/8	1 15/16	2	2 1/16	-----	2 1/4	-----	-----
C Distance Across Flats	1	1 5/16	1 5/16	1 1/2	1 7/8	2 1/4	2 11/16	3 1/4	3 3/4	5	-----	7 3/4*	-----	-----

* Distance Over Lugs

	MATERIAL SPECIFICATION HOSE FITTINGS	SPEC NO: 32.61
	QUICK DISCONNECT FEMALE COUPLER - ALUMINUM	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Quick disconnect female coupler, Aluminum, Buna-N gaskets, male NPT on one end with other end for connecting to quick disconnect male adapter.
RATING:	150 psig @ 100 DEG. F.
MANUFACTURER:	Dixon, Ever-Tite
SIZES:	1/2" thru 4"
MODELS:	Dixon "Andrews" line - type B, Ever-Tite Part B, or equal.

Issue Date: 07/16/92

Revision Date: 09/15/99

Approved by Matthew R. McGowan on 09/27/99

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Cam and Groove Information

3

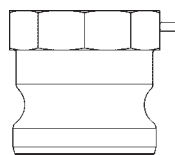
"EZ BOSS-LOCK"

No more fumbling with clamps, wire, clips or pins . .
*Just close the handles and the locking
 mechanism is engaged.*

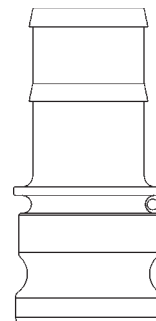
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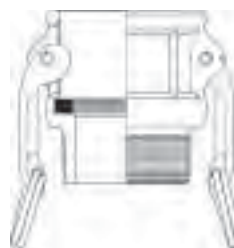
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CAM & GROOVE LINE DRAWINGS

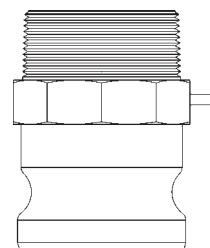
TYPE A
 (male adapter x female NPT)



TYPE E
 (male adapter x hose shank)



TYPE B
 (female coupler x male NPT)



TYPE F
 (male adapter x male NPT)



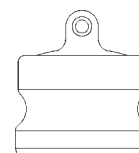
TYPE C
 (female coupler x hose shank)



TYPE DC *
 (dust cap)



TYPE D
 (female coupler x female NPT)



TYPE DP *
 (dust plug)

NOTE: Line drawings are representative of the Dixon / "Andrews" line of cam and groove.

* Dust Caps and Dust Plugs are NOT to be used in Pressure Applications for safety and environmental reasons.

WARNING:
UNDER NO CIRCUMSTANCES
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or steam service!

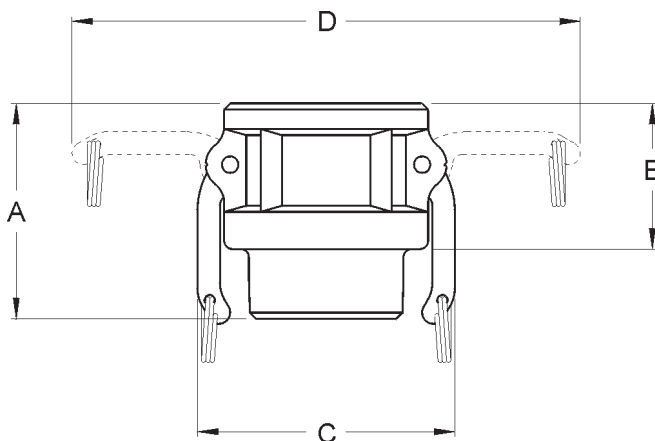
SAFETY
ALERT

Dixon "Andrews" Type B Couplers



Female Coupler x Male NPT

	Aluminum	Aluminum Hard Coat	Brass	Unplated Malleable Iron	Stainless Steel
Size	Part #	Part #	Part #	Part #	Part #
1/2"	50-B-AL	----	50-B-BR	----	50-B-SS
3/4"	75-B-AL	----	75-B-BR	----	75-B-SS
1"	100-B-AL	----	100-B-BR	----	100-B-SS
1 1/2"	150-B-AL	150-B-ALH	150-B-BR	150-B-MI	150-B-SS
2"	200-B-AL	200-B-ALH	200-B-BR	200-B-MI	200-B-SS
2 1/2"	----	----	----	----	250-B-SS
3"	300-B-AL	300-B-ALH	300-B-BR	----	300-B-SS
4"	400-B-AL	400-B-ALH	400-B-BR	300-B-MI	400-B-SS
5"	500-B-AL	----	----	400-B-MI	600-B-SS
6"	600-B-AL	600-B-ALH	----	----	----
8" *	800-B-AL	----	----	----	----



* "Andrews" and "Boss-Lock" Cam and Groove Couplings **DO NOT INTERCHANGE IN THE 8" SIZE.**

• See "Boss-Lock" for 1 1/4" and 2 1/2" couplers.

• The 8" "Andrews" design has 4 cam arms.

• **Finger rings are not supplied on 1/2" - 1" "Andrews" couplings.**

• 1/2" Andrews has only one cam arm.

**SAFETY
ALERT**

~~ALUMINUM, BRASS and MALLEABLE IRON DIMENSIONS~~

Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"
A Overall Length	2	2 3/16	2 17/32	2 7/8	2 13/16	3 9/32	----	3 15/16	4 1/32	4 3/16	4 7/16	8 7/16
B Coupler Length	1 7/32	1 3/8	1 19/32	1 31/32	1 29/32	2 7/32	----	2 15/16	2 11/32	2 5/16	2 5/8	3 13/16
C Distance Across Closed Cam Arms	1 17/32	2 1/8	2 7/16	3 1/4	3 9/16	3 15/16	----	5 15/32	6 9/16	7 9/16	10 3/32	12 1/32
D Distance Across Open Cam Arms	2 11/16	4 3/8	5 3/16	7 5/32	7 7/16	7 13/16	----	10 3/32	11 3/16	12 3/16	16 1/4	19 31/32

~~STAINLESS STEEL DIMENSIONS~~

Size	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"
A Overall Length	1 7/8	2 1/8	2 9/16	2 27/32	2 31/32	3 9/32	3 7/16	3 59/64	4 1/64	----	4 35/64	----
B Coupler Length	1 1/4	1 1/4	1 9/16	1 29/32	1 29/32	2 7/32	2 1/4	2 9/32	2 9/32	----	2 19/32	----
C Distance Across Closed Cam Arms	1 17/32	2 1/8	2 7/16	3 1/4	3 9/16	3 15/16	4 7/16	5 15/32	6 9/16	----	10 3/32	----
D Distance Across Open Cam Arms	2 11/16	4 3/8	5 3/16	7 5/32	7 7/16	7 13/16	8 11/32	10 3/32	11 3/16	----	16 1/4	----

	MATERIAL SPECIFICATION CARBON STEEL PIPE	SPEC NO: C02
	CARBON STEEL PIPE WITH STEEL FITTINGS	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Carbon steel pipe with steel fittings
RATING:	125 PSIG @ 350 DEG. F, 200 PSIG @ 150 DEG. F, Includes corrosion allowance of 0.050" min.
CONSTRUCTION:	Screwed for 1 1/2" and smaller, welded and/or flanged for 2" and larger.
PIPE:	Carbon steel, ASTM A53, Grade B: Threaded, schedule 80, seamless, 1 1/2" and smaller, plain end, schedule 40, seamless, 2" to 10", Plain end, 3/8" wall, seamless, 12" and above.
FITTINGS:	3000 lb ANSI B16.11, forged steel, threaded ends, 1 1/2" and smaller. Schedule 40, ANSI B16.9, ASTM A234, Grade WPB, carbon steel, butt welding ends, 2"-12". 3/8" wall, ANSI B16.9, ASTM A234, Grade WPB, carbon steel, butt welding ends, 14" to 24", or 125# flanged cast iron elbows and tees, ASTM A126, Class B with 125# ANSI B16.1 drilling with dimensions per ANSI A21.10 (AWWA C110). Location of tapped holes for drains shall be in accordance with ANSI B16.1. Use thread-o-lets on branch connections 1-1/2" and smaller, use stub-in or reducing tee connections for 2" and above.
UNIONS:	3000 lb forged steel, ASTM A105, Grade 2, integral steel seat, ground joint, threaded ends.
FLANGES:	150 lb ANSI B16.5, ASTM A105 forged carbon steel, slip-on, weld neck, or MSS lap joint/stub end for 2" and larger, threaded 1 1/2" and smaller. Where bolting to flat face cast iron flanges, flanges shall be furnished with a flat face. Others shall be raised face.

Issue Date: 12/01/89

Revision Date: 03/25/2008

Approved by Joseph P. McMahon on 03/25/2008

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	MATERIAL SPECIFICATION CARBON STEEL PIPE	SPEC NO: C13
	GALVANIZED CARBON STEEL PIPE	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Galvanized carbon steel pipe with galvanized iron or steel fittings.
RATING:	275 PSIG @ -20 to 150 DEG. F 215 PSIG @ 350 DEG. F Includes corrosion allowance of 0.050" minimum.
CONSTRUCTION:	Screwed 3" and smaller No bending permitted
PIPE:	Galvanized carbon steel, ASTM A53: Threaded, schedule 40, butt welded seam 2" and smaller. Threaded schedule 40, butt welded seam or seamless, 2 1/2" and 3".
FITTINGS:	150 lb., ANSI B16.3, ASTM A197, galvanized malleable iron, banded, threaded ends.
UNIONS:	150 LB., ASTM A197, galvanized malleable iron, integral iron seat, ground joint, threaded ends.
FLANGES:	150 lb., ANSI B16.5, ASTM A105, Grade 1, galvanized forged carbon steel, threaded. Where bolting to flat face cast iron flanges, steel flanges shall be furnished with a flat face. Others shall be raised face
ORIFICE FLANGES:	Instrument item.
BOLTING:	See attached Fastener Specification F03.
GASKETS:	See attached Gasket Specification G02.

Issue Date: 12/01/89

Revision Date: 04/10/92

Approved by Gerald Kirner on 11/09/2005

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	FASTENER	SPEC NO: F03
	MATERIAL SPECIFICATION	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Hex Bolt, low or medium carbon steel, ASTM A307 Grade B. 1/4" through 4" Proof load 55,000 psi. 1/4" through 4" Tensile strength: 60,000 psi minimum, 100,000 psi maximum. Zinc plated. Threads to be UNC unless specified UNF bolts to include (1) heavy hex nut, ASTM A563, Grade A.

Issue Date	Revision Date	Approved By	Approval Date
September 30, 2021		Robert Sprowls	September 30, 2021

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 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION GASKET	SPEC NO: G-46
	1/8" EPDM RUBBER (FDA)	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	EPDM, Color: Off-White, 1/8" thick.
RATING:	Durometer (Shore A +/- 5): 60
MANUFACTURER:	Garlock or equal.
SIZES:	Pipe gasket flange dimension per ANSI B16.21
MODELS:	Garlock- 8316 or equal.
SPECIFICATIONS:	Meets FDA Requirements
SERVICE CONDITIONS:	Temperature: -40 thru 300 degrees F. Pressure: 250 psig

Issue Date	Revision Date	Approved By	Approval Date
August 5, 2021		Robert Sprowls	August 5, 2021

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 CalgonCarbon <i>A Kuraray Company</i>	MATERIAL SPECIFICATION	SPEC NO: IS008
	PRESSURE INDICATING GAGES	
	PI-213 TO PI-218; PI-448 TO PI-560	

SAP PART NUMBER:				
CCC DRAWING NUMBER:				
MATERIAL:	As listed below:			
	Case:	4-1/2" size, stainless steel, steel, brass, aluminum and phenol.		
	Socket:	1/2" NPT male bottom connection, stainless steel.		
	Dial:	White litho with black figures.		
	Pointer:	Balanced micrometer.		
	Bourdon Tube:	Stainless steel.		
	Movement:	Stainless steel and Delrin.		
	Accuracy:	1% of full range.		
	Liquid Fill:	None		
RATING:	Temperature range of -4 DEG. F. to +150 DEG. F.			
MANUFACTURER:	Ashcroft, WIKA			
MODELS:	Ashcroft "Duragauge" - 1279, WIKA 232.34			
NOTES:	As listed below:			
	1. Spec. IS008 replaces Spec. No. 7209A-CS263			
	2. This specification replaces the Specs. listed below.			
RANGE:	As listed below:			
	ITEM NO.	SCALE RANGE	REPLACES THESE ITEMS	
	PI-213	0-15 PSIG	PI-101,7	SPEC. No. 7209A-CS161,2 (IS001,2)
	PI-214	0-30 PSIG	PI-102,8	SPEC. No. 7209A-CS161,2 (IS001,2)
	PI-215	0-60 PSIG	PI-103,9	SPEC. No. 7209A-CS161,2 (IS001,2)
	PI-216	0-100 PSIG	PI-104,10	SPEC. No. 7209A-CS161,2 (IS001,2)
	PI-217	0-160 PSIG	PI-105,11	SPEC. No. 7209A-CS161,2 (IS001,2)
	PI-218	0-200 PSIG	PI-106,12	SPEC. No. 7209A-CS161,2 (IS001,2)
	PI-448	0-300 PSIG		
	PI-557	0-300 PSIG *		
	PI-449	0-400 PSIG		
	PI-556	0-400 PSIG *		
	PI-450	0-800 PSIG		
	PI-558	0-800 PSIG *		
	PI-559	0-1500 PSIG		
	PI-560	0-1500 PSIG *		*With Steam Coil Siphon
GENERAL REQUIREMENTS:	Tag each assembly with Item No. and Service.			

Issue Date: 01/01/89

Revision Date: 12/16/2005

Approved by Gerald Kirner on 03/21/2006

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Bourdon Tube Pressure Gauges Solid-Front Process Gauge - SS Wetted Parts

→ **Type 232.34 - Dry Case**

Type 233.34 - Liquid-filled Case

WIKA Datasheet 23X.34

Applications

- For applications with high dynamic pressure pulsations or vibration a liquid filled case and socket restrictor are available
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petrochemical, power stations, mining, on and offshore, environmental technology, mechanical engineering and plant construction

Special features

- Excellent load-cycle stability and shock resistance
- Solid front thermoplastic case
- Positive pressure ranges to 30,000 psi
- All lower mount connection gauges are factory prepared for liquid filling

(LBM: must install membrane prior to field filling)

Standard Features

Design

ASME B40.100

Sizes

4½" & 6" (115 & 160 mm) dial size

Accuracy class

± 0.5% of span (ASME B40.100 Grade 2A)

→ ± 1.0% of span (ASME B40.100 Grade 1A)
(for 20,000 psi range and above)

Ranges

Vacuum / Compound to 200 psi

Pressure from 15 psi to 30,000 psi

or other equivalent units of pressure or vacuum

Working pressure

Steady: full scale value

Fluctuating: 0.9 x full scale value

Short time: 1.5 x full scale value

Operating temperature

Ambient: -40°F to +150°F (-40°C to +66°C) - dry

-4°F to +150°F (-20°C to +66°C) - glycerine filled

-40°F to +150°F (-40°C to +66°C) - silicone filled

Medium: max. +212°F (+100°C) (See Note 1 on reverse)

Temperature error

Additional error when temperature changes from reference temperature of 68°F (20°C) ±0.4% for every 18°F (10°C) rising or falling. Percentage of span.



Bourdon Tube Pressure Gauge Model 232.34

Weather protection

Weather resistant (NEMA 3 / IP54) - without membrane

→ Weather tight (NEMA 4X / IP65) - dry case or filled case with membrane installed

Pressure connection

Material: 316L stainless steel

Lower mount (LM) or lower back mount (LBM)

1/4" or 1/2" NPT with M4 internal tap

Restrictor

Material: Stainless steel (0.6 mm)

Bourdon tube

Material: 316L stainless steel

≤ 1,000 PSI: C-type

≥ 1,500 PSI: helical type

Movement

Stainless steel. Internal stop pin at 1.3 x full scale

Overload and underload stops - standard

Dampened movement - optional

Dial

White aluminum with black lettering, stop pin at 6 o'clock

Pointer

Black aluminum, adjustable

Case

Black fiberglass-reinforced thermoplastic (POCAN)

Solid front, blowout back

Turret-style case with built in rear flange lugs

Window

Clear acrylic with Buna-N gasket

Case filling

~~Glycerine 99.7% — Type 233.34~~

Cycle testing

400,000 - 2,000,000* cycles, depending upon pressure range

* Liquid filled

Note 1: The maximum continuous media temperature for this gauge is 212°F. However, higher temperatures can be maintained safely for short term exposure per table to the right. The user should consider temperature error and gauge component degradation when exposing gauge to any media or ambient temperature above 212°F. For continuous use in either ambient or media temperatures above 212°F, a diaphragm seal or other heat dissipating means is recommended. Consult factory for technical inquiries and application assistance.

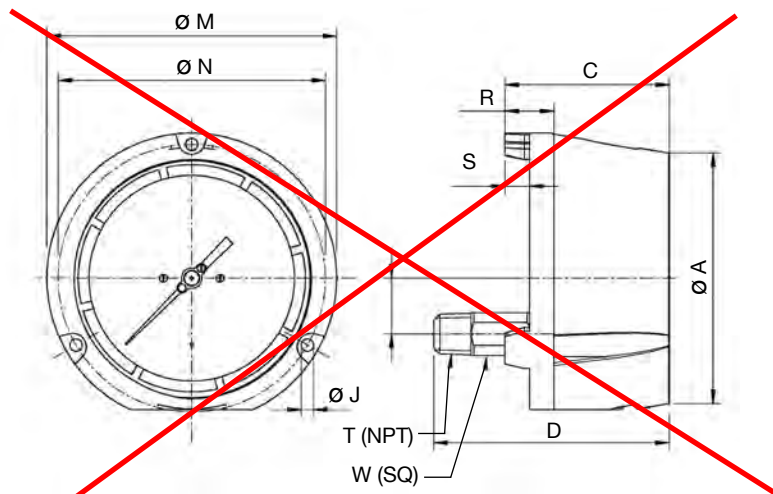
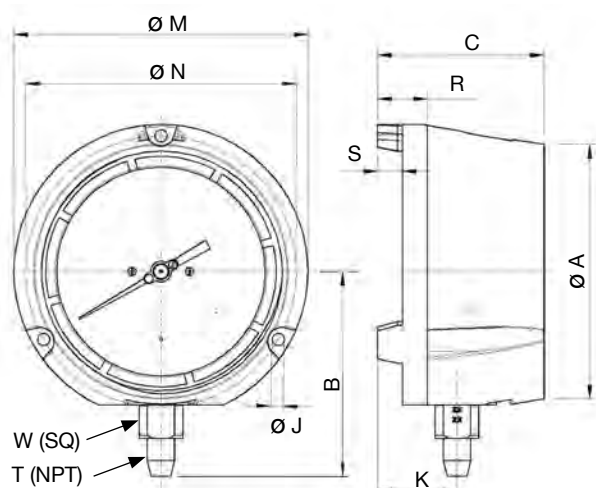
Optional extras

- ~~■ Silicone dampened movement~~
- ~~■ Panel mounting adaptor kit (field assembled)~~
- ~~■ Silicone case filling~~
- ~~■ Halocarbon case filling~~
- ~~■ Cleaned for oxygen service~~
- ~~■ Instrument glass or safety glass window~~
- ~~■ Drag pointer (maximum reading indicator)~~
- ~~■ Alarm contacts switches (magnetic or inductive)~~
- ~~■ Special process connections~~
- ~~■ Custom dial layout~~
- ~~■ External zero adjustment~~

Short term, intermittent maximum media temperature limits
(Optional glass window required for all these temperatures)

500°F (260 °C) -	Dry Gauge
250°F (130°C) -	Liquid filled gauge
300°F (150°C) -	Dampened movement gauge

Dimensions



Size

		A	B	C	D	J	K	L	M	N	R	S	T	W	Weight ¹
4.5"	mm	128	103	84	120.3	6.3	40	28.5	148	136.5	25	12.5		22	2 lb. dry
	in	5	4.06	3.31	4.74	0.248	1.57	1.12	5.83	5.37	0.99	0.49	1/2"	0.87	3 lb. filled
6"	mm	164	122.5	88	123.4	7.1	40.2	28.5	190	177.8	25.4	12.7		22	3 lb. dry
	in	6.46	4.82	3.46	4.86	0.28	1.58	1.12	7.5	7	1	0.5	1/2"	0.87	4 lb. filled

¹ Weight without optional accessories

Ordering information

Pressure gauge model / Nominal size / Scale range / Size of connection / Optional extras required
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.
Modifications may take place and materials specified may be replaced by others without prior notice.



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E-Mail info@wika.com
www.wika.com

	MATERIAL SPECIFICATION RUPTURE DISKS	SPEC NO: IS044
	DWC GRAPHITE RUPTURE DISKS	

SAP PART NUMBER:																																								
CCC DRAWING NUMBER:																																								
MATERIAL:	Impervious graphite Type: Standard.																																							
FLANGES:	150 # ANSI RF or FF companion flanges (furnished by others)																																							
MANUFACTURER:	Zook, BS&B																																							
SIZES:	As listed below: <table><tr><th>ITEM NO.</th><th>SIZE</th><th>BURSTING PRESSURE</th></tr><tr><td>PSE-157</td><td>2"</td><td>75 PSIG +/- 5%</td></tr><tr><td>PSE-170</td><td>2"</td><td>125 PSIG +/- 5%</td></tr><tr><td>PSE-252</td><td>3"</td><td>75 PSIG +/- 5%</td></tr><tr><td>PSE-307</td><td>3"</td><td>100 PSIG +/- 5%</td></tr><tr><td>PSE-577</td><td>3"</td><td>125 PSIG +/- 5%</td></tr><tr><td>PSE-305</td><td>3"</td><td>150 PSIG +/- 5%</td></tr><tr><td>PSE-605</td><td>3"</td><td>200 PSIG +/- 5%</td></tr><tr><td>PSE-582</td><td>4"</td><td>75 PSIG +/- 5%</td></tr><tr><td>PSE-583</td><td>4"</td><td>100 PSIG +/- 5%</td></tr><tr><td>PSE-580</td><td>4"</td><td>125 PSIG +/- 5%</td></tr><tr><td>PSE-581</td><td>4"</td><td>150 PSIG +/- 5%</td></tr><tr><td>PSE-606</td><td>4"</td><td>200 PSIG +/- 5%</td></tr></table>	ITEM NO.	SIZE	BURSTING PRESSURE	PSE-157	2"	75 PSIG +/- 5%	PSE-170	2"	125 PSIG +/- 5%	PSE-252	3"	75 PSIG +/- 5%	PSE-307	3"	100 PSIG +/- 5%	PSE-577	3"	125 PSIG +/- 5%	PSE-305	3"	150 PSIG +/- 5%	PSE-605	3"	200 PSIG +/- 5%	PSE-582	4"	75 PSIG +/- 5%	PSE-583	4"	100 PSIG +/- 5%	PSE-580	4"	125 PSIG +/- 5%	PSE-581	4"	150 PSIG +/- 5%	PSE-606	4"	200 PSIG +/- 5%
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PSE-606	4"	200 PSIG +/- 5%																																						
MODELS:	Zook - Mono Type Disk, BS&B - Monobloc Model MB																																							
SPECIFICATIONS:	ASME UD stamp required.																																							
NOTES:	As listed below: 1. Tag with Item No. and Service. 2. Vacuum Support: Furnish for disks with bursting pressure of 15 psig or less																																							
SERVICE CONDITIONS:	As listed below: <table><tr><td>Fluid Under Disks</td><td>Water</td></tr><tr><td>Pressure Fluctuation:</td><td>Back Pressure:</td></tr><tr><td>Temperature:</td><td>40 to 150 degrees F.</td></tr><tr><td>Operating Pressure:</td><td>80% of bursting pressure.</td></tr><tr><td>Back Pressure:</td><td>Atmospheric.</td></tr></table>	Fluid Under Disks	Water	Pressure Fluctuation:	Back Pressure:	Temperature:	40 to 150 degrees F.	Operating Pressure:	80% of bursting pressure.	Back Pressure:	Atmospheric.																													
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Issue Date	Revision Date	Approved By	Approval Date
September 29, 2022		Robert Sprowls	September 29, 2022

PROPRIETARY AND CONFIDENTIAL

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ZOOK®

Graphite Rupture Disks



ASME
CERTIFIED

ISO 9001



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E-Mail **zook@zook.cc**
www.zook.cc

ZOOK Rupture Disks provide many exclusive performance and service benefits. Information contained in this bulletin **should not** be applied to other rupture disks including impervious graphite designs of similar appearance.

ZOOK® Graphite Rupture Disks...

protect equipment and personnel from the effects of overpressurization in static and dynamic pressurized systems. The disk is designed to rupture at a predetermined burst rating when installed in a piping system.

Each disk is made from a single piece of graphite, a high-purity form of carbon, which is impregnated with phenolic resin. The resulting material, called impervious graphite, is impermeable and is resistant to most corrosives.

Easy to install and maintain, disks:

- are tamperproof
- have no springs or moving parts
- mount directly between standard flanges without special holders.

Options and accessories increase the flexibility of standard disks. TFE coated disks offer stick-resistant surfaces. Special gaskets and stainless steel armor are also available. Spacer rings let you replace metal rupture disks without requiring piping modification. For unique applications, our engineering department will work with you to create a custom-designed disk.

ZOOK is the first and largest company in the world committed to manufacturing QUALITY impervious graphite rupture disks, through product innovations and superior service. ZOOK is the first graphite rupture disk manufacturer to earn the ASME Code UD symbol stamp and certificate of authorization. Also, ZOOK's quality management system is certified to ISO 9001 and TÜV standards.

In addition:

- ZOOK offers 1-day shipment of disks with over 100 rating and diameter combinations. Service personnel are also available 24 hours-a-day, 7 days-a-week, 365 days-a-year to handle your emergency shut-down needs

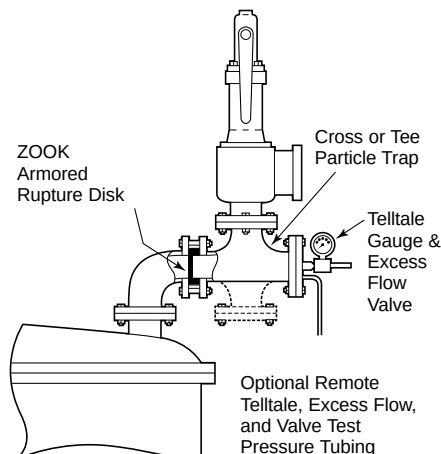
- produces a standard line of graphite disks as small as 1/2" diameter and disks with burst ratings as low as 0.25 psig
- tests disk performance at cryogenic and elevated temperatures

Applications

ZOOK Disks enhance *SAFETY* in chemical, petrochemical, pharmaceutical, food, medical, and related processing systems around the world. Other applications include: storage tanks, tank trailers, rail cars, barges, pressured switchgear, and air conditioning compressors.

ZOOK Disks also increase *system efficiency* by:

- eliminating back pressure effects on overpressure devices in common vent lines
- solving sourcing and cost problems for disks used with highly corrosive fluids
- offering ultra low rated pressure settings
- preventing relief valves from fouling and leaking



Installation

ZOOK Graphite Rupture Disks fit directly between standard flanges without the need for additional holders.

A flow arrow on each disk indicates proper orientation.

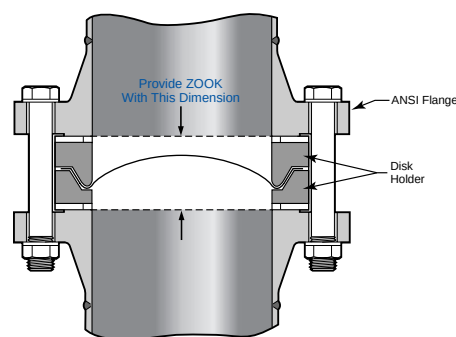
Armor provides additional protection from extraneous stress to the disk resulting from misaligned piping. Armor is standard on selected diameter and burst ratings and is required in fire case and toxic services. See ARMOR, page 7, for more information.

Gaskets should be ring type, non-metallic, relatively soft, and properly sized. See GASKETS, page 8, for more information.

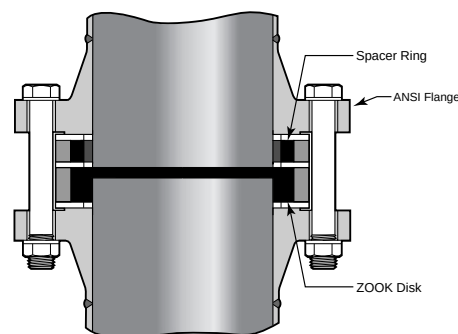
Normal good practice should be followed when making flange connections. Particular attention should be paid to ensure:

- concentric alignment of the disk and gaskets
- uniform cross-tightening of flange bolts
- adequate support of piping to withstand external loading and thrust during blowdown
- protection of personnel and equipment against high velocity open discharge of process material and rupture disk particles

METAL Rupture Disk Installation



Graphite Rupture Disk Replacement



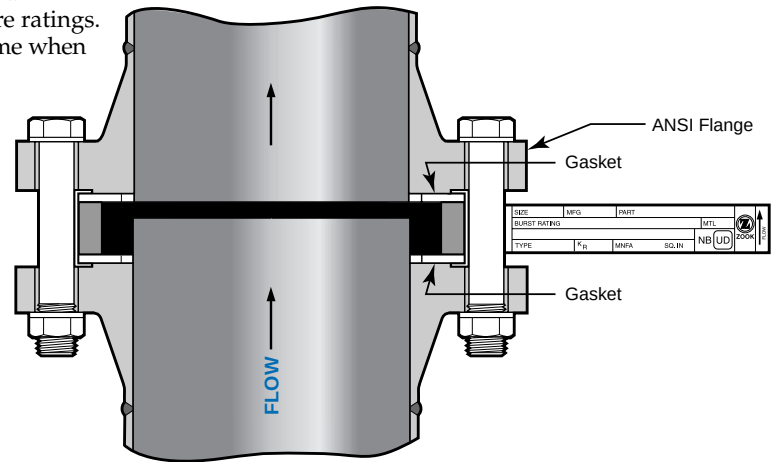
When replacing a metal rupture disk with a ZOOK Graphite Rupture Disk, a graphite lined armored spacer ring can be provided to fill the space of existing flange face-to-face distance, eliminating the need for piping modifications.

Detailed installation instructions are provided with each disk.

MONO Type Disks

the best choice for low and intermediate burst ratings

- Sizes 1/2" thru 24" diameters
 - Designed to fit ANSI Class 150 flanges (Higher ratings to fit Class 300 flanges are furnished in the INVERTED and DUPLEX Type Disks)
 - Burst ratings 0.25 to 150 psig
 - 0% manufacturing range
 - Operating pressures to 90% of the disk's marked burst pressure (Consult ZOOK for operating ratio for burst pressures below 15 psig)
 - Temperature ratings -290°F to +700°F (-179°C to +371°C). Maximum temperature rating without insulation is 430°F (221°C) or 700°F (371°C) with insulation. Consult ZOOK for higher temperature ratings. The specified temperature shall be at the disk location at the time when the disk is expected to rupture
 - Counterbored side of the disk contacts the process media
 - Vacuum supports are available for ratings below 25 psig
 - May be configured to withstand high back pressure generated in closed piping systems – request Bak-Pressure™ bulletin
 - Stocked MONO Disks, ready for immediate shipment
 - Sizes: 1", 1-1/2", 2", 3", 4", 6", 8" to fit ANSI Class 150 flanges
 - Burst Ratings: 10, 15, 20, 25, 30, 40, 50, 75, 100, 125, 150 psig @ 72°F (22°C)
- Note: Sizes 6" and 8" with burst ratings 125 and 150 psig @ 72°F (22°C) are stocked in INVERTED type
- ASME UD stamping available



Certified Flow Resistance Factor (K_f)

Support Style	K _f
MONO – no support	0.26
MONO – with bar	2.40
MONO – with cross	5.40
MONO – with ring	6.44
MONO – with plate	15.70

Required Vacuum Support Style for Full Vacuum Service

Size	Burst Rating	Support Style
1"	below 25 psig	MONO – with ring
1-1/2"	below 25 psig	MONO – with bar
2" - 14"	9 to 25 psig	MONO – with bar
2" - 14"	5 to below 9 psig	MONO – with cross
2" - 14"	below 5 psig	MONO – with plate

Specifications – ANSI Class 150

Disk Sizes	Minimum net flow area (MNFA) Sq. inches					Disk Dimensions				Burst Ratings psig	
	Full Bore	Vacuum support style				Diameter		Thickness*			
											
		Ring	Bar	Cross	Plate	I.D.	O.D.	Standard Disk	Insulated Unit	Min.	Max.
1/2"	0.19	N/A	N/A	N/A	N/A	1/2"	1-3/4"	5/8"	1-3/4"	25	150
3/4"	0.44	N/A	N/A	N/A	N/A	3/4"	2-1/8"	5/8"	1-3/4"	25	150
1"	0.78	0.44	0.60	0.47	0.32	1"	2-1/2"	7/8"	2-1/4"	10	150
1-1/2"	1.76	N/A	1.34	1.05	0.72	1-1/2"	3-1/4"	7/8"	2-1/4"	7	150
2"	3.14	N/A	2.39	1.86	1.30	2"	4"	7/8"	2-1/4"	3	150
3"	7.06	N/A	5.56	4.31	2.95	3"	5-1/4"	7/8"	2-1/4"	2	150
4"	12.56	N/A	10.56	8.81	5.47	4"	6-3/4"	7/8"	2-1/4"	1.5	150
6"	28.27	N/A	22.27	17.27	12.05	6"	8-5/8"	7/8"	2-1/4"	1	100
8"	50.26	N/A	40.26	31.82	21.14	8"	10-7/8"	1-1/8"	2-3/4"	0.50	100
10"	78.53	N/A	63.53	50.78	32.66	10"	13-1/4"	1-1/2"	3-3/8"	0.25	100
12"	113.09	N/A	89.09	69.09	47.24	12"	16"	2"	4-3/8"	0.25	75
14"	137.88	N/A	108.06	83.31	58.07	13-1/4"	17-5/8"	2-1/4"	4-7/8"	0.25	50
16"	182.65	N/A	144.52	112.65	84.49	15-1/4"	20-1/8"	2-1/2"	5-3/8"	0.25	50
18"	233.70	N/A	181.95	153.70	104.31	17-1/4"	21-1/2"	2-3/4"	5-7/8"	0.25	50
20"	291.03	N/A	233.28	184.53	122.49	19-1/4"	23-3/4"	3"	6-3/8"	0.25	40
24"	424.55	N/A	354.80	294.05	190.61	23-1/4"	28-1/8"	3"	6-3/8"	0.25	25

*Standard disk thickness does not include gaskets.

Insulated unit thickness includes all gaskets

Note: Maximum pressure rating of ANSI Class 150 flanges is 290 psig @ 100°F (38°C).

The maximum pressure rating is lower at higher temperatures.

Reference ASME/ANSI B16.5

ZOOK service personnel are available 24 hours-a-day, 7 days-a-week, 365 days-a-year

Technical Data

Testing Method

Standard disks are rated at the specified burst pressure without applying a Manufacturing Design Range (MDR) by bursting two or more disks to establish burst accuracy. Where higher than room temperature (+40°F to +100°F) service is specified, oven tests can be conducted, or disks can be room temperature tested with compensation made using a temperature curve developed specifically for our disks. (These disks are designated *Chart Compensated Disks*.)

ASME disks are tested at the specified coincident temperature.

ASME Code and Jurisdictional Regulations

Most jurisdictions require ASME Code compliance on Boiler and Pressure Vessel construction. All pressure vessels within the scope of the ASME Code Section VIII, Div. 1 shall be provided with pressure relief devices. It is the responsibility of the **user** to ensure that the required devices are properly installed prior to initial operation of the pressure vessels.

If company policy or jurisdictional regulation requires ASME Code compliance, the rupture disk devices used for pressure vessel overpressure protection shall bear the ASME Code UD symbol. The UD marking is the manufacturer's declaration that the device was manufactured in full compliance with the ASME Code.

Disks specified to ASME Code requirements are rated using a 0% MDR unless a special MDR is specified and agreed upon. 0% MDR disks are marked with the specified burst rating. Refer to the certified type for the flow resistance factors (K_R) and the Minimum Net Flow Area (MNFA).

Pressure Ratings and Burst Tolerances

Burst ratings range from 0.25 psig to above 1000 psig for sizes 1/2" thru 24". Refer to minimum and maximum values in tables provided for each disk. Standard burst tolerances are:

Pressure Rating psig @ 72°F (22°C)	Burst Tolerance
Above 40	±5%
15 to 40	±2.0 psi
5 to less than 15	±1.0 psi
Above 1 to less than 5	±0.75 psi
1 or less	+0.75 psi / -0

Consult ZOOK for tighter burst tolerance

Corrosion Resistance

Depending on the type and options, disks handle almost any corrosive except free fluorine. See CORROSION Guide, page 8.

Vacuum

Disks are self-supporting up to full vacuum at burst ratings of 25 psig and higher. At lower pressures, integral vacuum supports are available only for MONO Disks. External vacuum supports are available for DUPLEX Disks. Consult ZOOK for partial vacuum services.

Dimensional Standards

Standard disks fit directly between ANSI Class 150 or 300 flanges with flat or raised faces. Flat ring gaskets are required and can be attached to the disk before shipment. Consult ZOOK for flange requirements other than ANSI.

Capacity and Flow Resistance

Full bore opening at time of rupture is a consistent characteristic of ZOOK Disks and results in very low flow resistance values (K_R). Refer to K_R values in tables provided for each disk type.

Service Life

Indefinite service life is normal in static systems. Replacement is unnecessary at operating-pressure to burst-rating ratios to 90%. In cycling service, this ratio should be lowered.

Burst Sensors

For remote and quick detection of a ruptured condition, ZOOK offers the ZENSOR™: Rupture disk and sensing element are integral parts of the electrical circuit to eliminate false readings. Model BA: An external re-usable and replaceable indicator. Specify Model BA-L for optional leak detection.

Armor

Armor is available on any standard style, size and rating of graphite rupture disk. Standard material is Carbon Steel (316SS optional). Armor is required on the following:

- Disks for ANSI Class 300 flanges
- TWO-WAY Type Disks
- Disks rated for temperatures above 338°F (170°C), regardless of disk style or flange class
- Disks for ANSI Class 150 flanges. See table at right with the following sizes and burst ratings:

Sizes	Rated Over psig @ 72°F (22°C)
1/2" - 3"	150
4"	100
6" - 10"	75
12" - 24"	50

Where fire or blowdown temperatures exceeding 338°F (170°C) are design considerations, armor is required. Armored disks typically withstand the same conditions, i.e. blowdown temperatures, as the piping.

Disks not covered above are furnished unarmored unless armor is specifically ordered. Armor is highly recommended for:

- added safety
- greater reliability
- easier installation

WARNING

If a disk ruptures, material may:

- vent at high velocity with significant reaction thrust force
- contain disk particles and other solids and liquids
- be toxic or flammable.

The end user must make provisions to prevent personal injury and equipment damage. Use of disks described in this bulletin are intended for use only by persons with requisite technical skill and at their own discretion and risk. Because application, installation, and use are beyond our control, we make no warranties expressed or implied and do not assume any liability exceeding purchase price of the disk.

It is the responsibility of the end user to fully understand his process and determine the disk needed to properly protect the system.

Gaskets



Gaskets used with graphite disks are stocked in the following materials: Neoprene, Non-asbestos, solid PTFE, and PTFE envelope. Gaskets can be supplied loose or attached to the disk (Note: field installation of gaskets NOT recommended on TWO-WAY Disks or Insulated Units)

When supplying your own gaskets, follow dimensions in the chart, especially the inside diameter which provides proper clearance to ensure accurate burst. 1/8" thick gasket is recommended. Gaskets for INSULATED Disks are made from high-temperature material and are always supplied attached.

Gasket Dimensions

Disk Size	Flanges			
	ANSI Class 150		ANSI Class 300	
	I.D.	O.D.	I.D.	O.D.
1/2"	3/4"	1-3/4"	3/4"	2"
3/4"	1"	2-1/8"	1"	2-1/2"
1"	1-5/16"	2-1/2"	1-5/16"	2-3/4"
1-1/2"	1-29/32"	3-1/4"	1-29/32"	3-5/8"
2"	2-1/2"	4"	2-1/2"	4-1/4"
3"	3-3/4"	5-1/4"	3-3/4"	5-3/4"
4"	5"	6-3/4"	4-3/4"	7"
6"	7-1/8"	8-5/8"	7-1/8"	9-3/4"
8"	8-7/8"	10-7/8"	9"	12"
10"	11-5/8"	13-1/4"	N/A	N/A
12"	13-3/4"	16"	N/A	N/A
14"	14-1/2"	17-5/8"	N/A	N/A
16"	17"	20-1/8"	N/A	N/A
18"	19-1/2"	21-1/2"	N/A	N/A
20"	21-3/4"	23-3/4"	N/A	N/A
24"	25"	28-1/8"	N/A	N/A

Corrosion Guide

Refer to the chart to determine which disk is best suited for your system fluid. Corrosives not shown can typically be accommodated by our unlined Graphite Disks. If in doubt, use the DUPLEX Disk or contact ZOOK to obtain a material sample for testing.

INSULATED Disks cannot be used with liquids, hydro-fluoric and phosphoric acids or concentrated alkalis.

	MONO and INVERTED Disks	DUPLEX Disks*
Aluminum Hydroxide	No	Yes
Ammonium Hydroxide	No	Yes
Bromine (free)*	No	Yes
Calcium Chlorate	No	Yes
Calcium Hydroxide	No	Yes
Calcium Hypochlorite	No	Yes
Chloral	No	Yes
Chlorine (free)	No	Yes
Chromic Acid (plating)	No	Yes
Fluorine (free)	No	No
Hydrofluoric Acid	No	Yes
Iodine (free)	No	Yes
Molten Metal Alkalis	Yes	Yes
Nitric Acid	No	Yes
Oleum	No	Yes
Ozone	No	Yes
Potassium Chlorate	No	Yes
Potassium Hydroxide	No	Yes
Potassium Hypochlorite	No	Yes
Sodium Chlorate	No	Yes
Sodium Hydroxide	No	Yes
Sodium Hypochlorite	No	Yes
Sulfur Trioxide	No	Yes
Sulfuric Acid	No	Yes

*Upon request we will furnish liners in Kynar, FEP, PFA, or PTFE

Other Rupture Disks

Metal Rupture Disks and Disk Holders...

- Forward and Reverse-Acting Designs
- Full range of burst ratings and materials
- Non-fragmenting designs available
- Available with insert holders for bubbletight, metal-to-metal sealing

Sanitary Rupture Disks...

protect sanitary piping systems

- Metal or Graphite materials
- Ideal for food, pharmaceutical, medical, biotech other high purity systems
- Full range of burst ratings
- Comply with FDA requirements
- Full size range available
- No special holders or fittings required

Rail Car Rupture Disks...

can be used for a full year without change-out (regardless of number of trips)

- 60, 100, 135 or 165 psig burst ratings
- Meets or exceeds AAR A5.03 and A5.04 specifications
- Steel armored for added safety and greater reliability

Bak-Pressure™ Disks...

guard against excess pressure in common piping systems

- Burst ratings from 0.25 to over 1000 psig
- Sizes from 1/2" thru 24"

Transportation Rupture Disks...

protect over-the-road tank trailers and intermodal tanks

- Sizes from 2" thru 4"
- Metal or graphite materials available
- Stocked burst ratings: 30, 35, 40, 45, and 50 psig in graphite disks
- Last up to one year without change-out

For more information on any ZOOK Graphite Rupture Disks or to place an order contact:



ZOOK Enterprises, LLC
16809 Park Circle Drive
Box 419
Chagrin Falls, OH 44022

Local 440.543.1010
U.S.A. Toll Free 800.543.1043
Fax 440.543.4930
E-Mail zook@zook.cc
www.zook.cc

	MATERIAL SPECIFICATION PRESSURE SWITCH	SPEC NO: IS052
	PDS-294	

SAP PART NUMBER:	1001573
CCC DRAWING NUMBER:	
MATERIAL:	Dual indicating differential pressure switch with center zero indicating gage. MATERIALS: Case: Cast aluminum. Diaphragm: Buna-N Springs: 316 stainless steel. Magnet: Ceramic coated CASE: Type Enclosure: NEMA 4X Pressure Connections: 1/4" FNPT. Electrical Connections: 1/2" FNPT. Style: Panel Mount. MEASURING ELEMENT: Type: Diaphragm-Magnet Maximum Line Pressure: 500 PSIG. Maximum Range: 20-0-20 PSID. Dial: 4" diameter (minimum), calibrated. SWITCH: Type: Two SPST Rating: 0.7 amp @ 125 VAC Adjustment: External over range shown on the nameplate. Accuracy: +/-3% (1.2 PSI) Set Point: Factory set, +/- 18 PSIG differential pressure, switches to be wired.
MANUFACTURER:	Orange Research Inc.
MODELS:	Orange model # 1518 DGS-1A-4.5F-A-A-20-0-20
NOTES:	1 - Tag with item number.

Issue Date: 12/01/89

Revision Date: 04/19/2011

Approved by Joseph P. McMahon on 04/19/2011

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0-5" H₂O to 0-50 psid Diaphragm Sensor for Liquids or Gases

Features

- Low DP ranges at high line pressures, down to 0-5 inches H₂O
- Rugged, weather-proof design
- Gauge, switch and transmitter versions
- Popular in filtration, flow and level measurements

Select these diaphragm sensor models where low differential pressures exist. The popular 1516 model measures from 0-1 psid up to 0-50 psid. Our 1800 series models include our most sensitive diaphragm which can measure from 0-5" H₂O to 0-8 psid. We also offer compound range models with a zero center.

The diaphragm sensor separates the high and low-pressure ports making them popular for gases as well as liquids. There is no bypass between these ports as with our piston models.

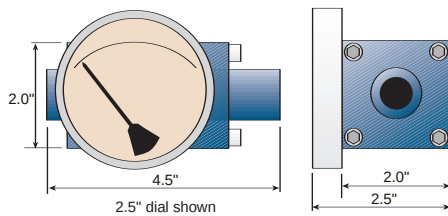
As differential pressure changes the diaphragm sensor magnet moves proportionally. This movement is tracked by a pointer magnet, which rotates, relaying the reading onto an easy-to-read 2.5 to 6 inch dial.

Select from a variety of options such as follower pointers, red arcs and mounting brackets along with switch, relay or transmitter outputs. More details on these models can be found on our DP introduction pages 2-5. Electrical details are on pages 26-27.

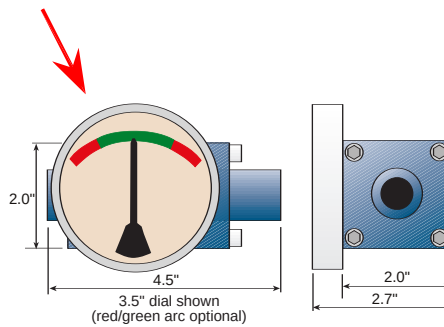


Dimensions

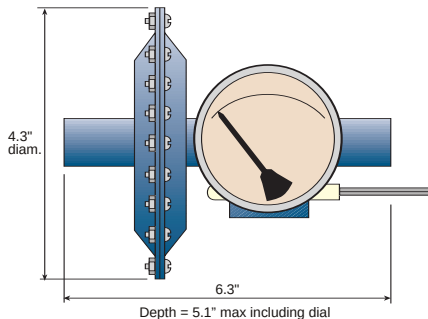
Detailed drawings on website.



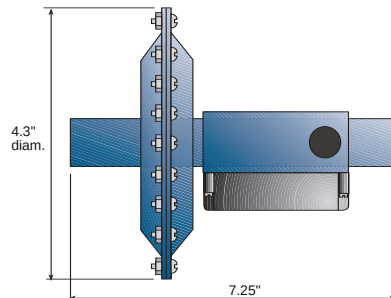
1516DG



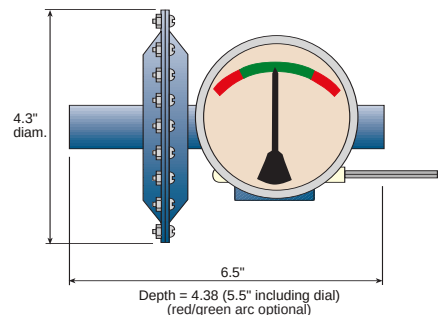
1518DG



1831DGS



1833DS



1835DGS

Specifications (Detailed Specification Sheets on Website)

Model	Differential pressure range	Maximum line pressure/temperature	Accuracy (F.S.) (Ascending)	Porting (Many porting types available)	Electrical Available*
1516DG/DGS/DS	0-1 to 0-50 psid (0-0.07 to 0-3.3 bar)	1500 psig (100 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches Class 1 Div. 2
1518DG/DGS	10-0-10 to 50-0-50 psid (0.5-0-0.5 to 3.3-0-3.3 bar)	1500 psig (100 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches Class 1 Div. 2
1831DG/DGS	0-5" H ₂ O to 0-8 psid (0-125 mm H ₂ O to 0-0.5 bar)	Aluminum body 100 psig (7 bar)/200°F (93°C) Stainless steel body 150 psig (10 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches No enclosure
1833DGS/DS/DGT/DT	0-5" H ₂ O to 0-8 psid (0-125 mm H ₂ O to 0-0.5 bar)	Aluminum body 100 psig (7 bar)/200°F (93°C) Stainless steel body 150 psig (10 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches 1 relay transmitter Class 1 Div.
1835DG/DGS/DS	5-0-5" H ₂ O to 8-0-8 psid (125 mm-0-125 mm H ₂ O to 0.5-0-0.5 bar)	Aluminum body 100 psig (7 bar)/200°F (93°C) Stainless steel body 150 psig (10 bar)/200°F (93°C)	2%	1/4" NPT	1 or 2 switches No enclosure

D=Diaphragm G=Gauge S=Switch T=Transmitter

*NEMA 4X switch models have a 1/2 inch NPT conduit port as standard. A DIN 43650A-PG11 with mating connector is optional, rated IP65 & NEMA 4X

How to Order

Select from each of the applicable categories to construct a model number. Use the model number when ordering or obtaining additional information and pricing from Orange Research or your local distributor.

Reordering? You must supply the Part Number from your instrument label.

Sample Model Number
1516DGS - 1A - 2.5B - A 0-1 psid, 1, 3, E

1516DGS	1A	2.5B	A	0-1 psid	1, 3, E
Model	Pressure Body	Dial Case	Electrical	Range	Options (more on pg. 5)
1516DG	<i>In-line ports:</i>	2.5B = 2.5" basic	A = SPST, N.O.	Model 1516:	1 = 1/2" NPT
1516DGS	1A = aluminum	3.5B = 3.5" basic	B = SPST, N.C.	0-1, 0-2, 0-3, 0-5, 0-8,	2 = plastic lens
1516DS	1C = 316 stainless steel	4.5B = 4.5" basic	C = SPDT	0-10, 0-15, 0-20, 0-25,	3 = liquid filled (glycerine)
1518DG	1E = brass	6B = 6.0" basic	A-A = 2 ea. - A	0-30, 0-35, 0-40, 0-50	4 = follower pointer
1518DGS			B-B = 2 ea. - B	psid	5 = Teflon coated magnet/spring
1831DG			C-C = 2 ea. - C		6 = red arc (specify range)
1831DGS	<i>Change "1" above to</i>	<i>Change "B" to "F"</i>	R2 = relay	Models 1831 & 1833:	7 = dual scale (specify both)
1833DGS	<i>"4" for back ports; to</i>	<i>above for flanged</i>	T1 = transmitter	0-5", 0-10", 0-15", 0-20",	8 = high temperature
1833DS	<i>"5" for bottom ports</i>	<i>dial case</i>		0-25", 0-30", 0-40",	Special Diaphragm & Seals
1835DG				0-50", 0-60", 0-80",	(Buna-N standard):
1835DGS	<i>1518 & 1800 series in-</i>			0-100", 0-150",	E = EPDM
1835DS	<i>line only; 1835 SS only</i>			0-200" H ₂ O; 0-8 psid	F = Fluorosilicone
					V = Viton
					T = Teflon (o-ring seals only)
<i>More models above</i>				<i>For compound ranges, see p 5</i>	

	MATERIAL SPECIFICATION STAINLESS STEEL PIPE	SPEC NO: S06
	INSTRUMENT PIPING, HEAT TRACING, ETC.	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Stainless steel tubing and flareless compression fittings, and stainless steel pipe and fittings.
RATING:	150 PSIG @ 365 DEG. F. 300 PSIG @ 100 DEG. F.
CONSTRUCTION:	For tubing systems 1" and smaller. Pipe and screwed pipe fittings to be used for take-off connections on larger pipe, manifolding, connections to screwed instruments, equipment, etc. Tubing to be used for all other piping in the system.
PIPE NIPPLES:	ASTM A312, Type 316, seamless, Schedule 80S, ANSI B36.19, annealed and pickled.
PIPE FITTINGS:	Type 316 stainless steel screwed fittings, dimensions per ANSI B16.3, forged, wrought or cast material rated 150 lb. Camco Fittings Co., or equal.
TUBING:	Type 316 stainless steel seamless tubing, 0.035" wall thickness, annealed and pickled, hardness 70-74 Rockwell "B", 1/4 O.D.
TUBE FITTINGS:	Type 316 stainless steel, flareless compression fittings, Crawford Fitting Company "Swagelok", or equal.

Issue Date: 01/01/89

Revision Date:

Approved by Joseph P. McMahon on 07/24/98

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	MATERIAL SPECIFICATION STAINLESS STEEL PIPE	SPEC NO: S15
	TYPE 316 STAINLESS STEEL PIPE AND FITTINGS	

SAP PART NUMBER:	
CCC DRAWING NUMBER:	
MATERIAL:	Type 316 stainless steel pipe and fittings.
RATING:	150 PSIG @ 365 DEG. F. 300 PSIG @ 100 DEG.F.
CONSTRUCTION:	Screwed for 3" and smaller
PIPE:	Threaded, Schedule 40S, ASTM A312, Type316, welded, ANSI B36.19, annealed and pickled.
FITTINGS:	Type 316 stainless steel screwed fittings, general dimensions to conform to ANSI B16.3 for malleable iron screwed fittings. Forged, wrought or cast material rated 150 Lb. @ 365 DEG.F., Camco Fittings Co., or equal.
FLANGES:	Type 316 stainless steel, threaded, MSS-SP-51, 150 Lb. flat face, serrated finish.
ORIFICE FLANGES:	Instrument Item.
BOLTING:	See attached Fastener Specification F03.
GASKETS:	See attached Gasket Specification G02.

Issue Date: 12/01/89

Revision Date: 06/20/2001

Approved by Gerald Kirner on 06/21/2001

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SECTION 3

LINING



TAB 1

ABOVE CONE LINING



Specification No. VS7

For

Vessel Lining Application Specification Using Vinyl Ester For Immersion Service

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FOR
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1. QUALITY REQUIREMENTS

- 1.1. Calgon Carbon Corporation relies on the joint effort between supplier and buyer to emphasize conformance to specification. If conflict exists between this specification, drawings, purchase orders, data sheets or appendix documents, it is the responsibility of the supplier to bring such conflict to the attention of Calgon Carbon Corporation for resolution.
- 1.2. All vendors are expected to supply products and services with zero defects. Vendors are encouraged to use error prevention processes in their manufacturing procedures to obtain this goal. Calgon Carbon Corporation prefers to address quality issues prior to, and during the lining process rather than at the end. Where the vendor does not fully meet the requirements of this specification, implementation of a corrective action plan to address any deficiencies will be required in writing and subject to Calgon Carbon Corporation approval.
- 1.3. The vendor agrees to retain objective evidence, including written records of the inspections, measurements and tests performed in the course of blasting, lining, testing, and inspecting. These records shall be made available to the Calgon Carbon Corporation's Quality Inspector for review upon request. Calgon Carbon Corporation may at its discretion use a third party quality inspector for auditing purposes. The vendor's quality department will be notified if this is the course of inspection. Calgon Carbon Corporation requires third party inspectors to perform inspections using the coating manufacture's standards, calibrations and methodologies. All inspectors are to identify themselves at the vendor's facility, inform the vendor of the purpose and scope of the inspection and to conduct themselves in a professional non-confrontational manner.
- 1.4. The vendor shall submit their corporate QA/QC program, QC personnel with contact info and responsibilities. Inspection, testing procedures and documents are to be submitted to Calgon Carbon Corporation for approval. Please send to the attention of Quality Inspector, Equipment and Assembly Plant, at 4301 Grand Ave, Neville Island, PA 15225.

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- 1.5. In the event of failure of the lining to withstand the service conditions set forth in Article 4.0, of this specification, the Vendor shall, at his expense, replace the defective materials and workmanship to Calgon Carbon Corporation's satisfaction.

2. SCOPE OF WORK

- 2.1. This specification covers materials, surface preparation, application and testing of protective coatings for internal lining of carbon steel vessels.
- 2.2. The scope of work includes all labor, materials, equipment and services required for surface preparation, lining and testing the vessels indicated on the drawings.
- 2.3. The entire internal surface of the designated vessels including all nozzles and manways shall be lined.
- 2.4. The lining must completely protect the internal metal surfaces from corrosion.

3. REFERENCE DOCUMENTS

- 3.1. Carboline Plasite 4110 Technical Bulletin, Carboline Company's or Hemple TL-220S AR most current version.
- 3.2. When needed use Carboline Plasite PA-3 Specification.
- 3.3. SSPC, "Pictorial Surface Preparation Standards."
- 3.4. SSPC, "Profile Comparative Panels."
- 3.5. NACE Publication RP0288-94, "Recommended Practices for Inspection of Linings on Steel and Concrete."

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- 3.6. NACE Publication 6F-166, "Recommended Practices for Inspection of Linings on Steel and Concrete."
- 3.7. D.M. Berger and S.E. Mrox, "Instruments for Inspection of Coatings," ASTM, Journal of Testing & Evaluation, Vol. 4, No.1, 1969.
- 3.8. NACE Publication 6J-162, "Guide to the Preparation of Contracts and Specifications for the Application of Protective Coatings."
- 3.9. NACE Standard RP-01-78, "Design, Fabrication and Surface Finish of Metal Tanks and Vessels to be lined for Chemical Immersion Service."
- 3.10. Ferrous Metals-Preparation Methods
- 3.10.1 Solvent Cleaning (SSPC-SP1): Solvents such as water, mineral spirits, xylol, toluol, ect., are used to remove solvent-soluble foreign matter from the surface of ferrous metal. Rags and solvents must be replenished frequently to avoid spreading the contaminant rather than removing it. Low-pressure (1500-4000 psi) high volume (3-5) gal./min.) water washing with appropriate cleaning chemicals is a recognized "solvent cleaning" method. All surfaces should be cleaned per this specification prior to using hand tools or blast equipment.
- 3.10.2 Hand Tool Cleaning (SSPC-SP2) (SSI-St2): A mechanical method of surface preparation involving wire brushing, scraping, chipping and sanding. Not the most desirable method of surface preparation, but can be used for mild exposure conditions. Optimum performances of protective coatings systems should not be expected when hand tool cleaning is employed.
- 3.10.3 Power Tool Cleaning (SSPC-SP3) (SSI-St3): A mechanical method of surface preparation widely used in industry and involving the use of power sanders or wire brushes, power chipping hammers, abrasive grinding wheels, needle guns, ect. Although usually more effective than hand tool cleaning, it is not considered adequate for use under severe exposure conditions or for immersion applications.

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- 3.10.4 Power Tool Cleaning to Bare Metal (SSPC-SP11): Utilizing same equipment as Power Tool Cleaning to remove all visible coatings and contaminants to bare metal substrate.
- 3.10.5 White Metal Blasting (SSPC-SP5), (SSI-Sa3), or (NACE #1): The removal of all visible rust, mill scale, paint, and contaminants, leaving the metal uniformly whit or gray in appearance. This is the ultimate in blast cleaning. Use where maximum performance of protective coatings is necessary due to exceptionally severe conditions such as constant immersion in water or liquid chemicals.
- 3.10.6 Near White Blast (SSPC-SP10), (SSI-Sa2½), or (NACE #2): In this method all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint, or other foreign matter have been completely removed from the surface by abrasive blasting, except for very light shadows, very slight streaks or slight discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint of coating. At least 95% of each square inch of surface areas shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above. From a practical standpoint, this is probably the best quality surface preparation that can be expected today for existing plant facility maintenance work.
- 3.10.7 Commercial Blast (SSPC-SP6), (SSI-Sa2), or (NACE #3): All oil, grease, dirt, rust scale and foreign matter are completely removed from the surface and all rust, mill scale and old paint are completely removed by abrasive blasting except for slight shadows, streaks, or discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint of coating that may remain. If the surface is pitted, slight residues of rust or paint may be found in the bottom of pits: at least two-thirds of each square inch of surface area shall be free of all visible residues and the remainder shall be limited to the light residues mentioned above.

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- 3.10.8 Brush Off Blast (SSPC-SP7), (SSI-Sa1), or (NACE #4): A method in which all oil, grease, dirt, rust scale, loose mill scale, loose rust, and loose paint or coatings are removed completely. Tight mill scale and tightly-adhered rust, paint and coatings are permitted to remain. However, all mill scale and rust must have been exposed to the abrasive blast pattern sufficiently to expose numerous flecks of the underlying metal fairly uniformly distributed over the entire surface.
- 3.10.9 High and Ultra-High Pressure Water Jet Cleaning (SSPC-SP12), or (NACE #5): As part of the surface preparation, deposits of oil, grease, and foreign matter must be removed by ultra-high pressure water jetting, by steam cleaning with detergent, or by methods in accordance with SSPC-SP1. The difference in the degrees of surface cleanliness is defined by the amount of pressure as follows:

Low Pressure		
Water Cleaning (LP WC)	34 MPa	(5 000 psi)
High Pressure		
Water Cleaning (HP WC)	34 to 70 MPa	(5,000 to 10,000 psi)
High Pressure		
Water Jetting (HP WJ)	70 to 170 MPa	(10,000 to 25,000 psi)
Ultra-High Pressure		
Water Jetting (UHP WJ)	Above 170 MPa	(25,000 psi)

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4. SERVICE CONDITIONS

- 4.1. The lining will be exposed to static and moving water slurries of granular activated carbon, resin and other abrasive media's.
- 4.2. The characteristics of the slurries will be as follows:
- 4.2.1 Media in Water
 - 4.2.2 Temperature - 35-100F
 - 4.2.3 pH - 5.0 to 9.0
 - 4.2.4 Density - 26 lbs./cu.ft. up to 36 lbs.cu.ft., Dry
 - 4.2.5 Abrasive - Yes

5. MATERIALS

- 5.1. Acceptable coatings are Plasite 4110 as supplied by Carboline Company or Hemple TL-220S AR. Products from other suppliers or manufacturers are not approved.

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6. DELIVERY, STORAGE AND HANDLING

- 6.1. Product Delivery: Lining material shall be delivered to the site in sealed, original, labeled containers with the manufacturers name, product number, batch number, color designation, and instructions for mixing and thinning.
- 6.2. Storage: Vendor shall be responsible for the proper storage of all coating materials. Damaged, leaking, or unlabeled containers shall be disposed of daily.
- 6.3. Storage Location: Lining materials shall be stored in a place specifically assigned for that purpose which is dry and out of direct sunlight and stored in a manner so as not to exceed the manufacturer's temperature limitations. In all cases, the storage and handling of lining material shall conform to the requirements of the manufacturer and the applicable safety regulatory agencies.

7. APPLICATION

7.1. Surface Preparation

- 7.1.1 The lining vendor shall install and maintain protective coverings on any surface not to be lined to protect the surface during surface preparation and lining application.
- 7.1.2 Grease, Oil & Interference Material: Surface contamination on bare steel such as grease, oil, tape tags, markings, etc. shall be removed by the vendor by solvent cleaning per SSPC-SPI, SSPC-SP12, or NACE #5 prior to blast cleaning.
- 7.1.3 Surface Irregularities: Prior to blast cleaning, all surfaces shall be inspected for weld spatter, weld flux, or any other surface irregularities. When discovered, they will be removed by grinding.

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- 7.1.4 Edges: All sharp edges will be ground to a smooth 1/8 inch radius. Areas inside the vessel that are not expected to be in direct contact with media are not required to be chamfered unless noted on the specific detail. (A specific example: the holes in the internal cone design. They do not require a radius or chamfer on their edge since filter nozzles must fit snugly into these holes for proper service.)
- 7.1.5 Ambient Conditions: Final blast cleaning shall not be performed when the surface temperature is less than 5°F greater than the dew point temperature of the surrounding air, nor when the relative humidity is greater than 90%.
- 7.1.6 Compressed Air Cleanliness: The air supply used for blast cleaning shall be free from moisture and oil contamination. The air cleanliness shall be verified at least once per shift for each compressor used. The test involves directing the air stream onto a piece of white paper held not more than 18-inches away from the air outlet. The test shall be run downstream of moisture and oil separators for a period of not less than two-minutes. Sufficient freedom from oil and water is confirmed if no soiling or discoloration is visible on the paper. If air contamination is evidenced, the filters shall be changed or cleaned, traps emptied, after-coolers, moisture separators or filters added, the equipment maintained, or such adjustments made as may be otherwise required to achieve clean, dry air for all blast cleaning, coating application, blow-down, or any other quality operations involving compressed air. Verification of this activity will be required by Calgon Carbon Corporation's inspector.
- 7.1.7 Abrasive/Profile: The abrasive selected shall be identified by the vendor prior to use. The abrasive shall have a sharp, hard cutting surface and shall be dry and free of oil or soluble salt contaminants. Copper slag shall not be used. The abrasive shall provide an anchor pattern of at least 4.0 mils in depth. The surface profile shall be measured using the WPCC 4000 Series Anchor Profile Comparator or Testex replica tape and measuring the results with a calibrated micrometer.

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7.1.8 Abrasive Blasting of Carbon Steel: The preparation of all carbon steel shall be by abrasive blast cleaning to remove all mill scale, rust and coatings.

7.1.9 Dry abrasive blast all interior steel surfaces in accordance with SSPC-SP5 or NACE #1, "White Metal Blast Cleaning."

7.2. Coating Application Equipment: Reference Source: Carboline Pa-3 Specification

7.2.1 CONVENTIONAL AIR SPRAY GUNS: The following chart indicates the standard types of conventional air spray guns, nozzles and air caps recommended for the best atomization, material break-up and high production rates. Use of a pot with an agitator is preferred.

Gun Fluid Air
Binks #2001 66-SS 63-PB

DeVilbiss JGA-510 E 797

Graco P-800 04-02
Note: The same guns may be used with a stainless needle and tip. GUN FLUID AIR Binks #2001 59ASS 251 with a 559SS needle.

7.2.2 Airless Spray Equipment: The airless pump shall be of sufficient size to properly atomize the coating with the spray tip selected. The orifice size required will range between .013" to .035" varying with the viscosity of the coating. In selecting a spray tip, a suitable fan width for the configuration of the substrate shall be of major consideration. The amount of thinner required will vary up to approximately 20% depending on temperature, substrate size and individual technique.

Note: If using Hemple TL-220S AR use a hopper/gravity set up.

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FOR
VINYL ESTER VESSEL LINING**

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GUN TIP Graco Bulldog (or equivalent) .013"-.035"

The high build vinyl ester coatings require a large capacity pump with a capability of 3 gpm, a minimum tip size of .025" with a 12" spray width recommended. The liquid pressure shall be in the range of 1800 to 2200 psi. Airless spray is not recommended for abrasion resistant formulations because of the extreme wear on the tips and lower units of the pump unless the airless unit is designed for abrasive type of materials.

7.2.3 Airless Spray Advantages and Disadvantages:

Advantages: No problem with contaminated air. Overspray is kept to a minimum and the production rate is high. Thick films may be obtained without runs or sags under some conditions.

Disadvantages: The large output of the gun makes it difficult to handle in small tanks where working conditions are crowded or cramped causing runs or sags.

Due to the large amount of liquid handled and the easy build properties of this equipment, it is possible, with improper thinning and improper technique, to apply the coating material at too high a rate per pass. The end result usually being solvent entrapment and porous film, runs and sags.

7.2.4 Equipment Manufacturers:

Supplier Name Supplier Address Product or Service

Binks Manufacturing Co.
9201 W. Belmont Avenue
Franklin Park, IL 60131
Air Atomizing & Airless Spray Equipment

DeVilbiss Ransburg
1724 Indian Wood Circle, Ste. F
Maumee, OH 43537

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Air Atomizing & Airless Spray Equipment

Graco, Inc.
P.O. Drawer 1441
Minneapolis, MN 55440
Airless Spray Equipment
Nordson Corporation 555 Jackson Street
Amherst, OH 44001
Airless Spray Equipment

7.3. Coating Application

7.3.1 All coatings must be applied in a controlled environment.

Surface Cleanliness: The surface of the prepared steel shall be blown down (clean, dry, compressed air), vacuumed prior to coating application to remove spent abrasive, dust and other interference material. If grease or oil is deposited on the surface, they shall be removed by solvent cleaning (SSPC-SP1) prior to coating application. Any rust which has formed shall be removed to the specified degree of cleanliness prior to lining, which may require reblasting.

7.3.2 Ambient Conditions: Coatings shall be applied only when the interior surface and air temperatures are between 60°F and 100°F, the relative humidity in the tank is less than 90%, and the temperature of the surface to be painted is at least 5°F above the dew point temperature of the air in the tank. Metal temperature shall be recorded on the form EAP-2A provided before application of coating under application data, under ST designation, see Appendix A.

7.3.3 Mixing: Lining's to be mixed shall have been delivered to the jobsite and stored in accordance with Section 6 of this specification and shall not have exceeded its shelf life. Mixing shall conform to the requirements of the coating manufacturer.

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Plasite 4110

Mix Part A into Part B using a high-speed mechanical air or an explosion proof motor agitator with mixing blades fitting close to sides of container, making sure all of Part A is completely mixed with Part B for approximately 15 to 30 minutes to be properly blended. Mix Part D (the promoter) into Part A & B until obtaining a smooth liquid free of any streaking from Part D is complete. Part C (the catalyst) can then be mixed into Part A, Part B & Part D blend.

Note: Splitting of kits must not be done.

Caution: The promoter (Part D) and the catalyst (Part C) must be separately mixed into Part A/Part B blend.

Any contact of

Unmixed Part D with Part C may lead to a fire or explosion.

Caution: Avoid breathing dust.

Hemple TL-220S AR

Is only a two part mix (Part A and Part B), only mix just prior to spraying, not in advance. Refer to technical bulletin when using. Thin only when strip coating.

Only complete kits shall be mixed. Lining which has skinned, gelled, separated, or otherwise deteriorated during storage to the extent that it cannot be remixed to a homogeneous film of the intended viscosity, uniformity and consistency shall not be used. Mixed coatings shall not be used beyond their pot life.

- 7.3.4 Thinning: Only Plasite 20 or other approved Calgon Carbon thinner shall be used for thinning. The amount of thinning will be limited (except for stripe coat). Thinners, as specified, shall be used to adjust coating for various application conditions. A ratio of 5-20% shall be used depending on ambient conditions and metal temperatures. At 75°F, a suggested thinning ratio is 5-10%; the amount of thinner may be increased at a ratio of approximately 5% per 5°. At higher temperatures, a slower evaporating solvent must be utilized. Thinner

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should be added if surface temperatures are lower than ambient. A faster evaporating solvent must be utilized in this case.

- 7.3.5 Methods: Coatings shall be applied by conventional or airless spray equipment. Coating applications shall be in accordance with the requirements of Calgon Carbon Corporation VS-7 Spec, SSPC-PA1 and the manufacturers Technical Bulletin. In the event of a conflict, the requirements of this specification, manufacturer's instructions and SSPC-PA1I shall prevail in that order. If NSF 61 is specified on the drawing, follow manufacturer's instructions for compliance to this standard.

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- 7.3.6 **Stripe Coat:** A stripe coat of vinyl ester thinned approximately 50% shall be applied to all edges, corners, welds, crevices and irregularities prior to each full coat application. Such striping shall extend a minimum of 3-inches beyond the edge or irregularity.
- 7.3.7 **Brush Application:** Brush application is not allowed except for touch-up repairs, inaccessible areas and stripe coating. Those areas for which the contractor desires to use brush application shall be carefully defined prior to the start of all work.
- 7.3.8 **Agitation:** Lining must be kept agitated in conventional spray pots or containers during lining application.
- 7.3.9 **Coating Thickness:** The coating shall be applied in a minimum of two coats. Each coat shall have a dry film thickness of between 17 and 23 mils, with a total system thickness of between 35 and 45 mils. Dry Film Thickness readings need to be taken after each coating of lining. The area then needs to be mapped to recognize the high and low areas. This must be done to avoid too little or too much mileage on the interior of the vessel. High mileage is not an acceptable condition, in most cases the coating will need to be removed to the 35 to 45 mils and the surface condition back to a smooth streamline surface. This is a very expensive process and should be avoided at all cost.
- 7.3.10 **Coating Continuity:** All coats shall have smooth, streamline surfaces free of dry spray, over spray, orange peel, fish eyes, craters, bubbles and other significant defects. Shadow-through, honey-comb spray, skips and misses are not acceptable. Runs or sags can be brushed out while the material remains wet. Areas where blast products or other debris have become embedded in the paint film shall be prepared by removing these products and touching up the area. In addition, the final coat shall be tested for discontinuities by performing high-voltage holiday testing at 3,500 volts to obtain a pinhole-free film. Holiday testing shall be performed only after a minimum cure time of 48-hours at 70°F with ventilation has elapsed after application of the final coat.

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- 7.3.11 Re-coat Time and Cleanliness: Subsequent coats shall be applied only after the previously-applied coat has been allowed to dry as required by the manufacturers Technical Bulletin, but as soon as possible in order to minimize exposure to inter-coat contamination. Any such surface contamination which is present shall be removed prior to the application of subsequent coats.

8. INSPECTION AND TESTING

8.1. Inspection

- 8.1.1 The lining vendor shall be responsible for inspecting all phases of the surface preparation and lining application in accordance with Calgon Carbon Corporation's and/or the coating manufacturer's inspection procedures.
- 8.1.2 Calgon Carbon Corporation reserves the right to inspect all phases of the lining operation to assure compliance with specification requirements. The vendor shall repair/correct any and all deficiencies at his own expense. The vendor shall provide accessibility and lighting for any inspections. It is not intended, however, that the presence or activity of such inspection shall in any way whatsoever relieve the vendor of his obligation to provide inspection of his own to assure compliance with this specification. In all cases, Calgon Carbon Corporation or its approved agent will perform final inspection before acceptance.
- 8.1.3 Calgon Carbon Corporation reserves the right to stop any and all work at any time for non-compliance with the requirements of this specification.

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8.2. Testing

8.2.1 Use a properly calibrated non-destructive Type II dry film thickness gage:

- Positector: Measures non-magnetic coating thickness over ferrous substrates with an accuracy of $\pm 3\%$. Digital reading remains until next measurement taken.
- MikroTest Thickness Gauge: A highly accurate hand gauge which operates on the attraction power of a permanent magnet through a non-magnetic coating to the base steel with an accuracy of $\pm 5\%$.

Frequency and method of calibration shall be in accordance with the SSPC-PA-2.

8.2.2 Determine the average dry film thickness of the lining. All areas with less than 30 mil DFT must have additional lining sprayed on before spark test. High or low areas that require remedial action will be marked so on the lining with chalk. When work is completed, all chalk markings shall be removed. Run thickness test prior to spark test.

8.2.3 One (1) reading shall be taken every 10-ft² and any reading outside of the manufacturer's acceptable range, either higher or lower, will require four (4) additional readings 1-ft in each direction from the suspect reading. Any average of the five (5) readings will be figured and must fall within the manufacturer's acceptable range. If not, mark the area to be corrected with chalk.

8.2.4 After all the readings are taken, they are to be averaged in three (3) sections: top head, shell, and the bottom head or cone. These three averages, along with all the readings taken, shall be recorded on a Calgon Carbon Lining Inspection Report (Appendix A).

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- 8.2.5 For method and frequency of calibration for the dry-film thickness gauge, see the calibration section of the Manufacturer's information. Any areas not in compliance shall be marked for remedial action with chalk by the inspector.
- 8.2.6 Spark test for pinholes with a 4500 VDC detector on all coated surfaces. A Tinker and Razor Model AP-W, or equivalent device, is required for this operation; 3500-volt maximum, minimum 48-hours at 70°F cure before spark test is run.

9. SPECIAL REQUIREMENTS FOR NSF-61 (WHEN SPECIFIED)

- 9.1. When the end-use application requires compliance with NSF-61, the vinyl ester lining must be applied in accordance with specific instructions found in the product bulletin. Applicator must follow these specific instructions.
- 9.2. Calgon Carbon Corporation will notify lining vendor that this section (9.0) applies by signifying such in the purchase order and/or drawings.
- 9.3. Force curing may follow the date of application but must be completed prior to the disinfection of the vessel at customer site.
- 9.4. The NSF criteria specified by the coating manufacturer cannot be altered.
- 9.5. Force curing must be conducted in a controlled manner. Heat rise shall be not greater than 1 degree per minute, up to the maximum temperature needed to achieve a 200 F minimal surface temperature. This is critical to avoid blistering or post-cure holidays.
- 9.6. Heat should be applied at top or bottom head to allow equal flow of hot air. If heating in the shell, there should be an internal attachment to allow heat to distribute equally so there is not a section of lining that heats faster than the rest. See appendix for recommended flow distribution according to Plasite's guide.

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- 9.7. A strip recorder with multiple thermocouples (or other similar device) is preferred to record the temperature during the force cure process. Records shall be forwarded to Calgon Carbon Corporation for retention. Please send to the attention of Quality Inspector, Equipment and Assembly Plant, at 4301 Grand Ave, Neville Island, PA 15225.

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10. APPENDIX A- INSPECTION PROCEDURE

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10. APPENDIX A-INSPECTION PROCEDURE

10.1. SECTION ONE SURFACE PREPARATION

- 10.1.1 Verify prior to blast cleaning that sharp edges weld spatter, slivers, laminations, scabs or any other surface irregularities have been adequately removed to provide a surface suitable for coating application.
- 10.1.2 Verify prior to blast cleaning that all heavy deposits of oil and/or grease have been adequately removed in accordance with "Solvent Cleaning" (SSPC-SPI).
- 10.1.3 Prior to blast cleaning operations, perform compressed air cleanliness test at least once per eight-hour shift. Insert a clean, white blotter or clean, white paper into the air stream no more than 18-inches from air source downstream of moisture and oil separators for approximately two minutes. Examine the blotter or paper for signs of moisture and/or oil contamination. Blast cleaning should not begin unless air is free of detrimental amounts of oil and/or water.
- 10.1.4 Verify that only clean and dry abrasives will be used. If bulk abrasive is to be used, verify that the abrasive is properly protected from rain, moisture and oil.
- 10.1.5 If abrasives are recycled, test for the presence of abrasive contamination. Add approximately one ounce of recycled abrasive to several ounces of clean water. Shake contents vigorously and visually examine the water level for signs of oil contamination.
- 10.1.6 Angular abrasive that will provide an anchor profile depth minimum equal to the SPCC 4000 Series Blast Comparator will be used.

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- 10.1.7 Verify that required protective coverings are intact to assure that previously-coated surfaces will not be damaged during blast cleaning operations.
- 10.1.8 Monitor and record ambient conditions and surface temperatures during blast cleaning operations using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables.
- 10.1.9 "Final blast cleaning" shall not be performed unless the surface temperature is at least 5°F higher than the dew point. "Rough blasting" may be performed regardless of ambient conditions, but must be "final blast cleaned" when conditions become favorable.
- 10.1.10 Verify that blast cleaned surfaces have been prepared in accordance with SSPC-SP5, SSI-Sa3, or NACE#1, "White Metal Blast Cleaning". SSPC-VIS-1 may be used as a visual reference. Mark all non-conforming areas with chalk or spray paint for rework.
- 10.1.11 Verify the profile (4 mils minimum) has been achieved using the WPCC 4000 Series Blast Comparator.
- 10.1.12 Using a dry film thickness gage, determine the magnetic base reading and record.

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10.2. SECTION TWO LINING MATERIAL PREPARATION

- 10.2.1 Verify that all containers are sealed, intact and properly labeled.
- 10.2.2 Verify that all coating material temperatures are at least 60°F before mixing by the use of a stem thermometer.
- 10.2.3 Verify type of coating mixed, record and retain batch numbers of all components, type of thinner and batch number, thinning ratios, time of mix, maximum pot life, etc.
- 10.2.4 Verify that all components are combined and thoroughly mixed in the proper proportions to obtain a uniform color, free of lumps.
- 10.2.5 Verify that only the recommended thinner is used.
- 10.2.6 Verify that the pot life is observed.

10.3. SECTION THREE APPLICATION LINING

- 10.3.1 Monitor and record ambient conditions and surface temperatures every three to four hours during lining application using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables. Coating application shall not be permitted when the surface temperature is less than 50°F above the dew point. No coatings shall be applied when the surface and/or material temperatures are less than 70°F. No coating shall be applied when the surface temperature is expected to drop below 60°F before it has dried. Coating application shall not be permitted when the relative humidity is greater than 90%.

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- 10.3.2 Verify compressed air cleanliness and test for conventional spray application and blow down operations (see Section 9.1.3). Coating material must be applied using an agitated conventional pressure pot using continuous agitation during application.
- 10.3.3 Verify that protective coverings previously established are intact.
- 10.3.4 Verify that surrounding air is free of airborne contaminants prior to the application of coatings.
- 10.3.5 Verify intercoat cleanliness and that blast-cleaned surfaces have been cleaned to assure that coatings will not be applied over oil, grease, dirt, dust, spent abrasive, etc.

10.4. SECTION FOUR APPLICATION OF FIRST COAT

- 10.4.1 Verify that vinyl ester has been applied to all surfaces prepared that day before visual oxidation takes place. Any surfaces not primed the same day shall be reblasted prior to primer application.
- 10.4.2 Verify that weld seams have been brush-coated at least 3-inches on each side of seam prior to spray application.
- 10.4.3 Verify that the first coat has been applied to a dry film thickness of 17-23 mils. Perform dry film thickness tests in accordance with SSPC-PA2. (Deduct magnetic base reading.)

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10.5. SECTION FIVE APPLICATION OF FINAL COAT

- 10.5.1 Verify that previously-coated surfaces have dried at least eight hours at 70°F with ventilation prior to application of second coat.
- 10.5.2 Verify that the final coat has been applied to a dry film thickness of 17-23 mils. Perform dry film thickness test in accordance with SSPC-PA2. (Deduct primer thickness.)

10.6. SECTION SIX FINAL INSPECTION OF LINED SURFACES

- 10.6.1 Verify that all surfaces have a smooth and uniform appearance free of any irregularities such as debris inclusions, scuff marks or spatter.
- 10.6.2 Verify that the total dry film thickness (minimum two coats) is 35-45 mils. Perform dry film thickness test in accordance with SSPC-PA2.
- 10.6.3 Allow 48-hours cure at 70°F before holiday testing. Verify that a void-free, continuous film has been achieved by performing high-voltage holiday detection on 100% of the coated surfaces. The voltage shall be set at 3,500-volts. Mark all discovered holidays and re-test all repairs.
- 10.6.4 All repairs shall be made in strict accordance with this specification.

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APPENDIX A

**BLP-002 A
Lining and Coating
Report Summary**

PROJECT/STOCK NO. _____ N.B. NO. _____ DATE _____

COMPANY _____ INSPECTOR _____

TYPE OF LINING _____ D.F.T. REQUIRED _____

TYPE OF PAINT _____ D.F.T. REQUIRED _____

TYPE OF PAINT _____ D.F.T. REQUIRED _____

EXTERIOR INSPECTION SUMMARY: _____

INTERIOR INSPECTION SUMMARY (VISUAL & UNDER CONE): _____

AVG. D.F.T. READINGS (PAINT): TOP _____ BOTTOM _____ SHELL _____ LEGS _____

AVG. D.F.T. READINGS (LINING):
TOP _____ BOTTOM _____ SHELL _____ UNDER CONE _____

CONTINUITY TEST (VOLTS _____) _____

REPAIRS REQUIRED: NO _____ YES _____

COMMENTS: _____

NOZZLES INSTALLED BY: _____ DATE: _____ SAP #: _____

NOZZLES VERIFIED BY: _____ DATE: _____ SAP #: _____

ALL REPAIRS HAVE BEEN MADE/INSPECTED AS DIRECTED ABOVE: DATE _____

BY _____ AUTHORIZED APPROVAL BY _____

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APPENDIX A

**BLP-001 A
Blasting Condition Report**

PROJECT SHORTNAME _____ NAT=L. BOARD NO. _____

PRE-SURFACE PREPARATION

RADIUS EDGES: Y___ N___ WELD SURFACE CONDITION: G___ B___
WELD SPATTER: Y___ N___ STEEL CLEANLINESS: G___ B___

SURFACE PREPARATION

INTERIOR BY _____ REQ=D. SSPC SP _____

REQ=D. ANCHOR PATTERN _____ MILS ACTUAL _____

PROFILE CLEANED: Y___ N___

LAP JOINTS FREE: Y___ N___

EXTERIOR BY _____ REQ=D. SSPC SP _____

SUBSTRATE CLEANED: Y___ N___

METHOD: TESTEX TAPE: _____ PROFILE COMPARATOR: _____

AMBIENT CONDITION

DATE	BAROMETRIC PRESSURE	WET BULB	DRY BULB	DEW POINT	RELATIVE HUMIDITY	SURFACE TEMP.

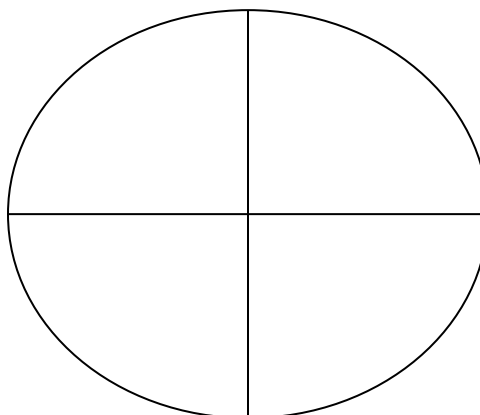


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APPENDIX A
BLP-002A REV.2
LINING DATA SHEET
Lining:

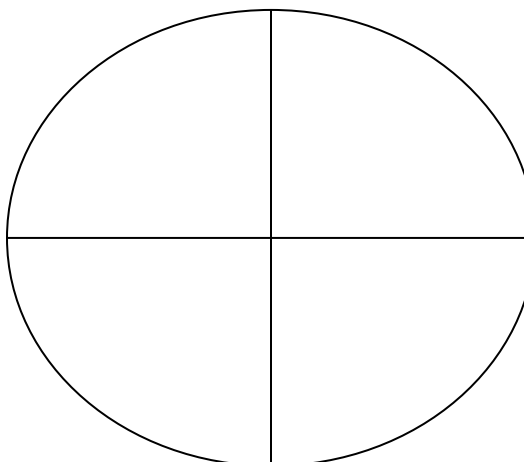
Top Head



Main Body



Bottom Head



Under Cone



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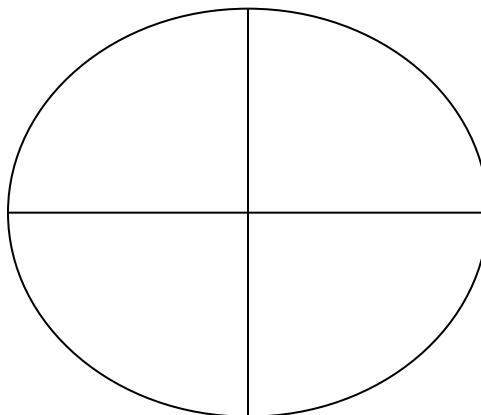
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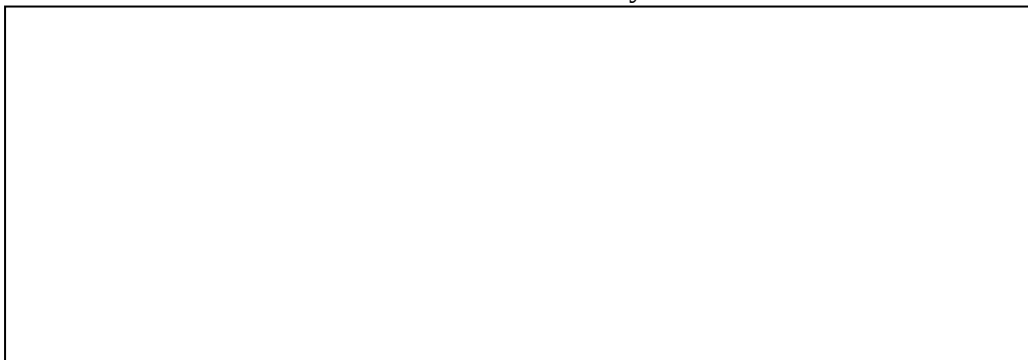
**BLP-002 A REV.2
EXTERIOR COATING SHEET**

Paint:

Top Head
Exterior

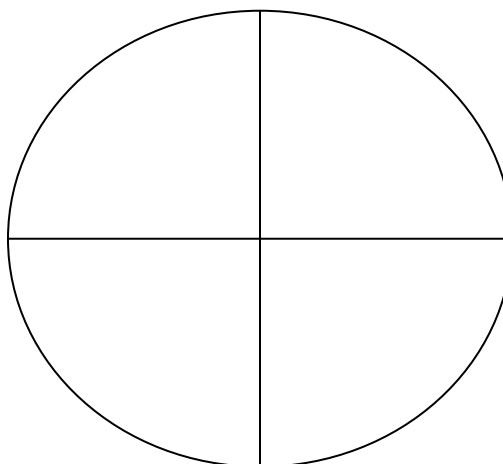
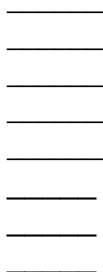


Main Body



Bottom Head
Exterior

Legs





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APPENDIX A

**BLP-002 A REV.2
FINAL LINING HOLIDAY SUMMARY**

NATIONAL BOARD: _____ MODEL # : _____

INSPECTION #1, DATE: _____
RESULTS:

INSPECTION #2, DATE: _____
RESULTS:

INSPECTION #3, DATE: _____
RESULTS:

INSPECTION #4, DATE: _____
RESULTS:

HOLIDAY FREE DATE: _____



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11. APPENDIX B- MANUFACTURER'S PRODUCT DATA

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SELECTION & SPECIFICATION DATA

Generic Type	Vinyl ester
Description	Vinyl ester resin combined with special curing system and inert flake pigment to provide outstanding chemical and physical properties. Specially formulated for excellent abrasion resistance. PLASITE 4110 meets the FDA requirements for 21 CFR, 175.300 and 177.2420 and is suitable for potable water service per NSF Std. 61. Uses: As a high chemical abrasion-resistant thick film for tank lining service and as a maintenance coating for severe exposure.
Features	Meets the criteria of NSF/ANSI/CAN 600
Color	Charcoal gray
Primer	For steel surfaces, coating is considered to be a "self-priming" system. Do not apply PLASITE 4110 directly to concrete. See reference to fillers and sealers in CONCRETE section.
Dry Film Thickness	35 - 45 mils (889 - 1143 microns) total thickness achieved in 2-3 multi-pass spray coats recommended for immersion service. Consult Carboline Technical Service Department for any deviation to this film thickness. Refer to APPLICATION section.
Coverage Rate	Plasite 4110 will cover approximately 960 mil ft. ² /gal. or 86.4 sq. m. per 25 microns/gal. This is a coverage obtained from field use on small jobs and includes loss in can, spray loss, small amount of shrinkage, etc. Application by conventional spray equipment may affect coverage.
VOC Values	As Supplied : 0.50 lbs/gal (60 g/L) Plasite Thinner #20 : Thinned 5% by volume 0.78 lbs/gal (93 g/L)
Dry Temp. Resistance	Continuous: 380°F (193°C) Non-Continuous: 460°F (238°C) Limited short excursions to 460 °F (238 °C) acceptable. Wet temperature resistance depends upon concentration and reagent exposure.
Topcoats	Not Applicable
Density	79.1 lbs/ft ³ (0.26384 lbs/ft ² at 40 mils)

SUBSTRATES & SURFACE PREPARATION

General	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.
Steel	Cleanliness: Abrasive blast to SSPC-SP10 (minimum) Profile: Minimum 4 mil (100 micron) dense, sharp anchor profile free of peening, as measured by ASTM D 4417. Defects exposed by blasting must be repaired.

SUBSTRATES & SURFACE PREPARATION

Aluminum Surface shall be clean and grease-free with a blast produced anchor pattern or "tooth" as described earlier under "Steel". In addition, the blasted surface shall be given a chemical treatment such as: Alodine 1200S available from Henkel Surface Tech, Iridite 14-2 produced by MacDermid Incorporated, Oakite Cryscoat 747 LTS and Oakite Cryscoat Ultraseal produced by Oakite Products.

Concrete or CMU Concrete shall be designed, placed, cured, and prepared per NACE No. 6/SSPC-SP 13, latest edition. Abrade to remove all laitance, loose concrete, etc. and to create surface profile in accordance with the appropriate ICRI CSP 5-7.

PERFORMANCE DATA

All test data was generated under laboratory conditions. Field testing results may vary.

Test Method	System	Results
Abrasion Resistance	Plasite 4110	11 milligrams average loss per 1000 cycles Taber CS-17 Wheel, 1000 gram weight
Elongation	Plasite 4110	1.7% using Method ASTM D638
Film Density	Plasite 4110	79.1 lbs/ft ³ 0.26384 lbs/ft ² at 40 mils
Pigments	Plasite 4110	Inert fillers and flake
Surface Hardness	Plasite 4110	Konig Pendulum Hardness of 134 seconds (Glass Standard = 250 seconds); ASTM Method D4366-84.
Thermal Shock	Plasite 4110	Unaffected by minus 70 °F to plus 200 °F in 5 cycles, or 40 to 380 °F in 10 cycles

MIXING & THINNING

Mixing Mix Part B into Part A using a mechanical high speed agitator, making sure all Part B is completely mixed with Part A. Maintain a good vortex while mixing until a smooth liquid, free of any unmixed particles of pigment, is obtained (approximately 15-30 minutes). After the pigments and liquid are thoroughly mixed, add the entire amount of the measured liquid promoter (Part D). Mix completely. (no color streaking or residue of part D should remain on the container sidewalls). Allow to cool if material temperature increases, then add Part C and necessary amount of Plasite Thinner 20. Mix an additional three to five minutes.

WARNING! The promoter (Part D) and the catalyst (Part C) must be separately mixed into the coating (Parts A&B). Any contact of unmixed Part C with Part D may lead to a fire or an explosion! Continuous mixing during use is required. Part A, Part B and Part D may be premixed up to 72 hours prior to adding Part C. Operator should wear face mask during high speed mixing of the coating components. Avoid breathing dust.

Kit components match as follows:

Small, 1 gallon kit:

Part A - Approximately 3/4 of a gallon in a one gallon container

Part B - Approximately 5.5 pounds in a one gallon container

Part C - Approximately 3.5 fluid ounces in a 6 ounce plastic bottle

Part D - Less than 0.5 fluid ounce in a 2 ounce plastic bottle

Large, 5 gallon kit:

Part A - Approximately 3.75 gallons in a 6 gallon container

Part B - Approximately 27 pounds in a one gallon container

Part C - Approximately 18 fluid ounces in a 1 quart plastic bottle

Part D - Approximately 1.4 fluid ounces in a 2 ounce plastic bottle

MIXING & THINNING

Thinning	Use 2 to 10% thinning with PLASITE Thinner #20 as needed to adjust coating for higher temperatures and various application conditions. Topcoating of previously coated films will require the addition of 2 to 20% thinner. Consult Carboline laboratory for unusual thinning requirements. See RECOATING TIME SECTION.
Pot Life	1.5-3 hours in one gallon cans and 1.5-2 hours in five gallon cans at 70 to 90 °F (21-32 °C) MATERIAL temperature. MATERIAL temperatures in excess of 90 °F will significantly reduce pot life. CAUTION! Do not attempt to extend pot life by mixing newly catalyzed coating into coating near the end of its pot life.

APPLICATION EQUIPMENT GUIDELINES

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

Conventional Spray	59ASS Fluid Nozzle 251 Air Cap 559SS Needle Pot pressure of approximately 50 psi Atomizing pressure of approximately 60 psi Use standard production type pressure pot with air motor drive agitator. Heavy-duty trigger spring recommended. Note: Application by conventional spray equipment may affect maximum film building capabilities and coverage rates. Applicators may prefer to apply additional coats to achieve the 40 mil nominal DFT.
Airless Spray	GPM Output 3.0 (minimum) Material hose 3/8" I.D. (minimum) Fluid nozzle 0.025" or larger Output PSI 1800-2200 12" minimum spray width All screens should be removed from pump and gun. CONTINUOUS MIXING DURING USE IS REQUIRED. Note: Conventional spray equipment is preferred. Expect higher wear rates to airless spray equipment lower units and spray tips.
Brush	Brush application is not recommended, but may be used for repairs or touch-up. Continuous mixing during use is required.

APPLICATION PROCEDURES

General

A minimum surface temperature of 70 °F (21 °C) is required to obtain polymerization of the coating system. Coating can be applied at a surface temperature as low as 60 °F (16 °C) but polymerization will be inhibited. Succeeding coats cannot be applied without damaging the system until the surface temperature rises sufficiently to obtain partial polymerization. This will require raising to the minimum surface temperature of 70 °F (21 °C) within 12 hours of application. Refer to CURING section. When surface temperatures are over 100 °F (38 °C), consult Carboline Technical Service for special instructions.

The mixed coating shall be applied utilizing a multi-pass spray system. Apply horizontal and vertical passes with 50% overlap. Special precautions are required at overlaps and welds to eliminate excessive film build. Spray gun should be perpendicular to surface at all times, approximately 14 in/36 cm from surface. For non-NSF applications, coating may be overcoated after initial "set" which will occur normally in 3 to 6 hours at 70 °F (21 °C) with proper ventilation. Initial "set" time will decrease as surface temperature increases. Refer to RECOATING TIME section.

When physical contact (foot traffic, scaffolding, etc.) with the previously applied coating, or for NSF applications is needed, a minimum of 10 hours at 70 °F (21 °C) substrate and air temperature with ventilation is required before proceeding. Previously applied coats must have reached a "non-tacky" state before being exposed to physical contact. This condition will occur in less time as surface temperature increases. Overcoating shall be performed as soon as possible to prevent contamination.

LINING REPAIR

Clean damaged area, removing all contaminants and loose coating. Abrasive blast substrate to original specification where coating has been exposed to environment and where oxidation is evident. Feather the original coating not less than 2 in/5 cm from damaged area.

If new coating is physically damaged and has not been in service, repair as shown above. For repairing holidays, sand surface and brush apply proper thickness of coating. Apply coating by brush or spray. Do not apply by brush on areas larger than 1 sq. ft./0.93 sq.m.

RECOATING TIME

May be recoated after initial 10 hour cure. Following coating must be applied within 30 days. Each following coat should be diluted approximately 2 to 20% with PLASITE Thinner 20. Note: Previously applied coating exposed to an accumulation of 24 hours of sunlight or surface temperatures in excess of 130 °F may result in intercoat disbondment. An applied coating film must be topcoated before an accumulation of 24 hours exposure has occurred or special procedures (such as shading with tarps) must be used.

Warning: Contamination of previously exposed coating film may be detrimental to adhesion of the repair and may affect life expectancy.

APPLICATION CONDITIONS

Condition	Material	Surface	Ambient	Humidity
Minimum	70°F (21°C)	60°F (16°C)	60°F (16°C)	0%
Maximum	90°F (32°C)	100°F (38°C)	100°F (38°C)	80%

A minimum surface temperature of 70 °F (21 °C) is required to obtain polymerization of the coating system. Coating can be applied at a surface temperature as low as 60 °F (16 °C) but polymerization will be inhibited. Succeeding coats cannot be applied without damaging the system until the surface temperature rises sufficiently to obtain partial polymerization. This will require raising to the minimum surface temperature of 70 °F (21 °C) within 12 hours of application. Refer to CURING. When surface temperatures are over 100 °F (38 °C), consult Carboline Technical Service Department for special instructions.

CURING SCHEDULE

Surface Temp.	Cure Time
70°F (21°C)	10 Days
90°F (32°C)	7 Days

Although coating may be applied at substrate temperatures as low as 60 °F (16 °C), the substrate temperature must be raised to at least 70 °F (21 °C) within 12 hours and held until coating surface is tack-free (approximately 10 hours) to avoid possible loss of cure. A minimum of 70 °F (21 °C) surface temperature is required to obtain polymerization of this coating.

Surface Temp.	Cure Time
110°F (43°C)	72 Hours
120°F (49°C)	36 Hours
130°F (54°C)	18 Hours
140°F (60°C)	10 Hours
150°F (66°C)	6 Hours
160°F (71°C)	4.5 Hours
170°F (77°C)	3.5 Hours
180°F (82°C)	2.5 Hours
190°F (88°C)	2 Hours
200°F (93°C)	1.75 Hours

Listed are a few curing schedules that may be used for time and work planning. Prior to raising the metal to the force curing temperature, it is necessary that an air dry time of 2 to 5 hours at temperatures from 70 °F (21 °C) to 100 °F (38 °C) be allowed. After the air dry time has elapsed, the temperature should be raised in increments of approximately 30 °F (17 °C) every 30 minutes until the desired force curing metal temperatures are reached. Any moisture from condensation of any source will kill the cure on freshly applied coating before it reaches a “non-tacky” stage. A force cure at 200 °F (93 °C) metal temperature for 4 hours is necessary to comply with NSF Standard 61 requirements. See NSF instructions below for compliance requirements.

CLEANUP & SAFETY

Cleanup	Clean with PLASITE Thinner 20. In case of spillage, absorb and dispose of in accordance with local applicable regulations.
Safety	Read and follow all caution statements on this product data sheet and on the SDS for this product. Employ normal workmanlike safety precautions. Keep container closed when not in use.
Ventilation	When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure, use MSHA/NIOSH approved respirator.
Caution	This product contains flammable solvents. Keep away from sparks and open flames. All electrical equipment and installations should be made and grounded in accordance with the National Electric Code. In areas where explosion hazards exist, workers should be required to use non-ferrous tools and wear conductive and non-sparking shoes.

TESTING / CERTIFICATION / LISTING

TESTING / CERTIFICATION / LISTING

Potable Water Certifications

- PLASITE 4110 is certified to NSF/ANSI Standard 61 for ambient potable water when the following requirements are met:
- The tank is 3,000 gallons/11,100 liters or larger.
- PLASITE Thinner #20, up to maximum of 20% by volume, may be used for thinning purposes.
- The coating must be applied in 2 to 3 coats to a maximum DFT of 45 mils/1125 microns.
- 10 hours of dry time between coats at 70°F to 100°F.
- 12 hours dry time of the final coat at 70°F to 100°F before force curing.
- Prior to placing the lining in service, it must be force cured at 200 °F/93 °C metal temperature for 4 hours.

PACKAGING, HANDLING & STORAGE

Packaging

- 1 gallon kit:**
Part A: Partially filled 1 gallon container
Part B: Partially filled 1 gallon container<
Part C: Partially filled 6 ounce plastic bottle
Part D: Partially filled 2 ounce plastic bottle
- 5 gallon kit:**
Part A: Partially filled 6 gallon container
Part B: Partially filled 5 gallon container
Part C: Partially filled 1 quart plastic bottle
Part D: Partially filled 2 ounce plastic bottle

Shelf Life

- At 75 °F (24 °C)
Part A : 4 months
Part B: 24 months
Part C: 12 months
Part D: 24 months

Cooler storage temperatures will increase shelf life. Storage at higher temperatures can result in substantially shorter shelf life.

Storage

Keep out of direct sunlight. Avoid excessive heat and do not freeze.

Shipping Weight (Approximate)

- 12 lbs. per 1 gallon kit
60 lbs. per 5 gallon kit

WARRANTY

To the best of our knowledge the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Carboline Company to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance, injuries or damages resulting from use. Carbolines sole obligation, if any, is to replace or refund the purchase price of the Carboline product(s) proven to be defective, at Carbolines option. Carboline shall not be liable for any loss or damage. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY CARBOLINE, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. All of the trademarks referenced above are the property of Carboline International Corporation unless otherwise indicated.



TAB 2

BELOW CONE LINING

SPECIFICATION NUMBER VS9 FOR UNDER CONE VESSEL COATING VINYL ESTER VESSEL LINING

1.0 SCOPE OF WORK

- 1.1 This specification covers materials, surface preparation, application and testing of protective coatings for coating under the internal cone of Carbon Steel Vessels.
- 1.2 The scope of work includes all labor, materials, equipment and services required for lining and testing the vessels indicated on the drawing and/or applicable documents.
- 1.3 The entire internal surface under the cone of the designated vessels shall be lined. This includes the under side of the internal cone, the inside of the bottom head and the portion of the straight side below the cone to shell seam..
- 1.4 The coating must satisfactorily protect the internal metal surfaces from corrosion and erosion by the treated water.
- 1.5 The Contractor shall guarantee that all materials and workmanship shall be free of defects and that they will conform to standards set forth for first-class workmanship and quality. In the event of failure of the coating to withstand the service conditions set forth in Article 3.0, the Contractor shall, at his expense, replace the defective materials and workmanship to the Buyer's satisfaction.

2.0 REFERENCE DOCUMENTS

- 2.1 Steel Structures Painting Council Surface Preparation Specification No. 1, "Solvent Cleaning" (SSPC-SP1-85).
- 2.2 Steel Structures Painting Council Surface Preparation Specification No. 2, "Hand Tool Cleaning" (SSPC-SP2-85).
- 2.3 Steel Structures Painting Council Surface Preparation Specification No. 3, "Power Tool Cleaning" (SSPC-SP3-85).
- 2.4 Steel Structures Painting Council Surface Preparation Specification No. 5, "White Metal Blast Cleaning" (SSPC-SP5-85).
- 2.5 NACE 6F-166 "Recommended Practices for Inspections of Linings on Steel and Concrete".

2.6 Plasite 4100 (4110) or Hemple TL-220S AR Technical Bulletin.

2.7 Caulking Materials Compound Semstone Thoixatrope-C Technical Bulletin.

3.0 SERVICE CONDITIONS

3.1 The coating will be exposed to static and turbulent water flow.

3.2 The characteristics of the slurries will be as follows:

3.2.1 Treated Wastewater or Groundwater

3.2.2 Temperature - 35 -100°F

3.2.3 PH - 5.0 to 9.0

3.2.4 Density Water

3.2.5 Abrasive - Minimal

4.0 MATERIALS

4.1 The coating shall be a heavy-duty, thick film, high-resistant vinyl ester resin material with abrasion resistant qualities. The lining material shall be suitable for spray application to a nominal 20 to 25 mil dry film thickness on a steel surface. The Semstone Thoixatrope-C mixed with vinyl ester shall be a thick brushable consistency.

4.2 The coating shall be Plasite No. 4110 or Hemple TL-220S AR , no other material is acceptable..

5.0 DELIVERY, STORAGE AND HANDLING

5.1 Product Delivery: Materials shall be delivered to the site in sealed, original, labeled containers with the product name, product number, batch number, color designation, and instructions for mixing and thinning.

5.2 Storage: Contractor shall be responsible for the proper storage of all coating materials. Damaged, leaking, or unlabeled containers shall be disposed of daily.

5.3 Storage Location: Materials shall be stored in a place specifically assigned for that purpose which is dry and out of direct sunlight. Materials shall be stored in a manner so as not to exceed the manufacturer's temperature limitations. In all cases, the storage and handling of materials shall conform to the requirements of the manufacturer and the applicable safety regulatory agencies.

- 5.4 Fire Prevention: All precautions to prevent fire shall be taken. Containers of flammable materials shall be opened only when needed. Rubbing cloths and oil rags shall be kept in tightly closed containers and removed from the site daily. Fire or other damage due to spontaneous combustion or other names shall be the Contractor's responsibility.

6.0 APPLICATION

6.1 UNDER THE CONE SURFACE PREPARATION

- 6.1.1 The Contractor shall install and maintain protective coverings on any surface not to be coated to protect the surface during surface preparation and coating application.
- 6.1.2 Grease, Oil, and Interference Material: Surface contamination on bare steel such as grease, oil, tape tags, markings, etc. shall be removed by the Contractor by solvent cleaning per SSPC-SP1 prior to blast cleaning.
- 6.1.3 Surface Irregularities: Prior to blast cleaning, all surfaces shall be inspected for weld spatter, weld flux, or any other surface irregularities. When discovered, they will be removed by the Contractor.
- 6.1.4 Edges: All sharp edges will be ground to a smooth radius. Areas inside the vessel that are not expected to be in direct contact with activated carbon are not required to be chamfered unless noted on the specific detail. (A specific example: the holes in the internal cone design. They do not require a radius or chamfer on their edge since filter nozzles must fit snugly into these holes for proper service.)
- 6.1.5 Ambient Conditions: Final blast cleaning shall not be performed when the surface temperature is less than 5°F greater than the dew point temperature of the surrounding air, nor when the relative humidity is greater than 90%.
- 6.1.6 Compress Air Cleanliness: The air supply used for blast cleaning shall be free from moisture and oil contamination. The air cleanliness shall be verified at least once per shift for each compressor used. The test involves directing the air stream onto a piece of white paper held not more than 18" away from the air outlet. The test shall be run downstream of moisture and oil separators for a period of not less than two minutes. Sufficient freedom from oil and water is confirmed if no soiling or discoloration is visible on the paper. If air contamination is evidence, the filters shall be changed or cleaned, traps emptied, after coolers, moisture separators or filters added, the equipment maintained, or such adjustments made as may be otherwise required to achieve clean, dry air for all blast cleaning, coating application, blow-down, or any other quality operations involving compressed air.
- 6.1.7 Abrasive/Profile: The abrasive selected shall be identified by the Contractor prior to use. The abrasive shall have a sharp, hard cutting surface and shall be dry and free of oil or soluble salt contaminants. Copper slag shall not be used. The abrasive shall provide an anchor pattern of 3.0 to 4.0 mils minimum in depth. The surface profile shall be measured using Testex Press-O-Film replica tape and a spring micrometer, or a visual comparator.

- 6.1.8 Abrasive Blasting --
Abrasive Blasting of Carbon Steel: The preparation of all carbon steel shall be by abrasive blast cleaning to remove all mill scale, rust, and coatings.
- 6.19. Dry abrasive blast clean all interior steel surfaces in accordance with SSPC-SP5, "White Metal Blast Cleaning".

6.2 COATING APPLICATION

- 6.2.1 Surface Cleanliness: The surface of the prepared steel shall be blown down (clean, dry, compressed air), brushed and/or vacuumed prior to coating application to remove spent abrasive, dust, and other interference material. If grease or oil have become deposited on the surface, they shall be removed by solvent cleaning (SSPC-SP1) prior to coating application. Work schedule shall be such that a minimal amount of time is allowed between surface preparation and coating application. Any rust, which has formed, shall be removed to the specified degree of cleanliness prior to coating.
- 6.2.2 Ambient Conditions: Coatings shall be applied only when the interior surface and air temperatures are between 60°F and 100°F, the relative humidity in the tank is less than 90%, and the temperature of the surface to be painted is at least 5°F above the dew point temperature of the air in the tank.
- 6.2.3 Mixing: Materials to be mixed shall have been delivered to the jobsite and stored in accordance with Section 5 and shall not have exceeded its shelf life. Mixing shall conform to the requirements of the coating manufacturer.
- 6.2.4 For 4100 (4110), mix Part II into Part I using a high-speed mechanical agitator with mixing blades fitting close to sides of container, making sure all of Part II is completely mixed with Part I. Mix well until obtaining a smooth liquid free of any unmixed particles of pigment. Add Part III and mix well. Part I is the liquid resin, Part II is the pigment, and Part III is the small portion of catalyst. Splitting of kits is not recommended. If necessary, mix Part I and Part II thoroughly and proportion mixture accurately with Part III. Continuous mixing during use is required. Operator should wear a facemask during high-speed mixing of the coating components. Avoid breathing dust.

Hemple TL-220S AR

Is only a two part mix (Part A and Part B), only mix just prior to spraying, not in advance. Refer to technical bulletin when using. Thin only when strip coating.

- 6.2.5 Only complete kits shall be mixed. Paint which has skinned, gelled, separated, or otherwise deteriorated during storage to the extent that it cannot be remixed to a homogeneous film of the intended viscosity, uniformity and consistency shall not be used. Mixed coatings shall not be used beyond their pot life.

- 6.2.6 Thinning: Only Plasite 20 thinner shall be used for thinning Plasite 4100 (4110) and the amount of thinning will be limited to about 10%. If NSF 61 criteria is specified, follow Plasite requirements for Thinner content. Hemple TL-220 AR is not recommended to be thinned.
- 6.2.7 Methods: 4100 (4110) coatings shall be applied by conventional spray. Coating applications shall be in accordance with the requirements of SSPC-PA1 and the Plasite 4100 (4110) Technical Bulletin. In the event of a conflict, the requirements of this specification, manufacturer's instructions and PA1 shall prevail in that order. Hemple TL-220 AR shall be applied by airless pump and hopper/gravity feed set up.
- 6.2.8. Methods: Semstaone Thixatrope-C shall be mixed with appropriate vinyl ester at an approximate 75% lining to 25% Semstone by hand to a paste like consistency than add hardener.
- 6.2.9 Agitation: Plasite 4100 (4110) material must be kept agitated in spray pots or containers during application.
- 6.2.10 Coating Thickness: Vinyl ester shall be applied to a dry film thickness of between 20 and 25 mils. The Semstone caulking mix shall be applied to a sufficient thickness to fill in all crevices and irregularities.
- 6.2.11 Coating Continuity: Coating shall have smooth, streamline surfaces relatively free of dry spray, over spray, orange peel, fish eyes, craters, bubbles, and other significant defects. Shadow-through, skips and misses are not acceptable. Runs or sags can be brushed out while the material remains wet. Areas where blast products or other debris have become embedded in the paint film shall be repaired by removing these products and touching up the area. Coatings shall be commercially continuous as defined by NACE Publication 6F-166; Calgon Carbon Corporation reserves the right to verify coating continuity.
- 6.2.12 Re-Coat Time and Cleanliness: Any required subsequent coats shall be applied only after the previously applied coat has been allowed to dry as required by the manufacturer's Technical Bulletins, but as soon as possible in order to minimize exposure to intercoat contamination. Any such surface contamination, which is present, shall be removed prior to the application of subsequent coats.

6.3 SAFETY

- 6.3.1 The coating system may be handled safely by trained personnel following normal laboratory and plant standards for good housekeeping and personal hygiene. In the event of skin contact complications, the affected areas should be washed with soap and water. Eye protection is recommended. Work shall be performed in well-ventilated areas away from an open flame. When in enclosed areas, although ventilated, fresh air masks should be provided.
- 6.3.2 The Plasite catalyst or curing agent is relatively stable at room temperature but must be protected from contamination, heat and fire and is classified by the Interstate

Commerce Commission as an “oxidizing material” and subsequently all shipping containers bear a yellow caution label. The catalyst is highly irritating if it gets into the eyes. Immediately rinse eyes thoroughly with water and get medical attention. The catalyst also can be a skin irritant and this should be removed with large quantities of soap and water. Since this is an oxidizing material, it should not be allowed to accumulate or remain in soaked rags or clothing.

7.0 INSPECTION AND TESTING

7.1 INSPECTION

7.1.1 Contractor Inspection: The Contractor shall be responsible for inspection of all phases of the surface preparation and coating application in accordance with the Inspection Procedure.

7.1.2 Owner Inspection: Calgon Carbon reserves the right to inspect all phases of the coating operation to assure compliance with specification requirements. The Contractor shall repair/correct any and all deficiencies at his own expense. The Contractor shall provide accessibility and lighting for any inspections. It is not intended, however, that the presence or activity of such inspection shall, in any way whatsoever, relieve the Contractor of his obligation to provide inspection of his own to assure compliance with this specification. In all cases, Calgon Carbon or its approved agent will perform final inspection before acceptance.

7.1.3 Work Stoppage: Calgon Carbon reserves the right to stop any and all work at any time for non-compliance with the requirements of this specification.

7.2 TESTING

7.2.1 Check dry film thickness of coating by means of a fixed probe or magnetic pull-off type gage. Dry film testing to be in accordance with SSPC-PA2.

8.0 INSPECTION PROCEDURE

8.1 SURFACE PREPARATION

8.1.1 The applicator is required to fill out an EAP-2A form (supplied by Calgon Carbon Corporation) and have the form available for the Calgon Carbon Corporation inspector at the time of his inspection. Approved lining applicators may use their own inspection format if agreed to by Calgon Carbon Corporation.

8.1.2 Verify prior to blast cleaning that sharp edges, weld splatter, slivers, laminations, scabs or any other surface irregularities have been adequately removed to provide a surface suitable for coating application.

8.1.3 Verify prior to blast cleaning that heavy deposits of oil and/or grease have been adequately removed in accordance with “Solvent Cleaning” (SSPC-SP1).

8.1.4 Prior to blast cleaning operations, perform compressed air cleanliness test at least once per eight-hour shift. Insert a clean, white blotter or clean, white paper into the

air stream no more than 18 inches from air source downstream of moisture and oil separators for approximately two minutes. Examine the blotter or paper for signs of moisture and/or oil contamination. Blast cleaning should not begin unless air is free of detrimental amounts of oil and/or water.

- 8.1.5 Verify that only clean and dry abrasives will be used. If bulk abrasive is to be used, verify that the abrasive is properly protected from rain, moisture, and oil.
- 8.1.6 If abrasives are recycled, test for the presence of abrasive contamination. Add approximately one ounce of recycled abrasive to several ounces of clean water. Shake contents vigorously and visually examine the water level for signs of oil contamination.
- 8.1.7 Angular abrasive that will provide an anchor profile depth minimum equal to two mils as measured by Testex Press-O-Film replica tape.
- 8.1.8 Verify that required protective coverings are intact to assure that previously coated surfaces will not be damaged during blast cleaning operations.
- 8.1.9 Monitor and record ambient conditions and surface temperatures during blast cleaning operations using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables and record on the EAP-2A form.
- 8.1.10 "Final blast cleaning" shall not be performed unless the surface temperature is at least 5°F higher than the dew point. "Rough blasting" may be performed regardless of ambient conditions, but must be "final blast cleaned" when conditions become favorable.
- 8.1.11 Verify that blast cleaned surfaces have been prepared in accordance with SSPC-SP5, "White metal blast cleaning". SSPC-VIS-1 may be used as a visual reference. Mark all non-conforming areas with chalk or spray paint for rework.
- 8.1.12 Verify the profile (one to two mils minimum) has been achieved using the Testex Press-O-Film replica tape.
- 8.1.13 Using a dry film thickness gage, determine the magnetic base reading and record.

8.2 COATING PREPARATION

- 8.2.1 Verify that all containers are sealed, intact and properly labeled.
- 8.2.2 Verify that all coating material temperatures are at least 60°F before mixing.
- 8.2.3 Verify type of coating mixed, batch numbers of all components, type of thinner and batch number, thinning ratios, time of mix, maximum pot life, etc. and record batch numbers on the EAP-2A form.
- 8.2.4 Verify that all components are combined and thoroughly mixed in the proper proportions to obtain a uniform color, free of lumps.

8.2.5 Verify that only the recommended thinner is used.

8.2.6 Verify that the pot life is observed.

8.3 APPLICATION OF ALL COATINGS

8.3.1 Monitor and record ambient conditions on the EAP-2A form and surface temperatures every three to four hours during coating application using a psychrometer, surface temperature thermometer and U.S. Weather Bureau Tables. Coating application shall not be permitted when the surface temperature is less than 5°F above the dew point. No coatings shall be applied when the surface and/or material temperatures are less than 70°F. No coatings shall be applied when the surface temperature is expected to drop below 60°F before it has dried. Coating application shall not be permitted when the relative humidity is greater than 90%.

8.3.2 Verify compressed air cleanliness and test for conventional spray application and blowdown operations (see Section 8.1.3). Plasite 4100 (4110) must be applied using an agitated conventional pressure pot using continuous agitation during application.

8.3.3 Verify that protective coverings previously established are intact.

8.3.4 Verify that surrounding air is free of airborne contaminants prior to the application of coatings.

8.3.5 Verify intercoat cleanliness and that blast-cleaned surfaces have been cleaned to assure that coatings will not be applied over oil, grease, dirt, dust, spent abrasive, etc.

8.4 APPLICATION

8.4.1 Verify that vinyl ester has been applied to all surfaces prepared that day before visual oxidation takes place. Any surfaces not coated the same day shall be reblasted prior to coating application.

8.4.2 Verify that weld seams, crevices and irregularities have been brush coated and filled in with the Semstone vinyl ester mix prior to the spray application of the vinyl ester.

8.4.3 Verify that the first coat has been applied to a dry film thickness of 20-25 mils. Perform dry film thickness tests in accordance with SSPC-PA2.

8.5 FINAL INSPECTION OF COATED SURFACES

- 8.5.1 Verify that all surfaces have a smooth and uniform appearance free of any irregularities.
- 8.5.2 Verify that the total dry film thickness (minimum two coats) is 20-25 mils. Perform dry film thickness tests.
- 8.5.3 All repairs shall be made in strict accordance with this specification. If repairs are required, the EAP-2 inspection form shall be completed as directed by the Calgon Carbon Corporation inspector.

9.0 SPECIAL REQUIREMENTS FOR NSF-61 (WHEN SPECIFIED)

- 9.1 When the end-use application requires compliance with NSF-61, Plasite must be applied in accordance with specific instructions found in the product bulletin. Applicator must follow these specific instructions.
- 9.2 CCC will notify applicator that this section (9.0) applies by signifying such in the purchase order and/or drawings and specifications.
- 9.3 Force curing may follow the date of application but must be completed prior to the disinfection of the vessel at customer site.
- 9.4 The NSF criteria specified by the manufacturer cannot be altered. Any deviation must be in writing to CCC for interpretation and decision making.
- 9.5 Force curing must be conducted in a controlled manner. Heat rise shall be not greater than 1 degree per minute, up to the maximum temperature needed to achieve a 200°F minimal surface temperature. This is critical to avoid blistering or post-cure holidays.
- 9.6 Heat should be applied at top or bottom head to allow equal flow of hot air. If heating in the shell, there should be an internal attachment to allow heat to distribute equally so there is not a section of lining that heats faster than the rest. See appendix for recommended flow distribution according to Plasite's guide.
- 9.7 A strip recorder with multiple thermocouples (or other similar device) is preferred to record the temperature during the force cure process. Records shall be forwarded to CCC for retention.

**** REVISIONS ****

This specification has been revised as indicated below. The new pages added and/or the existing pages revised are attached as replacements for those previously issued.

REVISION	DATE	BY	PAGE	REMARKS
A	11/15/1993	JMcM	All	Issued For Comment
1	6/18/1992	FRF	All	Issued For Construction
2	5/10/2000	MRM		Revised Paragraph 6.1.4
3	12/15/2005	JMcM	All	General Revision
4	11/9/07	RES	9	Added 9.0, NSF Force Curing
5	8/7/2019	TAB	All	Include Hemple TL-220S AR
6	09/21/2021	TAB	All	Increased millage to 20-25

ISSUED: JUNE, 1992



SECTION 4

PAINT SPECIFICATIONS

Specification Number: RS15
Polyurethane Painting (Top Coat)

Scope

- 1.1. This specification covers the minimum procedures required for the surface preparation and coating of equipment that has been painted previously.
- 1.2. The work to be performed under this specification consists of painting all metal materials including vessels, supports, base plates, skids, pipe, pipe supports, brackets, hanger rods, pipe clamps, and all other metal surfaces, not mentioned in Section 4.0, that are part of the system **references BLP-003 Painting and Coating of Metal Surfaces with Inspection.**
- 1.3. The “applicator” referred to in this specification could be Calgon Carbon Corporation or a sub-contractor.
- 1.4. Unless otherwise specified, the applicator shall furnish all paints and solvents, necessary tools, scaffolds, ladders, compressed air, etc.
- 1.5. The applicator will familiarize himself with rules and regulations as set forth by the Safety Department of the facility where painting is to be conducted and comply with these regulations.

2.0 Surface Preparation Of Painted Surfaces

- 2.1. Previously coated surfaces that are in good condition:

Maintenance painting will frequently not permit or require complete removal of all old coatings prior to re-painting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold mildew, mortar, efflorescence and sealers must be removed to assure sound bonding to the tightly adhering old paint.

In addition, glossy surfaces of old paint films must be clean and dull before re-painting. Thorough washing with an abrasive kitchen cleanser will clean and dull in one operation, or wash thoroughly and dull by sanding. Remove all sanding dust.

The applicator shall recognize that any surface preparation short of total removal of the old coatings may compromise the service length of the new coating system. The applicator shall always check for the compatibility of the previously-painted surface with the new coating by applying a test patch of 2-3 square feet. Allow to dry thoroughly; then check adhesion.

- 2.2. Previously coated surfaces that are not in good condition:

The applicator will hand-tool clean the surfaces to remove loose rust, loose mill scale and loose paint to the degree specified by SSPC-SP2-63 **and references Procedure BLP-001 Media Blasting of Steel Vessels, Pipe, and Structural which includes surface cleaning and prep.** The applicator shall accomplish this by hand chipping, scraping, sanding, wire brushing or abrasive blasting. The applicator shall further prepare the hand-tool cleaned surface per Paragraph 2.1 above.

3.0 Paint Application

- 3.1. Ensure base coat is cured before applying top coat of polyurethane.
- 3.2. The coating shall be applied in accordance with the manufacturer's instructions.
- 3.3. The system shall consist of at least one (1) coat of acrylic polyurethane to a total DFT of 3 nominal mils (acceptable range: 2-4 mils).
- 3.4. All paint shall be within its expiration date and furnished in unopened containers.
- 3.5. Thinners shall be used only as specified in the coating manufacturer application procedures.
- 3.6. Painting will not be allowed when the relative humidity is above 85% or the surface temperature is below 55°F without special permission from Calgon Carbon Corporation.
- 3.7. Any surface that develops rust or discoloration prior to painting shall be re-prepared per Section 2.2 above.

4.0 Areas NOT to be painted

- 4.1. Galvanized steel (new) and plastic, such as PVC pipe, are not to be painted.
- 4.2. Inside of pipes shall not be painted.
- 4.3. Gauge faces, nameplates, plastic or S/S fittings, flange faces, etc. shall be masked to protect against overspray and the masking shall be removed prior to shipping.
- 4.4. Inside of a vessel. Vessel lining is covered in a different specification.

5.0 Material Specification

- 5.1. The paint used shall be a two part acrylic polyurethane. The approved manufacturers and products are listed below. The manufacturer's specifications shall be followed along with any recommendations and precautions stated on the container's label.

Approved products include:

Hempel Hempthane HS 55610

Carboline -- Carbothane 134 HG

Sherwin Williams -- Acrolon 218 HS

International -- Interthane 990HS

Other manufacturers/products may be proposed, but are subject to Calgon Carbon Corporation approval prior to use.

- 5.2. The color shall match Carboline #A767 "Slate Gray" or as specified on the project drawings.

**** Revisions ****

This specification has been revised as indicated below. The new pages added and/or the existing pages revised are attached as replacements for those previously issued.

REVISION	DATE	BY	PAGE	REMARKS
0	7/19/1983	JDH	All	Issued for Construction
1	01/20/2010	RES	All	New format
2	08/27/2013	RES	2	Added Carbothane 134 HG
3	10/10/2016	TIG	1-2	Updated Procedure
4	10/16/2018	RES	3	Added Hempthane HS

Selection & Specification Data

Generic Type	Aliphatic Acrylic Polyurethane
Description	Thin film, high gloss finish with exceptional weathering performance characteristics. Used extensively in virtually all industrial markets, 134 HG provides a smooth, durable finish that has superior resistance to corrosion, abrasion and chemical exposure.
Features	• High solids, low VOC content • Excellent weatherability • Exceeds SSPC Paint 36 specification for a Level 3 urethane • Available in all Carboline colors including metallic-pigmented colors • Excellent flow characteristics allow for application by spray or roller • Superior impact and abrasion resistance • Indefinite recoatability • VOC compliant to current AIM regulations • Suitable for use in USDA inspected facilities
Color	Refer to Carboline Color Guide. Certain colors, particularly in non-lead safety oranges, reds and yellows may require multiple coats for adequate hiding. Check color suitability before use.
Finish	Gloss
Primer	Refer to Substrates & Surface Preparation.
Topcoat	Carbothane® 134 Clear Coat when required
Dry Film Thickness	2.0 - 3.0 mils (51 - 76 microns) per coat
Solids Content	By Volume 70% +/- 2%
Theoretical Coverage Rate	1123 ft ² at 1.0 mils (27.6 m ² /l at 25 microns) 561 ft ² at 2.0 mils (13.8 m ² /l at 50 microns) 374 ft ² at 3.0 mils (9.2 m ² /l at 75 microns)
VOC Values	Thinner 214 25 oz/gal 2.9 lbs./gal (348 g/l) Thinner 215 25 oz/gal 3.0 lbs./gal (362 g/l) Thinner 25 25 oz/gal 3.06 lbs./gal (366 g/l) As Supplied 2.2 lbs./gal (264 g/l) These are nominal values and may vary slightly with color.
Dry Temp. Resistance	Continuous: 200 °F (93 °C) Non-Continuous: 250 °F (121 °C) Discoloration and loss of gloss is observed above 200°F (93°C).
Limitations	*The alignment of aluminum flakes in aluminum-filled finishes is very dependent on application conditions and techniques. Care must be taken to keep conditions as constant as possible to reduce variations in final appearance. It is also advisable to work from a single batch of material since variations can occur from batch to batch. For more information consult Carboline Technical Service Department.

Substrates & Surface Preparation

General	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating. For all surfaces prime with specific Carboline primer as recommended by your Carboline sales representative. Refer to the specific primer's Product Data Sheet for detailed requirements.
Galvanized Steel	Prime with specific Carboline primer as recommended by your Carboline Sales Representative. Refer to the specific primer's Product Data Sheet for substrate preparation requirements.
Previously Painted Surfaces	Lightly sand to roughen and degloss the surface. Existing paint must attain a minimum 3A rating in accordance with ASTM D3359 "X-Scratch" adhesion test.

Performance Data

Test Method	System	Results
ASTM B117 Salt Fog	Blasted Steel 1 ct Org Zinc 1 ct. Epoxy 1 ct 134 HG	No rusting, blistering, loss of bond or any measurable creepage from the scribe after 3000 hours.
ASTM D2794 Impact Resistance	Blasted Steel 1 ct 134 HG	155 inch-pounds; no visible cracking. Gardner Impact Tester
ASTM D3359 Adhesion	Blasted Steel 1 ct. Epoxy 1 ct 134 HG	5A
ASTM D3363 Hardness	Blasted Steel 1 ct Epoxy 1 ct 134 HG	H
ASTM D4060 Abrasion	Blasted Steel 1 ct 134 HG	70 mg. loss after 1000 cycles, CS17 wheel, 1000 gm. load
ASTM D4541 Adhesion	Blasted Steel 1 ct. Epoxy 1 ct. 134 HG	2562 psi Pneumatic
ASTM D870 Immersion Resistance	Blasted Steel 1 ct. Org. Zinc 1 ct Epoxy 1 ct 134 HG	No rusting in the scribe; no blistering, softening or discoloration either 30 days of soft water imm
ASTM G26 Weatherometer	Blasted Steel 1 ct. Epoxy 1 ct. 134 HG	No blistering, rusting or cracking; gloss retention of 85%; color change of 1 McAdam unit after 2000
ASTM G53 ASTM D4587 Accelerated Weathering	Blasted Steel 1 ct. Org. Zinc 1 ct. Epoxy 1 ct. 134 HG	No rusting, blistering or loss of adhesion; less than 5% gloss loss after 3000 hours

Test reports and additional data available upon written request.

Mixing & Thinning

Mixing	Power mix Part A separately, then combine with Part B and power mix. DO NOT MIX PARTIAL KITS.
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Carbothane® 134 HG

Mixing & Thinning

Thinning	Spray: Up to 25 oz/gal (20%) w/ Thinner 214 or 25
	Brush: Up to 25 oz/gal (20%) w/ Thinner 215
	Roller: Up to 25 oz/gal (20%) w/ Thinner 215
	Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied. Carboline Thinner 236E may also be used to minimize HAP and VOC emissions.
Ratio	4:1 Ratio (A to B)
Pot Life	4 Hours at 75°F (24°C) and less at higher temps. Pot life ends when coating becomes too viscous to use. MOISTURE CONTAMINATION WILL SHORTEN POT LIFE AND CAUSE GELLATION.

Application Equipment Guidelines

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

Spray Application (General)	This is a high solids coating and may require adjustments in spray techniques. Wet film thickness is easily and quickly achieved. Spray equipment is available from manufacturers such as Binks, DeVilbiss and Graco.
Conventional Spray	Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, .070" I.D. fluid tip and appropriate air cap.
Airless Spray	*Pump Ratio: 30:1 (min.) GPM Output: 3.0 (min.) Material Hose: 3/8" I.D. (min.) Tip Size: .015-.017" Output PSI: 2100-2400 Filter Size: 60 mesh *Teflon packings are recommended and available from the pump manufacturer.
Brush & Roller (General)	Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or rerolling. For best results, tie-in within 10 minutes at 75°F (24°C).
Brush	Recommended for touch-up only. Use a medium, natural bristle brush.
Roller	Use a short-nap mohair roller cover with phenolic core.

Application Conditions

Condition	Material	Surface	Ambient	Humidity
Minimum	50 °F (10 °C)	35 °F (2 °C)	35 °F (2 °C)	10%
Maximum	100 °F (38 °C)	120 °F (49 °C)	95 °F (35 °C)	80%

Industry standards are for substrate temperatures to be above 5°F (3°C) the dew point. **Caution:** This product is moisture sensitive in the liquid stage and until fully cured. Protect from high humidity, dew and moisture contact until fully cured. Application and/or curing in humidities above maximum, or exposure to moisture from rain or dew may result in a loss of gloss and/or microbubbling of the product.

Curing Schedule

Surface Temp.*	Dry to Handle	Dry to Recoat & Topcoat w/ other finishes	Final Cure General
35 °F (2 °C)	36 Hours	36 Hours	14 Days
50 °F (10 °C)	16 Hours	16 Hours	10 Days
75 °F (24 °C)	8 Hours	8 Hours	7 Days
90 °F (32 °C)	4 Hours	4 Hours	5 Days

These times are based on a 2.0 mil (50 micron) dry film thickness. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure.

***Maximum recoat times are indefinite.** Surface must be clean and dry. As part of good painting practice it is recommended to test for adhesion by wiping the surface with Thinner 214 or 215. If the film shows a slight "tack" the surface is suitable for recoating without extensive surface preparation such as abrading.

Carboline Additive 101 can be used to accelerate the film forming process in this product for conditions outside of the parameters of this data sheet. Carboline Additive 101 is added at a rate of 1.0-2.0 oz per mixed gallon or a maximum of 6 oz per mixed five gallons. At this addition rate, Additive 101 will accelerate the cure rate of the urethane product between 25-40% depending on the substrate temperature range and reduce the pot life of the product by approximately 40-50% of that stated on the product data sheet. With the use of Additive 101, this product will continue to cure at temperatures as low as 20°F (-7°C).

Cleanup & Safety

Cleanup	Use Thinner 2 or Acetone. In case of spillage, dispose of in accordance with local applicable regulations.
Safety	Read and follow all caution statements on this product data sheet and on the MSDS for this product and use personal protective equipment as directed.
Ventilation	When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not able to monitor levels, use MSHA / NIOSH approved respirator.

Packaging, Handling & Storage

Shelf Life	Part A: Min. 36 months at 75°F (24°C) Part B: Min. 24 months at 75°F (24°C) *Shelf Life: when kept at recommended storage conditions and in original unopened containers.
Shipping Weight (Approximate)	1 Gallon Kit - 13 lbs (5kg) 5 Gallon Kit - 57 lbs (26 kg)
Storage Temperature & Humidity	40° -110°F (4°-43°C) 0-80% Relative Humidity
Flash Point (Setflash)	Carbothane 134 HG Part A: 50°F (10°C) Urethane Converter 811 Part B: 127°F (53°C)
Storage	Store Indoors.

This product is solvent based and not affected by excursions below these published storage temperatures, down to 10°F, for a duration of no more than 14 days. Always inspect the product prior to use to make sure it is smooth and homogeneous when properly mixed.



June 2015

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0859

Specification Number: RS17
EPOXY PAINTING

1.0 SCOPE

- 1.1 This specification covers the minimum procedures required for the surface preparation and coating of equipment that has not been previously painted. It also covers equipment that has been previously painted and **BLP-003 Painting and Coating of Metal Surfaces with Inspection and reference BLP-001 Media Blasting of Steel Vessels, Pipe and Structural which includes surface cleaning and prep.**
- 1.2 The work to be performed under this specification consists of painting all metal materials including vessels, supports, base plates, skids, pipe, pipe supports, brackets, hanger rods, pipe clamps, and all other metal surfaces, not mentioned in Section 5.0, that are part of the system.
- 1.3 The “applicator” referred to in this specification could be Calgon Carbon Corporation or a sub-contractor.
- 1.4 Unless otherwise specified, the applicator shall furnish all paints and solvents, necessary tools, scaffolds, ladders, compressed air, etc.
- 1.5 The applicator will familiarize himself with rules and regulations as set forth by the Safety Department of the facility where painting is to be conducted and comply with these regulations.

2.0 SURFACE PREPARATION OF PAINTED SURFACES

2.1 *Previously coated surfaces that are in good condition:*

Maintenance painting will frequently not permit or require complete removal of all old coatings prior to re-painting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold mildew, mortar, efflorescence and sealers must be removed to assure sound bonding to the tightly adhering old paint.

In addition, glossy surfaces of old paint films must be clean and dull before re-painting. Thorough washing with an abrasive kitchen cleanser will clean and dull in one operation, or wash thoroughly and dull by sanding. Remove all sanding dust.

It is recommended that water blasting be used (NACE Standard RP-01-72) which removes foreign matter by water (with cleanser) at pressures of 2,000-5,000 PSI at a flow of 4-14 gallons per minute.

The applicator shall recognize that any surface preparation short of total removal of the old coatings may compromise the service length of the new coating system. The applicator shall always check for the compatibility of the previously-painted surface with the new coating by applying a test patch of 2-3 square feet. Allow to dry thoroughly; then check adhesion.

2.2 *Previously coated surfaces that are not in good condition:*

The applicator will hand-tool clean the surfaces to remove loose rust, loose mill scale and loose paint to the degree specified by SSPC-SP2-63. The applicator shall accomplish this by hand chipping, scraping, sanding, and wire brushing. The applicator shall further prepare the hand-tool cleaned surface per Paragraph 2.1 above.

3.0 SURFACE PREPARATION OF UNPAINTED SURFACES

3.1 The metal surface shall be free of dirt, rust, rust-proofing, drawing oils and compounds, finger prints, mill scale, and other foreign substances both visible and invisible; thereby improving adhesion and reducing the tendency to blister and corrode on exposure.

3.2 The applicator shall use remove all loose rust and mill scale to the degree specified by SSPC-SP3-63 by power-tool chipping, de-scaling, sanding, wire brushing, grinding, or media blasting as a minimum. **SSPC-SP10** Near White Blast cleaning is preferred **reference BLP-001 Media Blasting of Steel Vessels, Pipe and Structural which includes surface cleaning and prep.**

4.0 PAINT APPLICATION

4.1 The coating shall be applied in accordance with the manufacturer's instructions and also references **BLP-003 Painting and Coating of Metal Surfaces with Inspection.**

4.2 The system shall consist of at least one (1) coat of epoxy mastic to a total DFT of 12 nominal mils (acceptable range: 10-14 mils).

4.3 All paint shall be within its expiration date and furnished in unopened containers.

4.4 Thinners shall be used only with the permission of Calgon Carbon Corporation.

4.5 Painting will not be allowed when the relative humidity is above 85% or the temperature is below 55°F without special permission from Calgon Carbon Corporation which references **BLP-003 Painting and Coating of Metal Surfaces with Inspection.**

4.6 Any surface that develops rust prior to painting shall be re-prepared per Sections 2.0 or 3.0 above.

4.7 Flange faces shall be fully painted from the outside diameter of the flange to the inside diameter of the flange to reduce the tendency for rust bleeding out from flanged joints after hydro testing. If customer specifications prohibit this practice, verify with engineering which specification is to prevail.

5.0 AREAS NOT TO BE PAINTED

5.1 Galvanized steel (new) and PVC pipe are not to be painted.

- 5.2 Inside of pipes shall not be painted.
- 5.3 Gauge faces, nameplates, plastic or S/S fittings and similar items shall be taped to protect against overspray. Tape shall be removed prior to shipping.
- 5.4 Inside of vessel shall be lined by others.

6.0 MATERIAL SPECIFICATION

- 6.1 The paint used shall be Hempel Hempadur Mastic 45880/45881 (two-part) epoxy coating system, or equal. The manufacturer's specifications are attached and shall be followed along with any recommendations and precautions stated on the paint can label.

Accepted substitutes are:

Carboline Carboguard 60
Sherwin-Williams -- Macropoxy 646 Series
International Protective Coatings -- Interseal 670

Other manufacturers may be proposed, but are subject to Calgon Carbon approval prior to use.

- 6.2 The color shall match Carboline #A767 "Slate Gray" or as specified on the project drawings.

**** REVISIONS ****

This specification has been revised as indicated below. The new pages added and/or the existing pages revised are attached as replacements for those previously issued.

REVISION	DATE	BY	PAGE	REMARKS
0	9/8/1989	FRF	All	Issued for Construction
1	1/30/1996	JPM	All	All New Pages; Revised Paragraph 4.1
2	4/15/1996	JPM	1-2-3	Revised Paragraphs 1.3, 2.2, 3.2, 4.1 ,5.3, 6.1 and 6.2
3	6/4/2002	JPM	All	Revised 1.2,1.5,3.2,5.3,6.1,6.2
4	6/08/2007	TAB	3	Revised 6.1 and 6.2
5	4/22/2008	RES	All	General Revision
6	01/13/2010	RES	3	Revised Paragraph 6.1 to SW 646
7	04/09/2013	RES	3	Revised Paragraphs 6.1 and 6.2
8	07/05/2016	RES	2	Revised Paragraphs 4.7 & 5.3, Flange Faces
9	10/10/2016	TIG	1-2	Revised Procedure
10	3/29/2018	RES	2	Revised Paragraph 4.2, Changed DFT
11	10/16/2018	RES	3	Revised Paragraph 6.1 to Hempel
12	2/19/2020	TIG	2	Revised Paragraph 3.2 changed SP7 to SP10

ISSUED: SEPTEMBER 8, 1989

SELECTION & SPECIFICATION DATA

Generic Type	Epoxy Polyamide
Description	Carboguard 60 is a high solids, versatile, abrasion resistant, chemical resistant, and corrosion resistant coating. It can be used as a primer, intermediate coat, or self-priming finish over steel or inorganic zinc primers. May be topcoated with itself, or a broad variety of high performance finish coats. This product has excellent wetting properties giving it the capability of going over marginally prepared substrates. It is ideal for maintenance and fabrication shop applications. An optional Glass Flake (GF) additive or micaceous iron oxide (MiO) additive can be purchased separately and may be used to enhance film strength for more abusive applications for severe marine or heavy industrial uses. Consult Technical Service for suitability as a lining or other exposures.
Features	• Low odor and low VOC • Available in a variety of rapid tint colors* • Attractive medium sheen for tank exteriors • Good chemical resistance • Used as a primer, intermediate, or finish coat • Fast cure & dry times • Can be applied over power tool cleaned surfaces • VOC compliant to current AIM regulations • Good abrasion resistance *RTS not recommended for immersion service.
Color	Primer color (0700) gray. Variety of other finish coat colors in rapid tint service. MiO additive will darken (grey) all colors.
Finish	Semi-Gloss
Primer	Self-priming. May be applied over organic and inorganic zinc rich primers. A mist coat may be required to minimize bubbling over zinc rich primers.
Dry Film Thickness	4 - 6 mils (102 - 152 microns) per coat as a primer or an intermediate without additives 4 - 10 mils (102 - 254 microns) per coat (2 coats) may be used direct-to-metal 8 - 12 mils (203 - 305 microns) per coat with GF or MiO additives Do not exceed 10 mils in a single coat (without additives)
Solids Content	By Volume 72% +/- 2%
Theoretical Coverage Rate	1155 ft²/gal at 1.0 mils (28.3 m²/l at 25 microns) 289 ft²/gal at 4.0 mils (7.1 m²/l at 100 microns) 96 ft²/gal at 12.0 mils (2.4 m²/l at 300 microns) Allow for loss in mixing and application.
VOC Values	Thinner 2 13 oz/gal 2.47 lbs./gal 296 g/l Thinner 2 6 oz/gal 2.23 lbs./gal 267 g/l Thinner 33 15 oz/gal 2.57 lbs./gal 308 g/l As Supplied 2.00 lbs./gal 240 g/l These are nominal values for the liquid components only and may vary slightly with color and with the addition of GF or MiO fillers.

SELECTION & SPECIFICATION DATA

Dry Temp. Resistance	Continuous: 300°F (149°C) Non-Continuous: 350°F (177°C)
	Exposure above 200°F/93°C may cause discoloration (darkening) or loss of gloss, but will not affect performance.
Limitations	RTS colors and the use of Additive 8505 with this product are not recommended for immersion service. Additive 8505 will cause discoloration of this product, but will not affect product performance in atmospheric service.
Topcoats	May be topcoated with Acrylics, Epoxies, Alkyds, or Polyurethanes depending on exposure and need.

SUBSTRATES & SURFACE PREPARATION

General	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.
Steel	For most applications: Immersion: SSPC-SP10 Non-immersion: SSPC-SP6 1.5-3.0 mils (38-75 microns)
Galvanized Steel	SSPC-SP16
Concrete or CMU	Concrete must be cured 28 days at 75°F (24°C) and 50% relative humidity or equivalent. Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.
Previously Painted Surfaces	SSPC-SP2 or SP3

PERFORMANCE DATA

Test Method	System	Results
ASTM D2794 Impact resistance	Blasted Steel 1ct.	100 in. lbs (direct)
ASTM D3366 Pencil Hardness	Blasted Steel 1 ct.	4H-5H
ASTM D4541 Adhesion	Blasted Steel 1ct. 2ct.	(Pneumatic) 1 ct. 1500+psi 2 ct. 1500+ psi
ASTM D522 Flexibility	Blasted Steel 1 ct.	No cracking, 5/8" Conical Mandrel Bend

Data based on Carboguard 60 without filler additives.

MIXING & THINNING

Mixing	Power mix separately, then combine and power mix. Allow mixed product 15 minute sweat in time before thinning if material is under 70°F. No sweat in needed above 70°F DO NOT MIX PARTIAL KITS. For GF or MiO additives, slowly add while mixing.
Thinning	Spray: Up to 13 oz/gal (10%) with Thinner #2. Brush & Roller: Up to 15 oz/gal (12%) with Thinner #33. Thinner 236E or 250E may be used as an exempt thinner in lieu of those listed above. Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied.

MIXING & THINNING

Ratio	• Liquid Components: 1:1 Ratio (A to B) • Glass Flake (GF) Additive: (1.8 lbs/mixed gal) • Micaceous Iron Oxide (MiO) Additive: (2.0 lbs/gal)
Pot Life	4 Hours at 75°F (24°C) Pot life ends when coating loses body and begins to sag. Pot life times will be less at higher temperatures. Carboline Additive 8505 can be used to aid the film forming process in the product for temperatures down to 35°F. Carboline Additive 8505 is added at a rate of 4 oz per mixed two gallon kit or 20 oz per mixed ten gallon kit. Allow mixed product 15 minute sweat in time before thinning, if material is under 70°F, and 24 hrs cure prior to topcoating for surface temperatures down to 40°F. At this addition rate, Additive 8505 will accelerate the cure rate of the epoxy product and reduce the pot life of the product.

APPLICATION EQUIPMENT GUIDELINES

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

Conventional Spray	Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, 0.070" I.D. fluid tip and appropriate air cap. For filler additives use a 0.110" I.D. fluid tip.
Airless Spray	Pump Ratio: 30:1 (min.) GPM Output: 2.5 (min.) Material Hose: 3/8" I.D. (min.) Tip Size: 0.017"-0.021" (0.035"-0.041" for filler additives) Output PSI: 2100-2500 Filter Size: 60 mesh (remove mesh for filler additives) PTFE packings are recommended and available from the pump manufacturer.
Brush & Roller (General)	Not recommended for tank lining applications except when striping welds. Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or re-rolling. For best results, tie-in within 10 minutes at 75°F (24°C). The addition of GF or MiO fillers is best applied by spray application.
Brush	Use a medium bristle brush.
Roller	Use 3/8" nap roller with a solvent resistant core.

APPLICATION CONDITIONS

Condition	Material	Surface	Ambient	Humidity
Minimum	50°F (10°C)	40°F (4°C)	40°F (4°C)	0%
Maximum	90°F (32°C)	140°F (60°C)	120°F (49°C)	85%

This product simply requires the substrate temperature to be above the dew point. Condensation due to substrate temperatures below the dew point can cause flash rusting on prepared steel and interfere with proper adhesion to the substrate. Special application techniques may be required above or below normal application conditions.

CURING SCHEDULE

Surface Temp.*	Dry to Handle	Dry to Recoat	Dry to Touch	Maximum Recoat Time
40°F (4°C)	30 Hours	48 Hours	3 Hours	1 Year
50°F (10°C)	20 Hours	24 Hours	2 Hours	1 Year
60°F (16°C)	8 Hours	10 Hours	1 Hour	1 Year
75°F (24°C)	5 Hours	7 Hours	45 Minutes	1 Year
90°F (32°C)	3 Hours	4 Hours	30 Minutes	1 Year

*These times are based on a 5.0 mil (125 micron) dry film thickness and 50% RH. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure. Excessive humidity or condensation on the surface during curing can interfere with the cure, can cause discoloration and may result in a surface haze. Any haze or blush must be removed by water washing before recoating.

NOTE: The maximum recoat times in the chart above are for atmospheric exposures. When used as a blast-hold primer for a tank lining, maximum recoat time is limited to 30 days. If the maximum recoat times have been exceeded, the surface must be abraded by sweep blasting or sanding prior to the application of additional coats. For force curing, contact Carboline Technical Service for specific requirements.

CLEANUP & SAFETY

Cleanup	Use Thinner 2 or Acetone. In case of spillage, absorb and dispose of in accordance with local applicable regulations.
Safety	Read and follow all caution statements on this product data sheet and on the SDS for this product. Employ normal workmanlike safety precautions. Use adequate ventilation. Keep container closed when not in use.
Ventilation	When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved respirator.

PACKAGING, HANDLING & STORAGE

Shelf Life	Part A & B: Min. 36 months at 75 °F (24 °C) Shelf Life: (actual stated shelf life) when kept at recommended storage conditions and in original unopened containers.
Storage Temperature & Humidity	40-100 °F (4-37.8 °C) 0-100% Relative Humidity
Storage	Store Indoors. This product is solvent based and not affected by excursions below these published storage temperatures, down to 10°F, for a duration of no more than 14 days. Always inspect the product prior to use to make sure it is smooth and homogeneous when properly mixed.
Shipping Weight (Approximate)	<u>2 Gallon Kit</u> 26 lbs. (12 kg) <u>10 Gallon Kit</u> 127 lbs. (58 kg)

PACKAGING, HANDLING & STORAGE

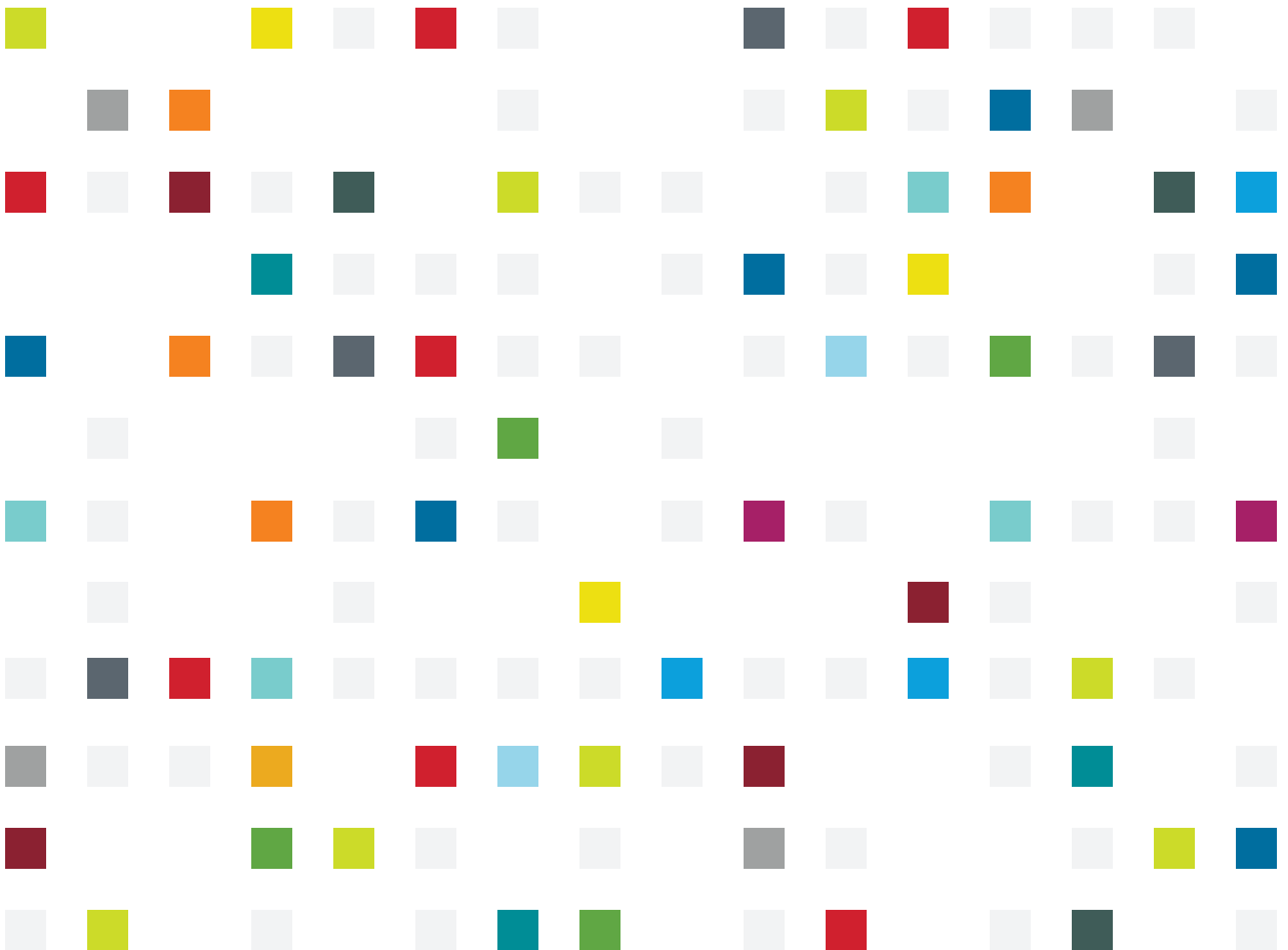
Flash Point (Setaflash)	Part A: 82°F (27.8°C)
	Part B: 71°F (21.7°C)
	Mixed: 78°F (25.6°C)

WARRANTY

To the best of our knowledge the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Carboline Company to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of products. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY CARBOLINE, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. All of the trademarks referenced above are the property of Carboline International Corporation unless otherwise indicated.

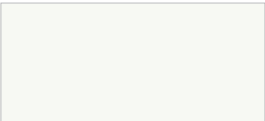
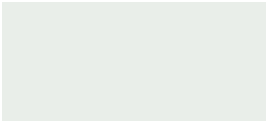
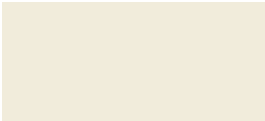
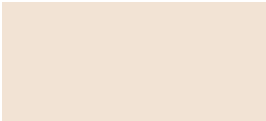
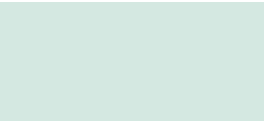
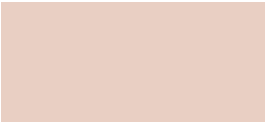
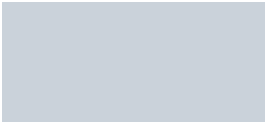
Color Logic

Intelligent Color Selection



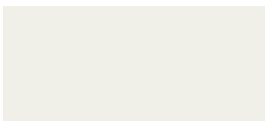
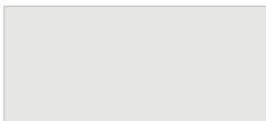
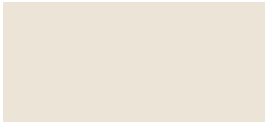
directions

new color developments and trends

				
1864 Vestal White	0832 Aviation White	0820 Carrera White	A882 Daybreak	C132 Blue Ice
				
G248 Sandcastle	8525 Classical	G171 Stratus Blue	G170 Viola	G169 Lapis Blue
				
7801 Constitution	G760 Grey Fog	J749 Louisiana Gray	4755 Pearl Gray	6225 Dark Beige
				
5255 Basket Weave	0855 Bamboo	0217 Desert Tan	B223 Cinnamon Kiss	7594 Merlot
				
F186 Window Pane	0381 Aleutian Green	4372 Hunter Green	F304 Wimbledon Green	2380 Rain Forest Green
				
1143 Nautilus	2127 Cyanine Blue	F193 Engine Blue	F140 Sapphire Blue	A700 Past Midnight

utility toolbox

maintenance and safety standards

				
A826 White Lotus	S800 Safety White	2133 Aquarius Blue	5141 Open Sky	S150 Safety Blue
				
C705 Light Gray	2716 Edison Gray	2713 Gull Gray	C703 Medium Gray	0754 Machine Gray
				
1675 Ignition Yellow	N625 Sun Yellow	6666 Safety Yellow	4444 Safety Orange	5555 Safety Red
				
1898 Aden White	9225 Cashew	G245 Dunes Tan	G250 Weathered Copper	F235 Dark Bronze
				
2394 Green Back	2383 Safety Green	D337 Offshore Green	C900 Black	

Colors shown are ink representation of actual color standards. Actual product appearance may vary slightly due to product, gloss, surface texture or method of application. Vibrant colors may require additional coats or a primer similar in color to the finish coat for optimum color rendition.

GLOBAL COATINGS LEADERS™

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PHONE: (84) 08-3822-7684





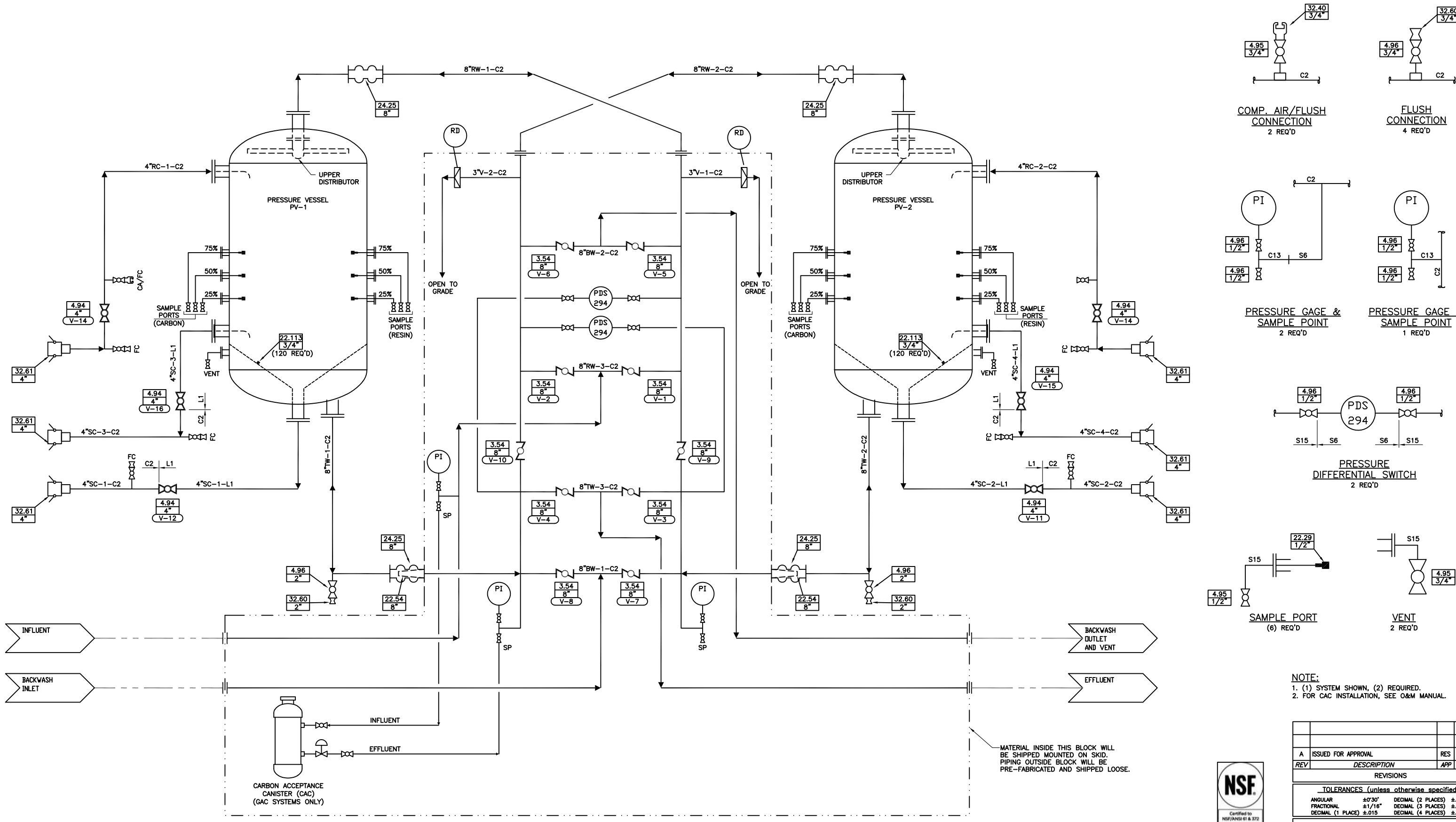
SECTION 5

DRAWINGS

SECTION 5

DRAWING INDEX

DRAWING NUMBER	REVISION	TITLE
91224266	A	Drinking Water Treatment System Model 12-40 DWC, 8" Piping Flow Diagram
91224267	B	Model 12-40, 125 PSIG 12 Ft. Dia., Internal Cone Vessel Arrangement, PV-1
91224268	B	Model 12-40, 125 PSIG 12 Ft. Dia., Internal Cone Vessel Arrangement, PV-2
91224269	C	Modular Adsorber System Model 12-40 DWC, 8" Piping General Arrangement
NEWARK-017	--	12" Sample Port Detail



NOTE:
1. (1) SYSTEM SHOWN, (2) REQUIRED.
2. FOR CAC INSTALLATION, SEE O&M MANUAL.



MATERIAL INSIDE THIS BLOCK WILL
BE SHIPPED MOUNTED ON SKID.
PIPING OUTSIDE BLOCK WILL BE
PRE-FABRICATED AND SHIPPED LOOSE.

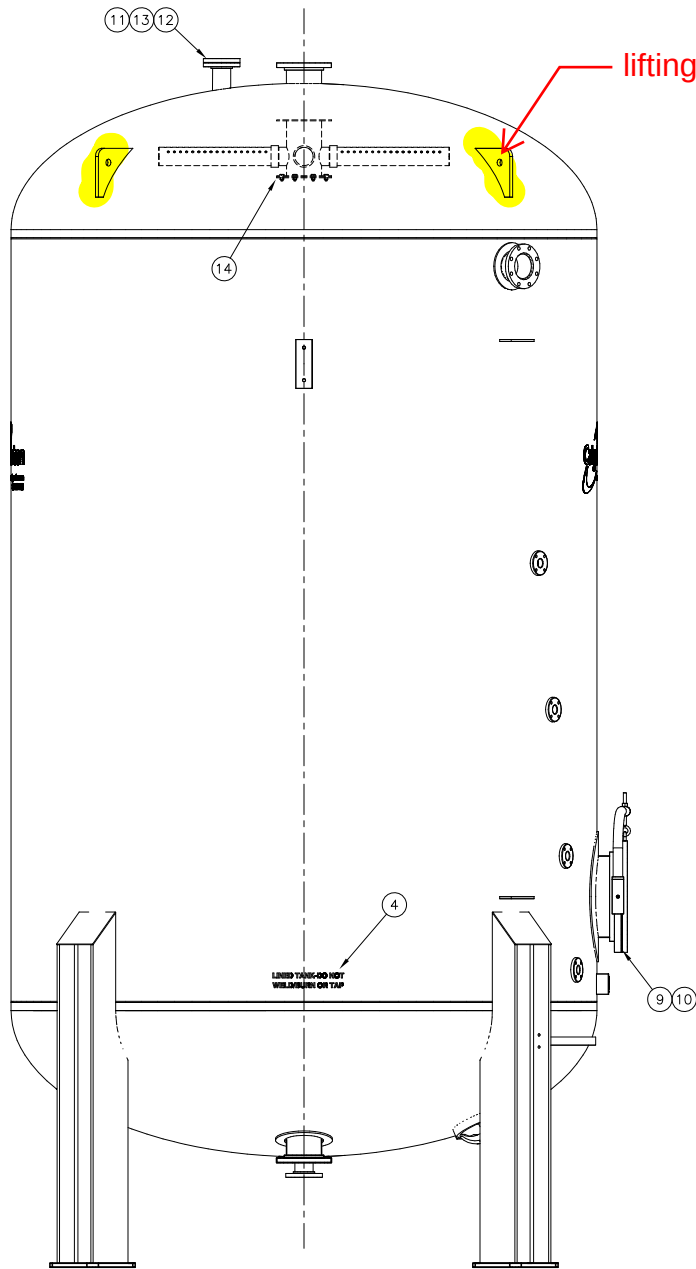
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REV	DESCRIPTION	APP	DATE
REVISIONS			
TOLERANCES (unless otherwise specified)			
ANGULAR	±0°30'	DECIMAL (2 PLACES)	±0.01
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±0.005
DECIMAL (1 PLACE)	±0.015	DECIMAL (4 PLACES)	±0.0005



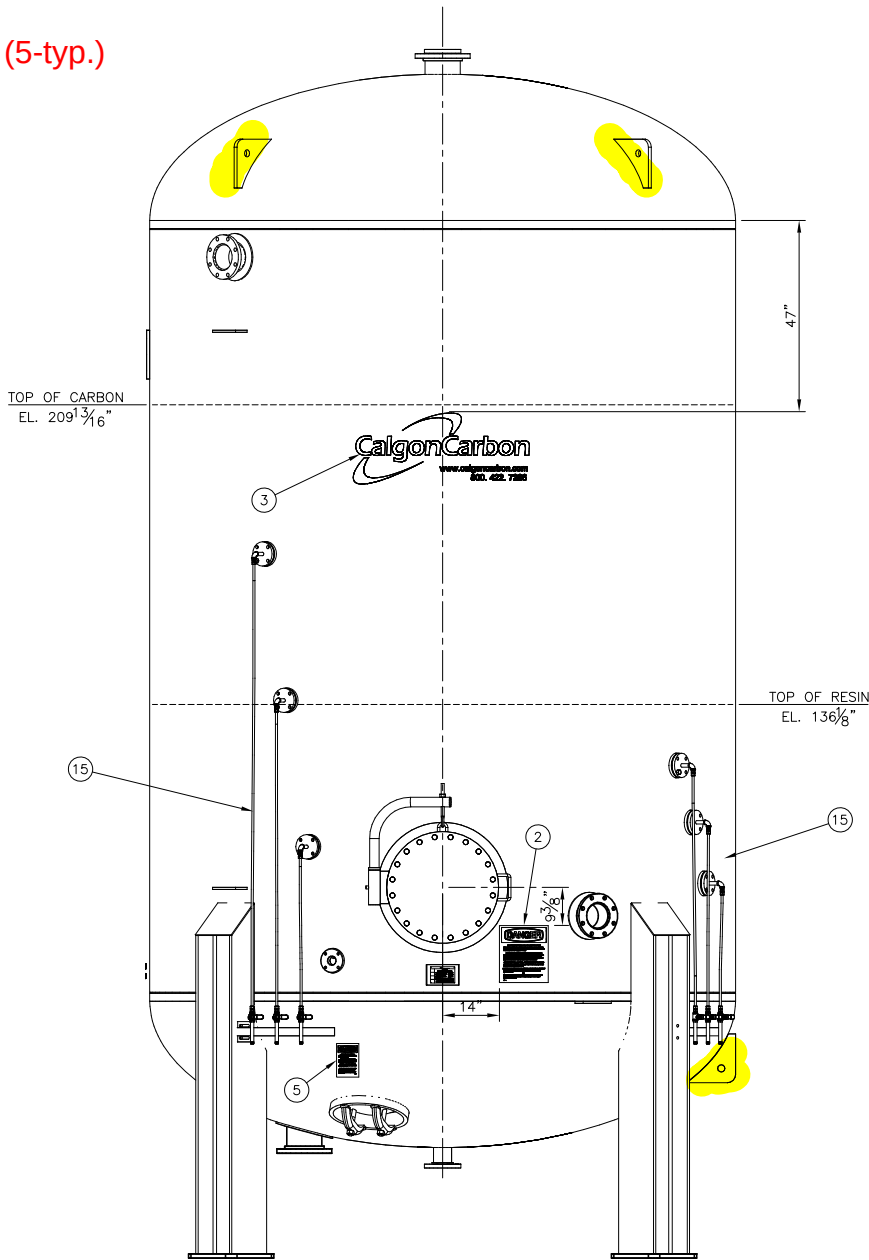
CLIENT		CITY OF NEWARK SOUTH WELL FIELD PLANT	
TITLE		DRINKING WATER TREATMENT SYSTEM MODEL 12-40 DWC, 8" PIPING FLOW DIAGRAM	
DWG. Size	D	SHEET No.	1 OF 1
DWG. No.	IXO.220002.NEWARK	SCALE	NONE
PROJECT No.	IXO.220002.NEWARK	REV.	A

MEDIA	SPECIALTIES	VALVES	DESIGN CONDITIONS	LEGEND	VESSELS	UTILITY REQUIREMENTS
MEDIA: GAC OR RESIN QUANTITY PER VESSEL: 40,000 LBS. OF GAC OR 828 CU.FT. RESIN SERVICE: POTABLE WATER (NSF/ANSI 61 CERTIFIED)	PRESSURE INDICATOR: 0-160 PSIG, WIKA 232.34 RUPTURE DISK: 125 PSIG BURST PRESSURE ZOOK PRESSURE DIFFERENTIAL SWITCH: ORANGE RESEARCH, 0-20-0 PSIG	PROCESS VALVES: CENTERLINE SERIES 200 CARBON VALVES: SHARPE SERIES 50 SAMPLE/VENT VALVES: SHARPE 50M76 UTILITY VALVES: HAMMOND MODEL UP8901	FLOW RATE: 1000 GPM (SERIES) 1400 GPM (PARALLEL) INFLUENT PRESSURE: 100 PSIG MAX. INFLUENT TEMP.: 120°F MAX. BACKWASH RATE: T.B.D. GPM @ 55°F. ELECTRIC POWER: 120 V, 60~ SINGLE PHASE, 15 AMP	BW - BACKWASH WATER FC - FLUSH CONNECTION RC - REACT.(OR VIRGIN) CARBON RW - RAW WATER SC - SPENT CARBON SLURRY SP - SAMPLE PORT TW - TREATED WATER V - VENT	12'-0" O.D. x 16'-0" S.S. ASME 2:1 ELLIPTICAL TOP AND BOTTOM HEADS. CARBON STEEL CONSTRUCTION. ASME SECT. VIII, DIV. 1 125 PSIG @ 140°F DESIGN. LINING TO BE FORCE CURED PER NSF/ANSI 61 PLASITE 4110	AIR, CARBON TRANSFER - 100 SCFM @ 30 PSIG MIN. PLANT WATER - 100 GPM @ 30 PSIG MIN. WIRING - MIN. AWG #16 TO PDS 294

V:\2022\IXO.220002.NEWMARK\Drawings Equipment\91224268 VA PV-2.dwg Mar 13, 2023 - 10:23am



LEFT ELEVATION



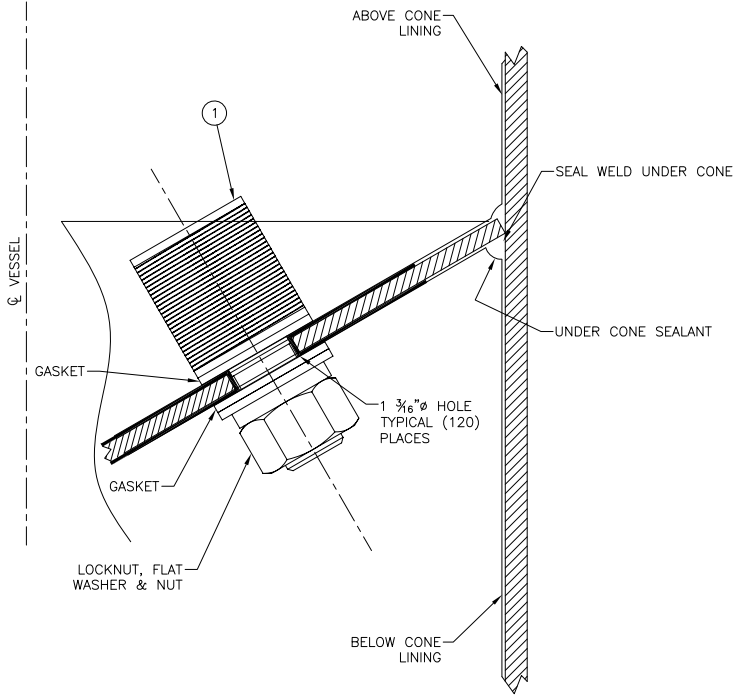
FRONT ELEVATION

BILL OF MATERIAL					
ITEM	QTY.	DESCRIPTION	MATERIAL	SAP No.	CCC SPEC
1	120	SEPTA	SS	1081827	22.113
2	1	DECAL, DANGER, MANWAY	----	1058401	----
3	2	DECAL, CALGON LOGO	----	1080872	----
4	2	DECAL, LINED TANK	----	1025014	----
5	1	DECAL, DANGER, ELLIPTICAL MANWAY	----	1002706	----
6	1	DECAL, CAUTION	----	1001322	----
7	1	DECAL, MATERIAL HAZARD	----	1076681	----
8	1	GASKET, ELLIPTICAL 14" x 18" x 1/4" THICK	WHITE EPDM	1053980	G46
9	2	GASKET, 20", 150#, 1/4" THICK	WHITE EPDM	1054140	G46
10	20	BOLT, 1 1/8" x 5" LG, HVY. HEX W/NUT & (2) SAE WASHERS, GALVANIZED	A-325 GR 1	1060550	----
11	1	FLANGE, 4" 150# FF BLIND	SA-105	1001712	C2
12	1	GASKET, 4" 150# BLIND, 3/8" THK	WHITE EPDM		G46
13	8	BOLT, 3/4" x 3 1/4" LG, HVY. HEX W/NUT & (2) SAE WASHERS, ZINC PLATED	A-307 GR B	1001076	----
14	1	UPPER DISTRIBUTOR (DWG. 90190646)	316 SS		----
15	1	(6) PORT SAMPLE PIPING ASSEMBLY	SS		

MATERIAL FOR ONE VESSEL.

NOTES:

- 1.) LOCATE MANWAY DANGER DECALS ITEMS (2) & (5) AS SHOWN.
- 2.) LOCATE LINED TANK DECALS ITEM (4) NEAR BOTTOM WELD SEAM TO CLEAR PIPING.
- 3.) LOCATE CCC LOGOS ITEM (3) AT 0' & 180', HEIGHT AS SHOWN.
- 4.) ITEMS (14) AND (15) TO BE FACTORY INSTALLED BY CCC.
5. MANWAY GASKET QTY. INCLUDES (1) SPARE.

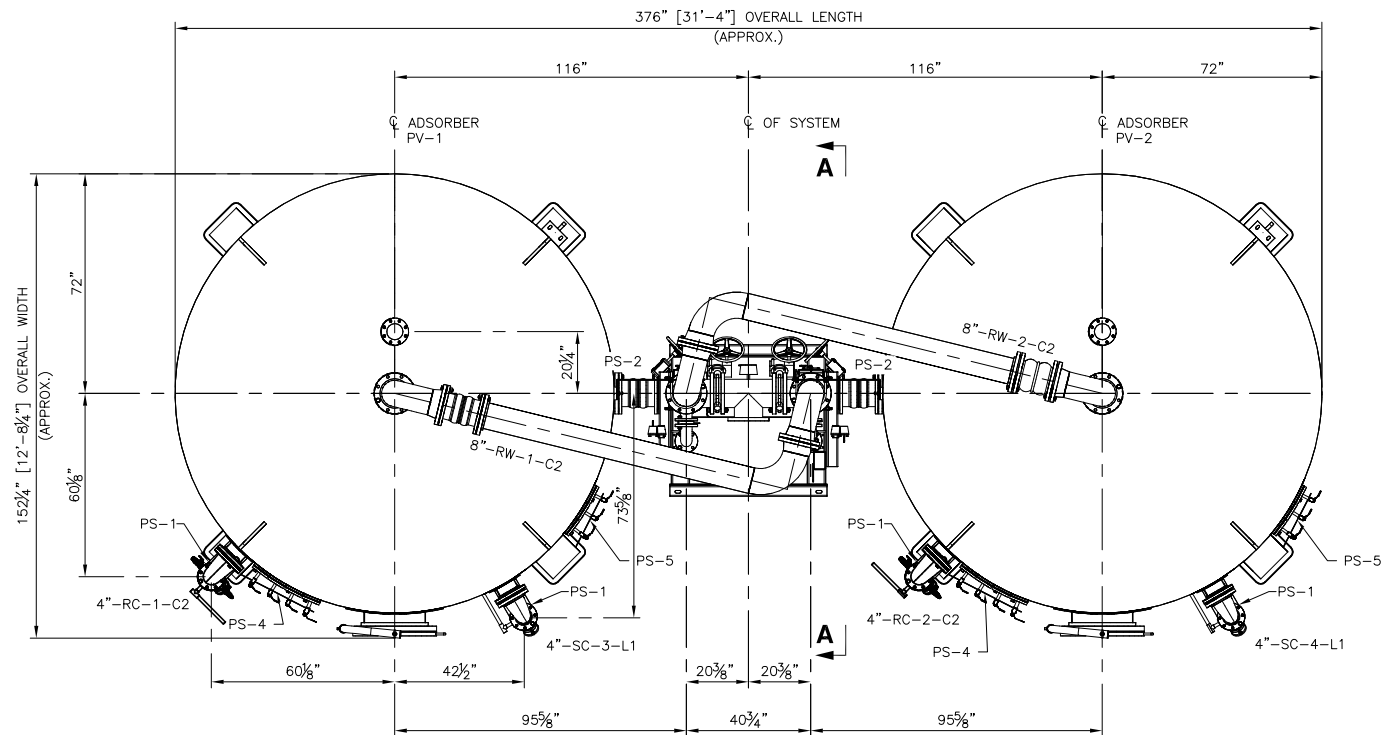


SECTION C-C
SHEET 1

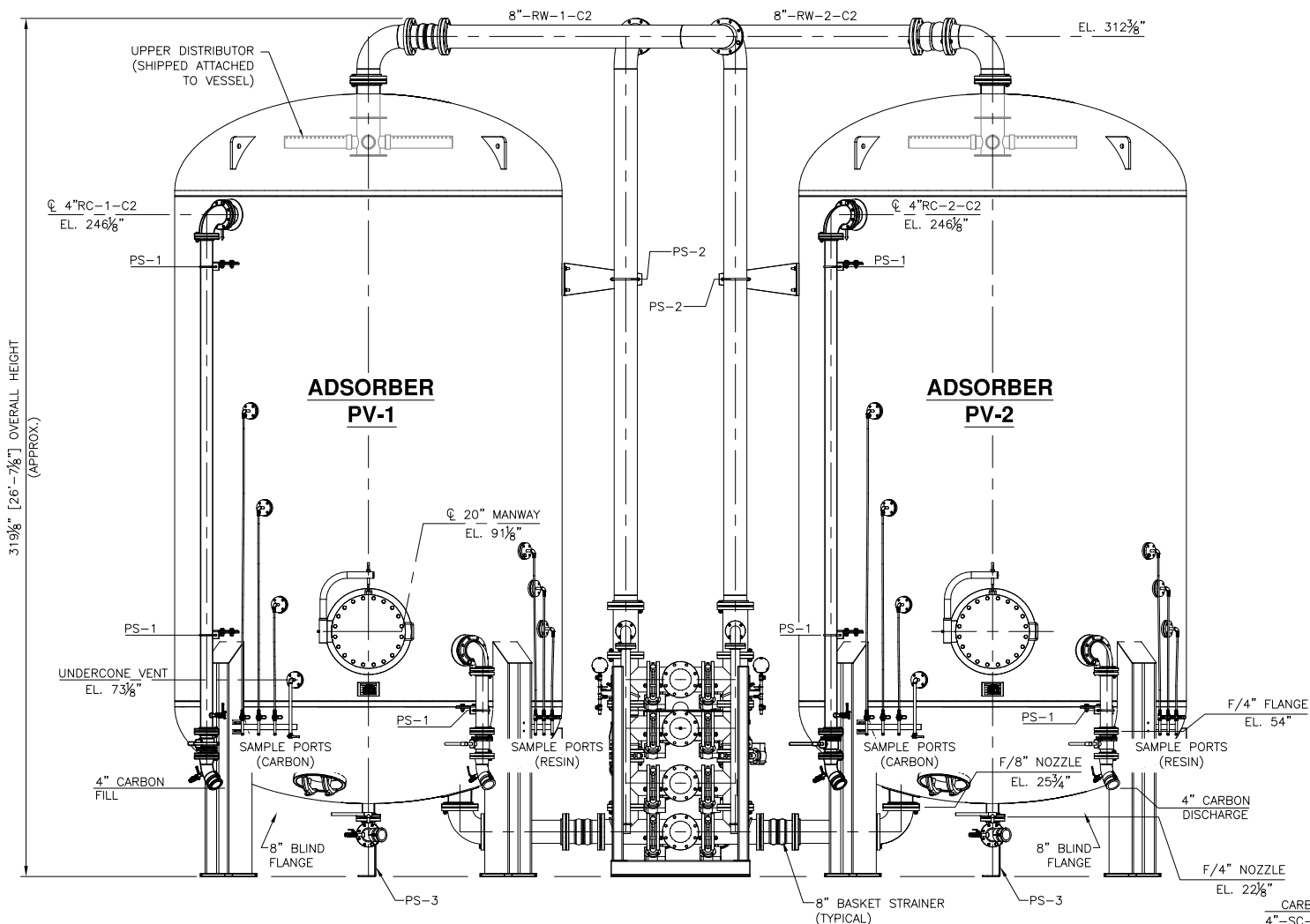
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	NAME	DATE
DRAFTER	JFS	9/13/22
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	IXO.220002.NEWMARK	

B	BED ELEVATIONS, SPARE MW GASKET	RES	2/21/23
A	ISSUED FOR APPROVAL	RES	9.30/22
REV	DESCRIPTION	APP	DATE
REVISIONS			
TOLERANCES (unless otherwise specified)			
ANGULAR	±0.30°	DECIMAL (2 PLACES)	±0.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±0.005
DECIMAL (1 PLACE)	±0.015	DECIMAL (4 PLACES)	±0.0005
CLIENT CITY OF NEWARK SOUTH WELL FIELD PALNT			
TITLE MODEL 12-40, 125 PSIG 12 FT DIA., INTERNAL CONE VESSEL ARRANGEMENT, PV-2			
DWG. Size	D	SHEET No. 2 OF 2	SCALE AS NOTED
PROJECT No.	91224268		REV. B

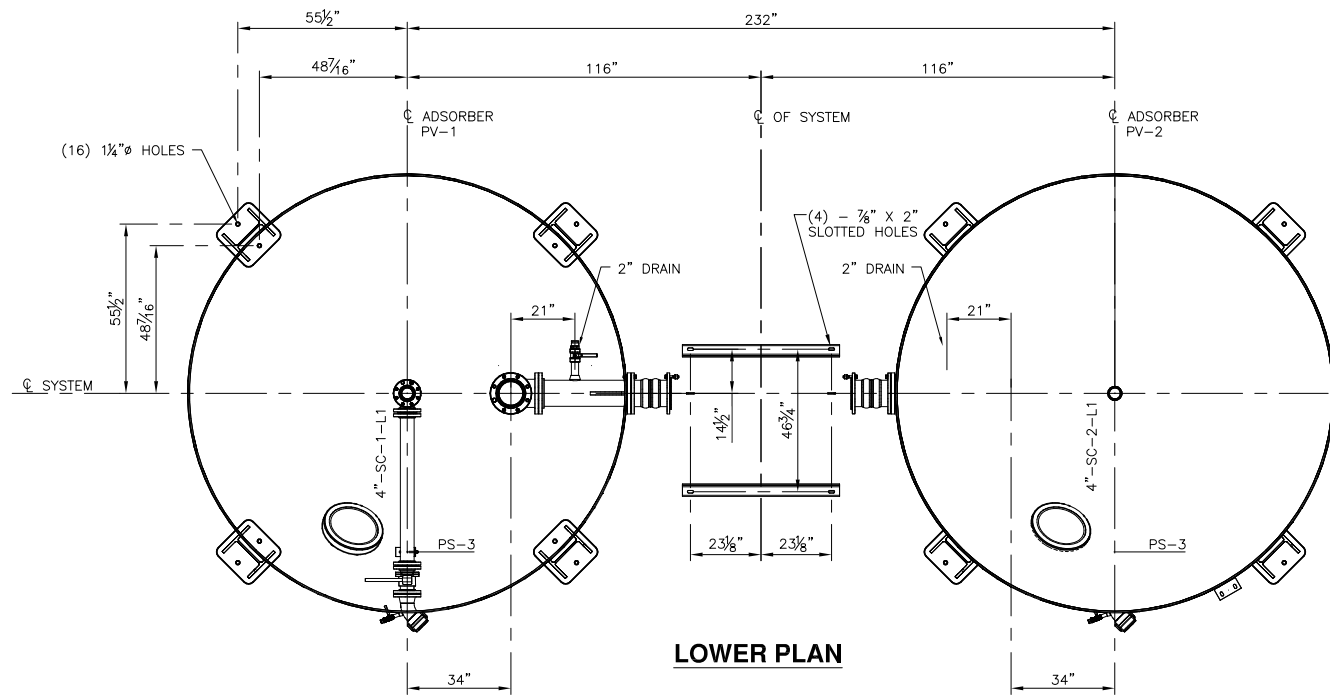
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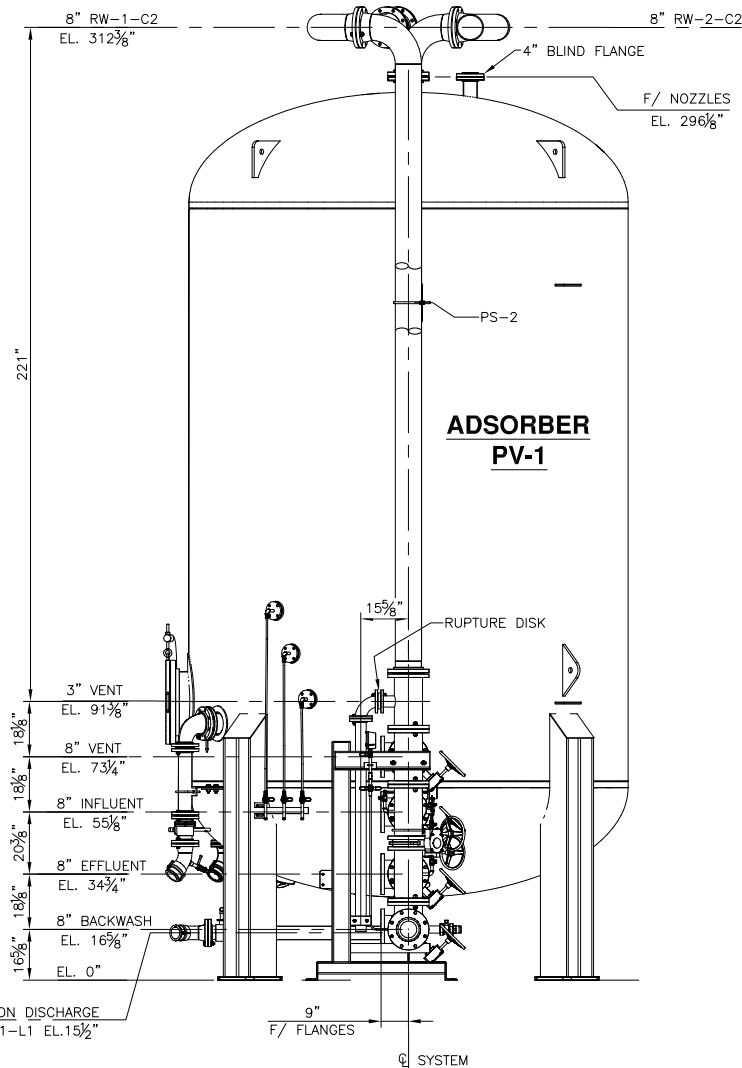
PLAN



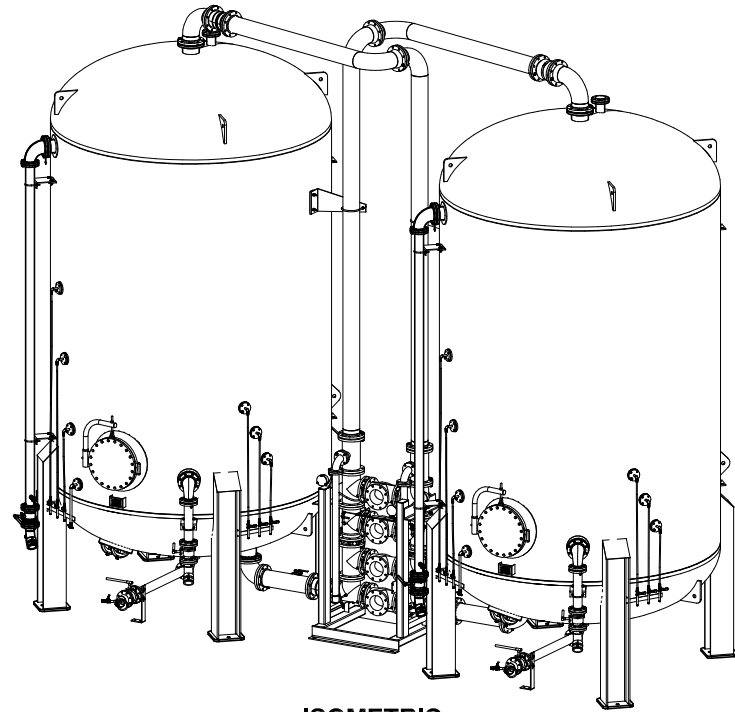
ELEVATION



LOWER PLAN



VIEW A-A



ISOMETRIC

- NOTES:
- (1) SYSTEM SHOWN, (2) REQUIRED.
 - VALVE MODULE STRUCTURAL FRAME, PIPE SUPPORTS AND FASTENERS TO BE UNPAINTED 316 SS.
 - (2) SPARE RUPTURE DISKS AND (2) SPARE MANWAY GASKETS TO BE PROVIDED FOR EACH SYSTEM.



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	NAME	DATE
DRAFTER	JFS	9/13/22
DESIGNER		
CHECKER		
APPROVAL		
PROJECT No.	1X0.220002.NEWMARK	

SYSTEM DATA			
DESIGN CONDITIONS		125 PSIG @ 140° F	
DESIGN CODE		ASME SECTION VIII DIVISION I	
APPROXIMATE WEIGHTS (LB.)			
VESSEL (EMPTY)		31,000	
CARBON (PER VESSEL)		40,000	
VESSEL (OPERATING)		191,000	
SYSTEM (EMPTY)		69,000	
SYSTEM (OPERATING)		391,000	
PAINT INFORMATION			
ITEM	MFG.	COLOR	SAMPLE
VESSEL	CARBOLINE	RAIN FOREST GREEN	
PIPING	CARBOLINE	RAIN FOREST GREEN	
SUPPORTS	SEE NOTE 2	N/A	

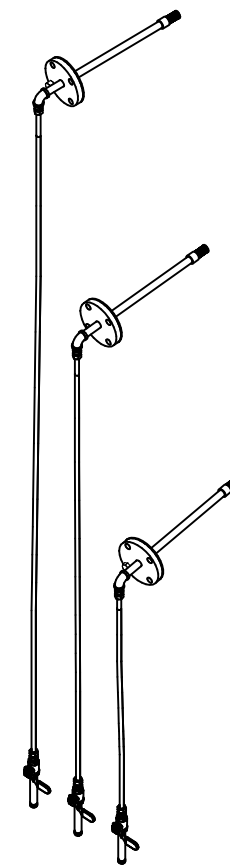
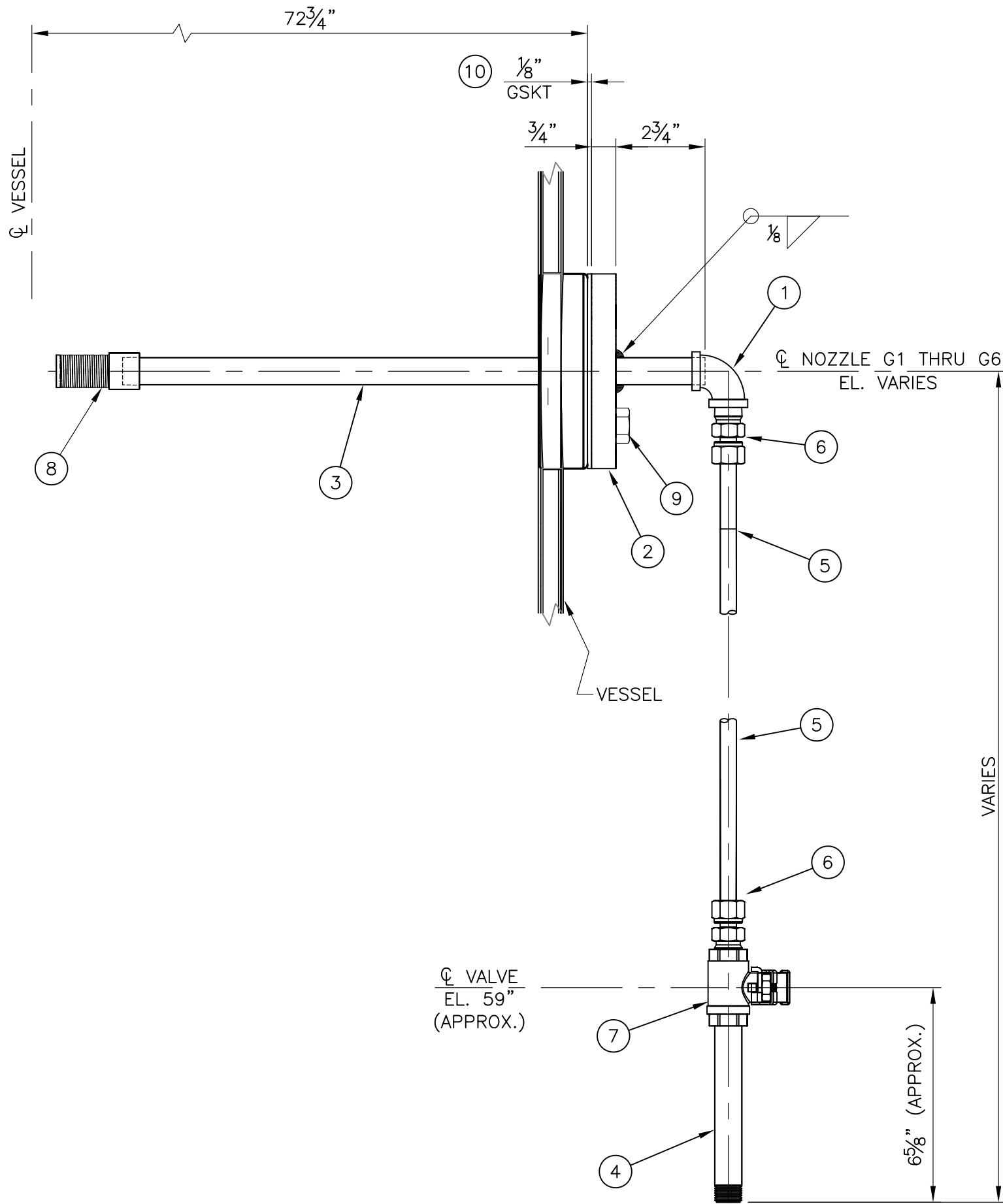
PIPE SUPPORT SCHEDULE			
#	DRAWING NO.	DESCRIPTION	QTY.
PS-1	90160401	4" CARBON FILL 4" CARBON DISCHARGE (UPPER)	6
PS-2	90130162	8" INFLUENT	2
PS-3	90130158	4" CARBON DISCHARGE	2
PS-4	90170541	SAMPLE PORT (CARBON)/VENT	2
PS-5	90220796	SAMPLE PORT (RESIN)	2

C	ROTATE 8" TIE-INS 180°	RES	4/4/23
B	ADD NOTES 2 & 3	RES	2/23/23
A	ISSUED FOR APPROVAL	RES	9/30/22
REV	DESCRIPTION	APP	DATE

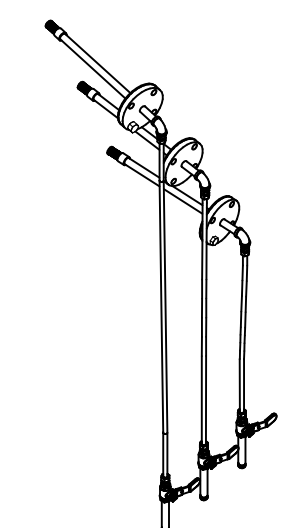
TOLERANCES (unless otherwise specified)			
ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005

CLIENT		CITY OF NEWARK SOUTH WELL FIELD PLANT	
TITLE		MODULAR ADSORBER SYSTEM MODEL 12-40 DWC, 8" PIPING GENERAL ARRANGEMENT	
DWG. Size	D	SHEET No.	1 OF 1
SCALE	NONE		
DWG. No.	91224269		
REV.	C		

V:\2022\IXO.220002.NEWARE\Drawings\Piping\NEWARK-017.dwg Jan 31, 2023 - 8:14am



CARBON SAMPLE
PIPING



RESIN SAMPLE
PIPING

ISOMETRIC

THIS DRAWING AND DESIGN IS THE PROPERTY OF CALGON CARBON CORPORATION AND IS NOT TO BE REPRODUCED IN WHOLE OR IN PART NOR EMPLOYED FOR ANY PURPOSE OTHER THAN SPECIFICALLY PERMITTED IN WRITING BY CALGON CARBON CORPORATION. THIS DRAWING LOANED SUBJECT TO RETURN ON DEMAND.		
	NAME	DATE
DRAFTER	JFS	9/23/22
DESIGNER		
CHECKER	XXX	PENDING
APPROVAL		
PROJECT No.	IXO.220002.NEWARE	

BILL OF MATERIAL			
MK	QTY.	SPEC	DESCRIPTION
1	1	S15	ELBOW, 1/2" THRD., 90°, 150#, 316 SS
2	1	S15	FLANGE, 2" PLATE, 6" O.D. X 7/8" I.D. X 3/4" THICK, 150# DRILLING, 316 SS
3	1	S15	PIPE, 1/2" X 18" LG, T.B.E., SCH. 40S, 316 SS
4	1	S15	NIPPLE, 1/2" X 6" LG, T.B.E., SCH. 40S, 316 SS
5	65'	S6	TUBING, 1/2", 316 SS (TOTAL PER SYSTEM)
6	2	S6	MALE ADAPTER, 1/2" MNPT X 1/2" TUBE
7	1	4.57	VALVE, 1/2" BALL, THRD., SS
8	1	22.29	FILTER NOZZLE, 1/2" FNPT, 316 SS, 1"ø WEDGEWIRE
9	4	F03	BOLT, 5/8" x 1 3/8", HVY. HEX
10	1	G46	GASKET, 2" FF, 1/8" THK., 150#, WHITE EPDM

MATERIAL SHOWN IS FOR (1) ASSEMBLY, (12) REQUIRED PER SYSTEM

- NOTES:
- SEE DRAWING NEWARK-001 FOR GENERAL FABRICATION NOTES.
 - SHIP ATTACHED TO VESSEL.

0	ISSUE FOR FABRICATION	RE	PENDING
REV	DESCRIPTION	APP	DATE
REVISIONS			
TOLERANCES (unless otherwise specified)			
ANGULAR	±0°30'	DECIMAL (2 PLACES)	±.010
FRACTIONAL	±1/16"	DECIMAL (3 PLACES)	±.005
DECIMAL (1 PLACE)	±.015	DECIMAL (4 PLACES)	±.0005
 A Kuraray Company			
CLIENT	CITY OF NEWARK SOUTH WELL FIELD PLANT		
TITLE	MODEL 12-40 SYSTEM 8" 'C2' BACKWASHABLE SAMPLE PORT PIPING		
DWG. Size	B	SHEET No.	1 OF 1
DWG. No.	NEWARK-017		SCALE NONE
			REV. 0