

# **SUPPLY & DRAINAGE** **SYSTEMS**

## **Volume X**

**Operations & Maintenance Manual**

# **Supply Tank Lining Product Data**

**Operations & Maintenance Manual  
December 2015**

# MasterSeal® 581

Waterproof cement-based coating for concrete and masonry

FORMERLY THOROSEAL®

## PACKAGING

MasterSeal 581:

- 50 lb (22.7 kg) polyethylene-lined bags for MasterSeal 581 white, standard gray, all landscape colors and custom colors
- 50 lb (22.7 kg) pails for MasterSeal 581 white, standard gray, and pearl gray

MasterEmaco A 660:

- 1 qt (0.9 L) bottles (8 qt per carton)
- 1 gal (3.8 L) bottles (4 gal per carton)
- 5 gal (18.9 L) pails
- 55 gal (208 L) drums

## YIELD

- 225 ft<sup>2</sup>/50 lb (20.9 m<sup>2</sup>/22.7 kg) bag as a base coat at 1/16" (1.6 mm) dry-film thickness.
  - 450 ft<sup>2</sup>/50 lb (41.8 m<sup>2</sup>/22.7 kg) bag as a topcoat at 1/32" (0.8 mm) dry-film thickness.
- Coverage will vary depending on surface texture and porosity.

## SHELF LIFE

1 year when properly stored

## VOC CONTENT

0 g/L less water and exempt solvents

## DESCRIPTION

MasterSeal 581 is a Portland cement-based coating for concrete and masonry that resists both positive and negative hydrostatic pressure. Polymer-modified with MasterEmaco A 660, MasterSeal 581 creates a low maintenance and highly durable waterproof barrier.

## PRODUCT HIGHLIGHTS

- Waterproof to help protect building interiors from dampness and moisture damage
- Resistant to both positive and negative hydrostatic pressure, making MasterSeal 581 suitable for use below grade interior and exterior and in water treatment construction
- Breathable, allowing interior moisture to escape without damaging coating
- Compatible with high-performance coatings, including a wide range of architectural coatings and textured finishes
- Hides minor surface defects and blemishes in architectural concrete
- Available in ten landscape colors and custom colors (with minimum order quantities)
- Certified to the NSF/ANSI Standard 61 for potable water contact

## APPLICATIONS

- Vertical and light-pedestrian horizontal surfaces
- Interior and exterior
- Above and below grade
- Alternative to mechanical finishing or rubbing of concrete
- Waterproofing basement and retaining walls
- Foundations
- Bridges and tunnels (non- traffic bearing surface)
- Water cisterns

## SUBSTRATES

- Cast-in-place and precast concrete
- Block, brick and porous stone

## COLOR

- White and standard gray
- Custom and landscape colors are available for 5,000 lbs (2,268 kg) minimum order.
- Ten landscape colors: bone, dijon, French vanilla, good earth, light khaki, Thoro gray, Navajo white, parchment, pearl gray and putty tan

## STORAGE

Transport and store in unopened containers and keep in a clean, dry place protected from rain, dew and humidity. Do not stack bags more than two pallets high. If dry onsite storage of bags is unavailable or if project is located in a very wet, humid climate zone, then specify MasterSeal 581 packaged in 50 lb (22.7 kg) metal pails. Store MasterEmaco A 660 in similar conditions. Do not allow MasterEmaco A 660 to freeze.

**Technical Data**

**Composition**

MasterSeal 581 contains cement, graded sand, and proprietary additives.

**Test Data**

PROPERTY	RESULTS	TEST METHOD
<b>Initial Set</b> , min, at 70° F (21° C), 50% rh	10	Lab Method
<b>Final Set</b> , at 70° F (21° C), 50% rh	90	Lab Method
<b>Density</b> , (cured), lbs/ft <sup>3</sup> (kg/m <sup>3</sup> )	129 (2,080)	Lab Method
<b>Positive resistance to hydrostatic pressure</b> , hrs, at 200 psi (1.4 MPa), 461 head ft, air cured at 70° F (21° C), 50% rh	752 No leakage, no softening	CRD C 48, modified
<b>Negative resistance to hydrostatic pressure</b> , hrs, at 200 psi (1.4 MPa), 461 head ft, air cured at 70° F (21° C), 50% rh	664 Limited dampness	CRD C 48, modified
<b>Water absorption</b> , %, boiling water submersion at 24 hours	3.6	ASTM C 67 (Section 7.3)
<b>Compressive strength</b> , psi (MPa) 7 days 28 days	4,200 (29) 6,030 (42)	ASTM C 109
<b>Flexural strength</b> , psi (MPa) 7 days 28 days	360 (2.5) 1,027 (7)	ASTM C 348
<b>Tensile strength</b> , psi (MPa) 7 days 28 days	250 (2) 440 (3)	ASTM C 190
<b>Modulus of elasticity</b> , psi (MPa) 28 days	2.72 x 10 <sup>6</sup> (1.87 x 10 <sup>4</sup> )	ASTM C 469
<b>Artificial weathering</b> , hrs Xenon Arc Carbon Arc	5,000 = No failure 500 = No failure	ASTM G 26 ASTM G 23
<b>Adhesion strength</b> , psi (MPa)	418 (2.9)	Test by tensile bond
<b>Artificial weathering</b> , 500 hours	No cracking, loss of adhesion, checking, or other defect	Atlas Type DMC weatherometer
<b>Freeze/thaw resistance</b> , 200 cycles	No change	ASTM C 666 (Procedure B)
<b>Salt spray resistance</b> , 300 hours	No defect	ASTM B 117
<b>Carbon Dioxide (CO<sub>2</sub>)</b> , in (mm)	1/16 (1.6) Equivalent to 3/4" (19 mm) new concrete	Lab Method Diffusion
<b>Permeance</b> , perms (metric permeability)	12 (0.10698) 18 x 10 <sup>3</sup> resistance	ASTM E 96 (water-vapor transmission) Swedish standard SS-02-15-82



**Test Data, continued**

PROPERTY	RESULTS	TEST METHOD
<b>Wind-driven rain</b> , hrs	8 = excellent	Fed. Spec. TT-P-0035 (Para 4.4.7)
<b>Coefficient of thermal expansion</b> , in/in/° F (mm/mm/° C), at 28 days	$6.99 \times 10^{-6}$ ( $5 \times 10^{-7}$ )	ASTM C 531
<b>Impact strength</b> (Gardener impact tester)	No chipping	Fed. Spec. TT-P-0035 (Cement paints para. 3.4.8)
<b>Hardness</b> , (Barber Coleman Impressor) Requirement min = 30, max = 60		Fed. Spec. TT-P-0035 (para 4.4.9)
7 days	35	
14 days	47	
21 days	52	
<b>Abrasion resistance</b> , 3,000 L sand	Passed	Fed. Spec. TT-P-141B
<b>Standard Reflectance</b>		ASTM D 2244 using Hunterlab D-25 meter
Gray MasterSeal 581	64.2	
White MasterSeal 581	88.1	
<b>Fungus resistance</b> , at 21 days	No growth; meets all requirements	Fed. Spec. TT-P-29B
<b>Surface burning characteristics</b>		ASTM E 84
Flame Spread	0	
Smoke developed	5	
<b>Fire Propagation</b>	Index = 1.5	BS476: Part 6:1981
Flame spread	Class 1	BS476: Part 7:1971

Test results are averages obtained under laboratory conditions. Reasonable variations can be expected.

## HOW TO APPLY

### SURFACE PREPARATION

1. Surface preparation is extremely important for proper adhesion. Substrates must be sound and free of dust, dirt, laitance, paints, oils, grease, curing compounds or any other contaminants. Verify substrate has properly cured. Concrete should obtain 80% of design strength, typically achieved within 3–14 days. If efflorescence is present, mechanically remove it before proceeding. For extreme cases where this is not adequate, contact Technical Service.
2. Patch all holes and non-moving cracks before installation with appropriate BASF product.
3. Relieve hydrostatic pressure in concrete block with weep holes.
4. Roughen or brush blast extremely smooth surfaces such as precast and cast-in-place concrete to ensure good mechanical adhesion of MasterSeal 581.
5. Completely saturate the substrate with water and allow surface to dry before application starts. A damp surface will prevent surface drag on the material, keep the substrate cool and eliminate flash drying.

### MIXING

1. Mix MasterSeal 581 with a mixing liquid consisting of a blend of MasterEmaco A 660 diluted with water. Maximum dilution ratio is one part MasterEmaco A 660 to three parts water. Approximately 6 quarts of mixing liquid is needed per 50 lbs of MasterSeal 581 powder. Up to 2 additional quarts of mixing liquid may be added when using as a rubbing compound.
2. For best results, mechanically mix MasterSeal 581 with a slow-speed drill and mixing paddle. Gradually add the powder to the mixing liquid while drill is running.
3. When properly blended, MasterSeal 581 will have the lump-free consistency of smooth, heavy batter.
4. Allow the MasterSeal 581 and MasterEmaco A 660 mixture to rest undisturbed for a minimum of 10 minutes to fully wet out all the powder. Then mix the wet mixture and apply. A small amount of mixing liquid can be added to the mixture.
5. Pot life is 60–90 minutes at 70° F (21° C). At high temperatures and low relative humidity, pot life can be significantly less.

### APPLICATION

1. Apply MasterSeal 581 with a tampico brush or broom or equivalent stiff fiber brush or by textured spray equipment. Spray applications of the first coat require back brushing or brooming to properly fill voids and achieve uniformity and optimum adhesion.
2. It is essential to work first coat thoroughly into the substrate to completely fill and cover all voids, holes and nonmoving cracks. Finish with a horizontal stroke for an even coat.
3. Allow to cure 24 hours, then apply the second coat and finish with a vertical stroke. Above grade, the second coat can be replaced with a Thoro high-build architectural coating to achieve better color uniformity.
4. On block or masonry walls, allow 5–7 days before applying second coat to eliminate joint read through or shadowing.

### SPECIFIC APPLICATIONS

Above-grade interior or exterior applications in positive pressure situations (direct contact with rain or standing water with a low head of pressure)

1. A 50 lb (22.7 kg) bag of MasterSeal 581 will provide the following coverage at the designated material usage.

#### RECOMMENDED COVERAGE:

- First Coat: 2 lbs/yd<sup>2</sup> (1.1 kg/m<sup>2</sup>) = 225 ft<sup>2</sup>/50 lb bag (20.9 m<sup>2</sup>/22.7 kg bag)
- Second Coat: 1 lb/yd<sup>2</sup> (0.54 kg/m<sup>2</sup>) = 450 ft<sup>2</sup>/50 lb bag (41.8 m<sup>2</sup>/22.7 kg bag)
- Total: 3 lbs/yd<sup>2</sup> (1.6 kg/m<sup>2</sup>), cured nominal thickness of 1/16" (1.6 mm).

Coverage will vary depending on surface texture and porosity.

2. A 3 lbs/yd<sup>2</sup> (1.6 kg/m<sup>2</sup>) application rate does not eliminate surface irregularities such as struck mortar joints. To hide surface irregularities, spray and back-brush a base coat of MasterSeal 581 at 2 lbs/yd<sup>2</sup> (1.1 kg/m<sup>2</sup>) and allow it to cure for 5–7 days. If additional leveling is required use MasterSeal 581 Plaster Mix.

### BELOW-GRADE INTERIOR APPLICATIONS

1. The standard application is 3 lbs/yd<sup>2</sup> (1.6 kg/m<sup>2</sup>).
2. For high hydrostatic pressure conditions (over 15 psi [0.10 MPa]), increase application rate to 4 lbs/yd<sup>2</sup> (2.2 kg/m<sup>2</sup>) and waterproof from the positive side wherever possible.

### BELOW-GRADE EXTERIOR APPLICATIONS

1. Use MasterSeal 582 (see Form No. 1019907) For high hydrostatic pressure conditions (over 15 psi [0.10 MPa]), apply a base coat of MasterSeal 582 at 2 lbs/yd<sup>2</sup> (1.1 kg/m<sup>2</sup>) and allow to cure for 5–7 days.
2. Then apply MasterSeal 581 at 2 lbs/yd<sup>2</sup> (1.1 kg/m<sup>2</sup>). If additional leveling is required use MasterSeal 581 Plaster Mix. A steel trowel finish is recommended.
3. For both below-grade interior and below-grade exterior applications where water might move between vertical walls and slab or footer, it is recommended to cut out and place a MasterSeal 590 cove at the wall and floor junction prior to the application of the MasterSeal 581 base coat.
4. MasterSeal 581 can be covered with extruded polystyrene insulation board during the second coat application. The board must be fully coated with MasterSeal 581 and embedded into the still-wet coating already in place on the walls. Use care when placing the coated board because it should not be moved or slipped. Once placed, do not move the board. After curing, prepare the above-grade portions of the boards by roughening or removing the surface skin and then coating with MasterSeal 581 to protect them from UV light degradation.

### WATERPROOFING POTABLE WATER TANKS OR RESERVOIRS

1. Install MasterSeal 581 as directed in the general Application instructions.
2. After MasterSeal 581 has fully cured, wash down the MasterSeal 581 surface with saline solution (salt brine, 1 lb salt per 1 gallon water).
3. Leave saline solution on the entire MasterSeal 581 surface for at least 24 hours.
4. Rinse off saline solution completely. If needed, reapply saline solution until final rinse water is completely clean and clear.

#### **COLOR UNIFORMITY**

With any cementitious product, such as MasterSeal 581, it may be difficult to achieve color uniformity due to weather and substrate variability. For this reason, it may be necessary to apply a topcoat of a MasterProtect architectural coating.

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#### **CLEAN UP**

Promptly clean hands and all tools with warm water while product is still wet. Cured material may only be removed mechanically.

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#### **FOR BEST PERFORMANCE**

- MasterSeal 581 must be modified with MasterEmaco A 660 to achieve the properties listed in the technical data section.
- Do not apply to substrates with active water leaks or moving cracks; patch all leaking static cracks and holes with MasterSeal 590. Repair any other nonmoving cracks or voids with the appropriate Thoro repair product and repair all moving cracks or voids with appropriate sealant.
- Do not apply in rain or when rain is expected within 24 hours. Do not apply above 90° F (32° C) or below 40° F (4° C) or when temperatures are expected to fall below 40° F (4° C) within 24 hours. For hot and cold temperature applications, store MasterSeal 581, MasterEmaco A 660 and water at 50° F (10° C) to 70° F (21° C) before use.
- Hot substrates will affect working time and material strength.
- Variations between inside and outside temperatures may result in condensation on below-grade walls treated with MasterSeal 581. This can be alleviated by assuring that adequate ventilation exists.
- Windy, dry or hot conditions may require rewetting of MasterSeal 581 during cure and the use of polyethylene barriers.
- Before specifying MasterSeal 581 for water retaining structures, conduct tests to determine water quality. MasterSeal 581 is not intended for continuous contact with acid or sulfate-containing water. Very soft water will have an adverse effect on MasterSeal 581.
- Service temperatures: immersion, up to 140° F (60° C); cleaning water, up to 200° F (93° C); dry air, up to 220° F (104° C).
- On all projects, it is recommended that a sample be prepared on site and approved prior to the commencement of the work. The site sample should confirm the color, texture and workmanship required until the job is finished and accepted. Retain the sample until final approval is secured.
- Allow MasterSeal 581 to cure 7–10 days before immersion in water.
- Proper application is the responsibility of the user. Field visits by BASF personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

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#### HEALTH, SAFETY AND ENVIRONMENTAL

Read, understand and follow all Safety Data Sheets and product label information for this product prior to use. The SDS can be obtained by visiting [www.master-builders-solutions.basf.us](http://www.master-builders-solutions.basf.us), e-mailing your request to [basfbcst@basf.com](mailto:basfbcst@basf.com) or calling 1(800)433-9517. Use only as directed.

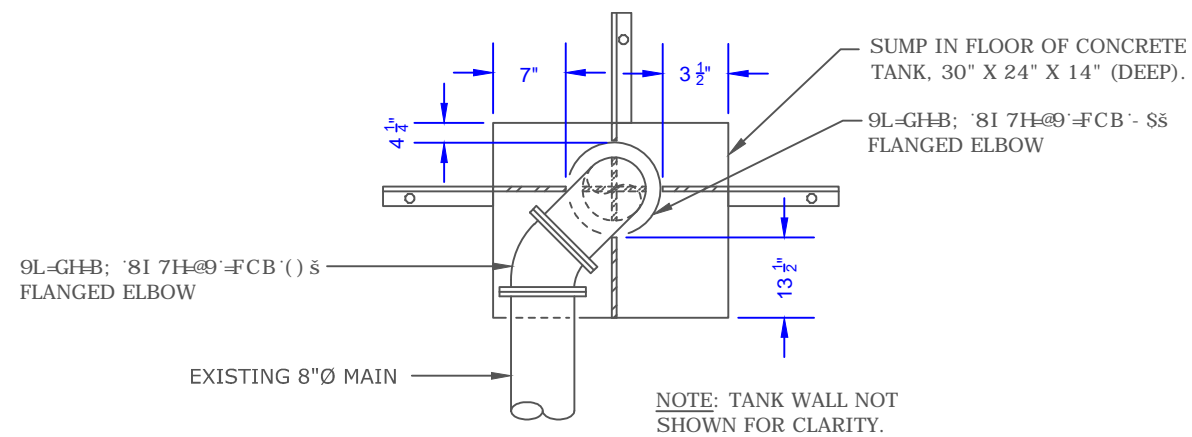
**For medical emergencies only,  
call ChemTrec® 1(800)424-9300.**

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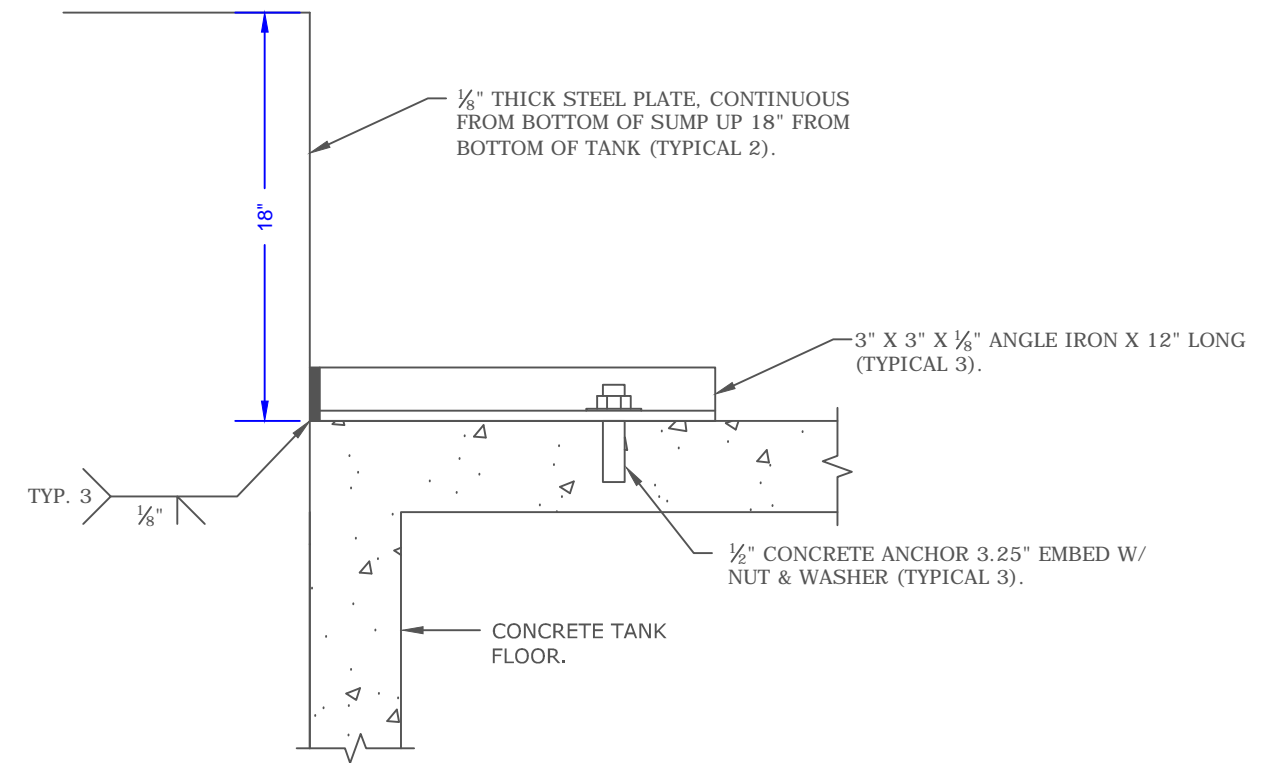
#### LIMITED WARRANTY NOTICE

BASF warrants this product to be free from manufacturing defects and to meet the technical properties on the current Technical Data Guide, if used as directed within shelf life. Satisfactory results depend not only on quality products but also upon many factors beyond our control. BASF MAKES NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ITS PRODUCTS. The sole and exclusive remedy of Purchaser for any claim concerning this product, including but not limited to, claims alleging breach of warranty, negligence, strict liability or otherwise, is the replacement of product or refund of the purchase price, at the sole option of BASF. Any claims concerning this product must be received in writing within one (1) year from the date of shipment and any claims not presented within that period are waived by Purchaser. BASF WILL NOT BE RESPONSIBLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFITS) OR PUNITIVE DAMAGES OF ANY KIND.

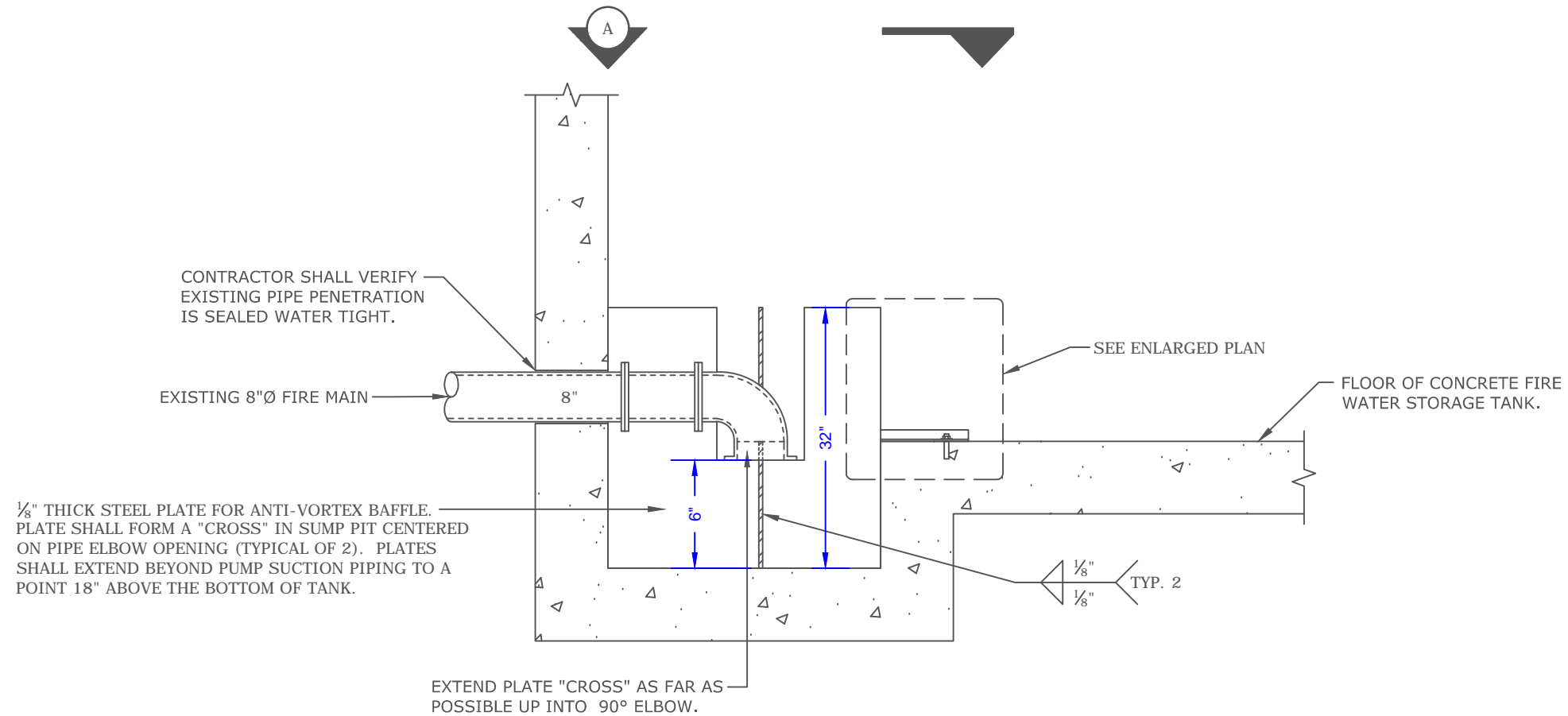
Purchaser must determine the suitability of the products for the intended use and assumes all risks and liabilities in connection therewith. This information and all further technical advice are based on BASF's present knowledge and experience. However, BASF assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights, nor shall any legal relationship be created by or arise from the provision of such information and advice. BASF reserves the right to make any changes according to technological progress or further developments. The Purchaser of the Product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with a full application of the product(s). Performance of the product described herein should be verified by testing and carried out by qualified experts.



**SECTION "A"**



**ENLARGED PLAN**



**ANTI-VORTEX BAFFLE DETAIL**

NOT TO SCALE

# **Supply Line Gate Valve Product** **Data**

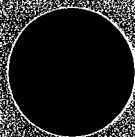
The original, and the definitive standard.

# RESILIENT WEDGE GATE VALVES

2" THROUGH 12"  
STYLE 4067



AWWA C509 250 PSI • UL/FM Approved 200 PSI • NSF 61 Certified •  
Full Water-Way • Fusion Bond Epoxy Coated • 10 Year Limited Warranty



M&H VALVE COMPANY

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[www.mh-valve.com](http://www.mh-valve.com)



For Generations



## COMMITTED TO ENVIRONMENTAL RESPONSIBILITY

M&H VALVE COMPANY IS COMMITTED TO PROTECTING OUR NATURAL RESOURCES THROUGH ENVIRONMENTALLY RESPONSIBLE MANUFACTURING PRACTICES, INCLUDING THE USE OF 80+% RECYCLED CONTENT IN OUR HYDRANTS AND VALVES.

To learn more about our commitment to the environment, call 256-237-3521

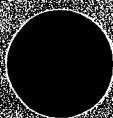
## RECOMMENDED SPECIFICATIONS

1. Valves shall conform to the latest revision of AWWA Standard C509 covering resilient seated gate valves for water supply service.
2. The valves shall have an iron body, bonnet, and O-ring plate. The wedge shall be totally encapsulated with rubber.
3. The sealing rubber shall be permanently bonded to the wedge per ASTM D429.
4. Valves shall be supplied with O-ring seals at all pressure retaining joints. No flat gaskets shall be allowed.
5. The valves shall be either non-rising stem or rising stem, opening by turning left or right, and provided with 2" square operating nut or a handwheel with the word "Open" and an arrow to indicate the direction to open.
6. Stems shall be cast copper alloy with integral collars in full compliance with AWWA. All stems shall operate with copper alloy stem nuts independent of wedge and of stem (in NRS valves).
7. All stems shall have two O-rings located above thrust collar and one O-ring below. Stem O-rings shall be replaceable with valve fully opened and subjected to full pressure. The stems on 2" – 12" shall also have a low torque thrust bearing located above and below the stem collar to reduce friction during operation.
8. Waterway shall be smooth, unobstructed and free of all pockets, cavities and depressions in the seat area. Valves 2" and larger shall accept a full size tapping cutter.
9. The body, bonnet and O-ring plate shall be fusion-bonded epoxy coated, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 and be NSF 61 Certified.
10. Each valve shall have maker's name, pressure rating, and year in which it was manufactured cast in the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to the requirements of AWWA C509 (and UL/FM where applicable).
11. Valves shall have all component parts cast and assembled in the USA and shall be manufactured by the M&H Valve Company.

ISO 9001



[www.mh-valve.com](http://www.mh-valve.com)



M&H VALVE COMPANY

605 West 23rd Street • Anniston, Alabama 36201  
PHONE 256-237-3521 FAX 888-549-5309

M&H Valve is a division of McWane, Inc.



For Generations



**SPECIFICATIONS / AVAILABLE CONFIGURATIONS & STYLE NUMBERS (2" - 12")  
M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

**M&H Valve AWWA C509 Resilient Wedge Gate Valves  
Meet or Exceed the Requirements of AWWA Standard C509**

Size Range	Water Working Pressure psi	Bubble Tight Seat Test psi	Hydrostatic Shell Test psi
AWWA 2" - 12"	250 Water Works	250 & 400	500
ULFM 4" - 12"	200 Fire Protection	250 & 400	500

Available End Connections	Size Range	Style No. With 2" Nut	Style No. With Hand wheel	Style No. With Post Plate
Mechanical Joint (NRS) (no 2 1/2")	2"-12"	4067-01	4067-01-HW	4067-01P (3"-12")
Flanged Ends (NRS)	2"-12"	4067-02	4067-02-HW	4067-02P (3"-12")
Flanged End X Mechanical Joint (NRS)	3"-12"	4067-13	4067-13-HW	4067-13P (3"-12")
Push-on (For PVC / SDR) (NRS)	2"-12"	4067-03	4067-03-HW	4067-03P (3"-12")
Threaded (NRS)	2"-3"	4067-07	4067-07-HW	4067-07P (3" only)
Threaded (NRS)(With T-Head Nut)	2"-3"	4067-07THN (With T-Head Nut)		
***Threaded (OS&Y)	2"-3"	N/A	4068-07	
Tyton X Tyton (NRS) (For D.I. / C900)	4"-12"	4067-22	4067-22-HW	4067-22P (4"-12")
Tyton X Flange (NRS) (For D.I. / C900)	4"-12"	4067-23	4067-23-HW	4067-23P (4"-12")
***Flanged Ends (OS&Y)	2"-12"	N/A	4068 & 4068A*	N/A
**Tapping Valve (NRS)	4"-12"	4751-01	4751-01HW	4751-01P (4"-12")
M.J. Cutting-in valve (NRS)	4"-12"	4576-01	4576-01-HW	4576-01P (4"-12")
****Flanged End (Open Mitre Box)	3"-12"	4211-O	4211-O-HW	N/A
****Flanged End (Enclosed Mitre Box)	4"-12"	4211-C	4211-C-HW	N/A

Notes: \*4068A is Tapped & Plugged in "A" Position (2" - 4" = 1/2" tap)(6" - 12" = 3/4" tap)  
 \*\*Each size accommodates a full size diameter tapping cutter.  
 \*\*\*2" OS&Y Flanged and Threaded versions are UL Listed.  
 \*\*\*\*Can provide with all available end connections.  
 2" and 2 1/2" are not included in AWWA C509.

NOTE: It is recommended that valves be installed with stems vertical when used in raw sewage or sludge applications or in water with excessive sediment.



**RECOMMEND SPECIFICATIONS (NRS STYLE 4067)(OS&Y STYLE 4068)(2"-12")  
M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

**RECOMMENDED SPECIFICATIONS (2"-12")**

1. Valves shall conform to the latest revision of AWWA Standard C509 covering resilient seated gate valves for water supply service.
2. The valves shall have an iron body, bonnet, and O-ring plate. The wedge shall be totally encapsulated with rubber.
3. The sealing rubber shall be permanently bonded to the wedge per ASTM D-429.
4. Valves shall be supplied with O-ring seals at all pressure retaining joints. No flat gaskets shall be allowed.
5. The valves shall be either non-rising stem or rising stem, opening by turning left or right, and provided with 2" square operating nut or a handwheel with the word "Open" and an arrow to indicate the direction to open.
6. Stems shall be cast copper alloy with integral collars in full compliance with AWWA. All stems shall operate with copper alloy stem nuts independent of wedge and of stem (in NRS valves). OS&Y (rising stems) shall be bronze
7. All stems shall have two O-rings located above the thrust collar and one O-ring below. Stem O-rings shall be replaceable with valve fully opened and subjected to full pressure.
8. The stems on 2"-12" shall also have a low torque thrust bearing located above and below the stem collar to reduce friction during operation.
9. Waterway shall be smooth, unobstructed and free of all pockets, cavities and depressions in the seat area. Valves 2" and larger shall accept a full size tapping cutter.
10. The body, bonnet and O-ring plate shall be fusion-bonded epoxy coated, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 and be NSF 61 Certified.
11. Each valve shall have maker's name, pressure rating, and year in which it was manufactured cast in the body. Country of origin to be clearly cast into body & cover castings.
12. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to the requirements of AWWA C509 (and UL/FM where applicable).
13. Valves shall have all component parts cast and assembled in the USA and shall be manufactured by the M&H Valve Company.

NOTE: It is recommended that valves be installed with stems vertical when used in raw sewage or sludge applications or in water with excessive sediment.

**September 1, 2012 / C509 Gate Valves**

**PRODUCT ANALYSIS (2"-12)**

**M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

<b>FEATURES</b>	<b>BENEFIT</b>
2"-12" Bubble Tight Closure at 250 psi (AWWA Service)	<ul style="list-style-type: none"> <li>• No Leakage – No loss of water</li> </ul>
Wedge Has Dual Rubber Seal	<ul style="list-style-type: none"> <li>• Assures drop-tight shut-off in either direction.</li> </ul>
Smooth, Unobstructed Waterway to Maximize Flow.	<ul style="list-style-type: none"> <li>• High flow characteristics</li> <li>• 100% smooth passage without turbulent flow</li> <li>• No sediment build up</li> <li>• Will not impede travel of line cleaning tools</li> </ul>
Only Three Internal Parts	<ul style="list-style-type: none"> <li>• Virtually maintenance free</li> </ul>
Integral Cast Tongue and Groove Between Wedge and Valve Body.	<ul style="list-style-type: none"> <li>• Positive gate alignment every time</li> </ul>
No Metal Seat Rings	<ul style="list-style-type: none"> <li>• Nothing to be damaged by scoring</li> </ul>
Delrin* Anti-Friction Thrust Bearing	<ul style="list-style-type: none"> <li>• Operating torque to close and open held to absolute minimum</li> </ul>
Solid, Bronze Stem Nut and High Strength Bronze Stem	<ul style="list-style-type: none"> <li>• No corrosion</li> <li>• Trouble free service</li> </ul>
Stem Nut is Self Centering	<ul style="list-style-type: none"> <li>• Eliminates possible stress on stem and wedge</li> </ul>
Two O-Ring Seals Above Stem Thrust Collar and One Below	<ul style="list-style-type: none"> <li>• Two O-Rings can be replaced with valve in service (Valve needs to be fully opened)</li> </ul>
High Strength Iron Wedge Fully Encapsulated with Rubber Permanently Bonded to Metal.	<ul style="list-style-type: none"> <li>• Trouble free service with minimum maintenance</li> <li>• No leaks – no wear</li> </ul>
No Lubrication Required	<ul style="list-style-type: none"> <li>• Trouble free service</li> </ul>
Body / Bonnet Epoxy Coating Inside & Out	<ul style="list-style-type: none"> <li>• Unprecedented Protection Against Corrosion and abrasion</li> </ul>
10 Year Limited Warranty Against Defective Materials or Workmanship	<ul style="list-style-type: none"> <li>• Customer assurance that M&amp;H believes in the strong product they produce.</li> </ul>
American Cast and Assembled	<ul style="list-style-type: none"> <li>• American Jobs</li> <li>• American backed for more than 100 years</li> <li>• American quality and accountability</li> </ul>

\* DuPont Trademark

NOTE: It is recommended that valves be installed with stems vertical when used in raw sewage or sludge applications or in water with excessive sediment.

**September 1, 2012 / C509 Gate Valves**

PERFORMANCE INFORMATION (AWWA & UL/FM)

**M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

**2"-12" AWWA PERFORMANCE INFORMATION**

1. Valve complies with AWWA C509 specs where applicable.
2. Valve is rated at 250psi working pressure.
3. Valve is bubble-tight at all pressures up to full rated pressure (250psi).
4. Valve has been subjected to torques 150 percent of the designated minimum required torques.
5. Valve has been cycle tested full opened to close 5,000 times without loss of bubble-tight seal.
6. Rubber to iron bond on wedge is inspected for strength as per ASTM D 429 specification.

**4"-12" UL/FM PERFORMANCE INFORMATION**

1. Valve complies with Underwriters Laboratory standard UL 262.
2. Valve is UL/FM rated at 200psi working pressure.
3. Valve is bubble-tight at all pressures up to the full rated pressure (200psi)
4. Valve is capable of bubble-tight seal at twice the rated pressure (400psi) for short periods of time.
5. 4"-6" valve sizes have been hydrostatically shell tested at five times the rated pressure (1,000 psi).
6. 8", 10", and 12" valve sizes have been hydrostatically shell tested at four times the rated pressure (800psi).
7. Valves has been subjected to torques 150 percent of the designated minimum required torques.
8. Valve has been cycle tested 5,000 times without loss of bubble-tight seal.
9. Rubber to iron bond on wedge is inspected for strength as per ASTM D 429 specification.

Note: For complete data on the tests Underwriters Laboratories performed reference UL File EX783

NOTE: It is recommended that valves be installed with stems vertical when used in raw sewage or sludge applications or in water with excessive sediment.

**September 1, 2012 / C509 Gate Valves**

**MATERIAL SPECIFICATIONS (1 of 2)**

**M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

**CAST IRON SPECIFICATION ASTM A126 CLASS B**

Physical Properties

Minimum tensile strength	31,000 psi
Minimum transverse strength	3,300 lbs.
Minimum deflection (12" Centers)	.12 in

Chemical Analysis (percent)

Phosphorus (maximum)	.75
Sulfur (maximum)	.15

**DUCTILE IRON SPECIFICATION ASTM A536**

Physical Properties

Minimum tensile strength	65,000 psi
Minimum yield strength	45,000 psi

**STYRENE BUTADINE RUBBER – ASTM D-5000 “O-Rings” & “Wedge / Seat Rubber”**

Hardness	78± 5
100% Modulus (PSI)	800

**ALTERNATE---EPDM “O-Rings” & “Wedge / Seat Rubber”**

Hardness	80± 2
100% Modulus (PSI)	600
Tensile (PSI)	1,450
Elongation (%)	150
Compression set, ASTM D395 Method B	18% max.

**September 1, 2012 / C509 Gate Valves**

## MATERIAL SPECIFICATIONS (2 of 2)

# M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)

### STANDARD CAST BRONZE—ASTM B584 CDA836 (Stem Nut)

#### Physical Properties

Minimum tensile strength	30,000psi
Minimum yield strength	14,000psi
Minimum elongation (in 2 inches)	20%

#### Chemical Analysis

*Copper	84.0 – 86.0
Lead	4.0 – 6.0
Tin	4.0 – 6.0
Nickel (maximum)	1.0
Zinc	4.0 – 6.0

\* = CU + NI = 79% Min

### CAST BRONZE – ASTM B584 CDA867 (Stem)

In accordance with SECTION 4.4.5 of AWWA C509

#### Physical Properties

Minimum tensile strength	80,000 psi
Minimum yield strength	32,000 psi
Minimum elongation (in 2 inches)	15%

#### Chemical Analysis

Copper	55.0 – 60.0
Lead (maximum)	.50 – 1.5
Aluminum	1.0 – 3.0
Iron	1.0 – 3.0
Nickel (maximum)	1.0
Zinc	30.0 – 38.0
Manganese	1.0 – 3.5
Tin (maximum)	.2

### ALTERNATE CAST BRONZE – NDZ-S ASTM B763 UNS C99500 (Stem )

In accordance with SECTION 4.4.5 of AWWA C509

#### Physical Properties

Minimum tensile strength	70,000 psi
Minimum yield strength	40,000 psi
Minimum elongation (in 2 inches)	12%

#### Chemical Analysis

Copper	82.8
Lead (maximum)	.25
Aluminum (maximum)	2.0
Iron (maximum)	5.5
Nickel (maximum)	5.5
Zinc (maximum)	2.0
Silicon (maximum)	2.0

September 1, 2012 / C509 Gate Valves

**FLOW COEFFICIENTS (2"-12")**

**M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

**FLOW COEFFICIENTS (2"-12")**

VALVE SIZE	Cv (FULL OPEN)	K (FULL OPEN)
2"	300	0.15
2 1/2"	500	0.130
3"	800	0.115
4"	1500	0.105
6"	3600	0.090
8"	6700	0.080
10"	10,500	0.080
12"	15,000	0.080

Note: 2" & 2 1/2" not included in AWWA C509

$$Cv = \frac{Q}{\sqrt{\Delta P}}$$

$$K = f \frac{L}{D}$$

Values given are calculated, based on hydraulic lab test on 6" R/W valve.

**September 1, 2012 / C509 Gate Valves**

**CR (CORROSION RESISTANCE ) INTERIOR & EXTERIOR COATING (1 of 2)**  
**M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

**CR (CORROSION RESISTANCE) COATING**

M&H Valves CR Coating is a high performance, one-part, heat-curable, thermoset coating which provides superior corrosion resistance protection for metal parts.

M&H Valves CR Coating material is a stable, non-toxic resin consisting of 100% solids. It is impervious to and imparts no taste to potable water. M&H CR Coating is formulated from materials deemed acceptable in the Food and Drug Administration's Document Title 21 of the Federal Regulations on food additives, Section 175.300 entitled "Resinous and Polymeric Coatings".

M&H Valves CR Coating is applied by a heat application, fusion—bonding process which secures the coating materials to the metal valve components. This process provides a continuous coating 6-8 mils thick with excellent adhesion qualities.

The durable M&H Valve CR Coating has a hard finish and exhibits excellent corrosion resistance in the most aqueous solutions and good abrasion resistance. It will not sag or cold flow or become soft during long-term storage. In addition to excellent corrosion resistance to aqueous solutions, the coating has excellent stability and resistance to acidic soil conditions.

M&H Valve CR Coating meets the requirements of the American Water Works Association Standard C-550 entitled "Protective Interior Coatings for Valves and Hydrants". This high performance coating has a ten year history of satisfactory service as a corrosion protection coating used in corrosive potable water applications and soil conditions.

**September 1, 2012 / C509 Gate Valves**



**CR (CORROSION RESISTANCE ) INTERIOR & EXTERIOR COATING (2 of 2)  
M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

**CR (CORROSION RESISTANCE) COATING**

CHEMICAL	Epoxy Rating	
	70°F	180° F
<b>ACIDS:</b>		
Acetic, 10%	F	N
Benzene Sulfonic, 10%	E	E
Benzoic	E	E
Boric	E	E
Chloracetic, 10%	E	E
Chromic, 5%	F	N
Citric, 10%	E	N
Fatty Acids	E	E
Fronmic, 90%	E	F
Hydrobromic, 20%	G	G
Hydrochloric, 20%	E	G
Hydrocyanic	E	E
Hydrofluoric, 20%	G	G
Hypochlorous, 5%	F	N
Lactic, 5%	F	N
Maleic, 25%	E	E
Nitric, 5%	E	G
Nitric, 30%	G	P
Oleic	E	E
Oxalic	E	E
Phosphoric	G	F
Picric	G	F
Steraric	E	E
Sulfuric, 50%	G	F
Tannic	E	E
Ketones	F	F
Ethers	F	F
Esters	F	F
Gasoline	E	E
Cargon Tetrachloride	E	E
<b>ORGANICS:</b>		
Aniline	G	P

CHEMICAL	Epoxy Rating	
	70°F	180° F
<b>ALKALIES:</b>		
Ammonium Hydroxide	E	E
Calcium Hydroxide	E	E
Potassium Hydroxide	E	E
Sodium Hydroxide	E	E
<b>ACID SALTS:</b>		
Aluminum Sulfate	E	E
Ammonium Chloride*	E	E
Copper Chloride*	E	E
Iron Chloride*	E	E
Zinc Chloride*	E	E
<b>ALKALINE SALTS:</b>		
Barium Sulfide	E	E
Sodium Bicarbonate	E	E
Sodium Carbonate	E	E
Sodium Sulfide	E	E
Trisodium Phosphate	E	E
<b>NETRAL SALTS:</b>		
Calcium Chloride*	E	E
Magnesium Chloride*	E	E
Potassium Chloride*	E	E
Sodium Chloride*	E	E
<b>SOLVENTS:</b>		
Alcohols	E	E
Aliphatic Hydrocarbons	E	E
Aromatic Hydrocarbons	E	E
Benzene	E	E
Formaldehyde, 37%	E	E
Phenol, 5%	E	G
Mineral Oils	E	E
Vegetable Oils	E	E

KEY: E – no attack  
 G – Appreciably no attack  
 F – some attack, but useable in some instances  
 P – attack, not recommended for use  
 N – rapidly attacked  
 \* - and nitrate and sulfate

**September 1, 2012 / C509 Gate Valves**

## VALVE ACCESSORIES

# M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)

### VALVE ACCESSORIES

Mechanical operational accessories are used for valves having special operational needs such as;

1. Location with limited access
2. Hazardous locations
3. Revision of operational position
4. High Torque Operation
5. Indication of Valve Position

Accessory selection must be evaluated for its capability to transmit the required torque requirements to the valve. To assure long-term trouble free operation, its materials of construction should take into account factors relating to corrosion and maintenance.

Accessories used on M&H valves can include the following:

- Electric Motor Operators
- Stem Guides
- Indicator Posts
- Hand wheels
- "T" Handles
- Extension Stems
- Floor Boxes
- Chain Wheels
- Floor stands (Non-rising stem)
- Position Indicators
- Miter Box Gearing
- Electronic Switches

September 1, 2012 / C509 Gate Valves

**LIMITED WARRANTY**

**M&H AWWA C509 RESILIENT WEDGE GATE VALVES (1993)**

**TEN YEAR LIMITED WARRANTY ON M&H VALVE RESILIENT WEDGE GATE VALVES**

M&H Valve Company warrants that its Resilient Wedge Gate Valves will be free from defects in material and workmanship under normal and customary use and maintenance for a period of ten (10) years from the date of purchase, provided the hydrant is installed and maintained according to M&H Valve instructions, and applicable codes. The foregoing warranty does not cover failure of any part or parts from external forces, including but not limited to earthquake, vandalism, vehicular or other impact, application of excessive torque to the operating mechanism or frost heave.

Should any M&H Valve Company part or parts fail to conform to the foregoing warranty, M&H Valve shall, upon prompt written notice thereof, repair, or replace, F.O.B. point of manufacture, such defective part or parts. Purchaser shall, if requested, return the part or parts to M&H Valve, transportation prepaid. Purchaser shall bear all responsibility and expense incurred for removal, reinstallation and shipping in connection with any part supplied under the foregoing warranty.

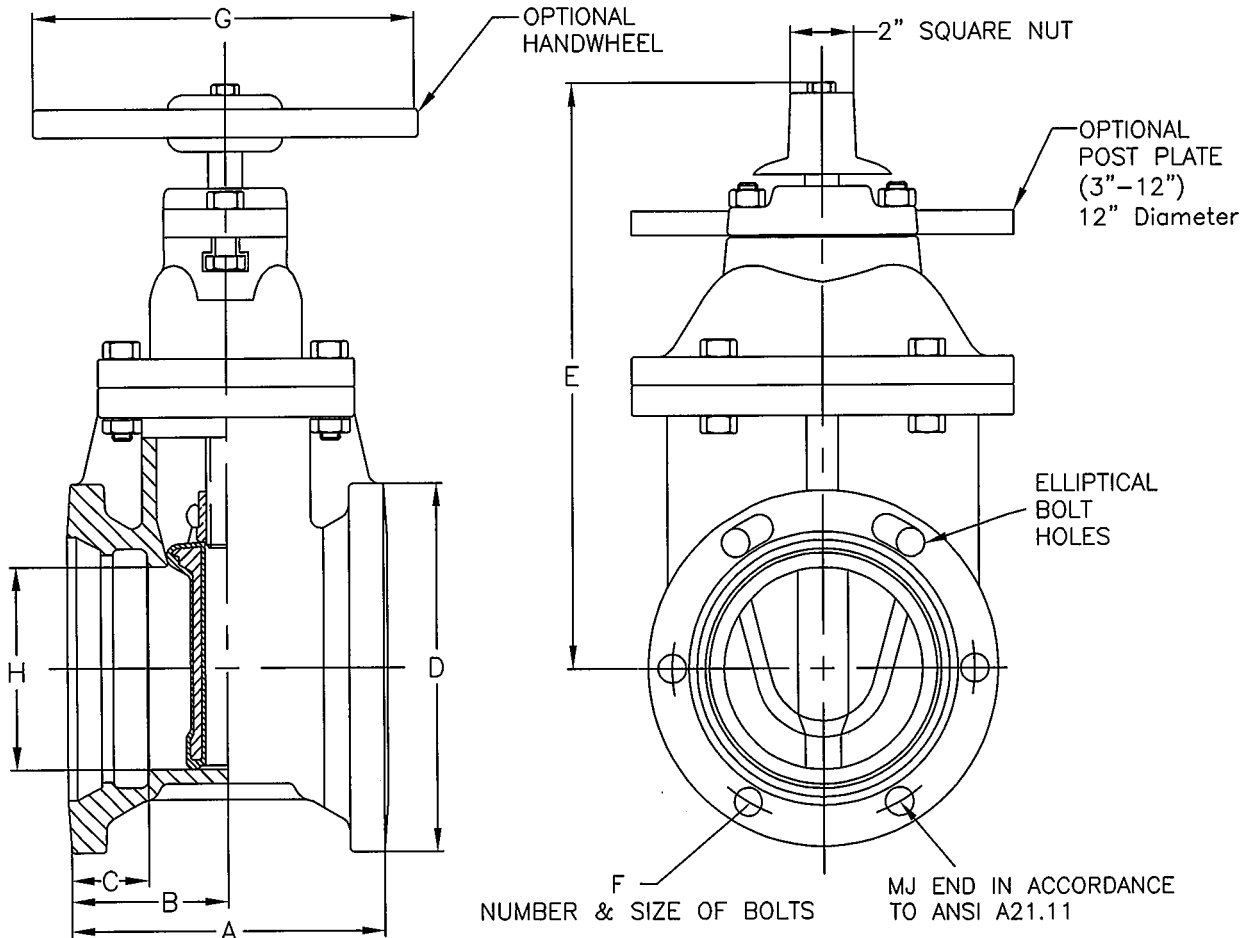
THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY WARRANTIES OF MERCHANTABILITY OR FITNESS. IN NO EVENT SHALL M&H VALVE COMPANY BE RESPONSIBLE OR LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL LOSSES, DAMAGES OR EXPENSES.

**September 1, 2012 / C509 Gate Valves**



COMPLIES WITH APPLICABLE REQUIREMENTS OF AWWA C509

4067-01 WITH 2" SQUARE NUT  
 4067-01HW WITH HANDWHEEL  
 4067-01P WITH POST PLATE (3"-12")



ELLIPTICAL BOLT HOLE DESIGN ALLEVIATES THE NEED FOR ANTI-ROTATIONAL BOLTS

VALVE SIZE	A	B	C	D	E	F	G	H	WEIGHT 2" NUT
**2	8 1/4	4 1/8	2 1/2	4 1/2	10 7/8	4-5/8	7 1/4	2	36
**2 1/2	—	—	—	—	—	—	—	—	—
3	8 1/2	4 1/4	2 1/2	7 3/4	12 3/8	4-5/8	10	3	60
4	9 1/2	4 3/4	2 1/2	9 1/8	14 3/4	4-3/4	10	4 1/4	82
6	10 1/2	5 1/4	2 1/2	11 3/8	19	6-3/4	12	6 1/4	134
8	13 1/8	6 9/16	2 1/2	13 3/4	22 1/2	8-3/4	14	8 1/4	201
10	15 1/2	7 3/4	2 1/2	15 3/4	26 1/2	8-3/4	18	10 1/4	366
12	18	9	2 5/8	18	30	9 3/4	18	12 1/4	481

HANDWHEEL--ADD 1# (2" - 2 1/2"), 6.5# (3"-4"), 7#(6"), 10#(8"), 16#(10" & 12")  
 INDICATOR POST PLATE ADD 16# (3"-12") ONLY  
 PALLET QUANTITIES 2" NUT: 46(2 1/2"), 36(3"), 30(4"), 24(6"), 10(8"), 6(10"), 6(12")  
 PALLET QUANTITIES HANDWHEEL: 36(2" & 2 1/2"), 30(3"), 30(4"), 18(6"), 8(8"), 6(10"), 4(12")  
 TURNS TO OPEN: 7 3/4(2"), 8(2 1/2"), 10(3"), 13 1/2(4"), 19 1/2(6"), 25 1/2(8"), 31 1/2(10"), 37 3/4(12")  
 \*\*2" and 2 1/2" not included in AWWA C509

M&H VALVE COMPANY  
 ANNISTON, ALABAMA  
 A DIVISION OF MCWANE INC.

DWN: TRIJ  
 DATE: 9/1/12  
 DWG. NO.  
 SD-11

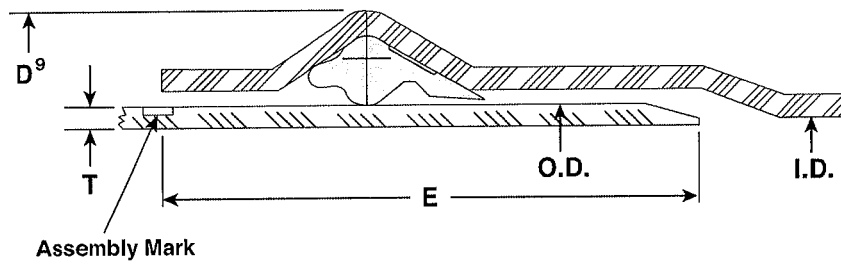
2" THRU 12"  
 RESILIENT SEAT GATE VALVE  
 C509-STYLE 4067-01  
 MJ X MJ



# GRAVITY SEWER

## SUBMITTAL AND DATA SHEET

PIPE SIZE (IN)	AVERAGE O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	MIN. E (IN)	APPROX. D (IN)	APPROX. WEIGHT (LBS/FT)
<b>SDR 35 (PS46) ASTM D3034</b>						
4	4.215	3.975	0.120	3.50	4.695	1.05
6	6.275	5.915	0.180	4.25	6.995	2.36
8	8.400	7.920	0.240	4.75	9.360	4.24
10	10.500	9.900	0.300	6.00	11.700	6.64
12	12.500	11.780	0.360	6.25	13.940	9.50
15	15.300	14.426	0.437	7.25	17.048	14.19
<b>SDR 26 (PS115) ASTM D3034</b>						
4	4.215	3.891	0.162	3.50	4.863	1.40
6	6.275	5.793	0.241	4.25	7.239	3.11
8	8.400	7.754	0.323	4.75	9.692	5.63
10	10.500	9.692	0.404	6.00	12.116	8.84
12	12.500	11.538	0.481	6.25	14.424	12.56
15	15.300	14.124	0.588	7.25	17.652	18.90
<b>PS46, ASTM F679</b>						
18	18.701	17.629	0.499	8.00	20.845	21.43
21	22.047	20.783	0.588	9.50	24.575	29.88
24	24.803	23.381	0.661	9.60	27.647	38.96
27	27.953	26.351	0.745	10.10	31.157	49.47
30 CIOD	32.000	30.194	0.853	16.75	35.612	64.18
36 CIOD	38.300	36.042	1.021	19.02	42.816	93.00
42 CIOD	44.500	41.948	1.187	22.43	49.604	—
48 CIOD	50.800	47.888	1.355	24.78	56.624	—
<b>PS115, ASTM F679</b>						
18	18.701	17.261	0.671	8.00	21.581	28.49
21	22.047	20.349	0.791	9.50	25.443	—
24	24.803	22.891	0.889	9.60	28.627	—
27	27.953	25.799	1.002	10.10	32.261	—
30 CIOD	32.000	29.070	1.148	16.75	36.348	—
36 CIOD	38.300	35.464	1.373	19.02	45.438	—
42 CIOD	44.500	41.072	1.596	22.43	51.356	—
48 CIOD	50.800	46.886	1.822	24.78	58.628	—



I.D. : Inside Diameter  
 O.D. : Outside Diameter  
 T : Wall Thickness  
 D<sup>9</sup> : Bell Outside Diameter  
 E : Distance between Assembly Mark to  
 the end of spigot.

Product Standard: ASTM 3034 (4"–15")  
 ASTM F679 (18"–48")  
 Pipe Compound: ASTM D1784 Cells Class 12454 or 12364  
 Gasket: ASTM F477  
 Integral Bell Joint: ASTM D3212  
 Pipe Stiffness: ASTM D2412  $F/\Delta Y = 46 \text{ PSI}$  or  $115 \text{ PSI}$   
 Pipe Length: 14 or 20 feet laying length  
 Installation: ASTM D 2321  
 JM Eagle™ Installation Guide

# **Pressure Transducer**

**Operations & Maintenance Manual  
December 2015**



## Microprocessor Bargraphic Display Scaling Meter



visit our website







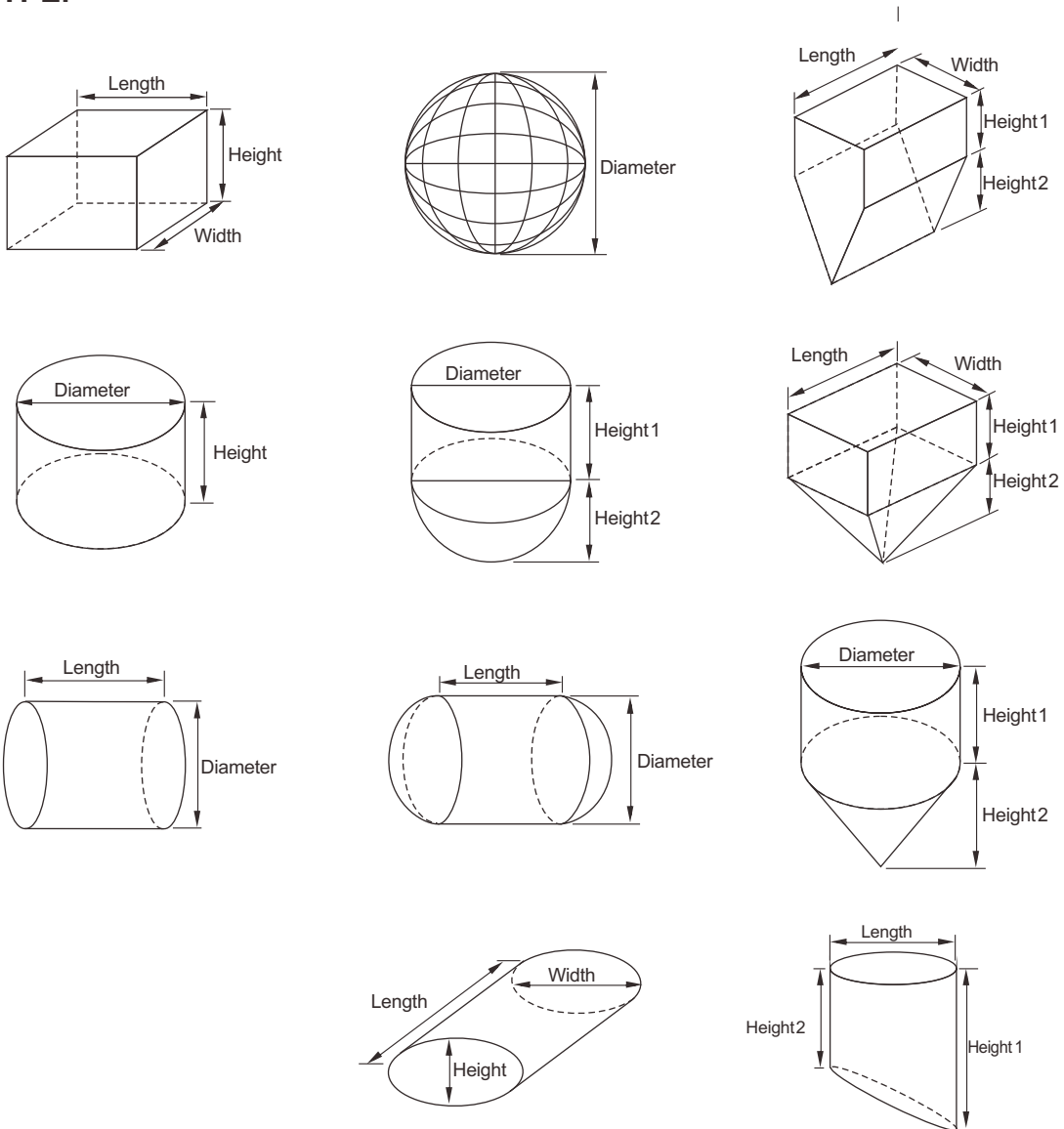
# NON-LINEAR TANK VOLUME CONVERSION FEATURE

## NON-LINEAR TANK VOLUME CONVERSION FEATURE





PM/PB Series support volume adjustment function for non-linear tanks. By means of a 20-point look-up table, panel meter calculate tank volume according to the material level measured.

Bundled with this package, a software is provided, user simply select tank type shown as below, and enter necessary dimension, tank volume and 20 control points will be calculated and reported.





### TANK TYPE:



# SPECIFICATIONS

		Microprocessor Bargraph Display Panel Meter			
Appearance					
Dimension (mm)		48 (W) x144 (H) x121.5 (D) DIN 3/16	48 (W) x144 (H) x121.5 (D) DIN 3/16	144 (W) x48 (H) x121.5 (D) DIN 3/16	144 (W) x48 (H) x121.5 (D) DIN 3/16
Model		PB-2471	PB-1471	PB-1470	PB-1570
Display		Dual Row 4-digit 7-segment LED Dual Column 101-segment LED Bargraph Display Totally 8 Set Points	4 Digits 7-Segment LED 101 LED Bargraph Display Totally 6 Set Points	4 Digits 7-Segment LED 101 LED Bargraph Display Totally 6 Set Points	5 Digits 7-Segment LED 101 LED Bargraph Display Totally 6 Set Points
Standard	Display Range	-1999 ~ +9999 °	-1999 ~ +9999 °	-1999 ~ +9999 °	-19999 ~ +32767 °
	Input signal	20mA, 200mA, 5V, 10V, 20V ,200V (Refer to Input Signal Setting)	20mA, 200mA, 5V, 10V, 20V ,200V (Refer to Input Signal Setting)	20mA, 200mA, 5V, 10V, 20V ,200V (Refer to Input Signal Setting)	20mA, 200mA, 5V, 10V, 20V ,200V (Refer to Input Signal Setting)
	Relay contact	4 Relay	4 Relay	4 Relay	4 Relay
	Power supply	85 ~ 265V AC or 18 ~ 36V DC	85 ~ 265V AC or 18 ~ 36V DC	85 ~ 265V AC or 18 ~ 36V DC	85 ~ 265V AC or 18 ~ 36V DC
Optional	Relay	Expand to 8 Relay	Expand to 6 Relay	Expand to 6 Relay	Expand to 6 Relay
	Analog output	4~20mA, 0~20mA, 2~10V and 0~10V	4~20mA, 0~20mA, 2~10V and 0~10V	4~20mA, 0~20mA, 2~10V and 0~10V	4~20mA, 0~20mA, 2~10V and 0~10V
	Communication port	RS-485 (Modbus)	RS-485 (Modbus)	RS-485 (Modbus)	RS-485 (Modbus)
	Non-Linear Function	Non-Linear Tank Volume Conversion Feature ( 20 points)	Non-Linear Tank Volume Conversion Feature ( 20 points)	Non-Linear Tank Volume Conversion Feature ( 20 points)	Non-Linear Tank Volume Conversion Feature ( 20 points)

# SPECIFICATIONS

		Microprocessor Digit Display Panel Meter			
Appearance					
Dimension (mm)		96 (W) x48 (H) x128.5 (D) DIN 1/8	96 (W) x48 (H) x128.5 (D) DIN 1/8	96 (W) x48 (H) x128.5(D) DIN 1/8	96 (W) x48 (H) x128.5(D) DIN 1/8
Model		PM-1430	PM-2430	PM-1530	PM-1430-W (4 digit) PM-1530-W (5 digit)
Display		4 Digits 7-Segment LED Totally 4 Set Points	Dual Channel Signal Input Dual 4 Digits LED Numeric Display Totally 4 Set Points	5 Digits 7-Segment LED Totally 4 Set Points	5 Digits 7-Segment LED Totally 4 Set Points
Standard	Display range	-1999 ~ +9999 °	-1999 ~ +9999 °	19999 ~ +32767 °	-1999 ~ +9999 ° -19999 ~ +99999 °
	Input signal	20mA, 200mA, 5V, 10V, 20V ,200V (Refer to Input Signal Setting)	20mA, 200mA, 5V, 10V, 20V ,200V (Refer to Input Signal Setting)	20mA, 200mA, 5V, 10V, 20V ,200V (Refer to Input Signal Setting)	20mA, 200mA, 5V, 10V, 20V ,200V (Refer to Input Signal Setting)
	Relay contact	2 Relay	4 Relay	2 Relay	4 Relay
	Power supply	85 ~ 265V AC or 18 ~ 36V DC	85 ~ 265V AC or 18 ~ 36V DC	85 ~ 265V AC or 18 ~ 36V DC	20 ~ 250Vac/Vdc 50/60Hz
Optional	Relay	Expand to 4 Relay	—————	Expand to 4 Relay	—————
	Analog output	4~20mA, 0~20mA, 2~10V and 0~10V	4~20mA, 0~20mA, 2~10V and 0~10V	4~20mA, 0~20mA, 2~10V and 0~10V	4~20mA, 0~20mA, 2~10V and 0~10V
	Communication port	RS-485 (Modbus)	RS-485 (Modbus)	RS-485 (Modbus)	RS-485 (Modbus)
	Non-Linear function	Non-Linear Tank Volume Conversion Feature ( 20 points)	Non-Linear Tank Volume Conversion Feature ( 20 points)	Non-Linear Tank Volume Conversion Feature ( 20 points)	Non-Linear Tank Volume And Input Signal Conversion ( each 20 points)

# PB-2471 Microprocessor Bargraph Display Panel Meter



## FEATURES:

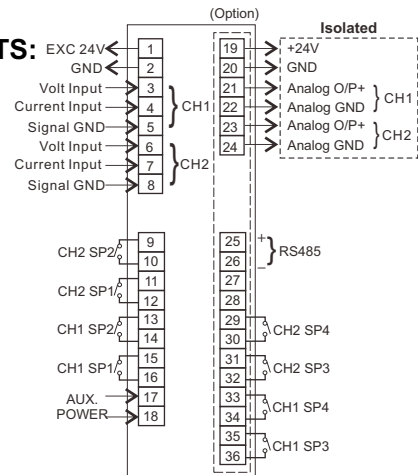
- Dual 4 Digits LED Numeric Display
- Dual 101-segment LED Bargraph display
- Wide Range of User Definable Scaling Ratio
- Modulized input signal boards available for different applications
- Optional Output Boards with Isolated Analog Output & Relay Output
- 85V~265VAC or 18~36VDC Switching Power Supply
- Support volume adjustment function for non-linear tanks (optional)

## SPECIFICATIONS

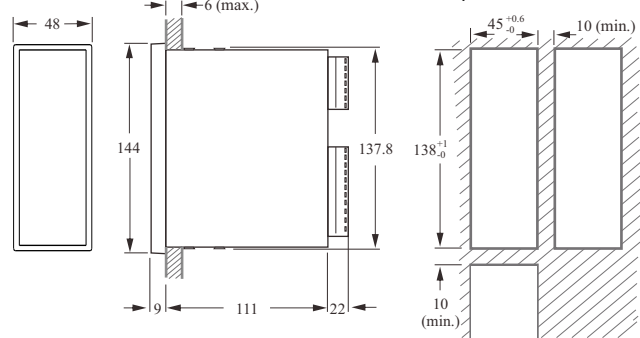
Dimension (mm)	48 (W) x144 (H) x121.5 (D) DIN 3/16
Model	PB-2471
Power supply	85 ~ 265V AC or 18~36V DC Switching Power Supply
Power supply for sensor	DC24V, 50mA
Display	Dual 4 Digits, 0.36" 7-Segment LED Display 101 LED Bargraph Display 4 LED set-point indicator Display Range: -1999 ~ +9999 Over Range Display: "1" or "-1"
Input signal	Range: Refer to Ordering information Accuracy: 0.1%FS or $\pm 1$ digit Temperature coefficient: 200ppm/ $^{\circ}$ C ADC Resolution: 4-1/2 digit Sampling Rate: 2 samples/second/channel
Relay contact	4 relay (up to 8 relay) 3A/250V AC or 5A/30V DC (N.C. / N.O. Jumper selectable)
Analog output	4~20mA, 0~20mA, 2~10V and 0~10V (optional)
Power consumption	Less than 12VA
Communication port	RS485 (optional) Modbus Protocol
Operating condition	0~50 $^{\circ}$ C (20 to 90% RH non-condensed)
Storage condition	0~70 $^{\circ}$ C (20 to 90% RH non-condensed)

## TERMINAL

### ARRANGEMENTS:



## EXTERIOR/CUTOUT DIMENSIONS (Unit:mm)



## ORDERING INFORMATION:

PB-2471-□□□□-□□□□□□□□

Power supply	S---85~265V AC T---18~36V DC	▲							
Input signal (CH1)	1---4~20mA DC with Exc 24V 2---0~20 mA DC with Exc 24V 3---0~200 mA DC with Exc 24V 4---5V DC with Exc 24V 5---10V DC with Exc 24V 6---20V DC with Exc 24V 7---200V DC with Exc 24V	▲							
Input signal (CH2)	1---4~20mA DC with Exc 24V 2---0~20 mA DC with Exc 24V 3---0~200 mA DC with Exc 24V 4---5V DC with Exc 24V 5---10V DC with Exc 24V 6---20V DC with Exc 24V 7---200V DC with Exc 24V	▲							
Relay contact	0---0 Relays 2---2 Relays 4---4 Relays 8---8 Relays	▲							
Non-Linear function	0---Without (Standard) 1---Support 20 points Vessel Conversion	▲							
Analog output	0---Without 5---Dual Analog output, 0~10V 6---Dual Analog output, 0/4~20mA	▲							
Communication port	0---Without 1---Support RS485 interface	▲							

**Ex:** PB-2471-S14-4000

Represents: PB-2471 Model, Power supply 85~265V AC, Analog input signal, CH1: 4~20mA, CH2: 0~5V, 4 relay contact, without Non-Linear Function, without Analog output.

# PB-1471 Microprocessor Bargraph Display Panel Meter



## FEATURES:

- 4 Digits LED Numeric Display
- 101-segment LED Bargraph display
- Wide Range of User Definable Scaling Ratio
- Modulized input signal boards available for different applications
- Optional Output Boards with Isolated Analog Output & Relay Output
- 85V~265VAC or 18~36VDC Switching Power Supply
- Support volume adjustment function for non-linear tanks (optional)

## SPECIFICATIONS

Dimension (mm) **48 (W) x144 (H) x121.5 (D) DIN 3/16**

Model **PB-1471**

Power SUPply **85 ~ 265V AC or 18~36V DC  
Switching Power Supply**

Power supply for sensor **DC24V, 50mA**

Display **4 Digits, 0.36" 7-Segment red LED  
Display**

Display **101 LED Bargraph Display  
6 LED set-point indicator  
Display Range: -1999 ~ +9999  
Over Range Display: "1" or "-1"**

Input signal **Range: Refer to Ordering information  
Accuracy: 0.1%FS or  $\pm 1$  digit  
Temperature coefficient: 200ppm/ $^{\circ}$ C  
ADC Resolution: 4-1/2 digit  
Sampling Rate:  
4 samples/second/channel**

Relay contact **4 relay (up to 6 relay)  
3A/250V AC or 5A/30V DC  
(N.C. / N.O. Jumper selectable)**

Analog output **4~20mA, 0~20mA, 2~10V and 0~10V (optional)**

Power consumption **Less than 9VA**

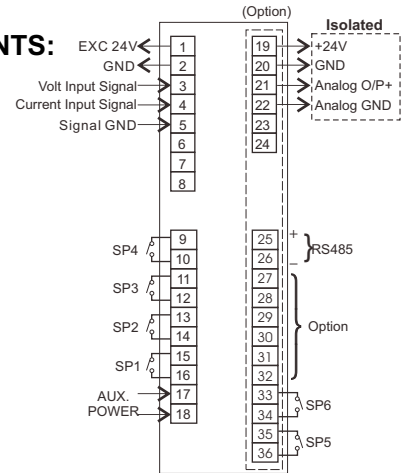
Communication port **RS485 (optional) Modbus Protocol**

Operating condition **0~50 $^{\circ}$ C(20 to 90% RH non-condensed)**

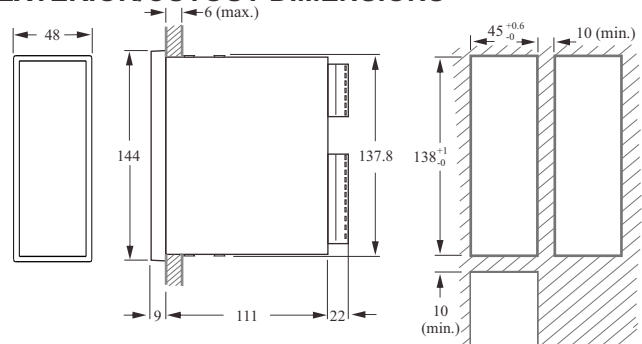
Storage condition **0~70 $^{\circ}$ C(20 to 90% RH non-condensed)**

## TERMINAL

### ARRANGEMENTS:



## EXTERIOR/CUTOUT DIMENSIONS



## ORDERING INFORMATION:

**PB-1471-□□□□-□□□□□□**

Power supply	S---85~265V AC T---18~36V DC
Input signal	01---4~20mA DC with Exc 24V 02---0~20 mA DC with Exc 24V 03---0~200 mA DC with Exc 24V 04---5V DC with Exc 24V 05---10V DC with Exc 24V 06---20V DC with Exc 24V 07---200V DC with Exc 24V  A1---2mA AC RMS A2---20mA AC RMS A3---200mA AC RMS A4---1A AC RMS A5---5A AC RMS  B1---100mV AC RMS B2---200mV AC RMS B3---2V AC RMS B4---20V AC RMS B5---200V AC RMS B6---600V AC RMS  C1--- $\pm 2$ mA DC with Exc 24V C2--- $\pm 20$ mA DC with Exc 24V C3--- $\pm 200$ mA DC with Exc 24V C4--- $\pm 1$ Amp DC C5--- $\pm 5$ Amp DC  D1--- $\pm 20$ mV DC with Exc 24V D2--- $\pm 50$ mV DC with Exc 24V D3--- $\pm 100$ mV DC with Exc 24V D4--- $\pm 200$ mV DC with Exc 24V
Relay contact	0---0 Relays 2---2 Relays 4---4 Relays 6---6 Relays
Non-Linear function	0---Without (Standard) 1---Support 20 points Vessel Conversion
Analog output	0---Without 1---0~10V Analog Output 2---0/4~20mA Analog Output
Communication port	0---Without 1---Support RS485 interface

**EX:** PB-1471-S01-4101

Represents: PB-1471 Model, Power supply 85~265V AC, Analog input signal 4~20mA, 4 relay contact, Support Non-Linear Function, without Analog output, Support RS485 interface.

# PB-1470 Microprocessor Bargraph Display Panel Meter



## FEATURES:

- 4 Digits LED Numeric Display
- 101-segment LED Bargraph display
- Wide Range of User Definable Scaling Ratio
- Modulized input signal boards available for different applications
- Optional Output Boards with Isolated Analog Output & Relay Output
- 85V~265VAC or 18~36VDC Switching Power Supply
- Support volume adjustment function for non-linear tanks (optional)

## SPECIFICATIONS

Dimension (mm) **144 (W) x48 (H) x121.5 (D) DIN 3/16**

Model **PB-1470**

Power supply 85 ~ 265V AC or 18~36V DC  
Switching Power Supply  
Power supply for sensor DC24V, 50mA

Display 4 Digits, 0.56" 7-Segment red LED Display  
101 LED Bargraph Display  
6 LED set-point indicator  
Display Range: -1999 ~ +9999  
Over Range Display: "1" or "-1"

Input signal Range: Refer to Ordering information  
Accuracy: 0.1%FS or  $\pm 1$  digit  
Temperature coefficient: 200ppm/ $^{\circ}$ C  
ADC Resolution: 4-1/2 digit  
Sampling Rate:  
4 samples/second/channel

Relay contact 4 relay (up to 6 relay)  
3A/250V AC or 5A/30V DC  
(N.C. / N.O. Jumper selectable)

Analog output 4~20mA, 0~20mA, 2~10V and 0~10V (optional)

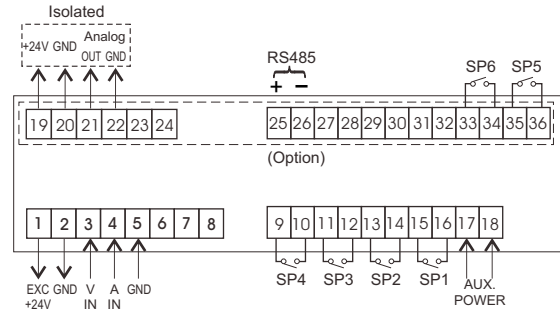
Power consumption Less than 9VA

Communication port RS485 (optional) Modbus Protocol

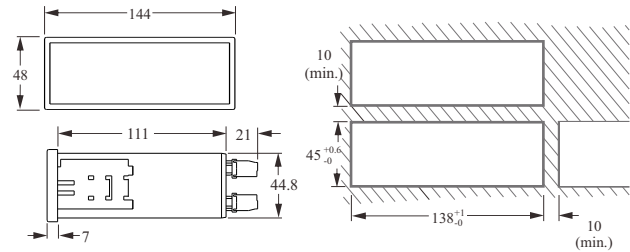
Operating condition 0~50 $^{\circ}$ C(20 to 90% RH non-condensed)

Storage condition 0~70 $^{\circ}$ C(20 to 90% RH non-condensed)

## TERMINAL ARRANGEMENTS:



## EXTERIOR/CUTOUT DIMENSIONS



## ORDERING INFORMATION:

PB-1470-□□□□□□□□

Power supply	S---85~265V AC T---18~36V DC
Input signal	01---4~20mA DC with Exc 24V 02---0~20 mA DC with Exc 24V 03---0~200 mA DC with Exc 24V 04---5V DC with Exc 24V 05---10V DC with Exc 24V 06---20V DC with Exc 24V 07---200V DC with Exc 24V  A1---2mA AC RMS A2---20mA AC RMS A3---200mA AC RMS A4---1A AC RMS A5---5A AC RMS  B1---100mV AC RMS B2---200mV AC RMS B3---2V AC RMS B4---20V AC RMS B5---200V AC RMS B6---600V AC RMS  C1--- $\pm 2$ mA DC with Exc 24V C2--- $\pm 20$ mA DC with Exc 24V C3--- $\pm 200$ mA DC with Exc 24V C4--- $\pm 1$ Amp DC C5--- $\pm 5$ Amp DC  D1--- $\pm 20$ mV DC with Exc 24V D2--- $\pm 50$ mV DC with Exc 24V D3--- $\pm 100$ mV DC with Exc 24V D4--- $\pm 200$ mV DC with Exc 24V
Relay contact	0---0 Relays 2---2 Relays 4---4 Relays 6---6 Relays
Non-Linear function	0---Without (Standard) 1---Support 20 points Vessel Conversion
Analog output	0---Without 1---0~10V Analog Output 2---0/4~20mA
Communication port	0---Without 1---Support RS485 interface

**EX:** PB-1470-S01-4101

Represents: PB-1470 Model, Power supply 85~265V AC, Analog input signal 4~20mA, 4 relay contact, Support Non-Linear Function, without Analog output, Support RS485 interface.



# PB-1570 Microprocessor Bargraph Display Panel Meter



## FEATURES:

- 5 Digits LED Numeric Display
- 101-segment LED Bargraph display
- Wide Range of User Definable Scaling Ratio
- Modulized input signal boards available for different applications
- Optional Output Boards with Isolated Analog Output & Relay Output
- 85V~265VAC or 18~36VDC Switching Power Supply
- Support volume adjustment function for non-linear tanks (optional)

## SPECIFICATIONS

Dimension (mm) **144 (W) x48 (H) x121.5 (D) DIN 3/16**

Model **PB-1570**

Power supply 85 ~ 265V AC or 18~36V DC  
Switching Power Supply

Power supply for sensor DC24V, 50mA

Display 5 Digits, 0.56" 7-Segment red LED Display  
101 LED Bargraph Display  
6 LED set-point indicator  
Display Range: -19999 ~ +32767  
Over Range Display: "1" or "-1"

Input signal Range: Refer to Ordering information  
Accuracy: 0.1%FS or  $\pm 1$  digit  
Temperature coefficient: 200ppm/ $^{\circ}$ C  
ADC Resolution: 4-1/2 digit  
Sampling Rate:  
4 samples/second/channel

Relay contact 4 relay (up to 6 relay)  
3A/250V AC or 5A/30V DC  
(N.C. / N.O. Jumper selectable)

Analog output 4~20mA, 0~20mA, 2~10V and 0~10V (optional)

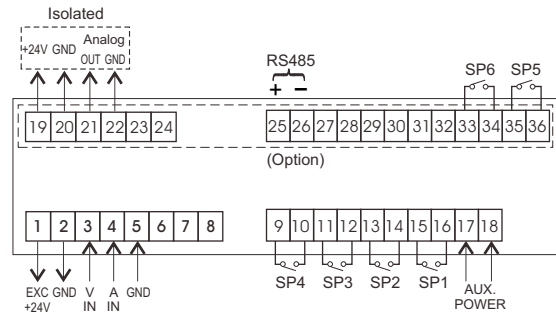
Power consumption Less than 9VA

Communication port RS485 (optional) Modbus Protocol

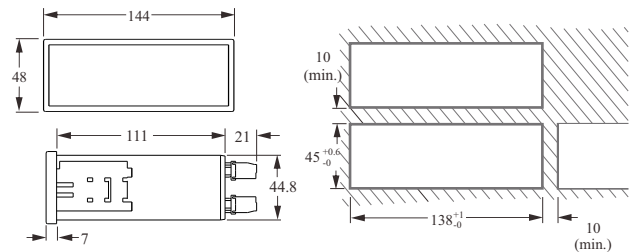
Operating condition 0~50 $^{\circ}$ C(20 to 90% RH non-condensed)

Storage condition 0~70 $^{\circ}$ C(20 to 90% RH non-condensed)

## TERMINAL ARRANGEMENTS:



## EXTERIOR/CUTOUT DIMENSIONS



## ORDERING INFORMATION:

PB-1570-□□□-□□□□

Power Supply	S---85~265V AC T---18~36V DC								
Input Signal	01---4~20mA DC with Exc 24V 02---0~20 mA DC with Exc 24V 03---0~200 mA DC with Exc 24V 04---5V DC with Exc 24V 05---10V DC with Exc 24V 06---20V DC with Exc 24V 07---200V DC with Exc 24V								
Relay Contact	A1---2mA AC RMS A2---20mA AC RMS A3---200mA AC RMS A4---1A AC RMS A5---5A AC RMS B1---100mV AC RMS B2---200mV AC RMS B3---2V AC RMS B4---20V AC RMS B5---200V AC RMS B6---600V AC RMS	C1--- $\pm 2$ mA DC with Exc 24V C2--- $\pm 20$ mA DC with Exc 24V C3--- $\pm 200$ mA DC with Exc 24V C4--- $\pm 1$ Amp DC C5--- $\pm 5$ Amp DC D1--- $\pm 20$ mV DC with Exc 24V D2--- $\pm 50$ mV DC with Exc 24V D3--- $\pm 100$ mV DC with Exc 24V D4--- $\pm 200$ mV DC with Exc 24V							
Non-Linear Function	0---Without (Standard) 1---Support 20 points Vessel Conversion								
Analog output	0---Without 1---0~10V Analog Output 2---0/4~20mA								
Communication port	0---Without 1---Support RS485 interface								

**EX:** PB-1570-S01-4101

Represents: PB-1570 Model, Power supply 85~265V AC, Analog input signal 4~20mA, 4 relay contact, Support Non-Linear Function, without Analog output, Support RS485 interface.



# PM-1430 Microprocessor Digit Display Panel Meter



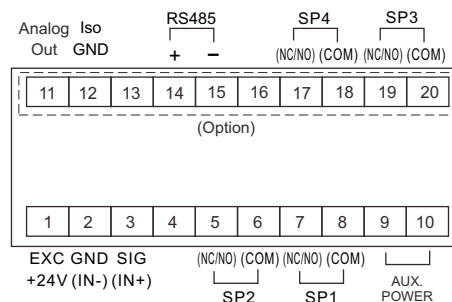
## FEATURES:

- 4 Digits LED Numeric Display
- Wide Range of User Definable Scaling Ratio
- Modulized input signal boards available for different applications
- Optional Output Boards with Isolated Analog Output & Relay Output
- 85V~265VAC or 18~36VDC Switching Power Supply
- Support volume adjustment function for non-linear tanks (optional)
- IP54 Class front panel

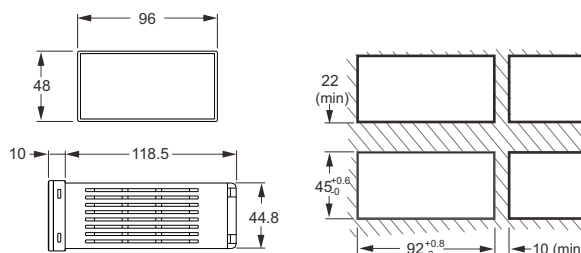
## SPECIFICATIONS

Dimension (mm)	96 (W) x48 (H) x128.5 (D) DIN 1/8
Model	PM-1430
Power supply	85 ~ 265V AC or 18~36V DC Switching Power Supply
Power supply for sensor	DC24V, 50mA
Display	4 Digits, 0.56" 7-Segment red LED Display 4 LED set-point indicator Display Range: -1999 ~ +9999 Over Range Display: "1" or "-1"
Input signal	Range: Refer to Ordering information Accuracy: 0.1%FS or $\pm 1$ digit Temperature coefficient: 200ppm/ $^{\circ}$ C ADC Resolution: 4-1/2 digit Sampling Rate: 4 samples/second/channel
Relay contact	2 or 4 relay 3A/250V AC or 5A/30V DC (N.C. / N.O. Jumper selectable)
Analog output	4~20mA, 0~20mA, 2~10V and 0~10V (optional)
Power consumption	Less than 7VA
Communication port	RS485 (optional) Modbus Protocol
Operating condition	0~50 $^{\circ}$ C (20 to 90% RH non-condensed)
Storage condition	0~70 $^{\circ}$ C (20 to 90% RH non-condensed)

## TERMINAL ARRANGEMENTS:



## EXTERIOR/CUTOUT DIMENSIONS



## ORDERING INFORMATION:

PM-1430-□ □ □ □ □ □ □ □

Power supply	S---85~265V AC T---18~36V DC	▲					
Input signal	01---4~20mA DC with Exc 24V 02---0~20 mA DC with Exc 24V 03---0~200 mA DC with Exc 24V 04---5V DC with Exc 24V 05---10V DC with Exc 24V 06---20V DC with Exc 24V 07---200V DC with Exc 24V  A1---2mA AC RMS A2---20mA AC RMS A3---200mA AC RMS A4---1A AC RMS A5---5A AC RMS  B1---100mV AC RMS B2---200mV AC RMS B3---2V AC RMS B4---20V AC RMS B5---200V AC RMS B6---600V AC RMS  C1--- $\pm 2$ mA DC with Exc 24V C2--- $\pm 20$ mA DC with Exc 24V C3--- $\pm 200$ mA DC with Exc 24V C4--- $\pm 1$ Amp DC C5--- $\pm 5$ Amp DC  D1--- $\pm 20$ mV DC with Exc 24V D2--- $\pm 50$ mV DC with Exc 24V D3--- $\pm 100$ mV DC with Exc 24V D4--- $\pm 200$ mV DC with Exc 24V	▲					
Relay contact	0---0 Relays 2---2 Relays 4---4 Relays		▲				
Non-Linear function	0---Without (Standard) 1---Support 20 points Vessel Conversion			▲			
Analog output	0---Without 1---0~10V Analog Output 2---0/4~20mA				▲		
Communication port	0---Without 1---Support RS485 interface					▲	

**EX:** PM-1430-S01-4101

Represents: PM-1430 Model, Power supply 85~265V AC, Analog input signal 4~20mA, 4 relay contact, Support Non-Linear Function, without Analog output, Support RS485 interface.

# PM-2430 Microprocessor Digit Display Panel Meter



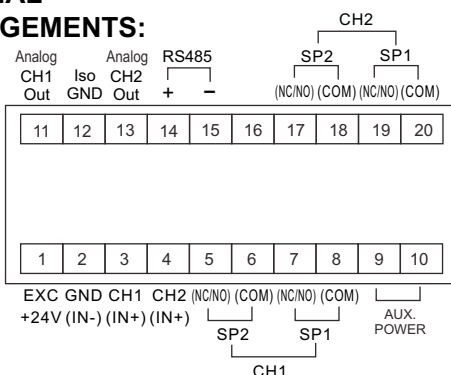
## FEATURES:

- Dual Channel Signal Input
- Dual 4 Digits LED Numeric Display
- Wide Range of User Definable Scaling Ratio
- Modulized input signal boards available for different applications
- Optional Output Boards with Isolated Analog Output & Relay Output
- 85V~265VAC or 18~36VDC Switching Power Supply
- Support volume adjustment function for non-linear tanks (optional)
- IP54 Class front panel

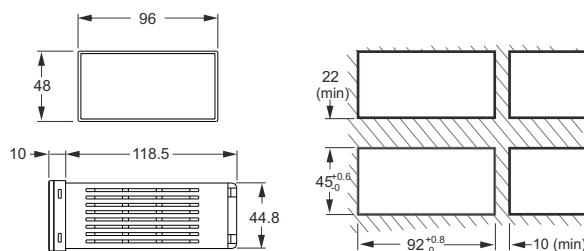
## SPECIFICATIONS

Dimension (mm)	<b>96 (W) x48 (H) x128.5 (D) DIN 1/8</b>
Model	<b>PM-2430</b>
Power supply	85 ~ 265V AC or 18~36V DC Switching Power Supply
Power supply for sensor	DC24V, 50mA
Display	CH1: 4 Digits, 0.36" 7-Segment red LED CH2: 4 Digits, 0.36" 7-Segment green LED 4 LED set-point indicator Display Range: -1999 ~ +9999 Over Range Display: "1" or "-1"
Input signal	Range: Refer to Ordering information Accuracy: 0.1%FS or $\pm 1$ digit Temperature coefficient: 200ppm/ $^{\circ}$ C ADC Resolution: 4-1/2 digit Sampling Rate: 2 samples/second/channel
Relay contact	4 relay 3A/250V AC or 5A/30V DC (N.C. / N.O. Jumper selectable)
Analog output	4~20mA, 0~20mA, 2~10V and 0~10V (optional)
Power consumption	Less than 7VA
Communication port	RS485 (optional) Modbus Protocol
Operating condition	0~50 $^{\circ}$ C(20 to 90% RH non-condensed)
Storage condition	0~70 $^{\circ}$ C(20 to 90% RH non-condensed)

## TERMINAL ARRANGEMENTS:



## EXTERIOR/CUTOUT DIMENSIONS



## ORDERING INFORMATION:

PM-2430-□□□□-□□□□

Power supply	S---85~265V AC T---18~36V DC
Input signal (CH1)	1---4~20mA DC with Exc 24V 2---0~20 mA DC with Exc 24V 3---0~200 mA DC with Exc 24V 4---5V DC with Exc 24V 5---10V DC with Exc 24V 6---20V DC with Exc 24V 7---200V DC with Exc 24V
Input signal (CH2)	1---4~20mA DC with Exc 24V 2---0~20 mA DC with Exc 24V 3---0~200 mA DC with Exc 24V 4---5V DC with Exc 24V 5---10V DC with Exc 24V 6---20V DC with Exc 24V 7---200V DC with Exc 24V
Relay contact	0---0 Relays 2---2 Relays 4---4 Relays 6---6 Relays
Non-Linear function	0---Without (Standard) 1---Support 20 points Vessel Conversion
Analog output	0---Without 5---Dual Analog Output 0~10V 6---Dual Analog Output 0/4~20mA
Communication port	0---Without 1---Support RS485 interface

**EX:** PM-2430-S14-4000

Represents: PM-2430 Model, Power supply 85~265V AC, Analog input signal CH1: 4~20mA , CH2: 0~5V, 4 relay contact, without Non-Linear Function, without Analog output.

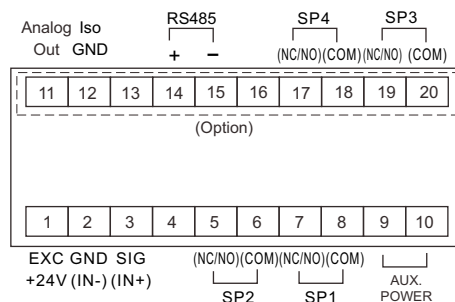
# PM-1530 Microprocessor Digit Display Panel Meter



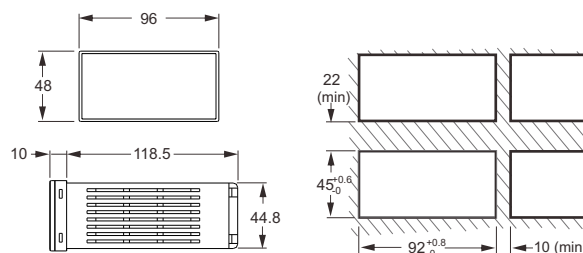
## FEATURES:

- 5 Digits LED Numeric Display
- Wide Range of User Definable Scaling Ratio
- Modulized input signal boards available for different applications
- Optional Output Boards with Isolated Analog Output & Relay Output
- 85V~265VAC or 18~36VDC Switching Power Supply
- Support volume adjustment function for non-linear tanks (optional)
- IP54 Class front panel

## TERMINAL ARRANGEMENTS:



## EXTERIOR/CUTOUT DIMENSIONS



## SPECIFICATIONS

Dimension (mm) **96 (W) x48 (H) x128.5 (D) DIN 1/8**

Model **PM-1530**

Power supply 20~250 Vac / Vdc 50/60Hz

Display 5 Digits, 0.56" 7-Segment red LED Display  
4 LED set-point indicator  
Display Range: -19999 ~ +99999  
Over Range Display: "1" or "-1"

Input signal Range: Refer to Ordering information  
Accuracy: 0.1%FS or  $\pm 1$  digit  
Temperature coefficient: 200ppm/ $^{\circ}$ C  
ADC Resolution: 4-1/2 digit  
Sampling Rate:  
24 samples/second/channel

Relay contact 2 or 4 relay  
3A/250V AC or 5A/30V DC  
(N.C. / N.O. Jumper selectable)

Analog output 4~20mA, 0~20mA, 2~10V and 0~10V (optional)

Power consumption Less than 7VA

Communication port RS485 (optional) Modbus Protocol

Operating condition 0~50 $^{\circ}$ C (20 to 90% RH non-condensed)

Storage condition 0~70 $^{\circ}$ C (20 to 90% RH non-condensed)

## ORDERING INFORMATION:

PM-1530-□□□□□□□□

Power Supply	S---85~265V AC T---18~36V DC	▲	□	□	□	□	□	□	□
Input signal	01---4~20mA DC with Exc 24V 02---0~20 mA DC with Exc 24V 03---0~200 mA DC with Exc 24V 04---5V DC with Exc 24V 05---10V DC with Exc 24V 06---20V DC with Exc 24V 07---200V DC with Exc 24V  A1---2mA AC RMS A2---20mA AC RMS A3---200mA AC RMS A4---1A AC RMS A5---5A AC RMS  B1---100mV AC RMS B2---200mV AC RMS B3---2V AC RMS B4---20V AC RMS B5---200V AC RMS B6---600V AC RMS  C1--- $\pm 2$ mA DC with Exc 24V C2--- $\pm 20$ mA DC with Exc 24V C3--- $\pm 200$ mA DC with Exc 24V C4--- $\pm 1$ Amp DC C5--- $\pm 5$ Amp DC  D1--- $\pm 20$ mV DC with Exc 24V D2--- $\pm 50$ mV DC with Exc 24V D3--- $\pm 100$ mV DC with Exc 24V D4--- $\pm 200$ mV DC with Exc 24V	▲	▲	▲	▲	▲	▲	▲	
Relay contact	0---0 Relays 2---2 Relays 4---4 Relays	▲	▲	▲	▲	▲	▲	▲	
Non-Linear function	0---Without (Standard) 1---Support 20 points Vessel Conversion	▲	▲	▲	▲	▲	▲	▲	
Analog output	0---Without 1---0~10V Analog Output 2---0/4~20mA	▲	▲	▲	▲	▲	▲	▲	
Communication port	0---Without 1---Support RS485 interface	▲	▲	▲	▲	▲	▲	▲	

**EX:** PM-1530-S01-4101

Represents: PM-1530 Model, Power supply 85~265V AC, Analog input signal 4~20mA, 4 relay contact, Support Non-Linear Function, without Analog output, Support RS485 interface.

# PM-1X30-W Microprocessor Digit Display Panel Meter



## FEATURES:

- 5 Digits LED Numeric Display
- Wide Range of User Definable Scaling Ratio
- Modulized input signal boards available for different applications
- Optional Output Boards with Isolated Analog Output & Relay Output
- 20~250Vac/Vdc 50/60Hz Switching Power Supply
- Support volume adjustment function for non-linear tanks (optional)
- IP54 Class front panel

## SPECIFICATIONS

Dimension (mm) **96 (W) x48 (H) x128.5 (D) DIN 1/8**

Model **PM-1□30-W**

Power supply **20~250 Vac / Vdc 50/60Hz**

Power supply for sensor

Display **5 Digits, 0.56" 7-Segment red LED Display**  
**4 LED set-point indicator**  
 Display Range: **-19999 ~ +99999**  
 Over Range Display: **"1" or "-1"**

Input signal **Range: Refer to Ordering information**  
**Accuracy: 0.1%FS or ± 1 digit**  
**Temperature coefficient: 200ppm/°C**  
**ADC Resolution: 4-1/2 digit**  
**Sampling Rate: 24 samples/second/channel**

Relay contact **4 relay**  
**3A/250V AC or 5A/30V DC**

Analog output **4~20mA, 0~20mA, 2~10V and 0~10V (optional)**

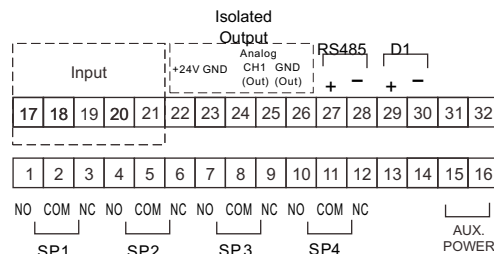
Power consumption **Less than 7VA**

Communication port **RS485 (optional) Modbus Protocol**

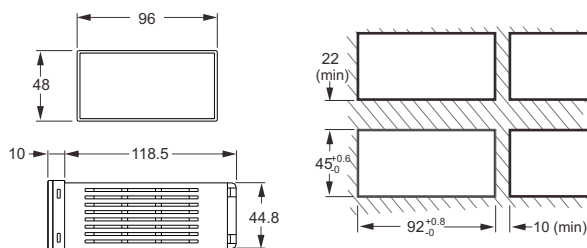
Operating condition **0~50°C(20 to 90% RH non-condensed)**

Storage condition **0~70°C(20 to 90% RH non-condensed)**

## TERMINAL ARRANGEMENTS:



## EXTERIOR/CUTOUT DIMENSIONS



## ORDERING INFORMATION:

**PM-1□30-W** □□-□□□□□□

Display	4 : 4 digit 5 : 5 digit
Power supply	20~250 Vac-dc, 50~60Hz
Input signal	01---4~20mA DC with Exc 24V 02---0~20 mA DC with Exc 24V 03---0~200 mA DC with Exc 24V 04---0~5V DC with Exc 24V 05---0~10V DC with Exc 24V 06---0~20V DC with Exc 24V 07---0~200V DC with Exc 24V  A1---0~2mA AC RMS A2---0~20mA AC RMS A3---0~200mA AC RMS A4---0~1A AC RMS A5---0~5A AC RMS  C1---0~±2 mA DC with Exc 24V C2---0~±20 mA DC with Exc 24V C3---0~±200 mA DC with Exc 24V C4---0~±1Amp DC C5---0~±5Amp DC  B1---0~100mV AC RMS B2---0~200mV AC RMS B3---0~2V AC RMS B4---0~20V AC RMS B5---0~200V AC RMS B6---0~600V AC RMS B7---0~1000V AC RMS  D1---0~±20mV DC with Exc 24V D2---0~±50mV DC with Exc 24V D3---0~±100mV DC with Exc 24V D4---0~±200mV DC with Exc 24V E1---5/10/20/50/100/200mV/ V DC (Option) with Exc 24V E2---1/2/5/10/20mV/V DC (Option) with ISO 10V E3---1/2/10/20/40mV/V DC (Option) with ISO 5V  F1---TC(K · J · E · N · T) & RTD (PT100 · JPT100) F2---TC(K · J · R · S · B · E · N · T) & RTD (PT100 · JPT100)
Relay contact	0-4:0-4 Relays
Non-Linear function	0---Without (Standard) 1---Support 20 points Vessel Conversion
Analog output	0---Without 1---0~10V Analog Output 2---0/4~20mA
Communication port	0---Without 1---Support RS485 interface
Digital input	0 : Without 1 : DI

**EX: PM-1530-S01-41011**

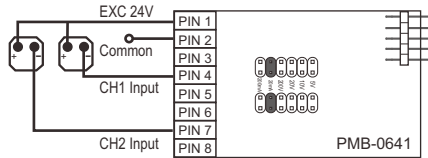
Represents: PM-1530 Model, Power supply 85~265V AC, Analog input signal 4~20mA, 4 relay contact, Support Non-Linear Function, without Analog output, Support RS485 interface.

# PB DC SIGNAL INPUT MODULE

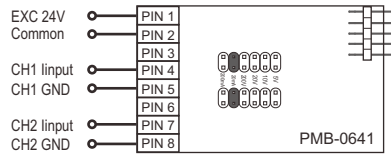
This section will elaborate how to adapt to different input signals in the PB series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Dual Channel Signal Input Module: (for PB-2471)

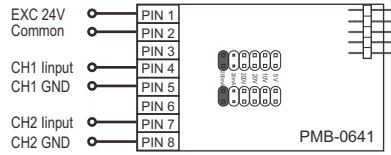
11: 4~20mA DC with Excitation +24V



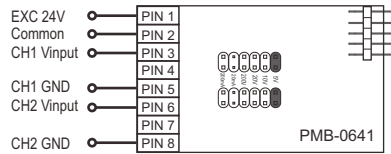
22: 0~20mA DC with Excitation +24V



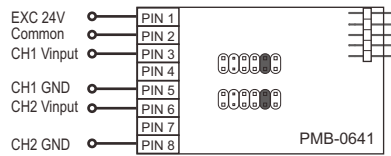
33: 0~200mA DC with Excitation +24V



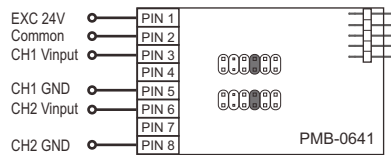
44: ±5V DC with Excitation +24V



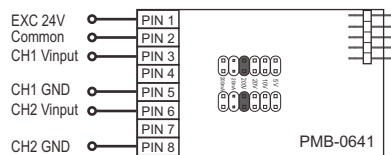
55: ±10V DC with Excitation +24V



66: ±20V DC with Excitation +24V

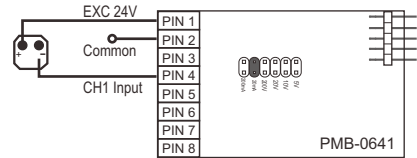


77: ±200V DC with Excitation +24V

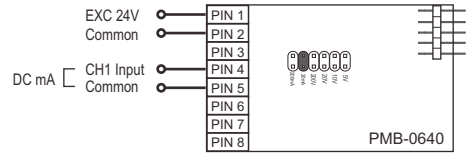


## Single Channel Signal Input Module: (for PB-1471, PB-1470, PB-1570)

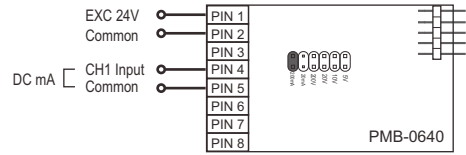
01: 4~20mA DC with Excitation +24V



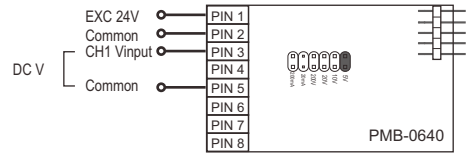
02: 0~20mA DC with Excitation +24V



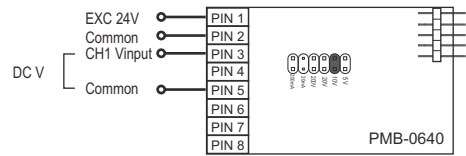
03: 0~200mA DC with Excitation +24V



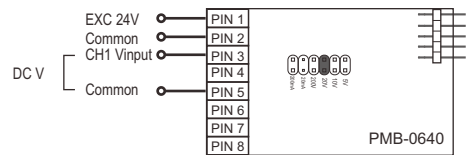
04: ±5V DC with Excitation +24V



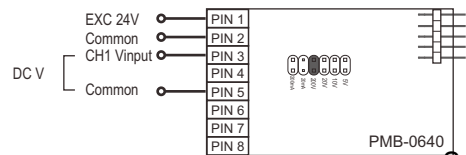
05: ±10V DC with Excitation +24V



06: ±20V DC with Excitation +24V



07: ±200V DC with Excitation +24V

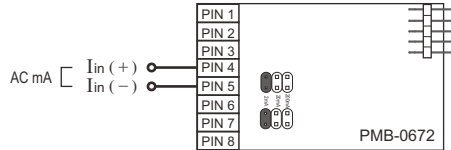


# PB AC SIGNAL INPUT MODULE

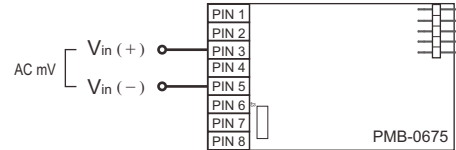
This section will elaborate how to adapt to different input signals in the PB series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Single Channel Signal Input Module: (for PB-1471, PB-1470, PB-1570)

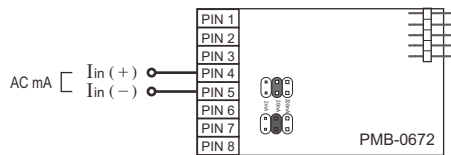
A1: 2mA AC Scaled RMS



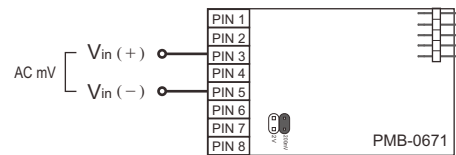
B1: 100mV AC Scaled RMS



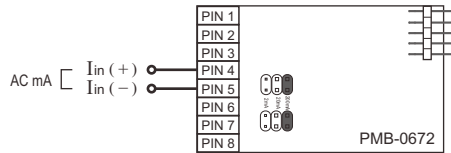
A2: 20mA AC Scaled RMS



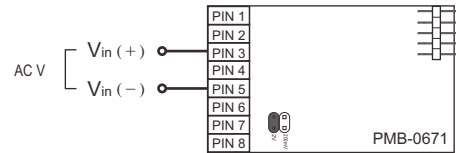
B2: 200mV AC Scaled RMS



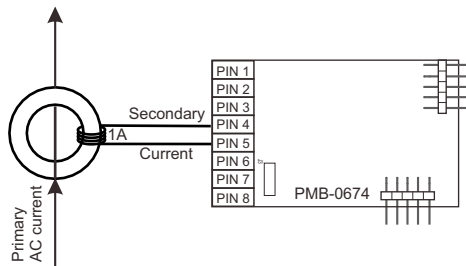
A3: 200mA AC Scaled RMS



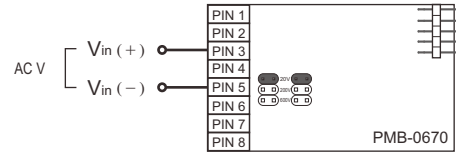
B3: 2V AC Scaled RMS



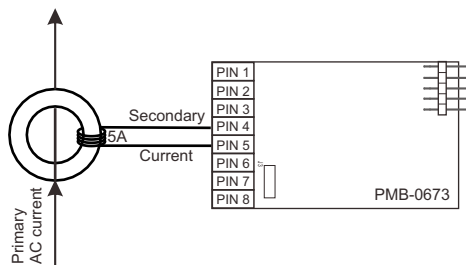
A4: 1Amp AC Scaled RMS



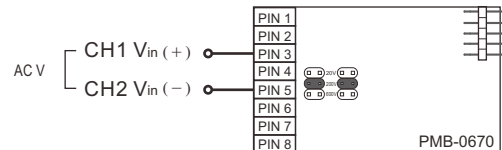
B4: 20V AC Scaled RMS



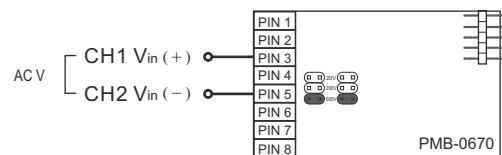
A5: 5 Amp AC Scaled RMS



B5: 200V AC Scaled RMS



B6: 600V AC Scaled RMS



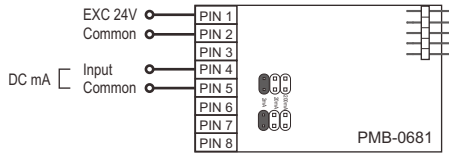


# PB DC SIGNAL INPUT MODULE

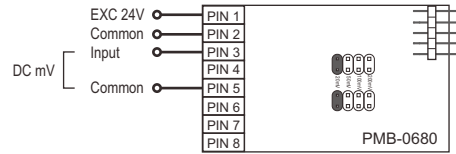
This section will elaborate how to adapt to different input signals in the PB series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Single Channel Signal Input Module: (for PB-1471, PB-1470, PB-1570)

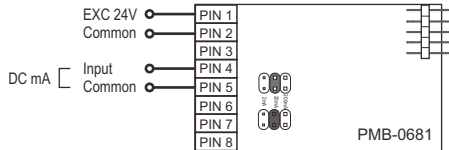
C1: 2mA DC with Excitation +24V



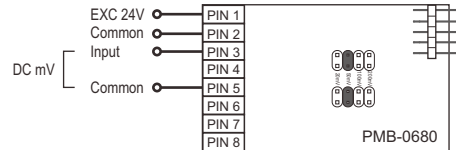
D1: 20 mV DC with Excitation +24V



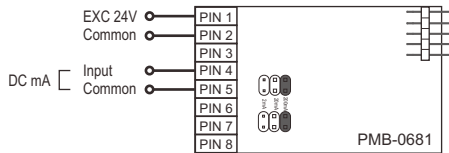
C2: 20mA DC with Excitation +24V



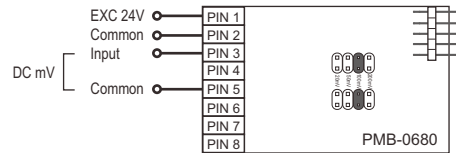
D2: 50 mV DC with Excitation +24V



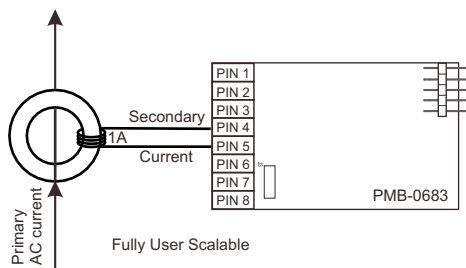
C3: 200mA DC with Excitation +24V



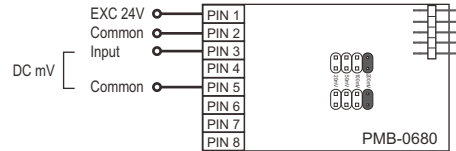
D3: 100 mV DC with Excitation +24V



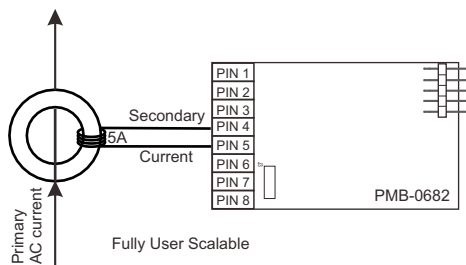
C4: 1A DC



D4: 200 mV DC with Excitation +24V



C5: 5A DC

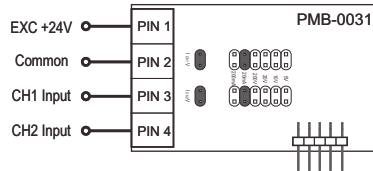


# PM DC SIGNAL INPUT MODULE

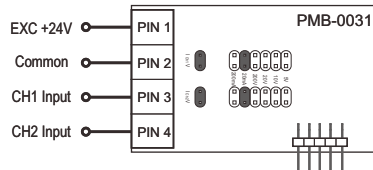
This section will elaborate how to adapt to different input signals in the PM series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Dual Channel Signal Input Module: (for PB-2430)

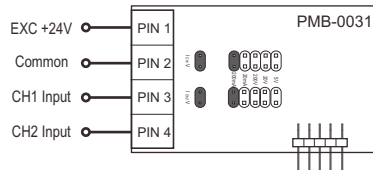
11: 4~20 mA DC with Excitation +24V



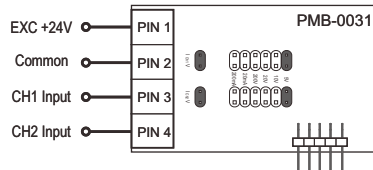
22: 200 mA DC with Excitation +24V



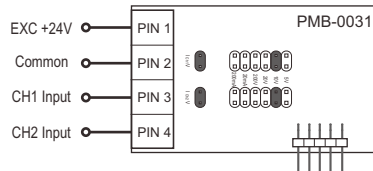
33: 200 mA DC with Excitation +24V



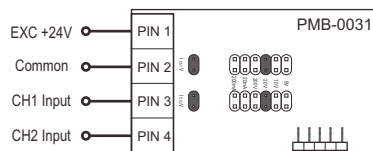
44: 5V DC with Excitation +24V



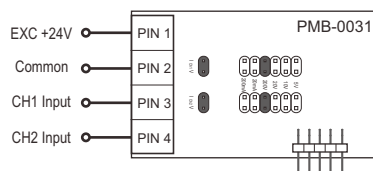
55: 10V DC with Excitation +24V



66: 20V DC with Excitation +24V

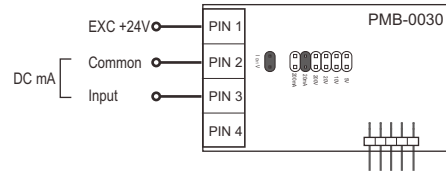


77: 20V DC with Excitation +24V

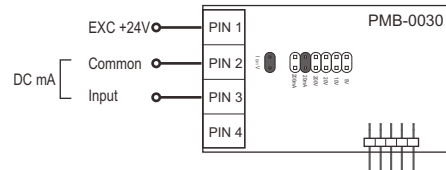


## Single Channel Signal Input Module: (for PB-1430, PB-1530)

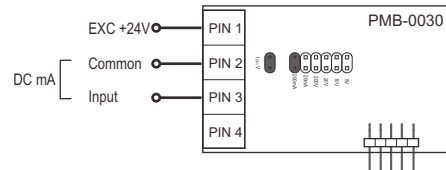
01: 4~20mA DC with Excitation +24V



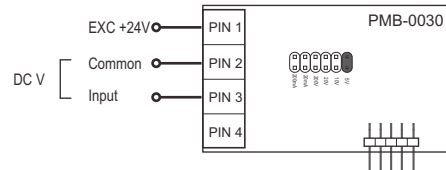
02: 20mA DC with Excitation +24V



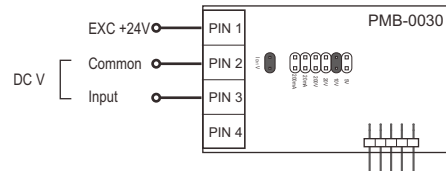
03: 200mA DC with Excitation +24V



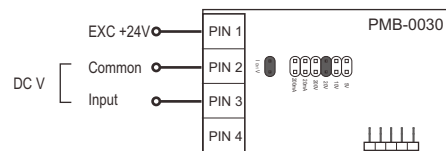
04: 5V DC with Excitation +24V



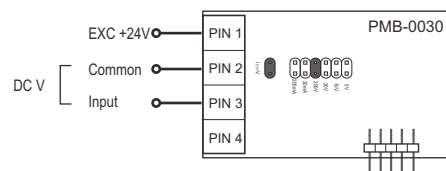
05: 10V DC with Excitation +24V



06: 20V DC with Excitation +24V



07: 200V DC with Excitation +24V



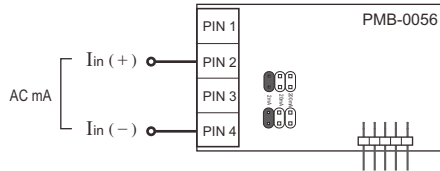


# PM AC SIGNAL INPUT MODULE

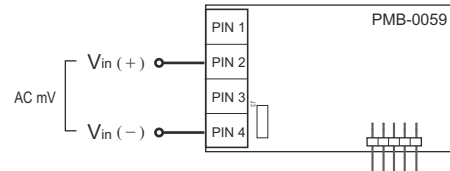
This section will elaborate how to adapt to different input signals in the PM series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Single Channel Signal Input Module: (for PM-1430, PM-1530)

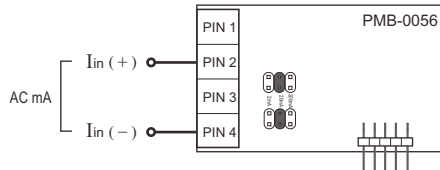
A1: 2mA AC Scaled RMS



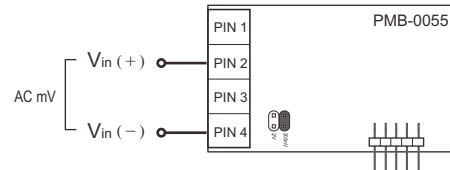
B1: 100mV AC Scaled RMS



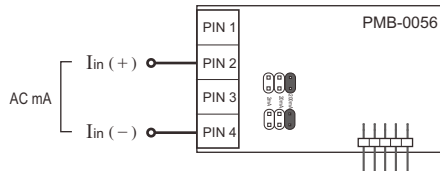
A2: 20mA AC Scaled RMS



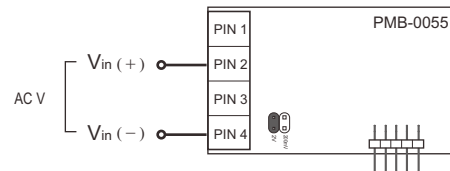
B2: 200mV AC Scaled RMS



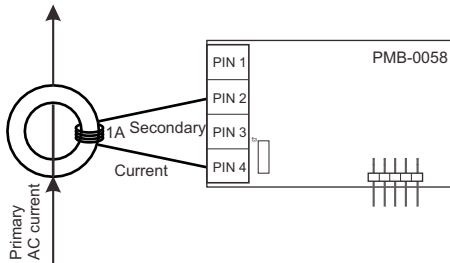
A3: 200mA AC Scaled RMS



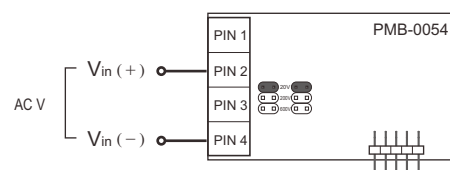
B3: 2V AC Scaled RMS



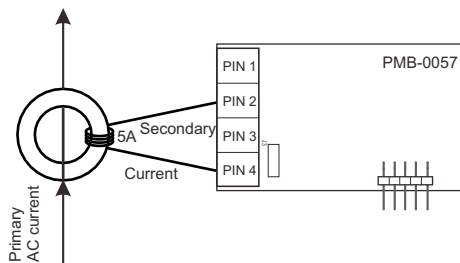
A4: 1Amp AC Scaled RMS



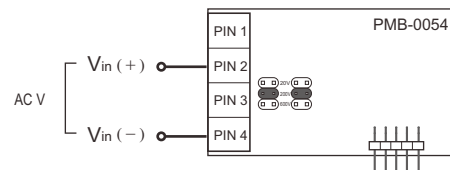
B4: 20V AC Scaled RMS



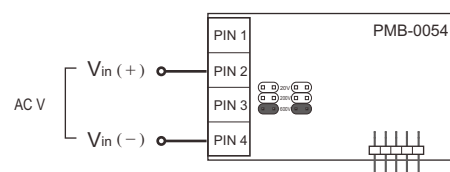
A5: 5 Amp AC Scaled RMS



B5: 200V AC Scaled RMS



B6: 600V AC Scaled RMS

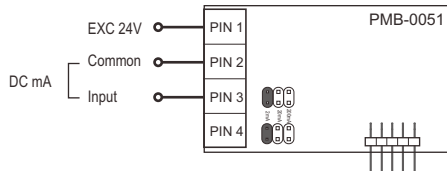


# PM DC SIGNAL INPUT MODULE

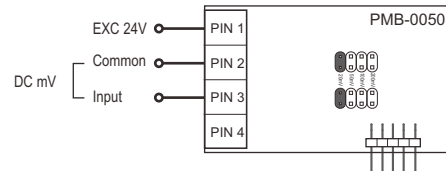
This section will elaborate how to adapt to different input signals in the PM series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Single Channel Signal Input Module: (for PM-1430, PM-1530)

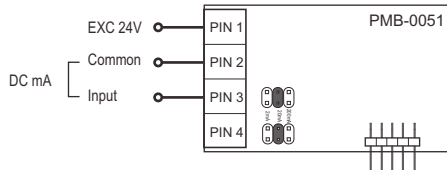
C1: 2mA DC with Excitation +24V



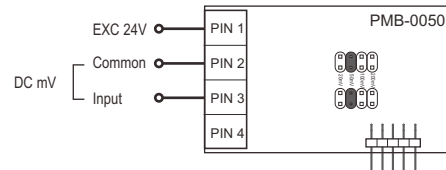
D1: 20 mV DC with Excitation +24V



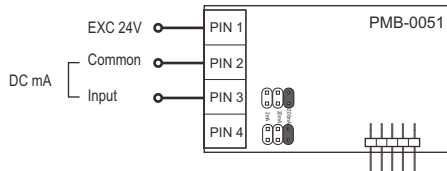
C2: 20mA DC with Excitation +24V



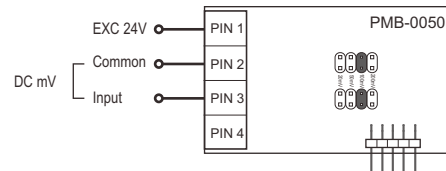
D2: 50 mV DC with Excitation +24V



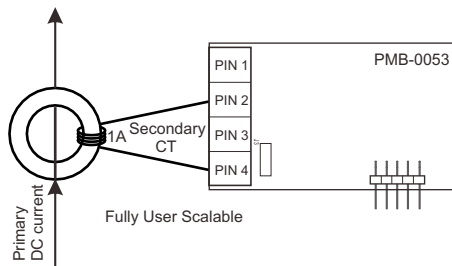
C3: 200mA DC with Excitation +24V



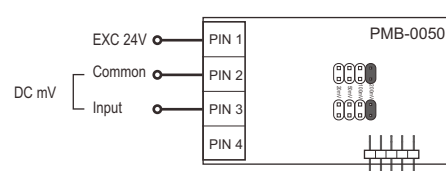
D3: 100 mV DC with Excitation +24V



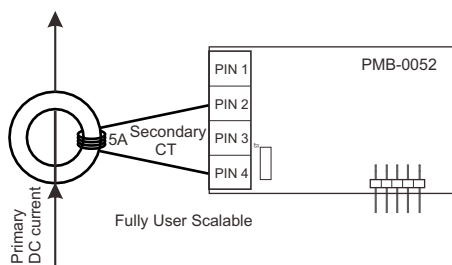
C4: 1A DC



D4: 200 mV DC with Excitation +24V



C5: 5A DC

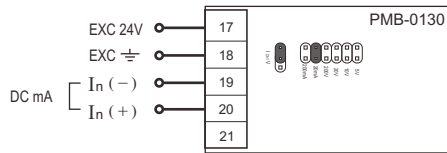


# PM -1X30-W DC SIGNAL INPUT MODULE(0)

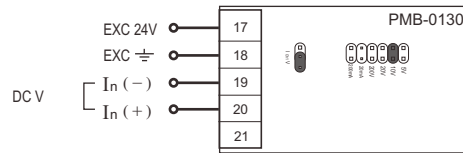
This section will elaborate how to adapt to different input signals in the PM series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Signal Input Module:

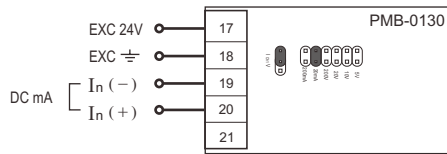
01: 4~20mA DC with Excitation +24V



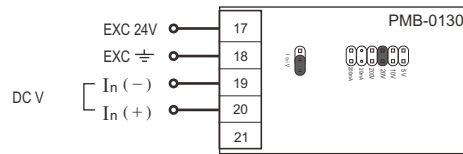
05: 0~10V DC with Excitation +24V



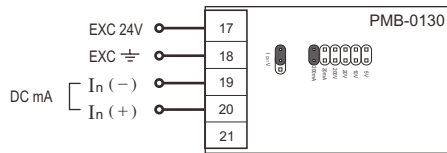
02: 0~20mA DC with Excitation +24V



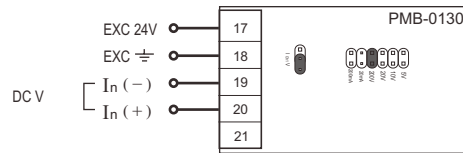
06: 0~20V DC with Excitation +24V



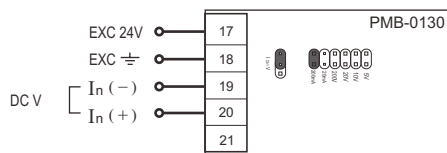
03: 0~200mA DC with Excitation +24V



07: 0~200V DC with Excitation +24V



04: 0~5V DC with Excitation +24V

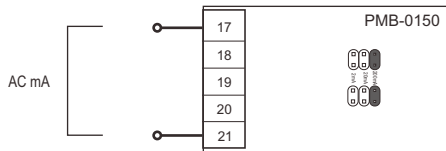


# PM -1X30-W AC SIGNAL INPUT MODULE(AB)

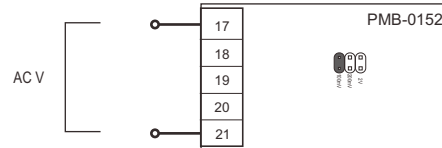
This section will elaborate how to adapt to different input signals in the PM series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Signal Input Module:

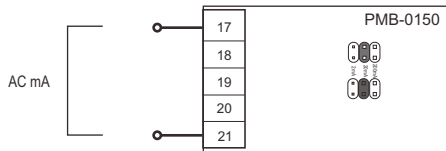
A1: 0~2mA AC RMS



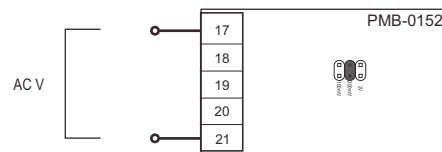
B1: 0~100mV AC RMS



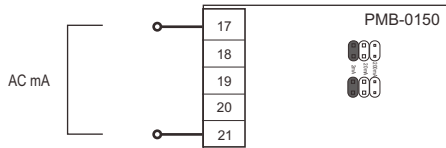
A2: 0~20mA AC RMS



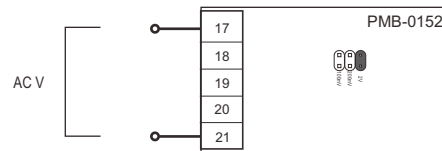
B2: 0~200mV AC RMS



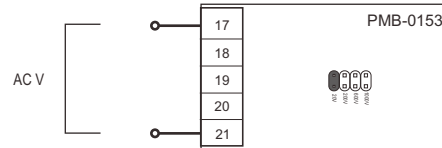
A3: 0~200mA AC RMS



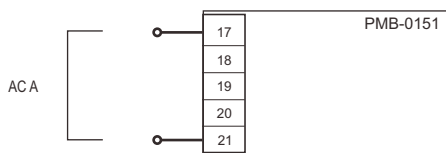
B3: 0~2V AC RMS



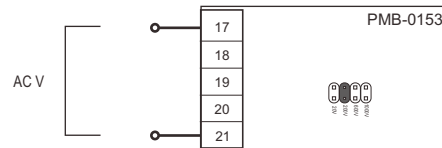
B4: 0~20V AC RMS



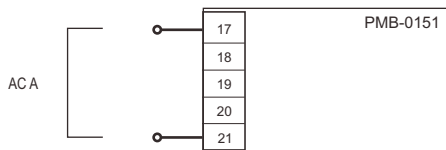
A4: 0~1A AC RMS



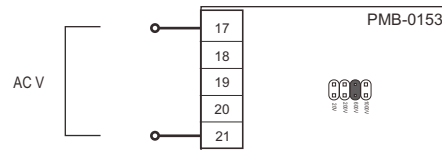
B5: 0~200V AC RMS



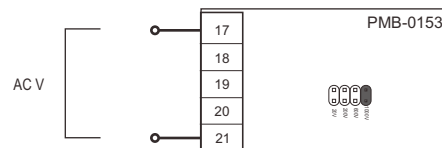
A5: 0~5A AC RMS



B6: 0~600V AC RMS



B7: 0~1000V AC RMS

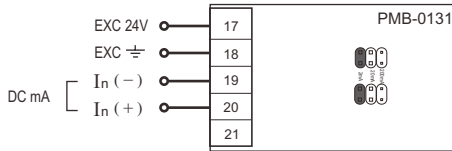


# PM -1X30-W DC SIGNAL INPUT MODULE(CDE)

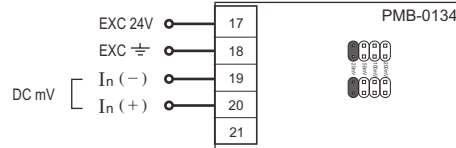
This section will elaborate how to adapt to different input signals in the PM series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Signal Input Module:

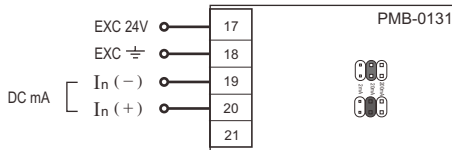
C1: 0~±2mA DC with Excitation +24V



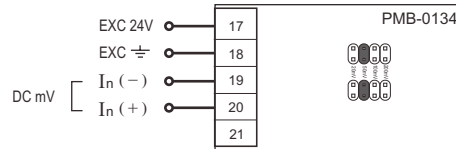
D1: 0~±20mV DC with Excitation +24V



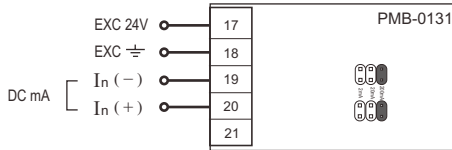
C2: 0~±20mA DC with Excitation +24V



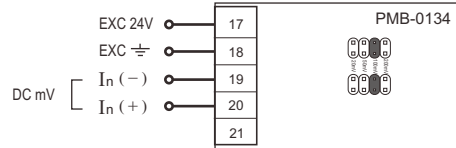
D2: 0~±50mV DC with Excitation +24V



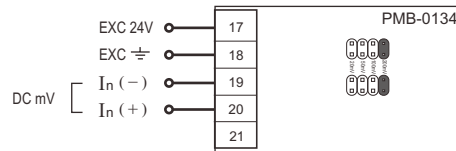
C3: 0~±200mA DC with Excitation +24V



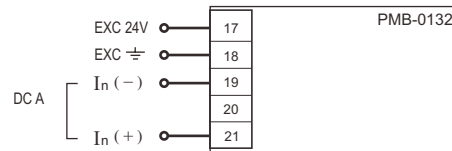
D3: 0~±100mV DC with Excitation +24V



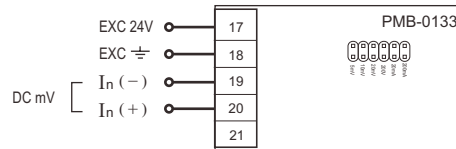
D4: 0~±200mA DC with Excitation +24V



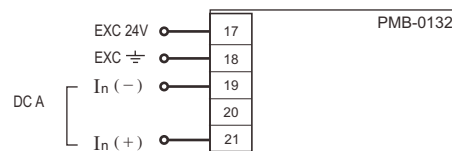
C4: 0~±1A DC



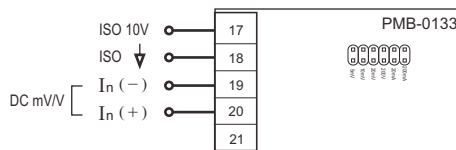
E1: 5/10/20/50/100/200mV DC (Option) with Excitation +24V



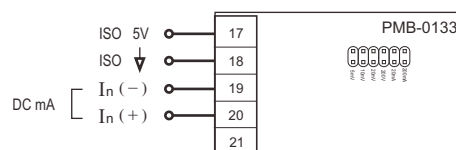
C5: 0~±5A DC



E2: 1/2/5/10/20mV/V (Option) with ISO 10V



E3: 1/2/10/20/40mV/V (Option) with ISO 5V

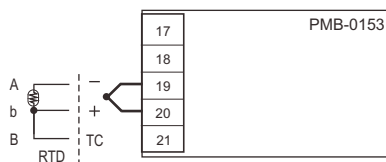


# PM-1X30-W TEMPERATURE SIGNAL INPUT MODULE

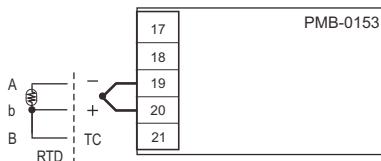
This section will elaborate how to adapt to different input signals in the PM series panel meter, by using the correct jumper and using iSEL command. Panel meter series can accommodate 6 types of conventional input signals, 20mA, 200mA, 5V, 10V, 20V, 200V, please refer below for setup.

## Signal Input Module:

F1: TC (K、J、E、N、T) & RTD (Pt100、JPT100)



F2: TC (K、J、E、N、T、R、S、B) & RTD (PT100、JPT100)



**FineTek Co., Ltd.**

No.16, Tzuchiang St., Tucheng Industrial Park, New Taipei City 236, Taiwan.  
TEL: 886 2 2269 6789 FAX: 886 2 2268 6682  
Email: info@fine-tek.com http://www.fine-tek.com

**Taichung Branch** TEL: 886 4 2465 2820 FAX: 886 4 2463 9926

**Tainan Branch** TEL: 886 6 289 0635 FAX: 886 6 289 4073

**Kaohsiung Branch** TEL: 886 7 333 6968 FAX: 886 7 536 8758

**Fine automation (ShangHai) Co., Ltd.**

No.451 DuHui Rd, MinHang District, Shanghai, China 201109  
TEL: 86 21 6490 7260 FAX: 86 21 6490 7276  
Email: info.sh@fine-tek.com

**FineTek Pte Ltd.**

No. 60 Kaki Bukit Place, #07-06 Eunos Techpark 2  
Lobby B, Singapore 415979  
TEL: 65 6452 6340 FAX: 65 6734 1878  
Email: info.sg@fine-tek.com

**FineTeK GmbH**

Frankfurter Str. 62, OG D-65428 Ruesselsehim, Germany  
TEL: 49 6142 17608 0 FAX: 49 6142 17608 20  
E-Mail: info@fine-tek.de

**Aplus Finetek Sensor inc.**

355 S. Lemon Ave, Suite D, Walnut, CA 91789  
Tel : 1 909 598 2488 Fax : 1 909 598 3188  
Email: peter.wu@aplusfine.com



Distributor:

08-PB-B1-EP, 01/21/2013

## PRESSURE TRANSDUCER

- All-laser-welded stainless steel for media isolation
- Integral "Smart" signal conditioning electronics
- Custom ASIC provides signal conditioning for calibration and temperature compensation
- +/-1% accuracy from -40°C to 105°C
- Standard and custom options available for OEM quantities
- Compact size, excellent price/performance ratio
- 5V DC power supply Input with 0.5 to 4.5 V DC output
- 8~30V DC power supply with 1~5V DC Output or 4-20 mA Output



### TYPICAL APPLICATIONS

- Refrigeration
- Fuel Cells
- Pumps
- Hydraulics
- Pneumatics
- Process Control
- Compressors
- Spraying System
- Flow
- Robotics
- Agriculture
- Hydrogen Storage

### SPECIFICATION

<b>Pressure Range</b>	0-5Bar, 0-10Bar, 0-20Bar, 0-100Bar, 0-200Bar (Gauge or Absolute)
<b>Over Pressure</b>	2 time of full scale
<b>Connection</b>	1/4"NPT, 1/8"NPT, G 1/4", G 1/8"
<b>Accuracy</b>	1%
<b>Stability</b>	0.25% F.S./year
<b>Total Error</b>	1.00%
<b>Operating Temp</b>	-20~80°C (-40~105°C optional)
<b>Output</b>	0.5-4.5V, 1~5V, 0~10V, 0.5~10.5V, 4-20mA
<b>Electrical Connection</b>	IP68 Cable Gland, DIN43650A
<b>Power Supply</b>	5Vdc, 8~30Vdc
<b>Approvals</b>	CE

### HOW TO ORDER

**Example: EC1510-200A-2U-C-5**

Pressure Range (Bar) ————

A: Absolute  
G: Sealed gauge

Connecting screw ————

1U: 1/8"NPT  
2U: 1/4"NPT  
3U: 1/2"NPT  
1V: G1/8"  
2V: G1/4"

Conduit ————

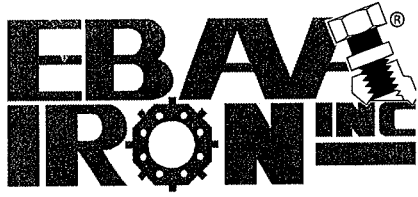
C: Cable Gland (std, 1M)  
D: DIN 43650A

Output Options ————

1: 0.5~4.5V  
2: 1~5V  
3: 0~10V  
4: 0.5~10.5V  
5: 4~20mA



# **Mega Flange Product Data**

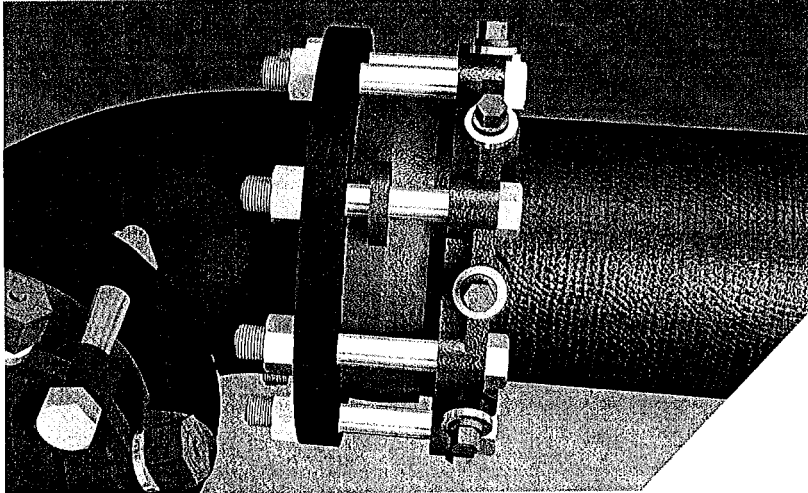


# Series 2100

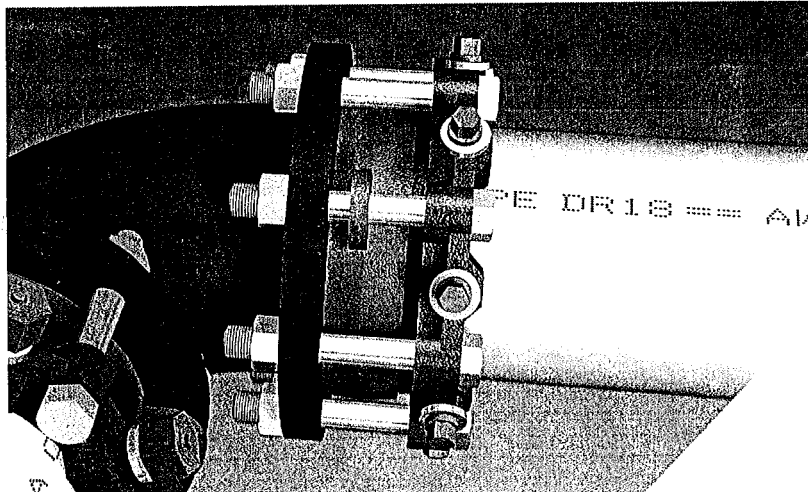
MEGAFLANGE®

Restrained Flange Adapter

U.S. Patent Nos. 4627774 and 5071175



Series 2106 on Ductile Iron Pipe



Series 2106 on C900 PVC Pipe

## Features and Applications:

- MEGAFLANGE adapts and restrains plain end Ductile Iron, PVC, Steel and HDPE pipe to flanged pipe or fittings, where the flange conforms to ANSI/AWWA C111/A21.11 with flange surface facing in accordance with ANSI/AWWA C207 of the latest revision.
- Meets ANSI B16.5 Class 150/125 drilling pattern.
- Flange Bolts are zinc coated, fastener class coated bolts or stainless steel bolts are available
- Not for use on plain end fittings
- MEGA-BOND® Restraint Coating System
- For more information regarding MEGA-BOND, refer to our web site @ [www.ebaa.com](http://www.ebaa.com)
- Minimum 2 to 1 Safety Factor
- Fully Restrained
- Constructed of ASTM A536 Ductile Iron
- UL listed on sizes 3 inch through 12 inch
- FM approved on sizes 4 inch through 12 inch on C900 Class 150 and Class 200 PVC Pipe
- Pipe can be cut to length in the field
- Joint deflection up to 5°
- Easy dismantling allows fast removal of valves, meters or fittings for replacement or repair

For use on water or wastewater pipelines subject to hydrostatic pressure and tested in accordance with either AWWA C600, C605 or ASTM D2774.

## Sample Specification

Restrained flange adapters shall be used in lieu of threaded or welded flanged spool pieces. Flanged adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10 (125#/Class 150 Bolt Pattern).

Restraint for flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to insure proper initial set of gripping wedges.

The flange adapters shall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6 inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.

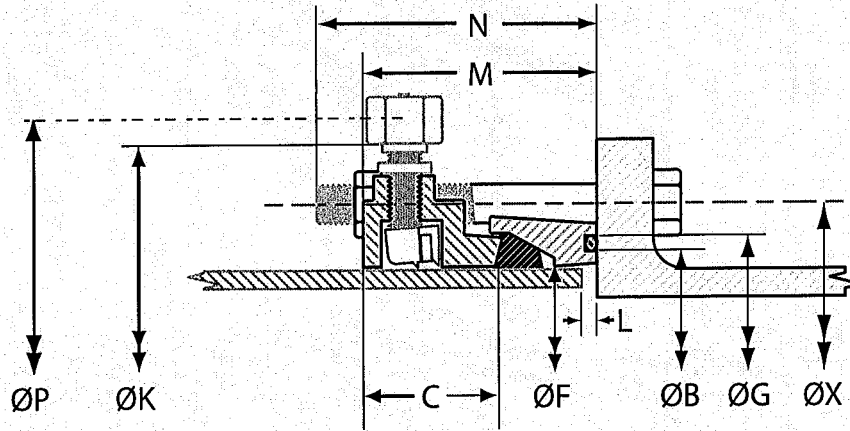
All internal surfaces of the gasket ring (wetted parts) shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C213. Sealing gaskets shall be constructed of EPDM. The coating shall meet ANSI/NSF-61. Exterior surfaces of the gasket ring shall be coated with a minimum of 6 mils of fusion bonded epoxy conforming to the applicable requirements of ANSI/AWWA C116/A21.16.

Restraint Ring coated with MEGA-BOND® Restraint Coating System More Information regarding MEGA-BOND can be found at [www.ebaa.com](http://www.ebaa.com).

Pressure ratings shall be a minimum of those shown in the table within current brochure.

The flange adapter shall be the Series 2100 MEGAFLANGE® Restrained Flange Adapter as produced by EBAA Iron, Inc. or approved equal.

**Series 2100 Submittal Reference Drawing**



Nominal Pipe Size	Series Number	Restraint Ring			Gasket Ring			Bolts				L MAX.	Assembly Deflection		Ship Weight (lbs.)	
		K	F	C	F	B	G	No.	Dia.	Length	X		Degrees	M		P*
3	2103	7.5	4.1	2.2	4.1	4.3	4.9	4	5/8	5 1/2	6.00	0.7	5.0	4.0	9.2	14
4	2104	9.0	4.9	2.2	4.9	5.4	6.0	8	5/8	5 1/2	7.50	0.6	5.0	4.0	10.0	20
6	2106	11.0	7.0	2.3	7.0	7.5	8.1	8	3/4	6	9.50	0.8	5.0	4.3	12.1	32
8	2108	13.5	9.2	2.4	9.2	9.8	10.4	8	3/4	6	11.75	0.9	5.0	4.5	14.3	38
10	2110	16.0	11.2	2.5	11.2	11.8	12.4	12	7/8	7 1/2	14.25	1.0	3.0	4.7	16.3	65
12	2112	19.0	13.3	2.5	13.3	13.8	14.4	12	7/8	7 1/2	17.00	1.0	3.0	4.8	18.4	73
14	2114	21.0	15.5	2.5	15.5	16.1	16.9	12	1	8	18.75	1.3	2.0	5.0	20.6	89
16	2116	23.5	17.6	2.5	17.6	18.2	19.0	16	1	8	21.25	1.3	2.0	5.0	22.6	109
18	2118	25.0	19.7	2.6	19.7	20.2	21.0	16	1 1/8	8 1/2	22.75	1.3	1.5	5.1	24.7	134
20	2120	27.3	21.8	2.6	21.8	22.4	23.2	20	1 1/8	8 1/2	25.00	1.3	1.5	5.1	26.8	157
24	2124	32.0	26.0	2.6	26.0	26.7	27.5	20	1 1/4	8 1/2	29.50	1.3	1.0	5.1	31.0	192
30	2130	38.5	32.2	3.3	32.2	32.9	34.1	28	1 1/4	11	36.00	2.0	1.0	6.0	38.8	296
36	2136	45.5	38.5	3.3	38.5	39.2	40.4	32	1 1/2	10 1/2	42.75	2.0	1.0	6.0	44.6	426
42	2142	52.3	44.7	4.1	44.7	45.8	47.0	36	1 1/2	12	49.50	2.0	1.0	8.0	50.8	642
48	2148	58.8	51.0	4.1	51.0	52.1	53.3	44	1 1/2	12	56.00	2.0	1.0	8.0	57.1	797

\* The "P" dimensions is measured with torque-limiting nuts twisted off.

**Minimal Distance**

Nominal Pipe Size	Required To Install N
3	4.75
4	4.56
6	5.00
8	4.88
10	6.31
12	6.25
14	6.62
16	6.56
18	6.94
20	6.81
24	6.62
30	8.88
36	8.12
42	9.38
48	9.25

**MEGAFLANGE TESTING RESULTS**

**PVC TESTING**

- Quick Burst Test
- DR18 tested to 755 PSI
- DR14 tested to 985 PSI
- Long Term Pressure Test
- On DR18 PVC pipe at 615 PSI for 1000 hours without failure
- Cyclic Pressure Test
- DR18 tested from 94 to 188 PSI for over 1,000,000 cycles

**DUCTILE IRON AND STEEL TESTING**

- Leakage Test (one minute required)
- Tested to twice rated pressure without leakage
- Hydrostatic Test (one minute required)
- 3 inch though 6 inch sizes tested to 5 times rated pressure
- 8 inch and 10 inch sizes tested to 4 times rated pressure
- 12 inch size tested to 3 times rated pressure
- Flexural Test
- Tested to withstand a bending moment based on requirements of NFPA 12-1991 "Standard for Installation of Sprinkler Systems"



**APPROVED**



Note: Dimensions are in inches and are subject to change without notice. All Dimensions are ± 1%.

# **Drainage PVC Product Data**

■

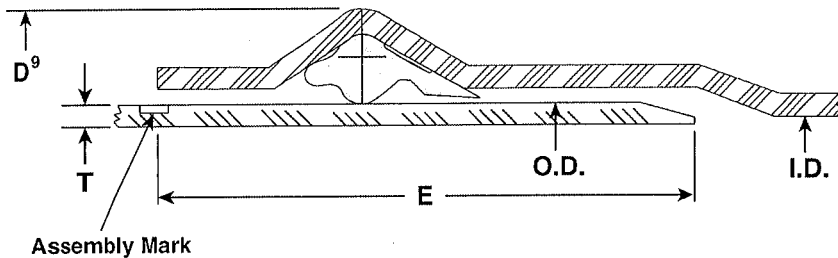


# BLUE BRUTE™

## SUBMITTAL AND DATA SHEET

PIPE SIZE (IN)	AVERAGE O.D. (IN)	NOM. I.D. (IN)	MIN. T. (IN)	MIN. E (IN)	APPROX. D <sup>9</sup> (IN)	APPROX. WEIGHT (LBS/FT)
<b>PRESSURE CLASS 165 psi (DR 25)</b>						
4	4.80	4.39	0.192	5.25	5.57	1.9
6	6.90	6.31	0.276	6.40	8.00	3.9
8	9.05	8.28	0.362	7.05	10.50	6.7
10	11.10	10.16	0.444	8.20	12.88	10.1
12	13.20	12.08	0.528	8.80	15.31	14.4
<b>PRESSURE CLASS 235 psi (DR 18)*</b>						
4	4.80	4.23	0.267	5.25	5.87	2.6
6	6.90	6.09	0.383	6.40	8.43	5.3
8	9.05	7.98	0.503	7.05	11.06	9.2
10	11.10	9.79	0.617	8.20	13.57	13.9
12	13.20	11.65	0.733	8.80	16.13	19.7
<b>PRESSURE CLASS 305 psi (DR 14)*</b>						
4	4.80	4.07	0.343	5.25	6.17	3.2
→ 6	6.90	5.86	0.493	6.40	8.87	6.7
→ 8	9.05	7.68	0.646	7.05	11.63	11.6
→ 10	11.10	9.42	0.793	8.20	14.27	17.6
12	13.20	11.20	0.943	8.80	16.97	25.1

Consult JM Eagle™ for CSA and other listing availability prior to shipment.  
**Note:** \*FM Approvals Pressure Class 150 psi for DR 18 and 200 psi for DR 14.  
 \* Contact your JM eagle™ sales representative for location availability.



I.D. : Inside Diameter  
 O.D. : Outside Diameter  
 T : Wall Thickness  
 D<sup>9</sup> : Bell Outside Diameter  
 E : Distance between Assembly Mark to the end of spigot.

Product Standard: ANSI/AWWA C900  
 Pipe Compound: ASTM D1784 Cells Class 12454  
 Gasket: ASTM F477  
 Integral Bell Joint: ASTM D3139  
 Certifications: ANSI/NSF Standard 61  
 UL Standard 1285  
 Pipe Length: 20 feet laying length  
 Installation: AWWA C605  
 JM Eagle™ Installation Guide

*JM Eagle™ also manufactures this pipe in green for sewer force main applications and purple, specifically for reclaimed water systems. This pipe is made to the same requirements as our standard products. The only difference is that the pigment used is green or purple. These products will not be marked with UL or NSF listing marks. Additionally, the green pipe will be marked "Forced Sewer" and the purple pipe will be marked: "Reclaimed Water... Do Not Drink."*

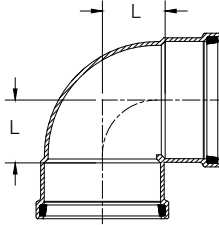
# **DRAINAGE PVC FITTINGS**

**Operations & Maintenance Manual  
December 2015**

# HARCO SDR-35 PVC GASKETED SEWER FITTINGS

## DESIGN DATA

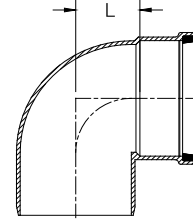
### 90° BEND GxG



(Molded fitting shown)

SIZE	PART #	STYLE	L	WT (approx.)
4	35-1804	M	2.4	1.4
6	35-1806	M	3.5	3.3
8	35-1808	M	4.6	7.0
10	35-1810	Fab	9.0	21.0
12	35-1812	Fab	11.5	30.0
15	35-1815	Fab	12.5	52.0

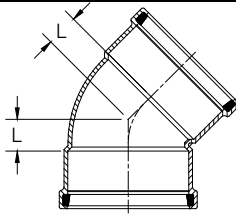
### 90° BEND GxS



(Molded fitting shown)

SIZE	PART #	STYLE	L	WT (approx.)
4	35-1904	M	2.4	1.1
6	35-1906	M	3.5	2.8
8	35-1908	M	4.6	6.1
10	35-1910	Fab	9.0	19.0
12	35-1912	Fab	11.5	30.0
15	35-1915	Fab	12.5	50.0

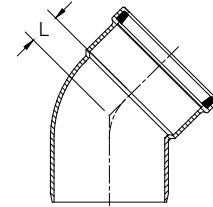
### 45° BEND GxG



(Molded fitting shown)

SIZE	PART #	STYLE	L	WT (approx.)
4	35-2204	M	1.2	1.2
6	35-2206	M	1.6	2.8
8	35-2208	M	2.2	5.7
10	35-2210	Fab	3.3	16.0
12	35-2212	Fab	5.5	24.0
15	35-2215	Fab	5.5	38.0

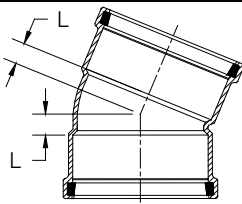
### 45° BEND GxS



(Molded fitting shown)

SIZE	PART #	STYLE	L	WT (approx.)
4	35-2304	M	1.2	0.9
6	35-2306	M	1.6	2.3
8	35-2308	M	2.2	5.0
10	35-2310	Fab	3.3	15.0
12	35-2312	Fab	5.5	23.0
15	35-2315	Fab	5.5	31.0

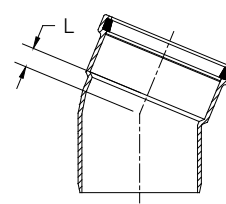
### 22.5° BEND GxG



(Molded fitting shown)

SIZE	PART #	STYLE	L	WT (approx.)
4	35-2404	M	0.7	1.1
6	35-2406	M	1.1	2.6
8	35-2408	M	1.3	5.1
10	35-2410	Fab	2.0	10.0
12	35-2412	Fab	2.5	25.0
15	35-2415	Fab	4.8	40.0

### 22.5° BEND GxS



(Molded fitting shown)

SIZE	PART #	STYLE	L	WT (approx.)
4	35-2504	M	0.7	0.9
6	35-2506	M	1.1	2.1
8	35-2508	M	1.3	4.4
10	35-2510	Fab	2.0	15.0
12	35-2512	Fab	2.5	22.0
15	35-2515	Fab	4.8	33.0

#### Notes:

- All lay lengths & weights are approximate and are subject to change without notice
- Fabricated fitting configurations may vary

#### Style Legend:

M - One Piece Molded  
Fab - Fabricated

Call For Other Sizes, Configurations & Gasket Materials

**CAUTION:** Vertical risers are not recommended  
Vertical risers are subject to problems without special consideration of soil/pipe interaction, dead & live loads, and installation procedures.

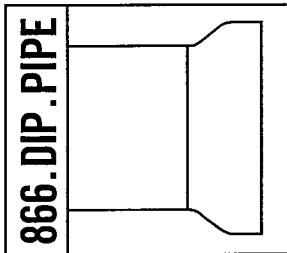


### THE HARRINGTON CORPORATION

P.O. BOX 10335 • LYNCHBURG VIRGINIA 24506 • 3721 COHEN PLACE • LYNCHBURG VIRGINIA 24504  
PHONE: (434) 845-7094 • FAX: (434) 845-8562 • E-MAIL: [sales@harcofittings.com](mailto:sales@harcofittings.com)

# **Ductile Iron Product Data**





# TYTON JOINT® Pipe



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## TYTON JOINT Pipe

Each of the following is a nationally recognized standards organization:

- American National Standards Institute (ANSI)
- American Water Works Association (AWWA)
- American Society for Testing and Materials (ASTM)
- Underwriters Laboratories (UL)
- National Fire Protection Association (NFPA)
- National Sanitation Foundation (NSF)
- Factory Mutual (FM)

TYTON JOINT is U.S. Pipe's trademark for pipe with a push-on type connection. Simplicity, sturdiness and water-tightness of the system are built into the system by design. Convincing proof of its worldwide acceptance is shown by the fact that more than 95% of the pipe now sold by U.S. Pipe is TYTON JOINT Pipe.

TYTON JOINT Pipe is available in sizes 3" through 64". Sizes 3" through 42" are available in nominal 18-foot laying lengths. 6" through 24" sizes along with sizes 48" through 64" are available in nominal 20-foot laying lengths.

TYTON JOINT Pipe in sizes 4" through 36" are UL Listed and sizes 4" through 16" are FM Approved.

When TYTON JOINT Pipe are used for bridge crossings or other above-ground installations, each length of pipe must be supported in a manner to restrict both vertical and horizontal movement.

TYTON® Gasket is the only accessory required when installing TYTON JOINT Pipe. It is a circular rubber gasket which has a modified bulb shape in cross section. Gaskets are furnished in accordance with ANSI/AWWA C111/A21.1. Composition and dimensions of the gasket have been carefully engineered to ensure a water-tight and lasting seal. The standard TYTON Gasket is manufactured of SBR - styrene butadiene rubber. Gaskets of special elastomers may be ordered for special applications. The gasket contour and bell socket contour ensure that the gasket will remain seated during proper assembly of the pipe. When joint restraint is required for push-on joint pipe, two options are available from U.S. Pipe. For joint restraint of 4" through 24", FIELD LOK 350® Gaskets may be used and for joint restraint for 30" and 36", FIELD LOK® Gaskets may be used. FIELD LOK 350 Gaskets are rated for 350 psi in sizes 4" through 24". In addition, for 4" through 36" sizes, TR FLEX Pipe and Fittings may be used and for 30" through 64" sizes, HP LOK® Pipe and Fittings may be used. TR FLEX Pipe and Fittings are rated for working pressures for 350 psi in 4" through 24" sizes, 250 psi in sizes 30" through 36" and for HP LOK Pipe and Fittings, the working pressure is 350 psi for 30" through 64". For higher pressure applications contact your U.S. Pipe representative. Complete details on both FIELD LOK 350 Gaskets and TR FLEX Pipe and Fittings can be found on our website, [www.uspipe.com](http://www.uspipe.com).

**NOTE:** U.S. Pipe qualifies for Federal Procurement under Public Law No. 94-580, Section 6002, known as the Resource Recovery Act of 1976, since, due to modern technology, recycled iron and steel scrap is used to a large degree in our Ductile Iron Pipe production.

*The plain end of the pipe is furnished beveled or with a quarter ellipse on the edge to allow assembly. More than 40 years of successful experience have proved its sealing capabilities. Hydrostatic tests have shown that the system will withstand pressures far in excess of rated pressures.*

*TYTON®, TYTON JOINT®, TR FLEX® and FIELD LOK 350® are Registered Trademarks of U.S. Pipe and Foundry Company, LLC.*

### **ANSI/AWWA C151/A21.5, Ductile-Iron Pipe, Centrifugally Cast for Water.**

Ductile Iron TYTON JOINT Pipe is centrifugally cast in metal molds in accordance with ANSI/AWWA C151/A21.5.

The asphaltic outside coating is in accordance with ANSI/AWWA C151/A21.51.

As specified in ANSI/AWWA C151/A21.51, pipe weights have been calculated using standard barrel weights and weights of bells being produced.

### **ANSI/AWWA C104/A21.4, Cement-Mortar Lining For Ductile-Iron Pipe and Fittings For Water.**

The cement-mortar lining and inside coating are in accordance with ANSI/AWWA C104/A21.4. Special linings and/or coatings can be furnished for specific conditions.

### **ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.**

TYTON® Gaskets are furnished in accordance with ANSI/AWWA C111/A21.11.

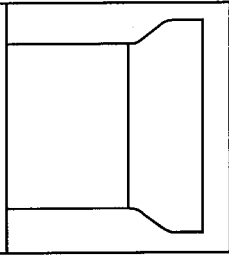
### **ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems.**

If specifiers and users believe that corrosive soils will be encountered where our products are to be installed, please refer to ANSI/AWWA C105/A21.5, for proper external protection procedures.

### **ASTM A746-03 "Standard specification for Ductile Iron Gravity Sewer Pipe."**

### **ASTM A716-08 "Standard Specification for Ductile Iron Culvert Pipe."**

### **ASTM A536 "Standard Specification for Ductile Iron Castings."**



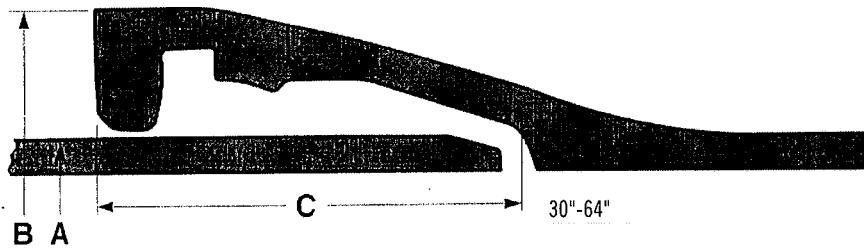
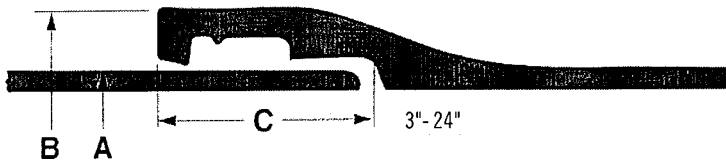
# TYTON JOINT® Pipe



2013 EDITION

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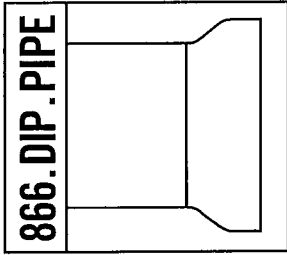
## Bell Dimensions



NOTE: Actual bell configuration may vary from illustration shown.

SIZE Inches	A PIPE OUTER DIAMETER Inches	B BELL OUTER DIAMETER Inches	C SOCKET DEPTH Inches
3	3.96	5.56	3.00
4	4.80	6.52	3.15
6	6.90	8.66	3.38
8	9.05	10.82	3.69
10	11.10	12.91	3.75
12	13.20	15.05	3.75
14	15.30	17.67	5.00
16	17.40	19.79	5.00
18	19.50	21.91	5.00
20	21.60	24.03	5.50
24	25.80	28.21	5.95
30	32.00	35.40	6.55
36	38.30	41.84	7.00
42	44.50	49.36	7.90
48	50.80	55.94	8.60
54	57.56	63.38	9.40
60	61.61	67.38	10.10
64	65.67	71.56	10.65

\*Subject to manufacturing tolerances. Dimensions in inches.



# TYTON JOINT<sup>®</sup> Pipe



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## Pressure Class

Nominal Thickness for Standard Pressure Classes of Ductile Iron Pipe

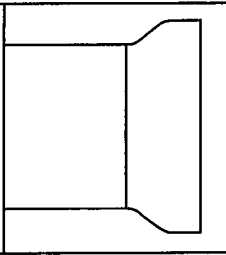
SIZE Inches	OUTSIDE DIAMETER Inches	NOMINAL THICKNESS Inches					CASTING TOLERANCES Inches
		PRESSURE CLASS*					
		150	200	250	300	350	
3	3.96	—	—	—	—	0.25**	0.05
4	4.80	—	—	—	—	0.25**	0.05
6	6.90	—	—	—	—	0.25**	0.05
8	9.05	—	—	—	—	0.25**	0.05
10	11.10	—	—	—	—	0.26	0.06
12	13.20	—	—	—	—	0.28	0.06
14	15.30	—	—	0.28	0.30	0.31	0.07
16	17.40	—	—	0.30	0.32	0.34	0.07
18	19.50	—	—	0.31	0.34	0.36	0.07
20	21.60	—	—	0.33	0.36	0.38	0.07
24	25.80	—	0.33	0.37	0.40	0.43	0.07
30	32.00	0.34	0.38	0.42	0.45	0.49	0.07
36	38.30	0.38	0.42	0.47	0.51	0.56	0.07
42	44.50	0.41	0.47	0.52	0.57	0.63	0.07
48	50.80	0.46	0.52	0.58	0.64	0.70	0.08
54	57.56	0.51	0.58	0.65	0.72	0.79	0.09
60	61.61	0.54	0.61	0.68	0.76	0.83	0.09
64	65.67	0.56	0.64	0.72	0.80	0.87	0.09

**NOTE:** Per ANSI/AWWA C150/A21.50 the thicknesses in above table include the 0.08" service allowance and the casting tolerance by size ranges.

Dimensions and weights of Special Classes (Thickness Classes) are found on pages 13, 14, 15 and 16.

\* Pressure Classes are defined as the rated water pressure of the pipe in psi. The thicknesses shown are adequate for the rated water working pressure plus a surge allowance of 100 psi. Calculations are based on a minimum yield strength of 42,000 and a 2.0 safety factor times the sum of the working pressure and 100 psi surge allowance.

\*\* Presently these are the lowest nominal thicknesses available in these sizes.



# TYTON JOINT® Pipe



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## Pressure Class – Thickness, Dimensions and Weight

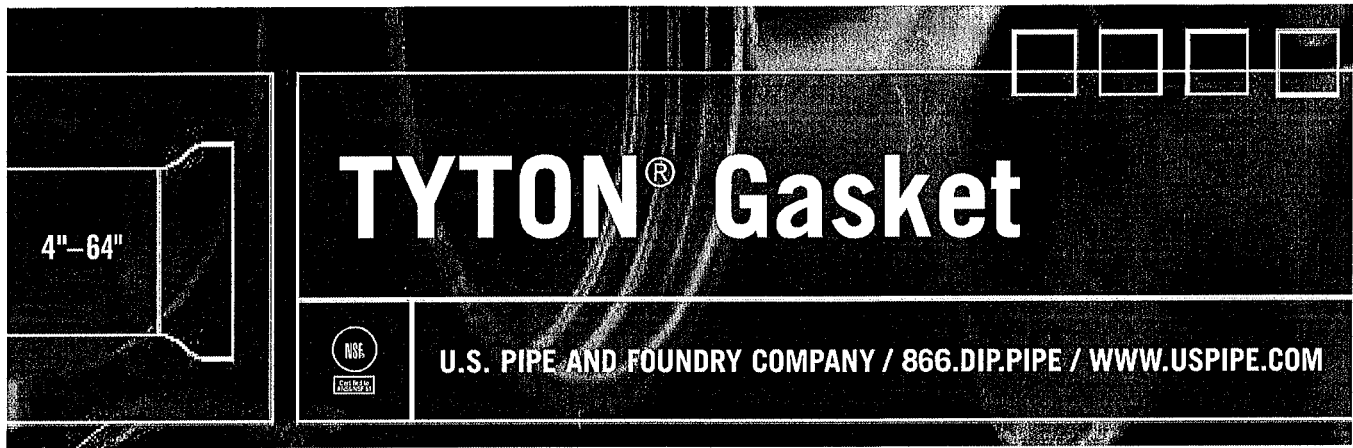
SIZE Inches	PRESSURE CLASS psi	THICKNESS Inches	OUTSIDE DIAMETER* Inches	18-FOOT LAYING LENGTH		20-FOOT LAYING LENGTH	
				BARREL WEIGHT PER FOOT Pounds	WEIGHT PER LENGTH† Pounds	BARREL WEIGHT PER FOOT Pounds	WEIGHT PER LENGTH† Pounds
3	350	0.25	3.96	8.9	170	—	—
4	350	0.25	4.80	10.9	205	—	—
6	350	0.25	6.90	16.0	305	335	—
8	350	0.25	9.05	21.1	400	445	—
10	350	0.26	11.10	27.1	515	570	—
12	350	0.28	13.20	34.8	660	730	—
14	250	0.28	15.30	40.4	780	865	—
14	300	0.30	15.30	43.3	920	1010	—
14	350	0.31	15.30	44.7	860	945	—
16	250	0.30	17.40	49.3	950	1050	—
16	300	0.32	17.40	52.5	1010	1115	—
16	350	0.34	17.40	55.8	1065	1175	—
18	250	0.31	19.50	57.2	1095	1210	—
18	300	0.34	19.50	62.6	1195	1320	—
18	350	0.36	19.50	66.2	1260	1390	—
20	250	0.33	21.60	67.5	1285	1420	—
20	300	0.36	21.60	73.5	1395	1540	—
20	350	0.38	21.60	77.5	1465	1620	—
24	200	0.33	25.80	80.8	1550	1710	—
24	250	0.37	25.80	90.5	1725	1905	—
24	300	0.40	25.80	97.7	1855	2050	—
24	350	0.43	25.80	104.9	1985	2195	—
30	150	0.34	32.00	103.5	2005	—	—
30	200	0.38	32.00	115.5	2220	—	—
30	250	0.42	32.00	127.5	2595	—	—
30	300	0.45	32.00	136.5	2810	—	—
30	350	0.49	32.00	148.4	2685	—	—
36	150	0.38	38.30	138.5	2945	—	—
36	200	0.42	38.30	152.9	2940	—	—
36	250	0.47	38.30	170.9	3265	—	—
36	300	0.51	38.30	185.3	3525	—	—
36	350	0.56	38.30	203.2	3845	—	—

NOTE: Thicknesses and dimensions of 3" through 64" Ductile Iron pipe conform to ANSI/AWWA C151/A21.51. Weights may vary from the standard because of differences in bell weights.

\*Tolerance of O.D. of spigot end: 3-12 in., ±0.06 in.; 14-24 in., +0.05 in., -0.08 in.; 30-48 in., +0.08 in., -0.06 in.; 54-64 in., +0.04 in., -0.10 in.

† Including bell; calculated weight of pipe rounded off to nearest 5 lbs.

Table continued on next page.



## TYTON® Gasket

U.S. Pipe's TYTON® Gasket is used in U.S. Pipe's TYTON JOINT® and HP LOK® Joint Ductile Iron Pipe & Fittings. It is a circular rubber gasket which has a modified bulb shape in cross section. The TYTON® Gasket conforms to ANSI/AWWA C111/A21.11. Composition and dimensions of the gasket have been carefully engineered to ensure a water-tight and lasting seal.

All TYTON® Gaskets are made from vulcanized synthetic rubber with a soft rubber bulb and harder heel joined in a strong, vulcanized bond. No reclaimed rubber is used in the process. All gaskets meet the requirements of the National Sanitation Foundation (NSF) Standard ANSI/NSF-61, *Drinking Water System Components – Health Effects*.

The standard rubber compound is SBR – Styrene Butadiene Rubber. This material has a maximum service temperature rating of 150°F and is used as the predominant gasket material for Drinking Water, Sea Water, Sanitary Sewer, Reclaimed Water, Raw Water, & Storm Water.

If low levels of certain contaminants are present in water and sanitary sewer applications, special elastomers are available. The following table may be used as a guide for common TYTON® Gasket water, sewer, and air applications.

U.S. Pipe can furnish these special elastomers if specified for specific applications. TYTON® Gaskets made of special elastomers are marked using colored dots.

<u>Elastomer</u>	<u>Color of Dot</u>
Neoprene®	Yellow
EPDM	Orange
Nitrile	Green
FKM	Red

Special care should be made during inventory and installation in order to insure the proper gasket is used in applications where specified.

ANSI/AWWA C111/A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

ANSI/AWWA C111/A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

TYTON® Gaskets are available in 4" - 64" sizes and the pressure rating is based on the performance requirements of ANSI/AWWA C111/A21.11.



REVISED 03.10

S & D - 65

4"–64"

# TYTON<sup>®</sup> Gasket



U.S. PIPE AND FOUNDRY COMPANY / 866.DIP.PIPE / WWW.USPIPE.COM

Description	Maximum Service Temperature <sup>1,2</sup>			Uses <sup>3</sup>
	Water & Sewer		Air <sup>4</sup>	
	Push-On & Mechanical Joint Gaskets	Push-On Joint Gaskets	Mechanical Joint Gaskets	
	°F	°F	°F	
SBR (Styrene Butadiene)	150	150	125	<b>Common:</b> Drinking Water, Sea Water, Sanitary Sewage, Reclaimed Water, Raw Water, Storm Water
Nitrile (NBR) (Acrylonitrile Butadiene)	150	150	125	<b>Common:</b> Hydrocarbons, Fats, Oils, Greases, Chemicals, Oils & Fluids, Refined Petroleum <b>Other Acceptable Services:</b> Drinking Water, Sanitary Sewage, Reclaimed Water, Raw Water, Storm Water
Neoprene <sup>®</sup> (CR) (Polychloroprene)	200	180	150	<b>Common:</b> Greasy Waste <b>Other Acceptable Services:</b> Sea Water, Sanitary Sewage, Reclaimed Water, Raw Water, Storm Water
EPDM (Ethylene Propylene Diene Monomer)	212	200	150	<b>Common:</b> Alcohols, Dilute Acids, Dilute Alkalis, Ketones (MEK, Acetone), Vegetable Oil <b>Other Acceptable Services:</b> Drinking Water, Sea Water, Sanitary Sewage, Reclaimed Water, Raw Water, Storm Water
FKM <sup>5</sup>	212	300	300	<b>Common:</b> Aromatic Hydrocarbons and Fuels, Acids, Vegetable Oils, Petroleum Products, Chlorinated Hydrocarbons, Most Chemicals and Solvents <b>Other Acceptable Services:</b> Drinking Water, Reclaimed Water, Raw Water, Storm Water

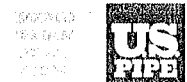
<sup>1</sup> Maximum service temperatures listed are intended as general guidelines for ductile iron pipe gaskets. For service temperatures greater than those listed, consult pipe manufacturer for specific recommendations.

<sup>2</sup> Maximum service temperature is not usually a meaningful parameter for piping gaskets; however, low temperatures during pipeline installation may necessitate precautions. Consult your U.S. Pipe Sales Representative for pertinent recommendations.

<sup>3</sup> Water, including sewage, with low levels of the listed contaminants.

<sup>4</sup> Lubricating oil in the air will adversely affect SBR and EPDM performance.

<sup>5</sup> Consult your U.S. Pipe Sales Representative for availability of FKM push-on gaskets.



REVISED 03.10

# **Ductile Iron Fittings Product Data**



**MECHANICAL JOINT C153 DUCTILE IRON  
COMPACT FITTINGS**  
 Sizes 3"-12" UL & 3"-10" FM Listed  
 For Fire Main Equipment

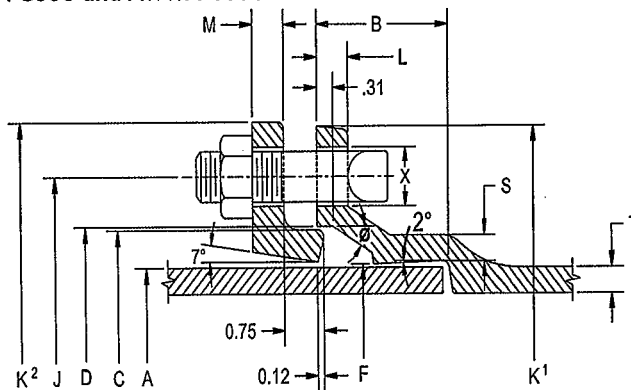
**SAMPLE SPECIFICATIONS** (Current ANSI/AWWA revisions apply)

Mechanical joint watermain fittings with accessories, 2" through \*64" shall be manufactured from ductile iron in accordance with and meet all applicable terms and provisions of standards ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.11. Ductile iron mechanical joint fittings 2" through 24" shall be rated for 350 PSI working pressure. Ductile iron 30" through 48" shall be rated for 250 psi working pressure. Flanged ductile iron fittings in 24" (610 mm) and smaller sizes may be rated for 350 psi (2,413 kPa) with the use of special (annular ring or comparable) gaskets. All coated and lined fittings meet requirements of NSF-61, NSF-372, and Annex G.

NOTE - EXCEPTIONS: Mechanical joint fittings with flanged branches are rated for water pressure of 250 PSI.  
 NOTE - Wyes over 12" are not pressure rated. Contact manufacturer for rating in your application.

NOTE - Fittings are cement lined and seal coated in accordance with ANSI/AWWA C104/A21.4. Fittings are available double cement-lined, bare, or epoxy coated upon request. Epoxy coating per ANSI/AWWA C116

NOTE - Installation per AWWA C600 and AWWA C651



**NOMINAL JOINT DIMENSIONS IN INCHES**

**BOLTS**

Size	A Dia.	B	C Dia.	D Dia.	F Dia.	J Dia.	K' Dia.	K² Dia.	L	M	S	T	X	Size	No.
2	2.51	2.50	3.50	3.60	2.61	4.75	6.19	6.89	.58	.62	.36	.30	3/4	5/8x3	2
3	3.96	2.50	4.84	4.94	4.06	6.19	7.62	7.69	.58	.62	.39	.33	3/4	5/8x3	4
4	4.80	2.50	5.92	6.02	4.90	7.50	9.06	9.12	.60	.75	.39	.34	7/8	3/4x3½	4
6	6.90	2.50	8.02	8.12	7.00	9.50	11.06	11.12	.63	.88	.43	.36	7/8	3/4x3½	6
8	9.05	2.50	10.17	10.27	9.15	11.75	13.31	13.37	.66	1.00	.45	.38	7/8	3/4x4	6
10	11.10	2.50	12.22	12.34	11.20	14.00	15.62	15.62	.70	1.00	.47	.40	7/8	3/4x4	8
12	13.20	2.50	14.32	14.44	13.30	16.25	17.88	17.88	.73	1.00	.49	.42	7/8	3/4x4	8
14	15.30	3.50	16.40	16.54	15.44	18.75	20.31	20.25	.79	1.25	.55	.47	7/8	3/4x4½	10
16	17.40	3.50	18.50	18.64	17.54	21.00	22.56	22.50	.85	1.31	.58	.50	7/8	3/4x4½	12
18	19.50	3.50	20.60	20.74	19.64	23.25	24.83	24.75	1.00	1.38	.68	.54	7/8	3/4x4½	12
20	21.60	3.50	22.70	22.84	21.74	25.50	27.08	27.00	1.02	1.44	.69	.57	7/8	3/4x4½	14
24	25.80	3.50	26.90	27.04	25.94	30.00	31.58	31.50	1.02	1.56	.75	.61	7/8	3/4x5	16
30	32.00	4.00	33.29	33.46	32.17	36.88	39.12	39.12	1.31	2.00	.82	.66	1½	1x6	20
36	38.30	4.00	39.59	39.76	38.47	43.75	46.00	46.00	1.45	2.00	1.00	.74	1½	1x6	24
42	44.50	4.00	45.79	45.96	44.67	50.62	53.12	53.12	1.45	2.00	1.35	.82	1¾	1½x6½	28
48	50.80	4.00	52.09	52.26	50.97	57.50	60.00	60.00	1.45	2.00	1.35	.90	1¾	1½x6½	32

NOTE: 2 Inch MJ ASTM A536 ductile iron Compact fittings (2"-22.5 bend, 2"-45 bend, 2"-90 bend, 2"x12" solid sleeve, 2"x2" tee, 4"x2" tee, and 4"x2" reducer) are available beginning 2012. Call Tyler Union for availability or additional product dimensions.

\*NOTE: Contact Tyler Union for 54"-64" product information.

NOTE: The fitting laying lengths provided are approximate, contact Tyler Union Waterworks for the laying length of a specific fitting.

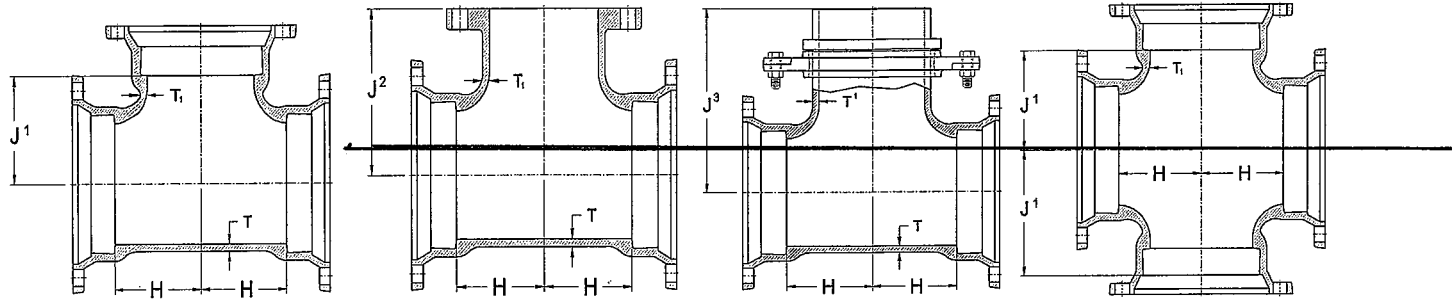




# MECHANICAL JOINT C153 DUCTILE IRON COMPACT FITTINGS

Sizes 3"-12" UL & 3"-10" FM Listed  
For Fire Main Equipment

## TEES



## CROSS

Size	Dimensions			Weights			MJ	MJxFE	†MJxS	Cross
	T	T <sup>1</sup>	*H	*J <sup>1</sup>	*J <sup>2</sup>	*J <sup>3</sup>				
3	.34	.34	3.5	3.50	5.5	...	26	29	...	31
4x3	.35	.34	3.5	4.00	6.5	...	35	34	...	39
4	.35	.35	4.0	4.00	6.5	...	36	39	...	45
6x3	.37	.34	4.0	4.00	6.5	...	51	54	...	...
6x4	.37	.35	4.0	5.00	8.0	...	52	57	...	62
6	.37	.37	5.0	5.00	8.0	10.50	66	68	77	79
8x3	.39	.34	4.0	6.50	9.0	...	56	...	...	...
8x4	.39	.35	4.5	6.50	9.0	...	72	82	...	84
8x6	.39	.37	5.5	6.50	9.0	11.50	79	81	105	98
8	.39	.39	6.5	6.50	9.0	11.50	90	101	116	112
10x3	.41	.34	4.0	7.50	11.0	...	80	...	...	...
10x4	.41	.35	4.5	7.50	11.0	...	82	92	...	98
10x6	.41	.37	5.5	7.50	11.0	13.00	99	116	114	121
10x8	.41	.39	6.5	7.50	11.0	13.00	116	128	138	135
10	.41	.41	7.5	7.50	11.0	...	132	144	...	156
12x3	.43	.34	4.0	8.75	12.0	...	99	...	...	...
12x4	.43	.35	4.5	8.75	12.0	...	108	118	...	119
12x6	.43	.37	5.5	8.75	12.0	14.25	119	133	132	138
12x8	.43	.39	6.5	8.75	12.0	14.25	126	146	149	149
12x10	.43	.41	7.5	8.75	12.0	...	159	174	...	187
12	.43	.43	8.75	8.75	12.0	...	171	198	...	202
14x6	.51	.44	6.5	10.50	14.0	16.00	183	205	211	210
14x8	.51	.45	7.5	10.50	14.0	...	211	...	...	231
14x10	.51	.46	8.5	10.50	14.0	...	229	244	...	255
14x12	.51	.47	9.5	10.50	14.0	...	245	284	...	269
14	.51	.51	10.5	10.50	14.0	...	281	291	...	299
16x6	.52	.45	6.5	11.50	15.0	17.00	222	230	243	250
16x8	.52	.46	7.5	11.50	15.0	...	245	248	...	264
16x10	.52	.47	8.5	11.50	15.0	...	265	287	...	286
16x12	.52	.48	9.5	11.50	15.0	...	277	312	...	312
16x14	.52	.51	10.5	11.50	15.0	...	317	348	...	...
16	.52	.52	11.5	11.50	15.0	...	337	324	...	451
18x6	.59	.44	6.5	14.50	15.5	18.00	275	261	279	...
18x8	.59	.45	7.5	14.50	14.5	...	280	351	...	...
18x10	.59	.47	8.5	12.50	...	...	286	...	...	...
18x12	.59	.49	9.5	12.50	...	...	372	...	...	...
18x14	.59	.56	10.5	12.50	...	...	415	...	...	...
18x16	.59	.57	11.5	12.50	...	...	445	...	...	...
18x18	.59	.59	13.0	12.50	...	...	490	...	...	...

NOTE: Contact TU Inside Sales representative for MJ Crosses larger than 16 inch. †MJxSwl Weights include swivel gland.

\*\*NOTE: 2"x2" and 4"x2" Compact C153 tees available in 2012. Call Tyler Union for information.

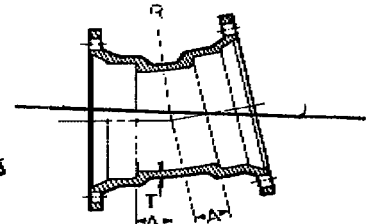
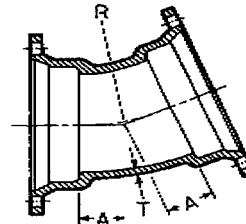
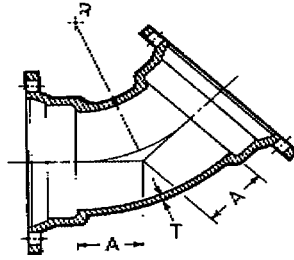
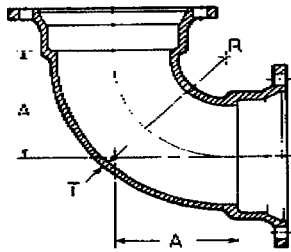
\*NOTE: "H" and "J" dimensions are approximates. contact Tyler Union for the laying length of specific fittings



# MECHANICAL JOINT C153 DUCTILE IRON COMPACT FITTINGS

Sizes 3"-12" UL & 3"-10" FM Listed  
For Fire Main Equipment

## BENDS



### 90° Bends (1/4)

### 45° Bends (1/8)

### 22½° Bends (1/16)

### 11¼° Bends (1/32)

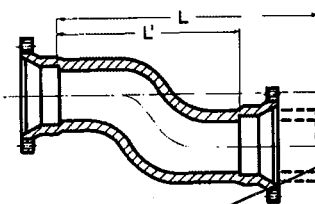
Size	Dimensions				Weight	Dimensions				Weight	Dimensions				Weight		
	T	*A	R			*A	R				*A	R					
3	.34	3.5	2.5		19	2.00	2.41		17	1.50	2.51		15	1.25	2.53		16
4	.35	4.0	3.0		22	2.50	3.56		20	1.75	3.81		18	1.50	5.12		18
6	.37	6.5	6.0		49	3.50	7.25		39	2.25	6.35		31	1.50	5.12		29
8	.39	7.5	7.0		64	4.00	8.44		56	2.85	11.80		50	2.06	15.80		45
10	.41	9.5	9.0		102	5.01	10.88		78	3.35	14.35		66	2.32	18.36		59
12	.43	10.5	10.0		129	5.98	13.25		102	3.86	16.90		87	2.56	20.90		82
14	.51	12.0	11.5		214	5.50	12.06		155	3.93	17.25		142	2.59	21.25		136
16	.52	13.0	12.5		273	5.98	13.25		204	3.98	17.50		178	2.62	21.50		157
18	.59	15.5	14.0		411	6.50	12.36		292	7.50	30.19		286	3.00	60.84		283
20	.60	17.0	15.5		519	7.00	13.59		372	8.50	35.19		376	3.50	71.07		374
24	.62	17.0	15.5		721	7.50	14.89		490	9.00	37.69		512	3.50	76.12		487
30	.66	21.50	19.0		930	10.50	9.31		716	6.75	21.36		665	4.75	22.84		600
36	.74	24.50	22.0		1450	11.50	21.73		1110	7.75	26.39		960	5.00	25.38		820
42	.82	29.25	26.7		2205	14.00	27.76		1610	9.00	32.68		1350	6.00	35.54		1180
48	.90	33.25	30.75		2990	15.00	30.17		2090	10.00	27.70		1760	6.50	40.61		1475

\*NOTE: "A" dimensions are approximate, contact Tyler Union for the laying length of a specific fitting

\*\*Note: 2 Inch Compact ductile iron 22.5, 45, and 90 degree bends available in 2012. Call Tyler Union for information.

## OFFSETS

Size	D	Dimensions		Weights	
		L'	L	MJxMJ	MJxPE
4	6	10	--	42	--
4	12	18	--	52	--
4	18	22	--	58	--
4	24	28	--	70	--
6	6	12	17.5	50	--
6	12	18	--	65	--
6	18	24	--	82	--
6	24	30	--	91	--
8	6	13	--	79	--
8	12	19	--	96	--
8	18	25	--	116	--
10	12	21	--	136	--
12	6	17	--	137	--



## BENDS

### 5-5/8 Bends (1/64) MJ x MJ

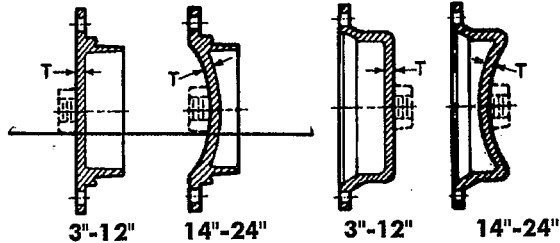
Size	Dimensions		
	*A	R	Weight
3	1.25	5.08	16
4	1.50	7.61	18
6	1.50	10.15	29
8	1.75	12.69	45
10	2.00	15.23	59
12	2.30	17.77	82
14	2.50	20.31	136
16	2.50	20.31	157
18	3.00	25.38	283
20	3.00	25.38	374
24	3.00	25.38	487
30	3.75	32.97	600
36	4.00	34.55	820
42	5.00	42.71	1180
48	5.50	47.35	1475



# MECHANICAL JOINT C153 DUCTILE IRON COMPACT FITTINGS

Sizes 3"-12" UL & 3"-10" FM Listed For Fire Main Equipment

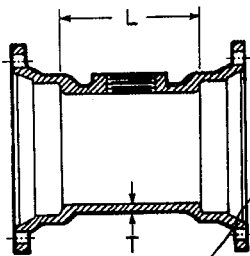
## SOLID & TAPPED PLUGS & CAPS



Size	Dimensions		Weights	
	T	Max. Tap	Plugs	Caps
3	.46	2	9	8
4	.46	2	9	10
6	.46	2	18	18
8	.46	2	25	26
10	.56	2	36	32
12	.56	2	47	46
14	.62	2	76	85
16	.62	2	98	94
18	.65	2	138	121
20	.66	2	158	149
24	.68	2	223	210
30	.66	2	355	345
36	.74	2	688	626
42	.82	2	1091	723
48	.90	2	1455	974



## \*TAPPED TEE



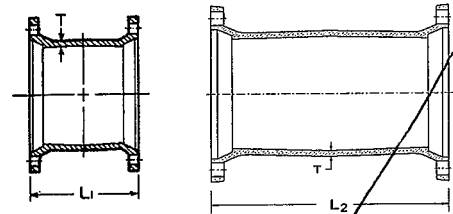
MJ x FE Flange  
Dimensions are on inside front cover.

MJ Tapped Tee (2" Tap)

Size	Dimensions		Max. Tap	Weights
	T	*L		
3	.34	6	2	19
4	.35	6	2	23
6	.37	6	2	35
8	.39	6	2	54
10	.41	6	2	68
12	.43	6	2	88
16	.52	6	2	164

Note: "L" dimensions are approximate, contact Tyler Union for laying length of a specific fitting

## SOLID SLEEVES

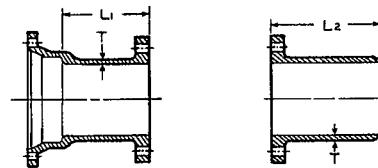


Size	T	Dimensions		Weights	
		L <sup>1</sup>	L <sup>2</sup>	Short	Long
3	.34	7.5	12	13	22
4	.35	7.5	12	19	25
6	.37	7.5	12	28	39
8	.39	7.5	12	38	55
10	.41	7.5	12	48	68
12	.43	7.5	12	62	81
14	.56	9.5	15	116	146
16	.57	9.5	15	138	174
18	.68	9.5	15	160	230
20	.69	9.5	15	212	269
24	.75	9.5	15	272	380
30	.66	15.0	15	500	...
30	.66	...	24	...	640
36	.74	15.0	15	725	662
36	.74	...	24	...	925
42	.82	...	24	...	1146
48	.90	...	24	...	1455

Note: 2"x12" C153 Sleeves available, call for information

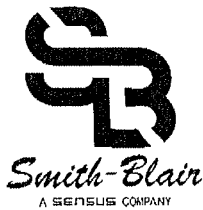
## ADAPTERS

\*Note: Verify non-domestic laying lengths with Tyler Union



Size	T	Dimensions		Weights	
		L <sup>1</sup>	L <sup>2</sup>	MJxFE	FExPE
3	.34	*6	12	18	...
4	.35	*6	12	26	23
6	.37	*6	12	36	35
8	.39	*6	12	50	50
10	.41	*6	12	60	69
12	.43	*6	12	88	88
14	.51	*6	12	127	...
16	.52	*6	12	155	149
18	.56	*6	...	195	...
20	.60	*6	...	275	...
24	.62	*6	...	305	...
30	.66	*7	...	470	...
36	.74	*8	...	750	...

# **Supply Line Coupling Product Data**



# 411, 413 and 415 Steel Couplings

1/2" thru 60" O.D. (larger sizes available)

## Product Specifications

**Coating:**  
Fusion bonded Flexi-Coat epoxy.

**Flanges:**  
Vary by size and style.  

- 1/2" to 2" are ductile iron, per ASTM A536.
- 2" to 12" are ductile iron, per ASTM A536 or carbon steel having a minimum yield of 30,000 PSI.
- 3" to 12" Z-Section Style are high strength, low alloy steel per ASTM A715, Gr. 80.
- 14" to 60" are AISI C1020 steel.

**Gasket:**  
Nitrile (Buna-N), compounded to resist natural gas, water, oil, acids, alkalis, most (aliphatic) hydrocarbon fluids and many chemicals.  
*Temperature Range: -20°F to +180°F.*

**Sleeve:**  
Carbon steel per ASTM A53C or having a minimum yield of 30,000 PSI.

**Bolts and Nuts:**  
Carbon steel per ASTM A307, electro-galvanized with di-chromate seal, or high strength, low-alloy steel with heavy semi-finished hexagon nuts.  
*Optional: 304 Stainless Steel*

## Features:

- Certified to NSF®/ANSI 61-G.
- Meets applicable AWWA C219 Standards.
- Allows for limited expansion and contraction.
- Will dampen vibration to reduced pipe fatigue.
- Easy to install, no special pipe end preparation required.
- Available in a wide variety of pipe O.D. sizes and sleeve lengths.
- Most sizes will accommodate anchor studs to restrain the joints.
- Can be custom made to fit odd O.D.s or other unusual applications.
- Provided with or without pipe stops to accommodate customer needs.
- Different styles allow for straight (411), transition (413) or reducing (415) connections.
- Has good deflection capabilities, allows change in piping direction without the need of elbows, bends, etc...
- Steel sizes built to specific O.D. and ductile iron sizes are built with range to accommodate the variances in ductile iron pipe O.D.s

Coupling Number	Size	Working Pressure*
411	1/2" and larger	150 PSI and up - check with factory
413	2"- 48" Nominal	150 PSI and up - check with factory
→ 415	6" - 48" Nominal	150 PSI and up - check with factory

\*The allowable working pressure of a coupling decreases as pipe diameter increases (regardless of manufacturer).

# Product Specifications

## SPECIFICATION:

The coupling shall also have a Flexi-Coat fusion bonded epoxy finish.

### (1/2"-2" nominal)

The coupling shall have a steel sleeve made of carbon steel with a minimum yield of 30,000 PSI.

The flanges shall be made of ductile iron per ASTM A536. The coupling shall have nuts and bolts made of carbon steel per ASTM A307 and be electro galvanized with a di-chromate seal.

### (2"-12" nominal)

The coupling sleeve shall be carbon steel per ASTM A53 or have a minimum yield of 30,000 PSI. The flanges shall be ductile iron per ASTM A536 or carbon steel with a minimum yield of 30,000 PSI. The coupling shall have bolts and nuts made of high-strength, low-alloy steel. The nuts shall be semi-finished hexagon type.

### (3"-12" nominal Z section style)

The coupling sleeve shall be carbon steel per ASTM A53 or have a minimum yield of 30,000 PSI. The flanges shall be ASTM A715 Grade 80 HSLA steel. The coupling shall have bolts and nuts made of high-strength, low-alloy steel. The nuts

shall be semi-finished hexagon type.

### (14" thru 60" nominal)

The coupling shall have a steel sleeve made of carbon steel with a minimum yield of 30,000 PSI. The flanges shall be AISI C1020 steel. The coupling shall have bolts and nuts made of high-strength, low-alloy steel. The nuts shall be semi-finished hexagon type. *OPTION: Nuts and bolts shall be 304 stainless steel.*

The coupling shall have plain wedge-style gaskets that are Nitrile (Buna N) NSF 61 listed. The gasket material shall be compounded to resist: water, oil acids, alkalis, most (aliphatic) hydrocarbon fluids and many other chemicals. The gasket shall have a temperature range of -20 to +180 F.

*OPTION: The coupling shall have wedge style gaskets of the same material above but also have a continuous brass spring molded into the leading edge of the gasket to insure metal contact between the pipe and the coupling sleeve. This is for extra protection against the line contents and makes the coupling electrically bonded to the pipe.*

The coupling shall be a Smith-Blair, Inc., 411, 413, 415 or approved equal.

### Approved By

Name:

Title:

Date:

THESE PRODUCT SPECIFICATIONS WERE CORRECT AT TIME OF PUBLICATION.

MATERIAL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

SEE CATALOG BROCHURE CC-411 FOR MORE DETAILS. VISIT SMITH-BLAIR'S WEBSITE AT [WWW.SMITH-BLAIR.COM](http://WWW.SMITH-BLAIR.COM) TO DOWNLOAD THE MOST CURRENT INFORMATION.



Ph: 870-773-5127 • Fax: 870-773-5212 • [www.smith-blair.com](http://www.smith-blair.com)  
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30 Globe Ave, Texarkana, AR 71854 • PO Box 5337, Texarkana, TX 75505

# **Foam Insulation Board Product Data**



## Description

R-Tech VI is a high-performance rigid insulation developed to be an alternative equal in applications where Type VI extruded polystyrene (XPS) is specified. R-Tech VI consists of a superior closed-cell, lightweight and resilient expanded polystyrene (EPS) with advanced polymeric laminate facers. The core of R-Tech VI is the same high-quality as our InsulFoam® brand insulations and meets or exceeds the compressive strength, flexural strength, dimensional stability and water absorption requirements of ASTM C578, *Type VI, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*. R-Tech VI is available with factory laminated metallic-reflective facers, white facers or a combination of the two. In addition, R-Tech VI offers a long-term stable R-Value, is an ENERGY STAR® qualified insulation and qualifies for LEED points.

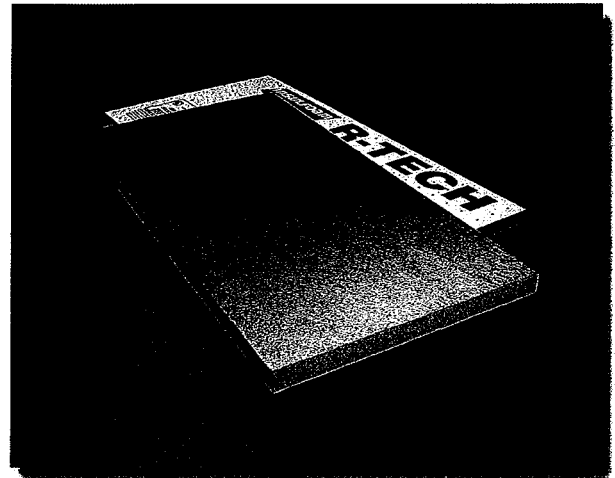
## Uses

R-Tech VI has been used successfully for numerous commercial, industrial and residential applications. The following are examples of the many R-Tech VI uses:

- ▼ Below Grade Insulation
- ▼ Sheathing
- ▼ Waterproofing Protection Board
- ▼ Concrete Panel Insulation
- ▼ Cavity Walls
- ▼ Concrete Slabs
- ▼ Interior Walls
- ▼ Radiant-Heated Floors
- ▼ Cold Storage & Freezers

## Advantages

- ▼ **Environmentally Friendly.** R-Tech VI contains no dyes, formaldehyde or ozone-depleting HCFCs, may contain recycled material and the foam core is 100% recyclable.
- ▼ **Stable R-Value.** Unlike XPS, there is no thermal drift. Designers are well served knowing the R-Tech VI thermal properties will remain stable over its entire service life. R-Tech is eligible for an InsulFoam 20-Year Thermal Performance Warranty – a warranty that's not prorated or limited to a percentage of the published R-Value.
- ▼ **User Friendly.** R-Tech VI can be ordered with the InsulSnap™ feature which scores the product longitudinally at any pre-ordered interval (commonly 16" or 24" o.c.). The InsulSnap feature minimizes labor by enabling the installer to cleanly break the product at the desired width while also minimizing product breakage and waste.
- ▼ **Water-Resistant.** R-Tech facers provide a surface that is virtually impervious to moisture.
- ▼ **Insect and Mold Resistant.** R-Tech VI can be manufactured with an inert additive that deters termites and carpenter ants. R-Tech VI does not sustain mold and mildew growth.



- ▼ **Jobsite Durability.** With a polymeric facer on either side of the R-Tech, it is an extremely flexible and durable insulation.
- ▼ **Cost-Effective.** R-Tech is typically less expensive than comparable insulation products.
- ▼ **Proven Performance.** The same fundamental EPS chemistry has been in use since the mid-1950s so the actual performance of the product is well known.
- ▼ **Code Approvals.** InsulFoam is recognized by the International Code Council Evaluation Service (ICC-ES) for numerous applications. Please contact your local InsulFoam representative for details.
- ▼ **Enhanced R-Values.** In certain applications, increased R-Values can be obtained by placing the metallic reflective side of the R-Tech towards a dead air space. R-Value gain is dependent on the amount of dead air space between the R-Tech and outer surface. R-Value gains are based on the *ASHRAE Handbook of Fundamentals*. See the attached Effective R-Value chart.

## Sizes

R-Tech VI is available in 4' x 8' sheets in thicknesses ranging from 3/8" to 5" in 1/8" increments. R-Tech VI can also be ordered with the InsulSnap feature which allows the end user to cleanly break the 4' x 8' sheets into any desired width. In addition, custom sizes are available upon request with little or no impact on lead times.

## Installation Recommendations

Please refer to the appropriate R-Tech application sheets for recommended installation procedures.



**Key Product Comparisons**

Property	R-Tech VI	Type VI XPS	Test Method
Density (min. pcf)	2.4	1.8	ASTM C303
Compressive Strength (psi, 10% deformation)	40	40	ASTM D1621
Flexural Strength (psi)	60	60	ASTM C203
Water Absorption (max. % vol.)	0.3	0.3	ASTM C272
Water Vapor Permeance (max. perm.)	< 1.1	1.1	ASTM E96
Dimensional Stability (maximum %)	2.0	2.0	ASTM D2126
Flame Spread	< 75	< 75	ASTM E84
Smoke Developed	< 450	< 450	ASTM E84

**Product Feature Summary**

Product Features	R-Tech VI	Type VI XPS
Stable R-Value	Yes	No
Free of HCFCs and Dyes	Yes	No
Available with Metallic Reflective Films	Yes	No
Available in a wide range of sizes and thicknesses	Yes	No

**Effective R-Values\* (metallic-reflective facer & dead air space)**

R-Tech VI Thickness	Design Temp.	Effective R-Value* (R-Tech MR + Air Space)
0.50"	25°	5.33
	40°	5.25
	75°	5.05
0.75"	25°	6.60
	40°	6.48
	75°	6.18
1.00"	25°	7.85
	40°	7.70
	75°	7.30
1.25"	25°	9.11
	40°	8.93
	75°	8.63
1.50"	25°	10.38
	40°	10.15
	75°	9.75
1.75"	25°	11.64
	40°	11.38
	75°	10.68
2.00"	25°	12.90
	40°	12.60
	75°	11.80
2.25"	25°	14.16
	40°	13.83
	75°	12.93
2.50"	25°	15.43
	40°	15.05
	75°	14.05

\* Requires 0.75" - 3.50" dead air space and the R-Tech metallic-reflective facer towards the dead air space.

**R-Value Comparisons**

R-Value	R-Tech VI	Type VI XPS	Test Method
Warranted R-Values @ 20 years	4.9/inch	Not Warranted	ASTM C518 @ 40 °F
	4.5/inch	Not Warranted	@ 75 °F
Warranted R-Values @ 15 years	4.9/inch	4.9/inch	ASTM C518 @ 40 °F
	4.5/inch	4.5/inch	@ 75 °F
Published R-Value (Thermal Resistance)	4.9/inch	5.4/inch	ASTM C518 @ 40 °F
	4.5/inch	5.0/inch	@ 75 °F

# **Link Seal Product Data**

**Operations & Maintenance Manual  
December 2015**



General Information

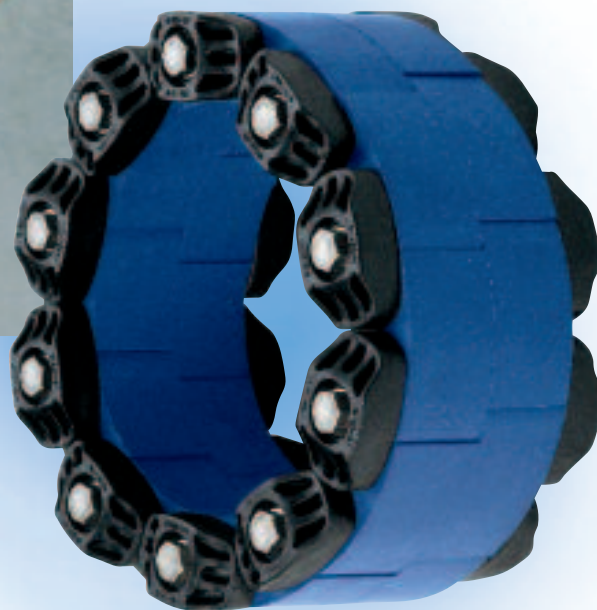
Technical Data

Selection Guide

Order Submittal Sheet

Installation Instruction

# PSI Link-Seal® Modular Seals



## Pipeline Accessories

# Link-Seal® Modular Seals

## General Information



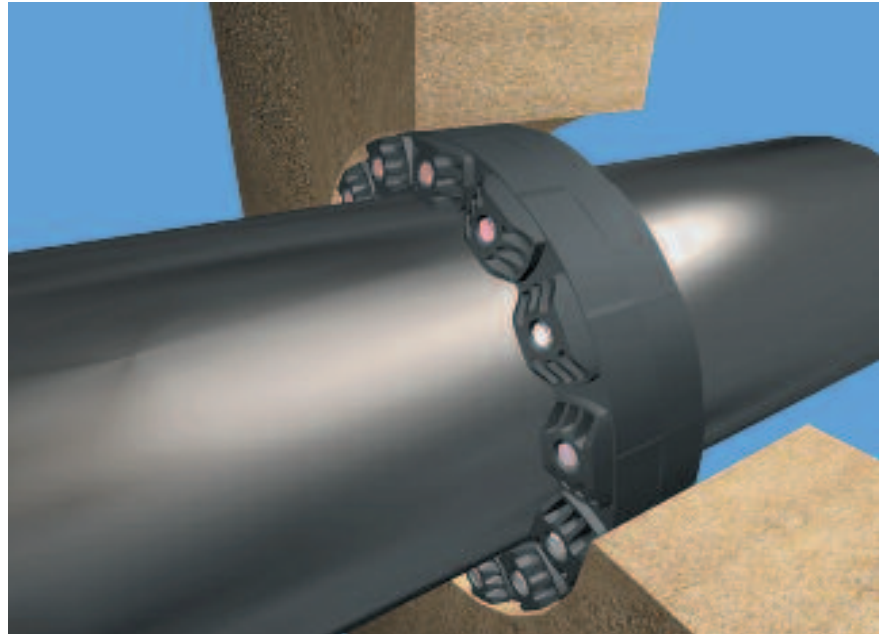
### Application range

Link-Seal® Modular Seals are considered to be the premier method for permanently sealing pipes of any size passing through walls, floors and ceilings. In fact, any cylindric object may be quickly, easily and permanently sealed, as they pass through barriers.

### Features

- Saves money and time
- Positive hydrostatic seal
- Long seal life
- Maximum protection against corrosion
- Oil, jet fuel and temperature resistant material available
- Configure a Link-Seal® modular seal to match your application
- ISO quality assurance

### The principle



**The radial expansion of the rubber ensures the hydrostatic pressure tightness**

# Link-Seal® Modular Seals

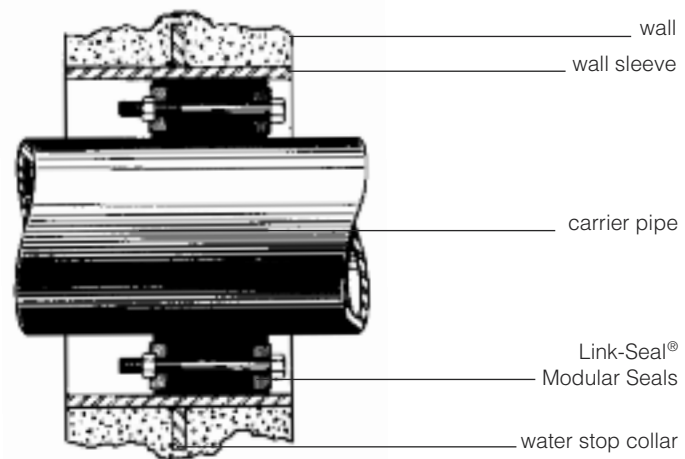
## Technical Data



### Material Properties

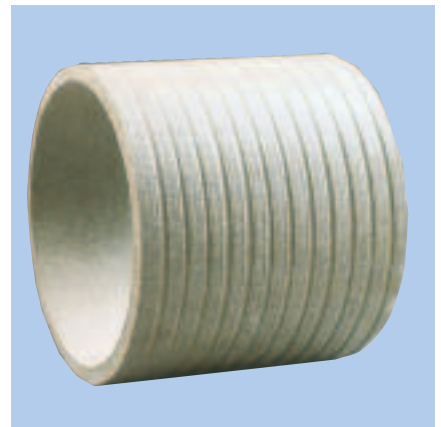
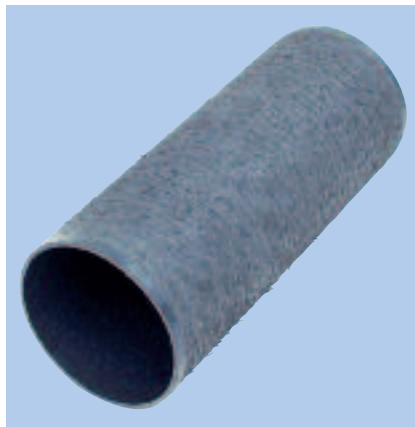
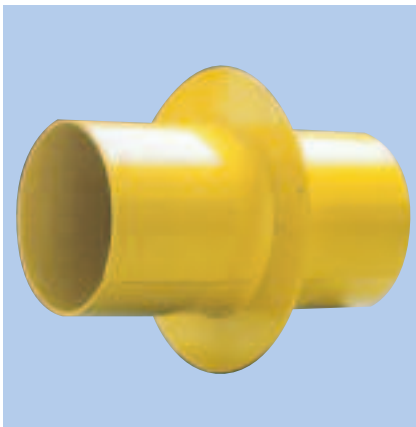
Temperature resistance	Standard version black Type T, grey Type O, green	-40° C up to +80° C -55° C up to +230° C -40° C up to +70° C
Oil, jet fuel resistance	Type O	
Special version for plastic pipes	blue EPDM	Shore 40 ± 5
Pressure tightness	up to 5 bar (TÜV and Lloyd's registered) Original Link-Seal® up to 3 bar (Lloyd's registered) Original Link-Seal® Typ BC and BS316 up to 2 bar (Lloyd's registered) Type S-LS	
Cathodic protection	Dielectrical strength 500 V/mm	

### Sectional drawing of a Link-Seal® Modular Seals



### Wall sleeve

PSI offers wall sleeves in PVC, carbon steel galvanised, stainless steel or asbestos free fibre cement.



# Link-Seal® Modular Seals

## Technical Data



Type	Version	Sealing Element	Pressure Plates	Bolts and Nuts	Temperature Range	Application
<b>C</b>	Standard	EPDM-rubber black	Reinforced Nylon Polymer	Carbon steel zinc dichromated	-40° C up to + 80° C	General application at normal atmosphere, in water or a humid environment. Suitable for electrical insulation and cathodic protection.
<b>B</b>	Shore 40±5	EPDM-rubber blue	Reinforced Nylon Polymer	Carbon steel zinc dichromated	-40° C up to + 80° C	See under type „C“, especially for plastic pipes
<b>S 316</b>	Standard stainless steel	EPDM-rubber black	Reinforced Nylon Polymer	stainless steel	-40° C up to + 80° C	High resistance against water, most other inorganic substances (acids and alkalis) and against most organic substances (e.g. acetic, acid, acetone).
<b>O</b>	Oil resistant	NITRILE-rubber green	Reinforced Nylon Polymer	Carbon steel zinc dichromated	-40° C up to + 70° C	Good resistance against oil, aromatic fuels, solvents and other mineral oil base products.
<b>BS 316</b>	Shore 40±5	EPDM-rubber blue	Reinforced Nylon Polymer	stainless steel	-40° C up to + 80° C	See type „S 316“, especially for plastic pipes
<b>OS 316</b>	Oil resistant	NITRILE-rubber green	Reinforced Nylon Polymer	stainless steel	-40° C up to + 70° C	Good resistance against oil, aromatic fuels, solvents and other mineral oil base products.
<b>KTW</b>	Shore 45±5	EPDM-rubber black incl. KTW-Stamp*	Reinforced Nylon Polymer blue	stainless steel	- 40° C up to + 80° C	Appropriate for drinking water applications
<b>T**</b>	High and low temperature	SILICONE-rubber grey	St 37 zinc dichromated	Carbon steel zinc dichromated	- 55° C up to + 230° C	No insulating properties, especially suitable for extreme temperatures.

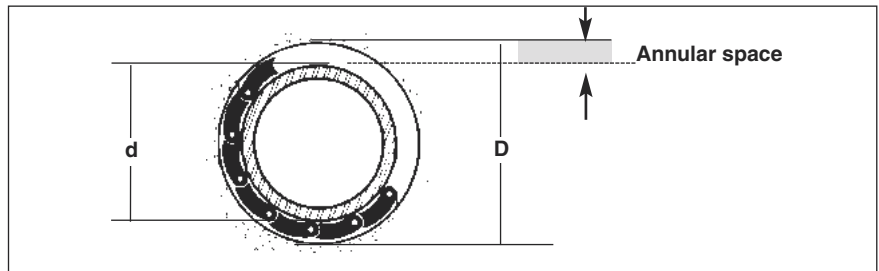
# Link-Seal® Modular Seals 3 Bar/Blue, 5 Bar/Black, Green & Grey

## Selection/Order Submittal Sheet



### 1. Which type is suitable?

Calculate the annular space. The annular space is half the difference between your pipe size and the wall opening diameter. Use the following formula:



Wall opening I.D. (D) -  Actual Pipe O.D. (d) =  Annular space  
 \_\_\_\_\_  
 2

From the adjacent chart, select the size closest to the annular space calculated in step 1. You have selected the correct size Link-Seal® modular seal if the free state thickness is less than the annular space and the expanded state thickness is greater than the annular space.

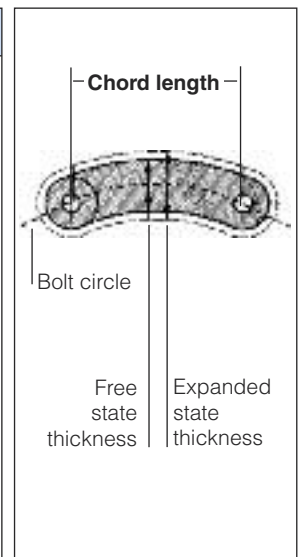
Type	Free state thickness	Annular space	Expanded state thickness	Necessary wall thickness
LS 200	12,7 mm		15,7 mm	75 mm
LS 265	16,0 mm		20,0 mm	75 mm
LS 275	16,0 mm		20,0 mm	75 mm
LS 300	18,0 mm		22,5 mm	100 mm
LS 310	18,0 mm		22,5 mm	100 mm
LS 315	21,1 mm		26,0 mm	100 mm
LS 325	23,2 mm		30,0 mm	120 mm
LS 340	25,5 mm		34,0 mm	120 mm
LS 360	32,0 mm		42,0 mm	120 mm
LS 400	36,3 mm		46,0 mm	140 mm
LS 410	37,0 mm		48,5 mm	140 mm
LS 425	28,4 mm		37,0 mm	140 mm
LS 440	44,0 mm		55,0 mm	140 mm
LS 475	41,3 mm		48,5 mm	140 mm
LS 500	60,3 mm		71,5 mm	150 mm
LS 525	55,4 mm		63,5 mm	150 mm
LS 575	48,0 mm		58,0 mm	150 mm
LS 615 <sup>a</sup>	81,6 mm		102,0 mm	150 mm
LS 625	83,0 mm		102,0 mm	150 mm
LS 650	69,0 mm		84,0 mm	150 mm
LS 700	95,0 mm		110,0 mm	150 mm

**Type:**

### 2. How many links do you need?

Calculate the number of links required to fit around the pipe and seal the annular space. Determine the bolt circle for Link-Seal® modular seal assembly by using the formular below.

Type	Chord length	Carrier Pipe O.D. min.	Carrier Pipe O.D. max.	min. No. of Segm.
LS 200	30,0 mm	from 21,3 mm	up to 323,9 mm <sup>1</sup>	4
LS 265	41,0 mm	from 50,0 mm	up to 406,4 mm <sup>1</sup>	5
LS 275	25,6 mm	from 0,0 mm	up to 90,0 mm	4
LS 300	41,0 mm	from 44,5 mm	up to 250,0 mm <sup>1</sup>	5
LS 310	57,5 mm	from 60,3 mm	up to 406,4 mm <sup>2</sup>	5
LS 315	38,4 mm	from 37,0 mm	up to 315,0 mm	5
LS 325	79,8 mm	from 133,0 mm	up to 711,0 mm	6
LS 340	41,4 mm	from 14,0 mm	up to 323,9 mm	4
LS 360	55,1 mm	from 40,0 mm	up to 406,4 mm	5
LS 400	93,1 mm	from 139,7 mm	up to 1220,0 mm	6
LS 410	67,6 mm	from 60,3 mm	up to 323,9 mm	5
LS 425	93,1 mm	from 144,0 mm	up to 1220,0 mm	6
LS 440	99,0 mm	from 100,0 mm	up to 1220,0 mm	5
LS 475	68,6 mm	from 60,3 mm	up to 1220,0 mm	5
LS 500	99,8 mm	from 100,0 mm	up to 1220,0 mm	5
LS 525	99,8 mm	from 133,0 mm	up to 1220,0 mm	6
LS 575	79,5 mm	from 130,0 mm	up to 1220,0 mm	5
LS 615 <sup>a</sup>	155,5 mm	from 219,0 mm	up to 3000,0 mm	6
LS 625	106,7 mm	from 133,0 mm	up to 2000,0 mm	5
LS 650	106,7 mm	from 133,0 mm	up to 2000,0 mm	5
LS 700	155,5 mm	from 219,0 mm	up to 3000,0 mm	6



<sup>1</sup> As from O.D. of 150 mm we recommend to enlarge your coredrill to install Link-Seal Type 310.  
<sup>2</sup> As from O.D. of 300 mm we recommend to enlarge your coredrill to install Link-Seal Type 325.  
<sup>3</sup> LS 615 NOT suitable for plastic pipes.

Wall Opening I.D. (D) +  Pipe Diameter O.D. (d) =  Bolt Circle :  Chord length :  Number  
 \_\_\_\_\_  
 2

x 3,14 =  :  =

**Number:**



Selection CD/  
Guide on request



# Link-Seal® Modular Seals Selection/Order Submittal Sheet



### 3. Which version is suitable?

Please determine the rubber and bolt quality suitable for your application. The relevant abbreviations are shown in the following chart.

Rubber	Bolts/nuts	
	galvanised	stainless steel
Standard EPDM-rubber (black)	C	S 316
Oil resistant Nitrile-rubber (green)	O	OS 316
Temperature resistant Silicone-rubber (grey)	T	TS 316*
EPDM-rubber (blue, Shore 40 ± 5)	B	BS 316

\* Special type

**Version:**

### 4. Correct product code?

Please select the correct product code corresponding to your choice.



Type	C	B	S 316	O	BS 316	OS 316
LS 200	2-025-00001	2-025-00300	2-025-00139	2-025-00040	2-025-00340	2-025-00156
LS 265	2-025-00017	2-025-00309	2-025-00186	-	2-025-00349	-
LS 275	2-025-00010	2-025-00301	2-025-00140	2-025-00039	2-025-00341	2-025-00150
LS 300	2-025-00002	2-025-00302	2-025-00141	2-025-00041	2-025-00342	2-025-00151
LS 310	2-025-00018	2-025-00310	2-025-00187	-	2-025-00359	-
LS 315	2-025-00012	2-025-00303	2-025-00146	2-025-00049	2-025-00343	2-025-00157
LS 325	2-025-00003	2-025-00304	2-025-00142	2-025-00042	2-025-00344	2-025-00152
LS 340	2-025-00004	2-025-00058	2-025-00143	2-025-00050	2-025-00064	2-025-00055
LS 360	2-025-00008	2-025-00050	2-025-00144	2-025-00051	2-025-00065	2-025-00056
<b>LS 400</b>	<b>2-025-00009</b>	<b>2-025-00305</b>	<b>2-025-00172</b>	<b>2-025-00043</b>	<b>2-025-00345</b>	<b>2-025-00153</b>
LS 410	2-025-00011	2-025-00306	2-025-00176	2-025-00052	2-025-00346	2-025-00154
LS 425	2-025-00005	2-025-00306	2-025-00174	2-025-00044	2-025-00346	2-025-00154
LS 440	2-025-00015	-	2-025-00176	2-025-00257	-	2-025-00258
LS 475	2-025-00006	2-025-00307	2-025-00145	2-025-00045	2-025-00347	2-025-00155
LS 500	2-025-00007	2-025-00308	2-025-00147	2-025-00046	2-025-00348	2-025-00158
LS 525	2-025-00013	2-025-00061	2-025-00148	2-025-00047	2-025-00067	2-025-00159
LS 575	2-025-00014	2-025-00062	2-025-00149	2-025-00053	2-025-00068	2-025-00160
LS 615	2-025-00215	-	2-025-00185	2-025-00220	-	2-025-00265
LS 625	-	2-025-00260	-	-	2-025-00261	-
LS 650	2-025-00016	-	2-025-00177	2-025-00255	-	2-025-00259
LS 700	-	2-025-00470	-	-	2-025-00471	-

**Product-Code:**

### 5. Order submittal sheet

Please copy the order sheet and fax to PSI Ltd  
Fax +44(0) 1480 404662



Selection CD/  
Guide on request

Quantity	Type	Version	Product-Code	Total

For further information please contact PSI Ltd. We apply our General conditions for sales on all orders. Subject to technical changes. The user must ensure that the chosen product is suitable for his application. Our warranty is limited to the replacement of defective found material. For prices please see our actual price list.

despatched by:

date/signature



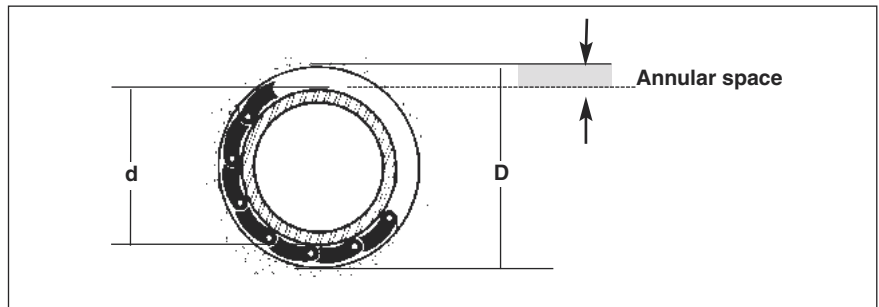
# Link-Seal Type S-LS (small Version) 2 bar

## Selection/Order Submittal Sheet



### 1. Which type is suitable?

Calculate the annular space. The annular space is half the difference between your pipe size and the wall opening diameter. Use the following formula:



Wall opening I.D. (D)	-	Actual Pipe O.D. (d)	=	Annular space
<input style="width: 100px; height: 20px;" type="text"/>	-	<input style="width: 100px; height: 20px;" type="text"/>	=	<input style="width: 100px; height: 20px;" type="text"/>
2				

From the adjacent chart, select the size closest to the annular space calculated in step 1. You have selected the correct size Link-Seal® modular seal if the free state thickness is less than the annular space and the expanded state thickness is greater than the annular space.

Type	Free state thickness	Annular space	Expanded state thickness	Necessary wall thickness
LS 200	17,7 mm		15,7 mm	70 mm
LS 275	16,0 mm		20,0 mm	70 mm
S-LS 300	17,5 mm		21,0 mm	70 mm
S-LS 315	20,1 mm		24,0 mm	70 mm
S-LS 325	24,0 mm		29,0 mm	90 mm
S-LS 340	24,5 mm		30,0 mm	70 mm
S-LS 360	31,5 mm		37,0 mm	90 mm
S-LS 400	35,5 mm		42,0 mm	90 mm
S-LS 410	36,5 mm		42,5 mm	90 mm
S-LS 425	28,6 mm		34,1 mm	90 mm
S-LS 440	44,0 mm		50,5 mm	90 mm
S-LS 475	41,3 mm		45,5 mm	90 mm
S-LS 500	61,0 mm		67,0 mm	110 mm
S-LS 525	53,0 mm		58,0 mm	110 mm
S-LS 575	48,0 mm		54,0 mm	100 mm
S-LS 625	83,0 mm		95,0 mm	100 mm
S-LS 650	69,0 mm		77,0 mm	100 mm

### Type:

Note: Type S-LS reduced pressure and sealing range

### 2. How many links do you need?

Calculate the number of links required to fit around the pipe and seal the annular space. Determine the bolt circle for Link-Seal® modular seal assembly by using the formular below.

Type	Chord length	Carrier Pipe O.D. min.	Carrier Pipe O.D. max.	min. No. of Segm.
LS 200	30,5 mm	from 21,3 mm	up to 323,9 mm <sup>1</sup>	4
LS 275	25,0 mm	from 0,0 mm	up to 30,0 mm	4
S-LS 300	40,5 mm	from 44,5 mm	up to 406,4 mm <sup>2</sup>	5
S-LS 315	37,0 mm	from 37,0 mm	up to 315,0 mm	5
S-LS 325	79,0 mm	from 88,9 mm	up to 711,0 mm	6
S-LS 340	42,0 mm	from 14,0 mm	up to 323,9 mm	4
S-LS 360	55,5 mm	from 16,0 mm	up to 406,4 mm	4
S-LS 400	93,0 mm	from 139,7 mm	up to 1220,0 mm	6
S-LS 410	68,0 mm	from 44,5 mm	up to 323,9 mm	4
S-LS 425	93,0 mm	from 134,0 mm	up to 1220,0 mm	6
S-LS 440	99,0 mm	from 100,0 mm	up to 1220,0 mm	5
S-LS 475	68,0 mm	from 60,3 mm	up to 1220,0 mm	5
S-LS 500	99,0 mm	from 100,0 mm	up to 1220,0 mm	5
S-LS 525	99,0 mm	from 133,0 mm	up to 1220,0 mm	6
S-LS 575	79,0 mm	from 130,0 mm	up to 1220,0 mm	5
S-LS 625	106,7 mm	from 133,0 mm	up to 2000,0 mm	5
S-LS 650	106,7 mm	from 133,0 mm	up to 2000,0 mm	5

<sup>1</sup> As from an O.D. of 150 mm we recommend to enlarge your coredrill to install Link-Seal Type S-LS 300.

<sup>2</sup> As from an O.D. of 250 mm we recommend to enlarge your coredrill to install Link-Seal Type S-LS 325.

Wall Opening I.D. (D)	+	Pipe Diameter O.D. (d)						
<input style="width: 100px; height: 20px;" type="text"/>	+	<input style="width: 100px; height: 20px;" type="text"/>						
2								
			x 3,14 =	Bolt Circle	Chord length	Number		
			=	<input style="width: 50px; height: 20px;" type="text"/>	:	<input style="width: 50px; height: 20px;" type="text"/>	=	<input style="width: 50px; height: 20px;" type="text"/>

### Number:



Selection CD/  
Guide on request



### 3. Which version is suitable?

Please determine the rubber and bolt quality suitable for your application. The relevant abbreviations are shown in the following chart

**Version:**

rubber	bolts/nuts	
	galvanised	stainless steel
<b>Standard EPDM-rubber black</b>	C	S 316
<b>KTW EPDM-rubber black acc. to German drinking recommendation</b>	–	KTW

### 4. Correct product code?

Please select the correct product code corresponding to your choice.



**Product-Code:**

Type	C	S 316	KTW
LS 200	–	–	2-025-00400
LS 275	–	–	2-025-00404
S-LS 300	2-024-00002	2-024-00141	2-024-00200
S-LS 315	2-024-00012	2-024-00146	2-024-00204
S-LS 325	2-024-00003	2-024-00142	2-024-00208
S-LS 340	2-024-00004	2-024-00143	2-024-00212
S-LS 360	2-024-00008	2-024-00144	2-024-00216
S-LS 400	2-024-00009	2-024-00172	2-024-00220
S-LS 410	2-024-00011	2-024-00173	2-024-00224
S-LS 425	2-024-00005	2-024-00174	2-024-00228
S-LS 440	2-024-00015	2-024-00176	2-024-00232
S-LS 475	2-024-00006	2-024-00145	2-024-00236
S-LS 500	2-024-00007	2-024-00147	2-024-00240
S-LS 525	2-024-00013	2-024-00148	2-024-00244
S-LS 575	2-024-00014	2-024-00149	2-024-00248
S-LS 625	2-024-00017	2-024-00179	2-024-00252
S-LS 650	2-024-00016	2-024-00177	2-024-00256

Note: Type S-LS reduced pressure and sealing range

### 5. Order submittal sheet

Please copy the order sheet and fax to PSI Ltd  
 Fax +44(0) 1480 404662



Selection CD/  
Guide on request

Quantity	Type	Version	Product-Code	Total

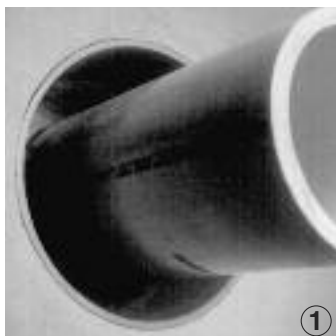
For further information please contact PSI Ltd. We apply our General conditions for sales on all orders. Subject to technical changes. The user must ensure that the chosen product is suitable for his application. Our warranty is limited to the replacement of defective found material. For prices please see our actual price list.

despatched by:

date/signature

# Link-Seal® Modular Seals

## Installation Instruction



Center the pipe, cable or conduit in wall opening or casing. Make sure the pipe is adequately supported on both ends. Link-Seal® modular seals are not intended to support the weight of the pipe.

①



Loosen rear pressure plate with nut just enough so links move freely towards and away from each other - connect both ends of belt.

②



Check to be sure bolt heads are facing the installer. Extra slack or sag is normal. Do not remove links if extra slack exists. Note: On smaller diameter pipes, links may need to be stretched.

③



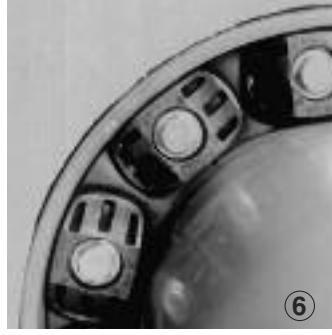
Slide belt assembly into annular space. For larger size belts, start inserting Link-Seal® modular seal assembly at the 6 o'clock position and work both sides up toward the 12 o'clock position in the annular space.

④



Start at 12 o'clock. Tighten any bolt in a clockwise manner. Tighten only by hand!

⑤



Do not tighten any bolt more than 4 turns at a time. Continue in a clockwise manner. Make 2 or 3 more passes at 3 turns per bolt until links have been uniformly compressed and the max. torque moment (see table) is reached.

⑥



Completed assembly

⑦

Repeat tightening after approx. 2 hours. Especially the Link-Seal® Type LS 500 up to LS 650 are, depending on the installation conditions (annular space, temperature, etc.) has to be tightened again for several times.

Max. torque moment			Type
for Type C, S316 rubber black O and OS316 rubber green Type T rubber grey Shore 55°± 5°	for Type BC and BS316 rubber blue, Shore 40°± 5°	for Type S-LS version C, S316 and KTW Shore 45°± 5°	
2 Nm	2 Nm	2 Nm	LS 200 up to LS 275
8 Nm	6 Nm	6 Nm	LS 300 up to LS 360
27 Nm	20 Nm	20 Nm	LS 400 up to LS 475
65 Nm	50 Nm	50 Nm	LS 500 up to LS 575
110 Nm	65 Nm	65 Nm	LS 615
65 Nm	50 Nm	50 Nm	LS 625 up to LS 700

# Link-Seal® Modular Seals

## Installation Instruction



Please consider the right equipment when you install Link-Seal®



### Link-Seal® Modular seals – Do's

1. Make sure pipe is centered.
2. Install the belt with the pressure plates evenly spaced.
3. Install the exact number of links indicated in sizing charts.
4. Check to make sure pipe is supported properly during backfill operations.
5. Make sure seal assembly and pipe surfaces are free from dirt.



### Link-Seal® Modular seals – Don't's

1. Don't install the belt with the pressure plates aimed in irregular directions (Staggered)
2. Don't install Link-Seal® Modular seals with spiral weld pipe.
3. Don't torque each bolt completely before moving on to the next.
4. Do not use high speed power tools.
5. Do not use power tools with Link-Seal® Modular seal S316 (X) bolts.
6. Please note that the Link-Seal® isn't a fixing point.

PSI warranty is limited to the replacement of faulty material. The user is responsible for checking if the products are suitable for application.

# Original Link-Seal® Selection Table

Selection for core drilled holes



KB	LS			Select Seal	
	Medium pipe Ø <sub>a</sub> [mm]	up	to	Quantity of elements	Type LS ...
50	10	-	18	4	275
80	40	-	48	8	275
	48	-	53	7	200
100	32	-	45	5	340
	48	-	57	6	315
	55	-	64	6	300
	62	-	68	6	265
	68	-	75	9	200
125	42	-	61	5	360
	58	-	74	7	340
	73	-	82	8	315
	80	-	89	8	300
	87	-	93	8	265
	95	-	100	12	200
150	50	-	67	5	475
	58	-	76	5	410
	66	-	82	6	360
	82	-	99	9	340
	105	-	114	7	310
	112	-	118	10	265
	118	-	125	14	200
200	90	-	104	6	575
	103	-	117	7	475
	103	-	124	7	410
	116	-	133	9	360
	132	-	149	13	340
	155	-	164	10	310
250	134	-	154	8	575
	140	-	160	6	440
	153	-	163	9	475
	158	-	177	7	400
	166	-	186	12	360
	178	-	192	7	425
	190	-	203	9	325
	206	-	212	12	310
	300	157	-	173	7
184		-	204	10	575
190		-	210	8	440
208		-	226	12	410
216		-	236	15	360
234		-	244	20	340
240		-	253	11	325
255		-	264	15	310
350	182	-	210	8	650
	207	-	229	9	500
	223	-	239	9	525
	234	-	254	12	575
	253	-	267	14	475
	253	-	274	14	410
	266	-	286	18	360
	258	-	274	10	400
	276	-	293	11	425
	286	-	296	24	340
	294	-	303	13	325
	307	-	314	18	310

# Original Link-Seal® Selection Table

Selection for core drilled holes



KB	LS			Select Seal	
	Medium pipe Ø <sub>a</sub> [mm]	up	- to	Quantity of elements	Type LS ...
400	200	-	234	9	625
	234	-	255	9	650
	264	-	279	11	500
	273	-	289	11	525
	284	-	304	14	575
	292	-	310	11	440
	303	-	317	16	475
	308	-	327	12	400
	326	-	341	12	425
	340	-	353	15	325
450	246	-	265	10	625
	266	-	286	7	615
	285	-	311	11	650
	307	-	329	12	500
	327	-	339	12	525
	335	-	354	16	575
	345	-	356	13	440
	355	-	367	19	475
	358	-	377	14	400
	376	-	393	14	425
500	375	-	386	24	360
	390	-	403	17	325
	296	-	334	12	625
	335	-	359	12	650
	357	-	379	14	500
	373	-	389	14	525
	385	-	400	18	575
	390	-	410	14	440
	408	-	427	15	400
	426	-	443	16	425
600	440	-	453	19	325
	396	-	434	15	625
	436	-	457	15	650
	457	-	479	17	500
	473	-	489	17	525
	490	-	503	17	440
	503	-	509	25	475
	508	-	527	19	400
	526	-	543	19	425
	540	-	553	23	325

All other sizes on request!

## Available in these versions:

- Type C: Rubber EPDM (black standard), screws galvanized
- Type BC: Rubber EPDM (blue, extra soft for plastic pipe)
- Type S316: Rubber EPDM (black), screws V4A-stainless steel
- Type BS316: Rubber EPDM (blue, extra soft for plastic pipe), screws V4A-stainless steel
- Type O: Rubber Nitril (green, oil-resistant), screws galvanized. Price on request.
- Type OS316: Rubber Nitril (green, oil-resistant), screws V4A-stainless steel. Price on request.



# Link-Seal Type S-LS Selection Table

(slim version up to 2,0 bar)

Selection for core drilled holes



KB	LS			Select Seal	
	Medium pipe $\varnothing_a$ [mm]	up	to	Quantity of elements	Type LS ...
50	10	-	18	4	275
80	40	-	48	8	275
	48	-	53	7	200
100	40	-	47	5	340
	52	-	57	6	315
	58	-	64	6	300
	68	-	75	9	200
125	51	-	61	5	360
	65	-	75	7	340
	77	-	83	8	315
	83	-	89	8	300
	95	-	100	12	200
150	59	-	67	5	475
	67	-	76	5	410
	76	-	86	7	360
	90	-	100	9	340
	108	-	115	10	300
	118	-	125	14	200
200	92	-	104	6	575
	109	-	117	7	475
	117	-	126	7	410
	126	-	136	9	360
	140	-	150	13	340
	158	-	164	14	300
250	134	-	144	6	525
	142	-	154	8	575
	150	-	161	6	440
	166	-	177	7	400
	176	-	186	12	360
	185	-	192	7	425
	192	-	202	9	325
	208	-	214	18	300
300	166	-	178	7	500
	192	-	204	10	575
	200	-	211	8	440
	215	-	226	12	410
	226	-	236	15	360
	240	-	250	20	340
	258	-	264	21	300
350	196	-	211	8	650
	216	-	228	9	500
	234	-	241	9	525
	242	-	254	12	575
	259	-	267	14	475
	266	-	276	14	410
	276	-	286	18	360
	290	-	300	24	340
	308	-	314	25	300

# Link-Seal Type S-LS Selection Table

(slim version up to 2,0 bar)

Selection for core drilled holes



KB	LS			Select Seal	
	Medium pipe $\varnothing_a$ [mm]	up	to	Quantity of elements	Type LS ...
400	210	-	234	9	625
	246	-	255	9	650
	266	-	278	11	500
	284	-	292	11	525
	292	-	304	14	575
	299	-	311	11	440
	309	-	317	16	475
	316	-	328	12	400
	328	-	335	21	360
	332	-	342	12	425
450	342	-	352	15	325
	260	-	280	10	625
	296	-	311	11	650
	316	-	328	12	500
	334	-	342	12	525
	342	-	354	16	575
	349	-	356	13	440
	359	-	367	19	475
	366	-	378	14	400
	382	-	392	14	425
500	376	-	386	24	360
	392	-	402	17	325
	310	-	334	12	625
	346	-	359	12	650
	366	-	378	14	500
	384	-	392	14	525
	392	-	404	18	575
	399	-	411	14	440
	409	-	417	21	475
	416	-	428	15	400
600	432	-	442	16	425
	442	-	452	19	325
	410	-	434	15	625
	446	-	460	15	650
	466	-	478	17	500
	484	-	492	17	525
	492	-	504	22	575
	499	-	510	17	440
	509	-	516	26	475
	516	-	528	19	400
532	-	542	19	425	
542	-	552	23	325	

All other sizes on request!

## Available in these versions:


- Type C: Rubber EPDM (black standard), screws galvanized
  - Type S316: Rubber EPDM (black), screws V4A-stainless steel
  - Type KTW: Rubber EPDM (with blue print „KTW“, pressure plate blue), screws V4A-stainless steel
- KTW = Version for drinking water**





# Original Link-Seal® Modular Seals Certificate





## DET NORSKE VERITAS

### TYPE APPROVAL CERTIFICATE

**CERTIFICATE NO. P-11485**  
 This Certificate consists of 2 pages

This is to certify that the  
**Deck/Bulkhead Penetration**  
 with type designation(s)  
**LINK-SEAL SYSTEM of the types LS 200, LS 275, LS 300, LS 315, LS 325 and LS 500.**


Manufactured by  
**PSI Pipeline Seal & Insulator, Inc**  
 Houston, United States

is found to comply with  
 Det Norske Veritas Rules for Classification of Ships


Application  
 Pipe penetrations of watertightness bulkheads and decks, except fire divisions

Temp. range: Type D, C, X: -80°C to +120°C  
 Max. work. press.: Type D: 7.0 bar, Type C and X: 5.0 bar  
 Size: See page 2

Place and date  
Brevik, 2004-05-11  
for Det Norske Veritas AS




John Olav Nævdal  
Head of Section



Local Office  
DNV Houston

This Certificate is valid until  
2008-02-31



Tull Berg-Nelson  
Surveyor

Notes: This Certificate is subject to terms and conditions attached. Any significant change in design or construction may render this Certificate invalid. The validity also relates to the Type Approval Certificate and not to the approval of representative samples.



## BESCHEINIGUNG

Prüfbericht:	004117514
Auftraggeber:	PSI Products GmbH Ulrichstraße 25 72116 Mühlhausen
Hersteller:	PSI Pipeline Seal and Insulator, Inc. 8505 South Street Houston, Texas 77021 U.S.A.
Gegenstand:	Ringraum-Dichtung in Modul-Bauseize

Der o.g. Gegenstand wurde unter Berücksichtigung technischer Regeln geprüft und die qualitätsrelevanten Maßnahmen für die Fertigung beauftragt.

Der Geltungsbereich mit allen Einzelheiten ist in dem Prüfbericht enthalten.

Der Hersteller ist berechtigt, an dem o.g. Gegenstand das Deutlichkeitszeichen

**TÜV - SW 007 - 94**

anzubringen.

Mannheim, den 24. September 2004  
04-024-6474/jp

TÜV RAVENHERRN SACHSEN SÜDWEST E.V.  
Bau und Betrieb  
Dampf- und Druckbehälter  
Kompetenzzentrum Druckbehälteranlagen  
Die Sachverständigen





Certificate

Class: APPROVED

Client: PSI Products GmbH  
 Ulrichstrasse 25  
 72116 Mühlhausen, Germany

Class Under Consideration:

Inspection Dates:  
 From: 08 August 2004 To: 15 August 2004

Issue Date: 26 September 2004  
 Valid Until: 01/01/2007

This certificate is issued to the client named in the certificate, who hereby certifies that the relevant technical specifications of the certificate and the rules in force at the time of the certificate have been fully complied with in the design and construction of the product.

**Link-Seal® in Modulbauweise**  
 Modell LS der Materialtypen C, D und BC  
 Modell S-LS des Materialtyps C

Diese Tests wurden entsprechend der Beschreibung von PSI Products GmbH "Druckprüfung für die Ringraumdichtung Typ Link-Seal® in Modulbauweise" durchgeführt. Die Daten der Prüfbeschreibung in der 08. August 2004.

The inspection was carried out in accordance with the following:

**Schweißverfahren**

The Schweißverfahren (the Processes) of the client named in the certificate shall be in accordance with the following, unless otherwise stated:

Link-Seal® Typ	Erschweißter Druck
LS 200-028 Typ E	7 bar
LS 200-028 Typ BC	7 bar
LS 200-028 Typ D	7 bar
S-LS 200-027 Typ C	7 bar



A.H. Zornigman  
Surveyor in Charge Register (MBA)

A member of the Lloyd's Register Group

# **Reinforced Concrete Pipe** **Product Data**

**Operations & Maintenance Manual**  
**December 2015**

*Delivering Reliability*



## Concrete Pipe

*Manufactured in  
Platteville*

*oldcastleprecast.com/amcorlittleton  
Sales and Service (303) 791-1100*

S & D - 95

## CONCRETE PIPE

### APPLICATION

Concrete pipe designed and manufactured at Oldcastle Precast, Platteville is designed for Storm Drains, Culverts and Storm Sewers

### SPECIFICATIONS

Concrete pipe designed and manufactured by Oldcastle Precast meets ASTM C-76, ASTM C-443, AASHTO M170, and APWA specifications.

\*Complete product submittals are available upon request

Concrete: 28 Day Minimum Compressive Strength 4,000 psi

Steel Mesh: ASTM A-165 Grade 65

Cement: Type I/II or Type III, Unless otherwise specified.

### ADDITIONAL INFORMATION

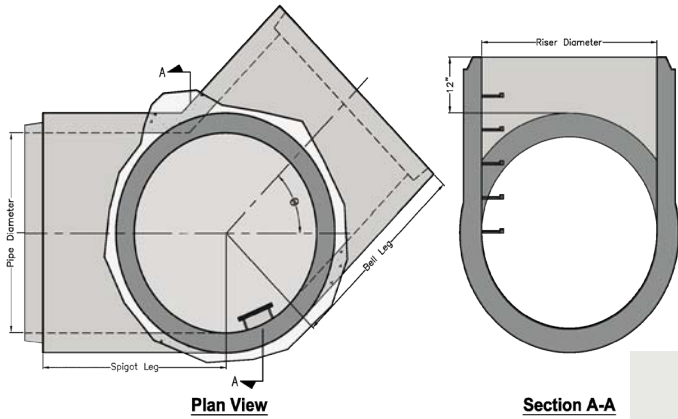
Oldcastle Precast, Platteville is ACPA certified, NPCA certified and CDOT approved. Oldcastle Precast manufactures and supplies all related storm water and drain way products. Our gasketed pipe joints provide a water-tight seal per ASTM C-443. Drainage accessories are available.



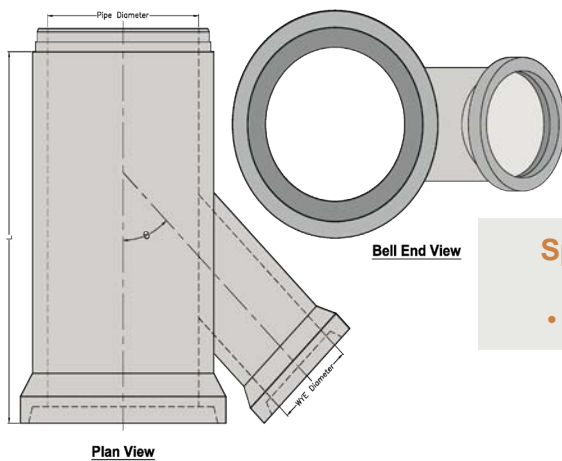
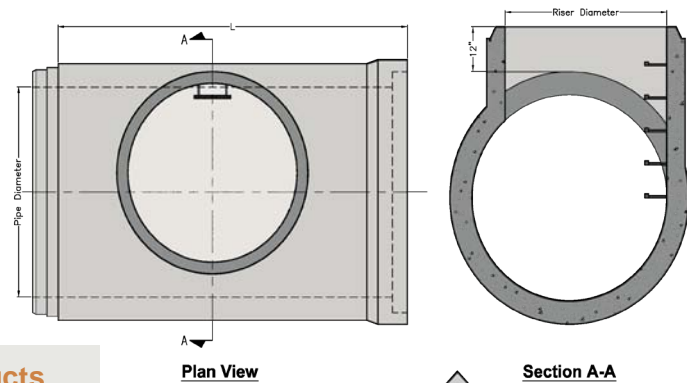
**Standard Pipe Sizes are Available in:  
Class III through Class V**



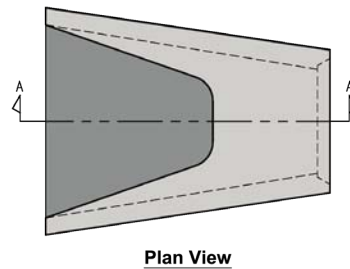
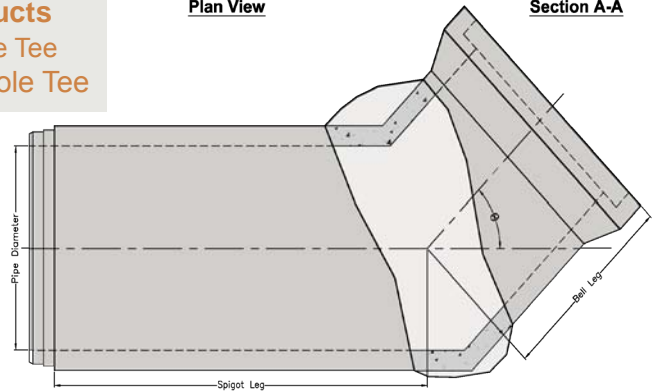




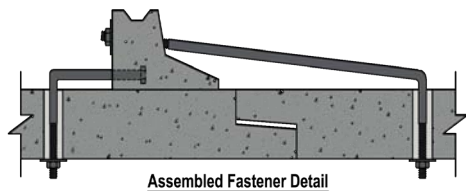
**Special Products**  
• Elbow Manhole Tee  
• Standard Manhole Tee



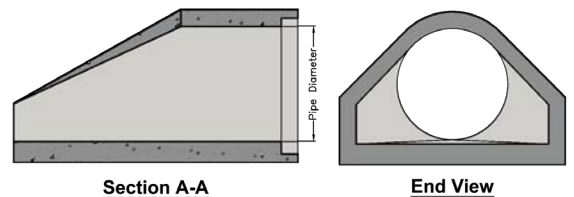
**Special Products**  
• Wye Pipe  
• Standard Elbow



**Flared End Sections**



**Concrete Pipe Joint Fasteners**



## ORDERING INFORMATION

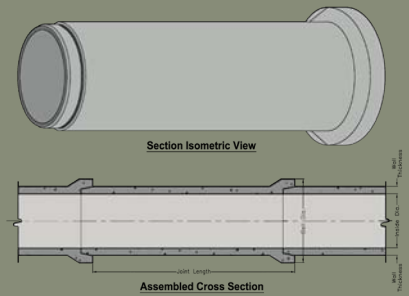
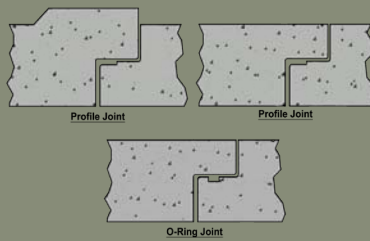
Our team of precast specialists makes it easy to meet specific project needs. To reach our sales department, call (303) 791.1100 or e-mail [amcorlittleton@oldcastleprecast.com](mailto:amcorlittleton@oldcastleprecast.com).

To access our interactive product catalog and CAD drawings, visit us online at [oldcastleprecast.com/amcorlittleton](http://oldcastleprecast.com/amcorlittleton)

# Pipe

[oldcastleprecast.com/amcorlittleton](http://oldcastleprecast.com/amcorlittleton)

Delivering Reliability



Inside Dia (Inches)	Bell Dia (Inches)	Wall Thickness (Inches)	Joint Length (Feet)	Weight Per/Ft (lbs./Ft.)	Inside Dia (Inches)	Bell Dia (Inches)	Wall Thickness (Inches)	Joint Length (Feet)	Weight Per/Ft (lbs./Ft.)
12"	20.000"	2.75"	7.5'	135 lbs.	36"	45.500"	4.00"	8.0'	548 lbs.
15"	23.875"	3.00"	7.5'	185 lbs.	42"	N/A	5.25"	8.0'	813 lbs.
18"	27.625"	2.50"	7.5'	192 lbs.	48"	N/A	5.75"	8.0'	1000 lbs.
21"	31.625"	2.75"	7.5'	259 lbs.	54"	N/A	6.25"	8.0'	1196 lbs.
24"	33.000"	3.00"	7.5'	276 lbs.	60"	N/A	6.75"	8.0'	1485 lbs.
30"	39.000"	3.50"	8.0'	404 lbs.	72"	N/A	7.75"	8.0'	2086 lbs.



## Oldcastle Precast Littleton, CO Division

8392 Riverview Parkway  
Littleton, CO 80125

Phone: (303) 791-1100  
Fax: (303) 791-1120  
[oldcastleprecast.com/amcorlittleton](http://oldcastleprecast.com/amcorlittleton)

## Oldcastle Precast Platteville, CO Division

427 North Front Street  
Platteville, CO 80651

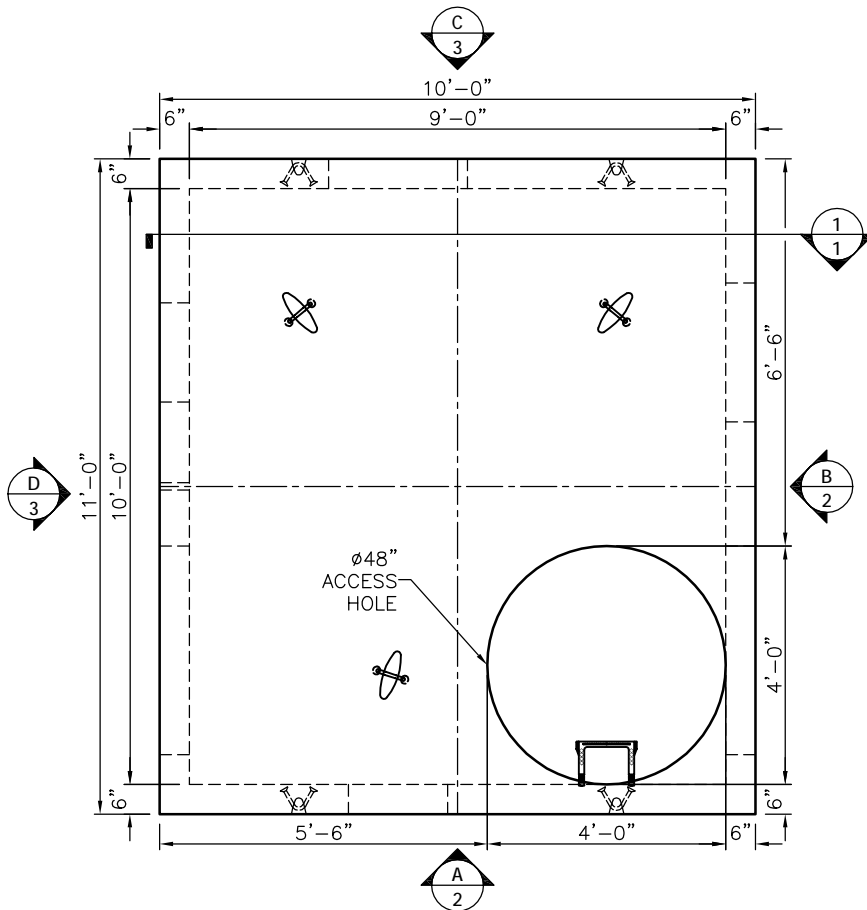
Phone: (970) 785-6066  
Fax: (970) 785-6087  
[oldcastleprecast.com/amcorplatteville](http://oldcastleprecast.com/amcorplatteville)

## Oldcastle Precast

Oldcastle Precast is the leading manufacturer of precast concrete, plastic and polymer products in the United States. With more than 80 locations nationwide, our products are always close at hand. Our 5,000 employees are committed to upholding core values of reliability, quality and service in revolutionary ways. Our attention to detail exceeds the expectations of customers from some of the largest companies in the U.S., across a spectrum of industries.

# **Manhole Product Data**

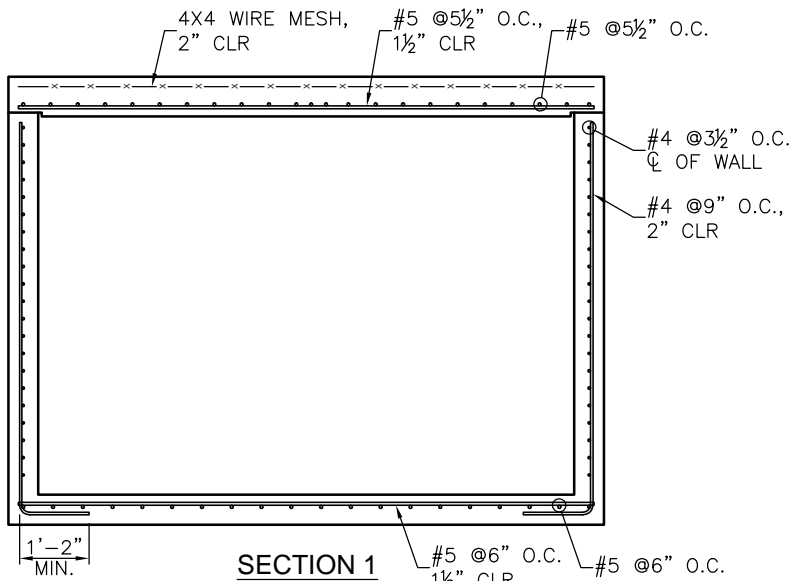
**Operations & Maintenance Manual  
December 2015**



**VIEW P**  
SCALE: 5/16" = 1'-0"  
(R&C NOT SHOWN FOR CLARITY)



06/23/15



**SECTION 1**  
SCALE: 5/16" = 1'-0"

\*THIS MUST BE FILLED OUT BEFORE MANUFACTURING BEGINS\*

APPROVED W/ NO EXCEPTIONS TAKEN:   
 APPROVED AS NOTED:   
 REVISE AND RESUBMIT:

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

**SHOP NOTES**

1. CONCRETE STRENGTH: 6000 PSI
2. CONCRETE FINISH: SMOOTH FINISH
3. 1500 PSI MINIMUM STRIPPING STRENGTH REQ'D
4. BASE TO BE ROLLED AFTER STRIPPING
5. ALL REBAR TO BE EPOXY COATED

**DESIGN NOTES**

- 1) MIN. DESIGN CRITERIA IS AS NOTED UNLESS OTHERWISE SPECIFIED
- 2) DESIGN LOADINGS:
  - A. LIVE LOAD: AASHTO HL-93
  - B. SOIL WEIGHT = 120 PCF
  - C. DEPTH OF OVERBURDEN: 2.0' MIN. - 6.0' MAX.
  - D. ASSUMED WATER TABLE: 10' BELOW GRADE
  - E. EQUIV. FLUID PRESSURE = 40 PCF
  - F. LATERAL LIVE LOAD SURCHARGE PER LRFD
- 3) CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 6000 PSI (MIN.)
- 4) STEEL REINFORCEMENT: REBAR, ASTM A-775 GRADE 60
- 5) CEMENT: ASTM C-150 SPECIFICATIONS

**PRODUCT WEIGHTS**

SECTION	WEIGHT (LBS)	VOLUME (CY)
LID	9,743	2.41
BASE	25,088	6.20

**Oldcastle Precast**<sup>®</sup>  
 8392 RIVERVIEW PARKWAY, LITTLETON, CO 80125  
 PHONE: 303-791-1100 FAX: 303-791-1120

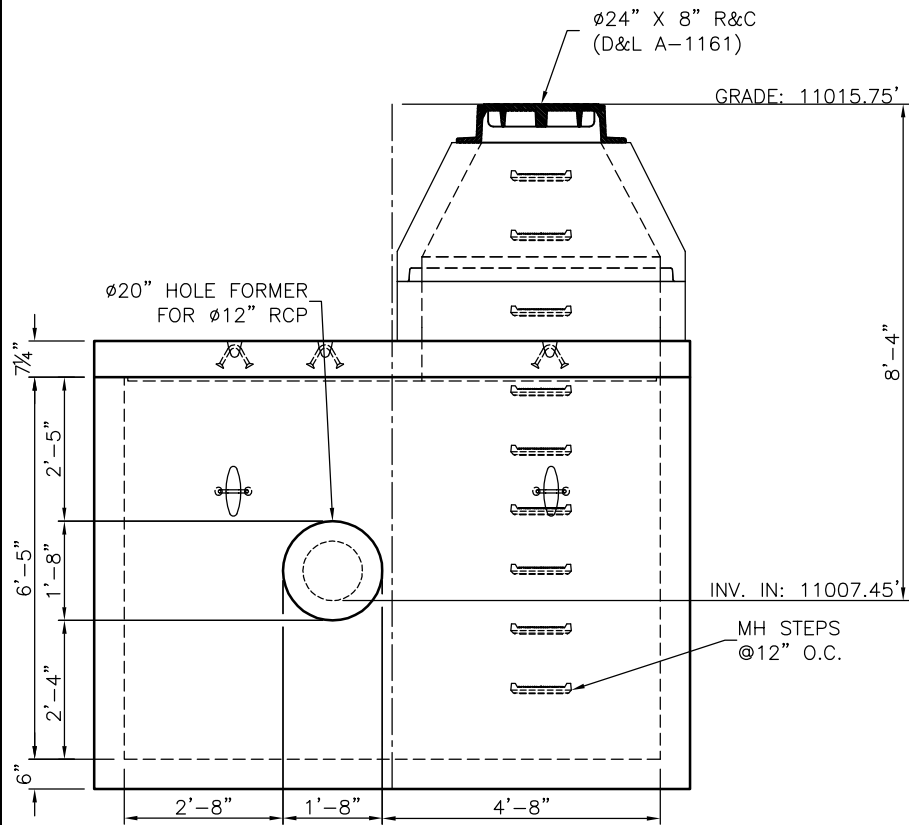
THIS DOCUMENT IS THE PROPERTY OF OLDCASTLE PRECAST, INC. IT IS CONFIDENTIAL, SUBMITTED FOR REFERENCE PURPOSES ONLY, AND SHALL NOT BE USED IN ANY WAY INJURIOUS TO THE INTERESTS OF, OR WITHOUT THE WRITTEN PERMISSION OF OLDCASTLE PRECAST, INC. COPYRIGHT © 2015 OLDCASTLE PRECAST, INC. ALL RIGHTS RESERVED.

9'-0" x 10'-0" x 6'-5" VAULT  
 SUBMITTAL DRAWING  
 EJMT-FFSS  
 COLORADO

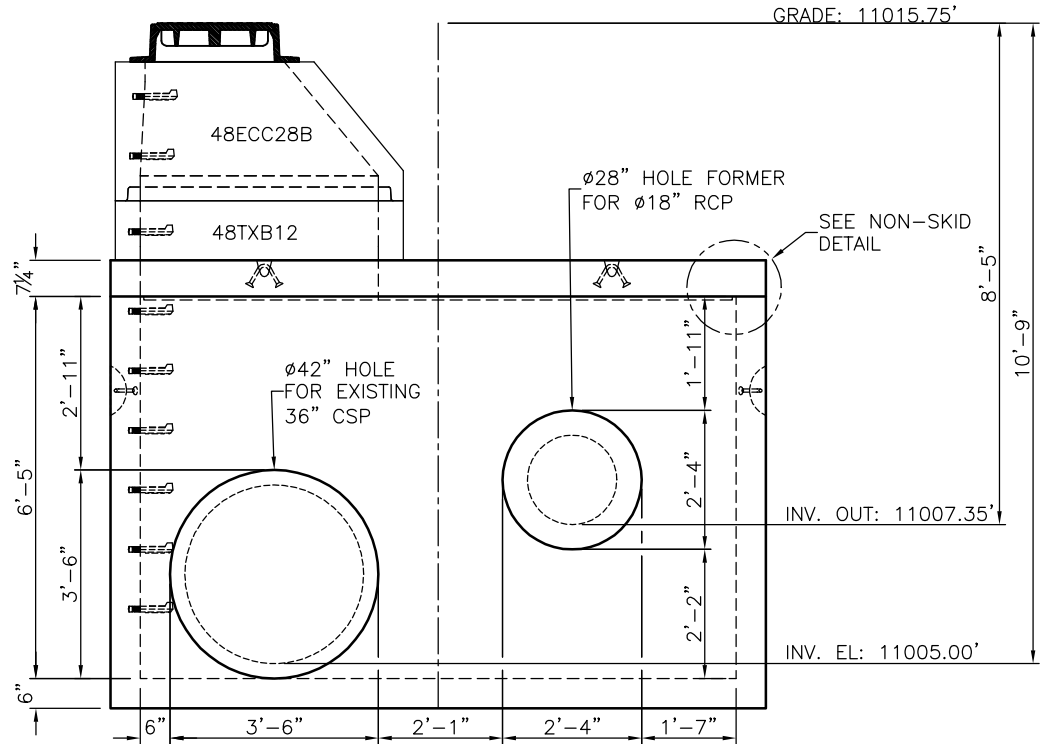
CUSTOMER  
**BARNARD CONSTRUCTION**

DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
6/4/15	SF	BS			
DRAWING NUMBER 110-Manhole 2				REVISION	SHEET
				S & D 1	1003

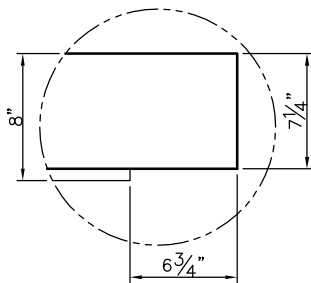




**VIEW A**  
SCALE: 5/16" = 1'-0"



**VIEW B**  
SCALE: 5/16" = 1'-0"



**NON-SKID LID DETAIL**  
(FOR 6" WALLS)



06/23/15

**\*\*FLOW CHANNEL FOR EXISTING 36" CSP TO BE COMPLETED IN FIELD BY OTHERS\*\***

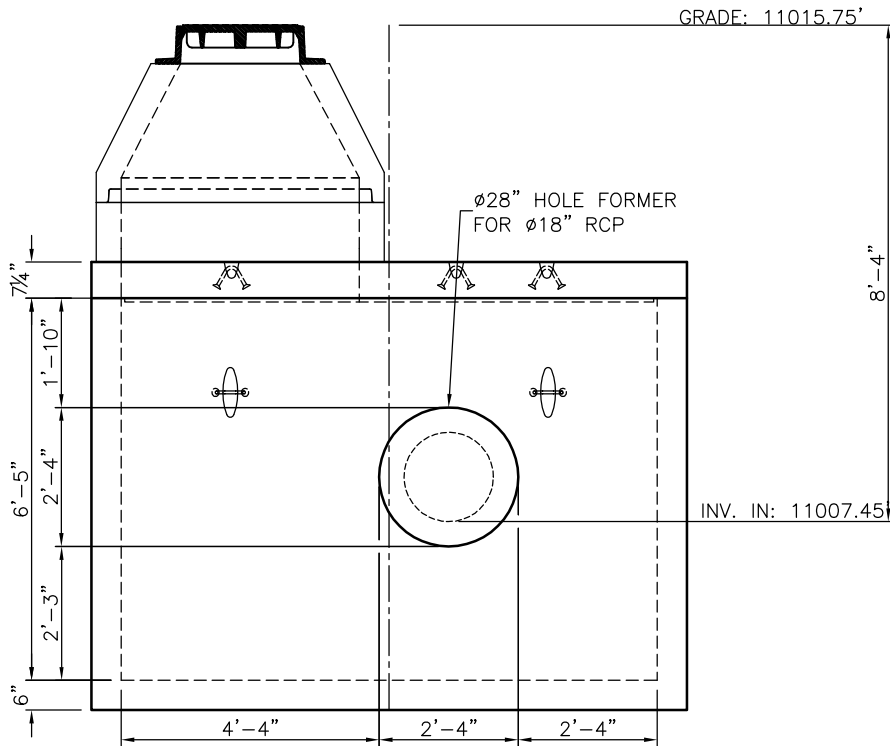


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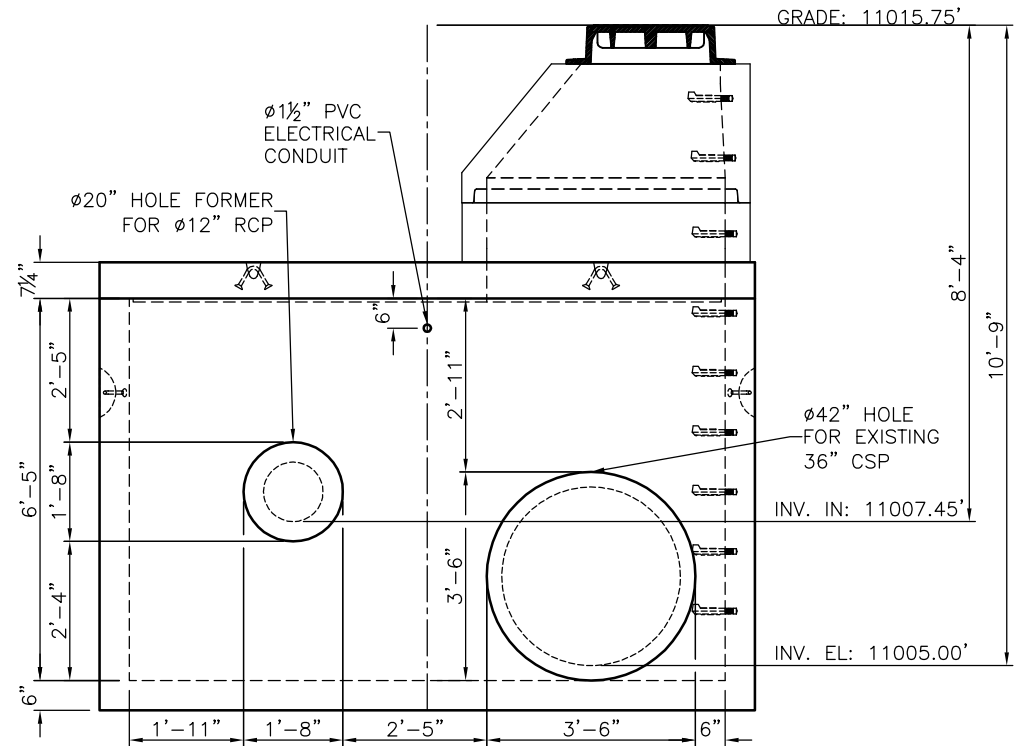
9'-0" x 10'-0" x 6'-5" VAULT  
SUBMITTAL DRAWING  
EJMT-FFSS  
COLORADO

CUSTOMER  
**BARNARD CONSTRUCTION**

DATE	SALES SF	DRAWN BS	ENGINEER	CHECKED	SALES ORDER
6/4/15					
DRAWING NUMBER				REVISION	SHEET
110-Manhole 2					S & D 1013



VIEW C  
SCALE: 5/16" = 1'-0"



VIEW D  
SCALE: 5/16" = 1'-0"



06/23/15

**\*\*FLOW CHANNEL FOR EXISTING 36" CSP TO BE COMPLETED IN FIELD BY OTHERS\*\***

**Oldcastle Precast®**  
 8392 RIVERVIEW PARKWAY, LITTLETON, CO 80125  
 PHONE: 303-791-1100 FAX: 303-791-1120

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9'-0" x 10'-0" x 6'-5" VAULT  
 SUBMITTAL DRAWING  
 EJMT-FFSS  
 COLORADO

CUSTOMER  
**BARNARD CONSTRUCTION**

DATE	SALES SF	DRAWN BS	ENGINEER	CHECKED	SALES ORDER
6/4/15					

DRAWING NUMBER	REVISION	SHEET
110-Manhole 2	S & D 1	1023

Job Name: EJMT Fire Suppression

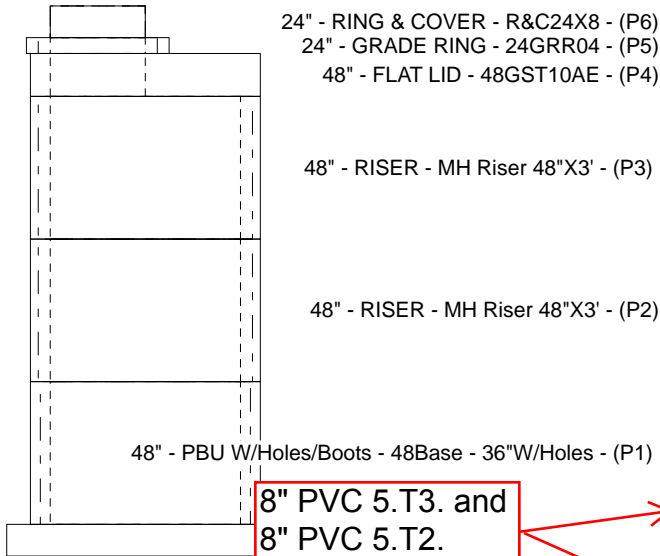


- 1) 24" - RING & COVER - R&C24X8
- 1) 24" - GRADE RING - 24GRR04
- 1) 48" - FLAT LID - 48GST10AE
- 1) 48" - RISER - MH Riser 48"X3'
- 1) 48" - RISER - MH Riser 48"X3'
- 1) 48" - PBU W/Holes/Boots - 48Base - 36"W/Holes
- 3) 48" - Conseal - 1" Conseal
- 2) 16" - HOLE
- 2) 12" - HOLE
- 9) Step - 8503700

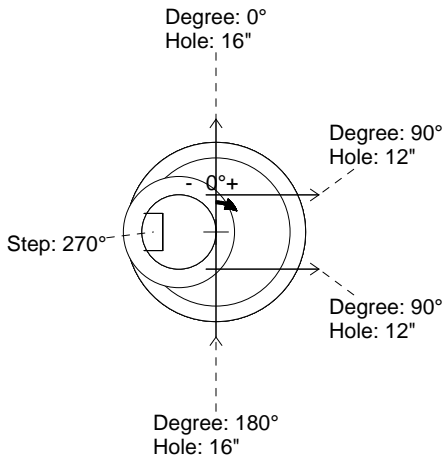
Structure ID: **Manhole #5**

Size: 48"  
Rim to Invert: 10.77'  
Step Position: 270°  
Floor (Top): 999.063'

Identify number of steps required. Step shall be placed a maximum of 16" apart.



Position	Elev	Angle	Hole	UP (L)	Pipe	Connector
Rim	1010'					
Reducer						
Invert 1	999.23'	0°	16"	0"	12" PVC	16" HOLE
Invert 2	1006.2'	90°	12"	11.64"	8" PVC	12" HOLE
Invert 3	1006.2'	90°	12"	11.64"	8" PVC	12" HOLE
Invert 4	999.28'	180°	16"	0.6"	12" PVC	16" HOLE
Invert 5						
Invert 6						
Invert 7						
Invert 8						



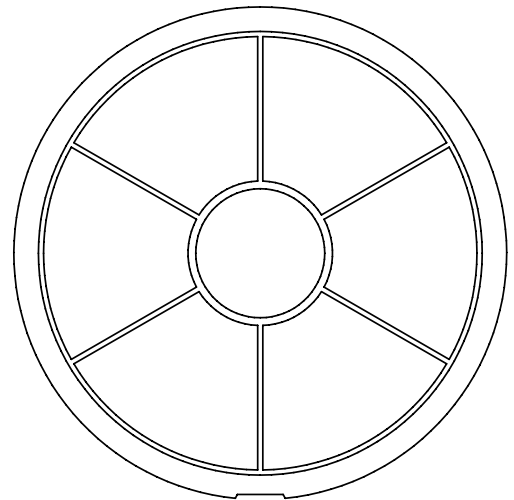
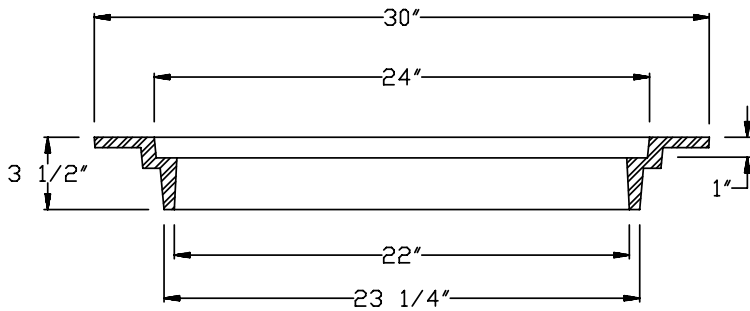
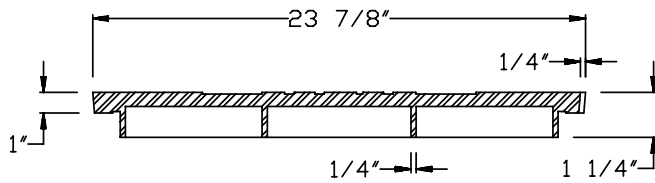
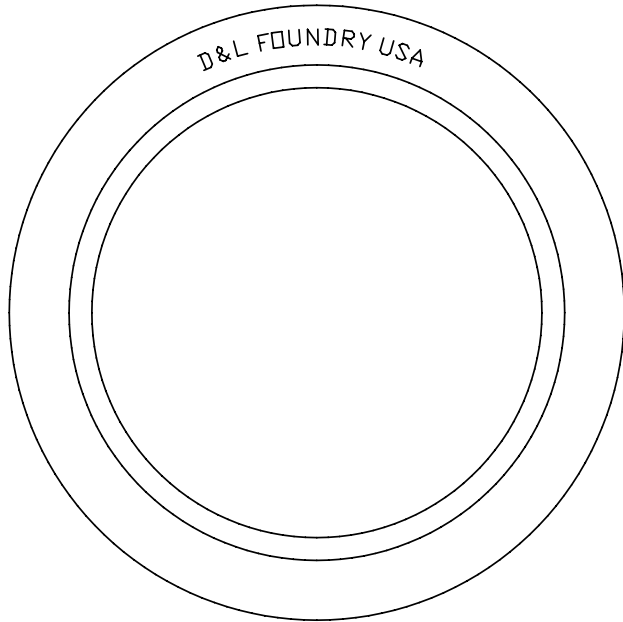
Bottom of Hole - Left - Top of Floor


	0°	90°	180°	270°	360°
(P3)	②	③	11.64"	11.64"	
(P2)					
(P1)	①		④	0.6"	

- (P3) - 48" - RISER - MH Riser 48"X3'
- (P2) - 48" - RISER - MH Riser 48"X3'
- (P1) - 48" - PBU W/Holes/Boots - 48Base - 36"W/Holes

**B-5086**

# Manhole Ring and Cover



CAST IRON to conform to ASTM A-48, CLASS 35B	<b>D&amp;L No. B-5086</b>		 D&L Foundry P.O. Box 1319 Moses Lake, WA 98837 Phone: (509) 765-7952 Fax: (509) 765-8124		
	Est. weight	185 lbs.			
Designation B-5086	Date of Drawing MAR 1994	Prepared by D&L Supply	Scale 1" = 9 1/4"	Sheet Number 1	Total Sheets 1

8392 Riverview Pkwy.  
Littleton, CO 80125

PHONE: 303-791-1100  
FAX: 303-791-1120

**ANALYSIS AND DESIGN OF UNDERGROUND  
PRECAST CONCRETE STRUCTURES  
USING ULTIMATE STRENGTH DESIGN METHODS**

<b>VAULT:</b>	Barnard Construction - Eisenhower Tunnel BBMH#2		
<b>SIZE:</b>	9'-0" x 10'-0" x 6'-5"		
<b>PRODUCTS INCLUDED:</b>	<b>ID#</b>	<b>COMMENTS</b>	
LID	0		
<b>BOTTOM SECTION</b>			

**APPLICABLE CODES:**

- [1]-AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
- [2]-BUILDING CODE REQUIREMENTS for REINFORCED CONCRETE: ACI 318-11
- [3]-ASTM STANDARD PRACTICE for MINIMUM STRUCTURAL DESIGN LOADING for UNDERGROUND PRECAST CONCRETE WATER AND WASTEWATER STRUCTURES: C890

**MATERIAL PROPERTIES:**

- 1) CEMENT: ASTM C-150 SPECIFICATIONS
- 2) STEEL REINFORCEMENT:  
REBAR - ASTM A-615 GRADE 60 OR A706 GRADE 60  
WWF - ASTM A-185 GRADE 65
- 3) CHEMICAL ADMIXTURES: ASTM C-494 SPECIFICATIONS
- 4) AIR -ENTRAINMENT ADMIXTURES FOR CONCRETE: ASTM C-260 SPECIFICATIONS
- 5) FLY ASH: ASTM C-618 SPECIFICATIONS
- 6) AGGREGATES: ASTM C-33 SPECIFICATIONS



06/23/15

**ALL PRODUCTS ARE DESIGNED AND APPROVED BY AN IN-HOUSE PROFESSIONAL ENGINEER.**

<b>Designed By:</b>	<b>Patrick McGinnis, PE</b>
<b>Checked By:</b>	Jason Martin, PE

**NOTE:** Code selection is predicated on most stringent design criteria and/or practical engineering science. Upon request, Oldcastle Precast will furnish copies of any raw-material certifications that are required to prove compliance with the above referenced specifications

22-Jun-15  
04:13:54 PM

**BASIC DESIGN PARAMETERS AND INPUT DATA**

CODE REFERENCES ARE MADE WHEN APPLICABLE/OTHERWISE BASIC ENGINEERING APPLIES

INPUT TYPE OF STRUCTURE "U" for Utility, "W" for Water Related	<b>W</b>	LOCATION:	<b>110</b>
VAULT:	<b>Barnard Construction - Eisenhower Tunnel BBM#2</b>	SIZE:	<b>9'-0" x 10'-0" x 6'-5"</b>

PRINTOUT?

NOTE: **PLACEMENT OF REBAR: INCHES OF COVER FROM TENSION SURFACE**

MACROS	COMPONENT CHECKLIST:	PRODUCT ID	MARK WITH "X"	THICKNESS OR INSIDE HEIGHT.		COVER (IN) 0 = CL	Y or N
Shear&Moment							
Vu	Mu	LID	x	8.00	IN	1.50	Y
Vu	Mu	TOP SECTION		0.00	FT	0.00	N
Vu	Mu	RISER		0.00	FT	0.00	N
Vu	Mu	BOTTOM SECTION	x	6.42	FT	0.00	Y
Vu	Mu	BASE OF A BOTTOM SECTION		6.00	IN	1.50	Y
		WALL THICKNESS		6.00	IN	Buoyancy	N
		INSIDE VAULT WIDTH(SHORT)		9.00	FT	Cover Page	Y
		INSIDE VAULT WIDTH(LONG)		10.00	FT	Design Criteria	Y

DATA COMMON TO ALL COMPONENTS:	VALUE	UNITS	NOTES
fy	60,000	PSI	GRADE 60
fc	6,000	PSI	@ 28 DAYS
DEPTH OF FILL	6.00	FEET	ON LID
LAT. LL SURCHARGE DETERMINED FOR EACH SECTION			
SOIL DENSITY	120	PCF	DRY WT
EQUIVALENT SOIL FLUID PRESSURE	40	PCF	ON WALLS
WATER TABLE "YES" or "NO"	YES		81.60 PCF ON WALLS
WATER DEPTH:	10.00	FEET	BELOW GRADE
LIVE LOADING:	HL-93		16 KIP WHEEL LOAD
			64 PSF UNIFORM LL
DESIGN STANDARD:	AASHTO LRFD-12	Exposure	

AASHTO LRFD 3.11.6.4

NOTE: LOAD FACTORS, CRACK CONTROL, AND PHI FACTORS WILL BE AFFECTED BY DESIGN STANDARDS SPECIFIED

LOAD FACTORS:	LF	NOTES
LIVE LOAD FACTOR: AASHTO LRFD 3.4	1.75	
DEAD LOAD FACTOR: AASHTO LRFD 3.4	1.25	
HORIZONTAL SOIL LOAD FACTOR: AASHTO LRFD 3.4	1.50	
VERTICAL SOIL LOAD FACTOR: AASHTO LRFD 3.4	1.30	
LL SURCHARGE LOAD FACTOR: AASHTO LRFD 3.4	1.75	

PLAN VIEW DIMENSIONS:	VALUE	UNITS
OUTSIDE LID/BASE WIDTH	10.00	FEET
OUTSIDE LID/BASE LENGTH	11.00	FEET
INSIDE VAULT WIDTH	9.00	FEET
INSIDE VAULT LENGTH	10.00	FEET

**SUMMARY OF WEIGHTS AND SOIL LOADING (UNFACTORED) ON COMPONENTS:**

WEIGHT LBS	COMPONENT	"X" FT	VERTICAL PSF	LAT. PRESSURE (PSF) (NO SURCH.)	POSITION OF "X" FROM TOP OF SOIL
11000.00	LID	6.00	720.00		TOP OF LID
	LID	6.67		266.67	BOTTOM OF LID
0.00	TOP SECTION	6.67		266.67	BOTTOM OF WALL
0	RISER	6.67		266.67	BOTTOM OF WALL
27500	BOTTOM SECTION (Includes Apron)	6.67		266.67	TOP OF WALL
	BASE OF A BOTTOM SECTION	13.08	1070.00	651.60	TOP OF BASE

38500 LBS. - TOTAL WEIGHT OF CONCRETE (DOES NOT INCLUDE PENETRATIONS, BLOCKOUTS, OR ACCESS HOLES)

256.7 CUBIC FT. - TOTAL VOLUME OF CONCRETE

PAGE 1

**SHEAR ANALYSIS OF LID:**

**BASIC DATA**

INSIDE VAULT WIDTH	9.00 FEET
INSIDE VAULT LENGTH	10.00 FEET
WALL THICKNESS	6 INCHES
RATIO: LENGTH:WIDTH	1.11
<b>TWO-WAY SLAB DESIGN:</b>	
% OF LOAD IN SHORT DIRECTION	57.45%
% OF LOAD IN LONG DIRECTION	42.55%
SLAB THICKNESS	8 INCHES
SHORT SPAN LENGTH	9.50 FEET
LONG SPAN LENGTH	10.50 FEET

AASHTO 3.24.6.1

AASHTO 3.24.6.1

AASHTO 3.24.6.1

Special Circ. **No Change**

**DEAD LOADS: ultimate**

SLAB, WuDL:	0.125 KSF
OVERBURDEN, WuSL:	0.936 KSF
WuDL TOTAL=	1.061 KSF

**LIVE LOAD: ultimate**

CONTROLLING WHEEL LOAD(P)	60 KIPS
IMPACT	8%
<b>WHEEL FOOTPRINT ON LID:</b>	
WIDTH OF FOOTPRINT	11.73 FEET
LENGTH OF FOOTPRINT	14.57 FEET
WuLL (PATCH LOAD)	0.67 KSF
PU	113.66 KIPS

AASHTO LRFD 3.6.2

AASHTO LRFD 3.6.1.2.5

WHEEL(S) DISTRIBUTED THROUGH FILL

WHEEL(S) DISTRIBUTED THROUGH FILL

**SHEAR ANALYSIS: SHORT DIRECTION**

**NOTES:**

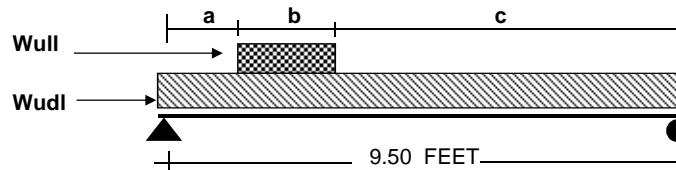
CALCULATE SHEAR @:	<b>"Face of Support"</b>	
a	0.25 FEET	50% OF WALL
b	9.25 FEET	LIVE LOAD LENGTH
c	0.00 FEET	LENGTH TO OTHER END
	9.50 FEET	SPAN LENGTH

ASSUMED REBAR FOR SHEAR:	<b>#5 REBAR</b>
CONCRETE COVER TO REBAR:	1.50 INCH
EFFECTIVE DEPTH, d <sub>eff</sub> :	6.19 INCH

The assumed rebar is used to estimate the effective depth for shear calculations only. It does not represent the required reinforcing diameter.

Access Type **N/A**

$V_u(LL) = \% * (W_{uLL})(b) / ((2c) + b) / 2l$	2.05 KIPS/FT	E=	<b>1.00</b>
$V_u(DL+Lane Load) = W_u(l/2-a)$	2.74 KIPS/FT		
<b>V<sub>u</sub> =</b>	<b>4.79 KIPS</b>	<b>ACTUAL V<sub>u</sub> PER FT-WIDTH</b>	
f' shear	0.90		
b=	12 INCHES		<b>OK</b>
d=	6.19 INCHES		
<b>f'V<sub>c</sub>=</b>	<b>9.80 KIPS</b>	<b>ALLOW.V<sub>c</sub> PER FT-WIDTH</b>	LRFD 5.8.3.3



**Shear Overdesign %**

Short Dir.: 51.1%  
Long Dir.: 59.0%

**PUNCHING SHEAR ANALYSIS: LL ON ACCESS HOLE**

OPENING SIZE	<b>48</b> IN	<b>Circular</b>
PERIMETER "b <sub>o</sub> " WITH FULL WHEEL	6.50 FEET @ d/2 from opening	
"PU for one Wheel"	36.40 KIP	
DEPTH CAST IN ELEMENT	<b>0</b> IN	<b>OK</b>
<b>f'V<sub>c</sub>=</b>	<b>134.58</b> KIP	

**MOMENTS/As OF LID:**

**BASIC DATA**

INSIDE VAULT WIDTH	9.00 FT
INSIDE VAULT LENGTH	10.00 FT
WALL THICKNESS	6.00 INCHES
RATIO: LENGTH:WIDTH	1.11
<b>TWO-WAY SLAB DESIGN:</b>	
% OF LOAD IN SHORT DIRECTION	57.45%
% OF LOAD IN LONG DIRECTION	42.55%
SLAB THICKNESS	8 INCHES
SHORT SPAN LENGTH	9.50 FEET
LONG SPAN LENGTH	10.50 FEET

AASHTO 3.24.6.1  
 AASHTO 3.24.6.1  
 AASHTO 3.24.6.1

**DEAD LOADS:**

SLAB	0.125 KSF
OVERBURDEN	0.936 KSF
Wudl=	1.061 KSF

**LIVE LOAD:**

CONTROLLING WHEEL LOAD(P)	60 KIPS
IMPACT	8%
WHEEL FOOTPRINT ON LID:	
WIDTH OF FOOTPRINT	11.73 FEET
LENGTH OF FOOTPRINT	14.57 FEET
WuLL (PATCH LOAD)	0.67 KSF
PU	113.66 KIPS

AASHTO LRFD 3.6.2  
 AASHTO LRFD 3.6.1.2.5  
 WHEEL(S) DISTRIBUTED THROUGH FILL  
 WHEEL(S) DISTRIBUTED THROUGH FILL

ANALYSIS OF 1' WIDE STRIP

**AASHTO LRFD 5.7.3.2**

	SHORT SPAN	LONG SPAN	
a	0.00	0.00	END TO LOAD
b	9.50	10.50	LOAD LENGTH
c	0.00	0.00	LOAD TO OTHER END
SPAN LENGTH	9.50	10.50	FEET
%OF LOAD	57.45%	42.55%	
MAX REACTION FOR MOMENT	6.14	4.76	KIPS/FT
CONTROLLING CASE	Uniform Load	Uniform Load	E short= <b>1.000</b> E long= <b>1.00</b>
LOCATION OF Mmax	4.75	5.25	FEET FROM MAX REACTION END
<b>Mu Max =</b>	<b>11.97</b>	<b>10.83</b>	FT-KIPS AT MAX MOMENT LOCATION
<b>Mwsd Max =</b>	<b>8.04</b>	<b>7.27</b>	FT-KIPS AT MAX MOMENT LOCATION
b=	12	12	INCHES WIDTH OF STRESS BLOCK
d=	6.19	5.56	INCHES
<b>As req'd (Neg indicates As min)</b>	<b>0.400</b>	<b>0.404</b>	<b>SQ INCHES (min or 133% of req'd or req'd)</b>
check <b>As provided</b>	<b>0.669</b>	<b>0.669</b>	<b>SQ INCHES</b>
input REBAR SIZE #	<b>5</b>	<b>5</b>	#
input REBAR SPACING	<b>5.50</b>	<b>5.50</b>	INCHES
Phi * Mn = (Moment Capacity)	<b>19.61</b>	<b>17.52</b>	FT-KIPS AASHTO LRFD 5.7.3.2

**CRACK CONTROL: MIDDLE OF SHORT SPAN AASHTO LRFD 5.10.3.2 & 5.7.3.4**

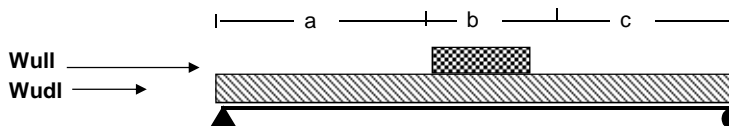
fs	25.78 KSI
dc	1.81 INCHES
<b>Actual Spacing, S</b>	<b>5.5 INCHES O.C.</b>
check <b>Smax</b>	<b>15.5 in</b>

CRACK CONTROL CHECK

OK

LONG DIRECTION CHECK

OK





**SHEAR ANALYSIS OF BOTTOM SECTION**

**BASIC DATA**

INSIDE VAULT WIDTH	9.00 FT
INSIDE VAULT LENGTH	10.00 FT
WALL THICKNESS	6.00
INSIDE HEIGHT	6.42
<b>TWO WAY WALL DESIGN:</b>	
% OF LOAD IN CANTILEVER DIRECTION	14.10%
% OF LOAD IN LONG WALL/BENDING	85.90%
SLAB THICKNESS	6.00 INCHES
SHORT SPAN LENGTH	9.50 FEET
LONG SPAN LENGTH	10.50 FEET
DEPTH TO TOP OF WALL	6.67 FEET
DEPTH TO BOTTOM OF WALL	13.08 FEET

STIFFNESS METHOD..AASHTO 8.6

STIFFNESS METHOD..AASHTO 8.6

Special Circ. **No Change**

**LATERAL SOIL PRESSURES: ultimate**

$W_{LLS} =$	0.140 KSF	<b>Apply Live Load Surcharge Pressure:</b> <b>YES</b>
$W_a =$	0.400 KSF	
$W_b @ "d" =$	0.542 KSF	
$W_b$	0.577 KSF	

ASSUMED REBAR FOR SHEAR:	<b>#4 REBAR</b>
CONCRETE COVER TO VERT. REBAR:	<b>2.25</b> INCH
CONCRETE COVER TO HORIZ. REBAR:	<b>2.75</b> INCH
EFFECTIVE DEPTH, $d_{eff}$ CANTILEVER:	<b>3.50</b> INCH
EFFECTIVE DEPTH, $d_{eff}$ HORIZONTAL:	<b>3.00</b> INCH

The assumed rebar is used to estimate the effective depth for shear calculations only. It does not represent the required reinforcing diameter.

Single, Outside Mat Only W/ Clearance to L-Bars

**NO**

**SHEAR VALUES: @TOP OF BASE (CANTILEVER DIRECTION)**

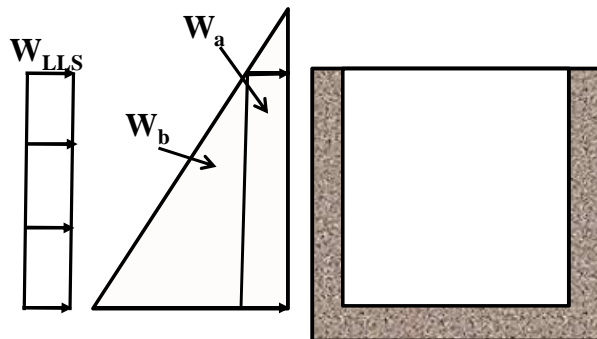
$x = \text{SPAN} - "d"$	6.13 FT	
$V_u @ "d" =$	<b>0.70 KIPS</b>	<b>ACTUAL <math>V_u</math> PER FT</b>
$f$ shear	0.90	
$b =$	12.00 INCHES	<b>OK</b>
$d =$	3.50 INCHES	
$fV_c =$	<b>7.22 KIPS</b>	<b>ALLOW. <math>V_c</math> PER FT</b>

LRFD 5.8.3.3

**SHEAR VALUES: @END OF LONG WALL**

$x = \text{SPAN} - 2"d"$	9.50 FT	
$V_u @ "d" =$	<b>3.38 KIPS</b>	<b>ACTUAL <math>V_u</math> PER FT</b>
$f$ shear	0.90	
$b =$	12.00 INCHES	<b>OK</b>
$d =$	3.00 INCHES	
$fV_c =$	<b>7.22 KIPS</b>	<b>ALLOW. <math>V_c</math> PER FT</b>

LRFD 5.8.3.3



Bottom Section - Elevation View - Loading

**MOMENT/As IN WALL OF BOTTOM SECTION**

input required on this sheet

INSIDE VAULT WIDTH	9.00 FT
INSIDE VAULT LENGTH	10.00 FT
WALL THICKNESS	6.00 IN
INSIDE HEIGHT	6.42 FT
<b>TWO WAY WALL DESIGN:</b>	
% OF LOAD IN CANTILEVER DIRECTION	14.10%
% OF LOAD IN LONG WALL/BENDING	85.90%
SLAB THICKNESS	6.00 INCHES
SHORT SPAN LENGTH	9.50 FEET
LONG SPAN LENGTH	10.50 FEET
DEPTH TO TOP OF WALL	6.67 FEET
DEPTH TO BOTTOM OF WALL	13.08 FEET

STIFFNESS METHOD..AASHTO 8.6  
 STIFFNESS METHOD..AASHTO 8.6  
 STIFFNESS METHOD..AASHTO 8.6

**LATERAL SOIL PRESSURES: ultimate**

$W_{LLS}$ =	0.140 KSF	<b>Apply Live Load Surcharge Pressure:</b> <b>YES</b>
$W_a$ =	0.400 KSF	
$W_b$ =(@H/2)	0.289 KSF	

+or-M

ANALYSIS OF 1' WIDE STRIP

**AASHTO LRFD 5.7.3.2**

	CANT. SPAN	BENDING LONG L	BENDING CORNER	BENDING SHORT L	
SPAN LENGTH	6.42	10.50		9.50	FEET
%OF LOAD	14.10%	85.90%	85.90%	85.90%	
Mudl due to $W_{LLS}$ :	0.41	0.65	1.01	0.35	
Mudl due to $W_a$	1.16	1.85	2.88	0.99	FT-KIPS PER FT OF WIDTH
Mudl due to $W_b$	0.56	1.34	2.08	0.72	FT-KIPS PER FT OF WIDTH
<b>Mu=</b>	<b>2.13</b>	<b>3.83</b>	<b>5.98</b>	<b>2.05</b>	FT-KIPS PER FT OF WIDTH
<b>Mwsd=</b>	<b>1.38</b>	<b>2.49</b>	<b>3.89</b>	<b>1.34</b>	FT-KIPS PER FT OF WIDTH
b=	12	12	12	12	INCHES WIDTH
d=	3.50	3.00	3.00	3.00	INCHES
As req'd (Neg indicates As min)	-0.164	0.267	0.428	-0.186	SQ INCHES (min or req'd)
check As provided	0.262	0.673	0.673	0.673	SQ INCHES
input REBAR SIZE #	4	4	4	4	#
input REBAR SPACING	9.00	3.50	3.50	3.50	INCHES
Phi * Mn = (Moment Capacity)	4.41	8.99	8.99	8.99	FT-KIPS AASHTO LRFD 5.7.3.2
INFLECTION POINT	N/A	23.6	N/A	28.2	INCHES FROM CL OF WALL

check  $\phi M_n > M_u$  **OK**

EVERY OTHER VERT. BAR MAY BE STOPPED 12 INCHES UP FROM THE INSIDE OF THE BOTTOM SLAB AASHTO LRFD 5.11.1.2

**CRACK CONTROL: CORNER AASHTO LRFD 5.10.3.2 & 5.7.3.4**

$f_s$	26.53 KSI
$d_c$	3.00 INCHES
Actual Spacing, S	3.5 INCHES O.C.
check $S_{max}$	4.9 in

CRACK CONTROL CHECK **OK**

LONGWALL CRACK CONTROL CHECK: **OK**

**CRACK CONTROL: CANTILEVER AASHTO LRFD 5.10.3.2 & 5.7.3.4**

$f_s$	19.68 KSI
$d_c$	2.50 INCHES
Actual Spacing, S	9.0 INCHES O.C.
check $S_{max}$	12.6 in

CRACK CONTROL CHECK **OK**

**SHEAR ANALYSIS OF BOTTOM SECTION SLAB:**

**BASIC DATA**

INSIDE VAULT WIDTH	9.00 FEET
INSIDE VAULT LENGTH	10.00 FEET
WALL THICKNESS	6.00 INCHES
RATIO: LENGTH:WIDTH	1.11
<b>TWO-WAY SLAB DESIGN:</b>	
% OF LOAD IN SHORT DIRECTION	59.88%
% OF LOAD IN LONG DIRECTION	40.12%
SLAB THICKNESS	6 INCHES
SHORT SPAN LENGTH	9.50 FEET
LONG SPAN LENGTH	10.50 FEET

AASHTO 3.24.6.1

AASHTO 3.24.6.1

AASHTO 3.24.6.1

Special Circ. **No Change**

**DEAD LOADS: ultimate**

STRUCTURE WEIGHT (un-factored):	38.50 KIPS
UNIFORM LOAD DUE TO Weight, $W_{uDC}$ :	0.438 KSF
OVERBURDEN, $W_{uEV}$ :	0.936 KSF
$W_{uDL}$ Total=	1.374 KSF

**LIVE LOAD: ultimate (Wull only)** *(NOTE: Program determines worse case loading condition and direction of traffic)*

CONTROLLING LOAD CASE:	2.574 WHEELS TOTAL ON TOP	
		<b>NOTES:</b>
TOTAL DISTRIBUTED LIVE LOAD (on base)	38.62 KIPS	64PSF UNIFORM LIVE LOAD INCLUDED
TRANSFERRED TO BASE(ultimate):	74.62 KIPS	
IMPACT:	0.00%	
DISTRIBUTION AREA (Outside areas of Vault):	110.00 FEET <sup>2</sup>	
$W_{uLL}$ : including Lane Load	0.79 KSF	

ASSUMED REBAR FOR SHEAR:	<b>#5 REBAR</b>
CONCRETE COVER TO REBAR:	1.50 INCH
EFFECTIVE DEPTH, $d_{eff}$ :	4.19 INCH

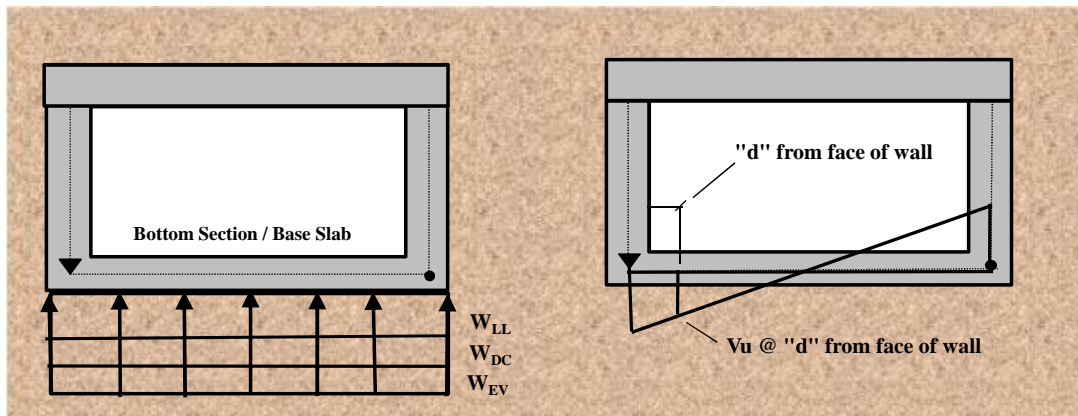
The assumed rebar is used to estimate the effective depth for shear calculations only. It does not represent the required reinforcing diameter.

**SHEAR ANALYSIS: SHORT DIRECTION**

$a=50\%$ OF WALL + d	0.60 FT	50% OF WALL + d, CHANGE IF HAUNCH
PLATE ANALYSIS COEFFICIENT	0.357	$V(END) = C * w * l$
$V_u$ @ END =	7.35 KIPS	

$V_u$ @ "a" =	6.57 KIPS	<b>ACTUAL <math>V_u</math> PER FT</b>
$f$ shear	0.90	
b =	12.00 INCHES	WIDTH
d =	4.19 INCHES	
$fV_c$ =	7.22 KIPS	<b>ALLOW. <math>V_u</math> PER FT</b>

LRFD 5.8.3.3



Shear Overdesign Short Direction: 9.0%  
 Shear Overdesign Long Direction: 9.2%

**MOMENTS/As OF BOTTOM SECTION SLAB:**

**BASIC DATA**

INSIDE VAULT WIDTH	9.00 FT
INSIDE VAULT LENGTH	10.00 FT
WALL THICKNESS	6
RATIO: LENGTH:WIDTH	1.11
<b>TWO-WAY SLAB DESIGN:</b>	
% OF LOAD IN SHORT DIRECTION	59.88% MOMENT
% OF LOAD IN LONG DIRECTION	40.12% MOMENT
SLAB THICKNESS	6 INCHES
SHORT SPAN LENGTH	9.50 FEET
LONG SPAN LENGTH	10.50 FEET

AASHTO 3.24.6.1  
 AASHTO 3.24.6.1  
 AASHTO 3.24.6.1

**DEAD LOADS: ultimate**

STRUCTURE WEIGHT (un-factored):	38.50 KIPS
UNIFORM LOAD DUE TO Weight, $W_{uDC}$ :	0.438 KSF
OVERBURDEN, $W_{uEv}$ :	0.936 KSF
$W_{uDL}$ Total=	1.374 KSF

**LIVE LOAD: ultimate (Wull only)**

CONTROLLING LOAD CASE: 2.574 WHEELS TOTAL ON TOP	
<b>NOTES:</b>	
TOTAL WHEEL/AXLE LOAD (P)(above lid)	38.62 KIPS
TRANSFERRED TO BASE(ultimate):	74.62 KIPS
IMPACT:	0.00%
DISTRIBUTION AREA (Outside areas of Vault)	110.00 FEET <sup>2</sup>
$W_{uLL}$ :	0.79 KSF

ANALYSIS OF 1' WIDE STRIP	SHORT SPAN	LONG SPAN	Mid-span moment multiplication factor due to degree of fixity:	
<b>AASHTO LRFD 5.7.3.2</b>			0.907	SOME FIXITY
SPAN LENGTH	9.50	10.50	FEET	
PLATE MOMENT COEFF. ( $c * w * L^2$ )	0.052	0.0368		
			REACTION AT END/FT WIDTH	
$M_{udl}@L/2=$	5.85	5.06	FT-KIPS	PER FT WIDTH
$M_{ull}@l/2$	3.37	2.91	FT-KIPS	PER FT WIDTH
<b><math>M_u@l/2 =</math></b>	<b>9.22</b>	<b>7.97</b>	FT-KIPS	PER FT WIDTH
<b><math>M_{wsd}@l/2</math></b>	<b>6.49</b>	<b>4.81</b>	FT-KIPS	PER FT WIDTH
b=	12.00	12.00	INCHES	WIDTH
d=	4.19	3.56	INCHES	
<b>As req'd (Neg indicates As min)</b>	<b>0.466</b>	<b>0.479</b>	<b>SQ INCHES (min or 133% of req'd or req'd)</b>	
check <b>As provided</b>	<b>0.614</b>	<b>0.614</b>	<b>SQ INCHES</b>	
input REBAR SIZE #	<b>5</b>	<b>5</b>	#	
input REBAR SPACING	<b>6.00</b>	<b>6.00</b>	INCHES	
$\Phi * M_n =$ (Moment Capacity)	<b>11.92</b>	<b>10.01</b>	FT-KIPS	<b>AASHTO LRFD 5.7.3.2</b>

CORNER L-BARS SHALL EXTEND 1.08 FT MIN. INTO BASE FROM THE CENTER OF WALL @ 2.25" BOT. CLR MAX.

**CRACK CONTROL: MIDDLE OF SHORT SPAN AASHTO LRFD 5.10.3.2 & 5.7.3.4**

$f_s$	34.01 KSI
$d_c$	1.81 INCHES
<b>Actual Spacing, S</b>	<b>6.0 INCHES O.C.</b>
check <b>S<sub>max</sub></b>	<b>9.1 in</b>

**CRACK CONTROL CHECK**

**LONG DIRECTION CHECK**

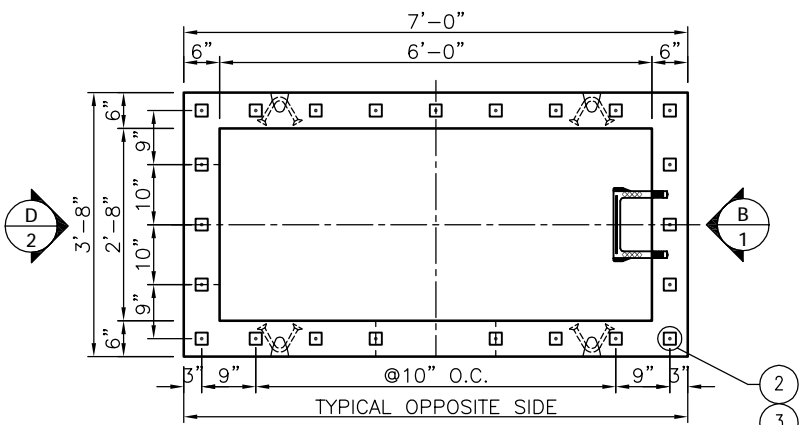
# **Inlet Product Data**

**Operations & Maintenance Manual  
December 2015**

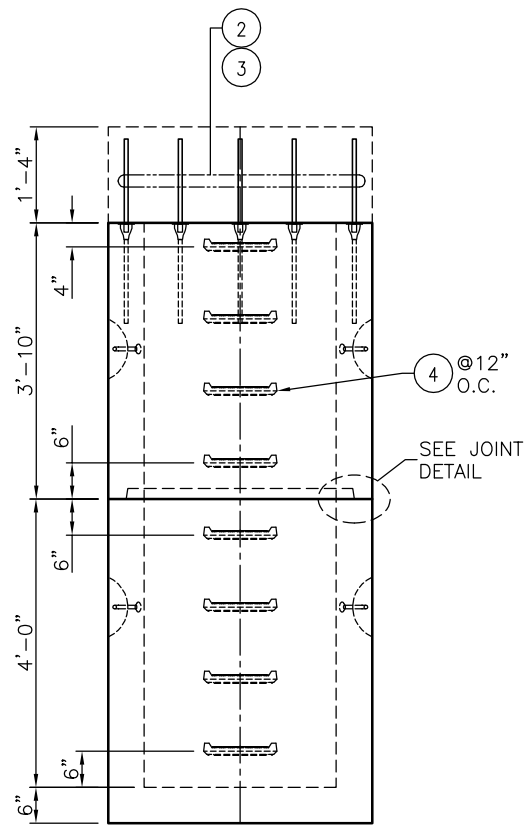
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 APPROVED AS NOTED:   
 REVISE AND RESUBMIT:

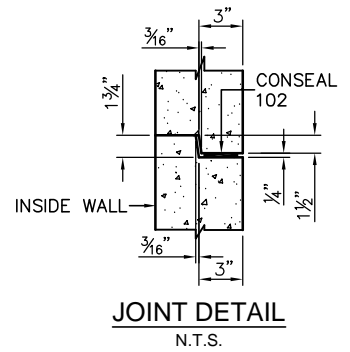
SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_



**VIEW P**  
SCALE: 3/8" = 1'-0"



**VIEW B**  
SCALE: 3/8" = 1'-0"



**JOINT DETAIL**  
N.T.S.

**SHOP NOTES**

1. CONCRETE STRENGTH: 6000 PSI
2. CONCRETE FINISH: SMOOTH FINISH
3. 1500 PSI MINIMUM STRIPPING STRENGTH REQUIRED
4. BASE TO BE ROLLED AFTER STRIPPING

**TOP RISER - BILL OF MATERIALS**

#	QTY	U/M	DESCRIPTION	ITEM #
1	4	EA	4 3/4" MBV6671 V-ANCHOR	8101920
2	23	EA	#5 COUPLER (EPOXY COATED)	8011350
3	46	EA	14" DOWEL MALE	8011230
4	4	EA	MH STEPS	8503700
	1.32	CY	6000 PSI TYPE I/II MIX	8501730
		CWT	#4 EPOXY COATED BAR	8010600

**BASE - BILL OF MATERIALS**

#	QTY	U/M	DESCRIPTION	ITEM #
1	4	EA	4 3/4" MBV6671 V-ANCHOR	8101920
4	4	EA	MH STEPS	8503700
	1.87	CY	6000 PSI TYPE I/II MIX	8501730
		CWT	#4 EPOXY COATED BAR	8010600

**PRODUCT WEIGHTS**

SECTION	WEIGHT (LBS)	VOLUME (CY)
TOP RISER	5,340	1.32
BASE	7,561	1.87

8392 RIVERVIEW PARKWAY, LITTLETON, CO 80125  
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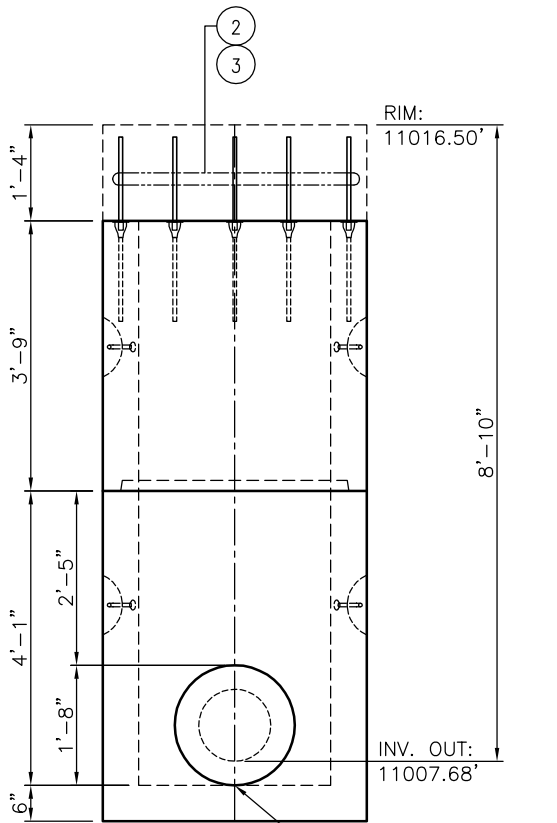
**DOUBLE VANE GRATE INLET**  
 SUBMITTAL DRAWING - DROP INLET 2  
 EISENHOWER TUNNEL  
 COLORADO

CUSTOMER  
**BARNARD INC**

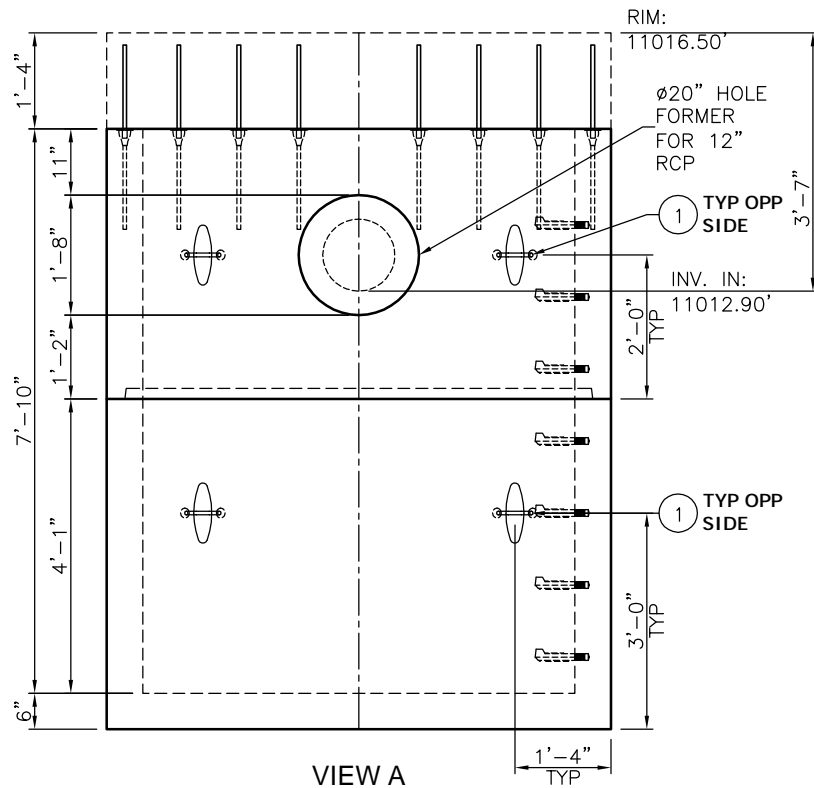
DATE	SALES SF	DRAWN BS	ENGINEER	CHECKED	SALES ORDER
7/1/15					126090
DRAWING NUMBER			REVISION SHEET		
110-126090-DBL VANE_IN2			S & D 2 of 4 2		

**DESIGN NOTES**


- 1) MIN. DESIGN CRITERIA IS AS NOTED UNLESS OTHERWISE SPECIFIED
- 2) DESIGN LOADINGS:  
 A. AASHTO HS - 20 - 44, W/ IMPACT.  
 B. SOIL WEIGHT = 120 PCF  
 C. EQUIV. FLUID PRESSURE = 40 PCF.  
 D. 80 PSF LATERAL LIVE LOAD SURCHARGE
- 3) CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 6000 PSI (MIN.)
- 4) STEEL REINFORCEMENT: REBAR, ASTM A-775 GRADE 60
- 5) CEMENT: ASTM C-150 SPECIFICATIONS



**VIEW D**  
SCALE: 3/8" = 1'-0"  
Ø20" HOLE FORMER FOR 12" RCP



**VIEW A**  
SCALE: 3/8" = 1'-0"



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**DOUBLE VANE GRATE INLET**  
SUBMITTAL DRAWING – DROP INLET 2  
EISENHOWER TUNNEL  
COLORADO

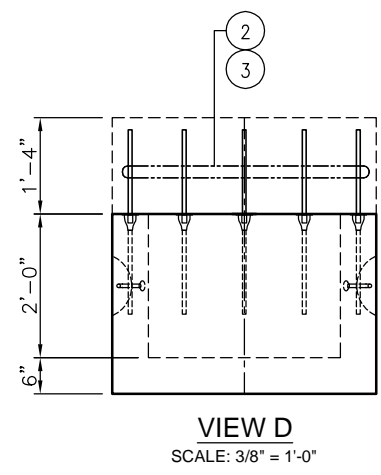
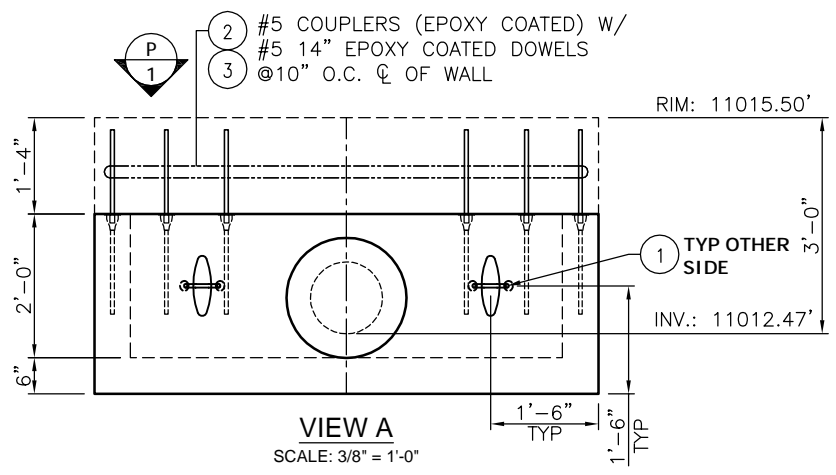
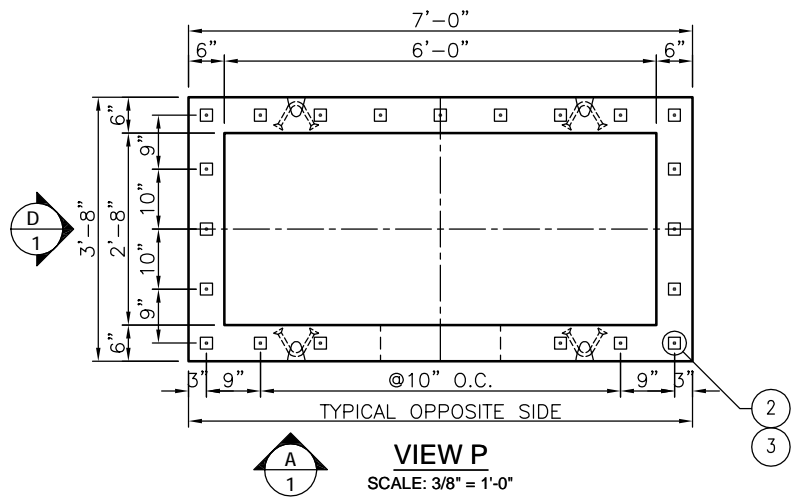
CUSTOMER  
**BARNARD INC**

DATE	SALES	DRAWN	ENGINEER	CHECKED	SALES ORDER
7/1/15	SF	BS			126090
DRAWING NUMBER				REVISION	SHEET
110-126090-DBL VANE_IN2				S & D 2	1 of 2

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APPROVED W/ NO EXCEPTIONS TAKEN:   
 APPROVED AS NOTED:   
 REVISE AND RESUBMIT:

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_



② #5 COUPLERS (EPOXY COATED) W/  
 #5 14" EPOXY COATED DOWELS  
 ③ @10" O.C.  $\phi$  OF WALL

**DESIGN NOTES**

- 1) MIN. DESIGN CRITERIA IS AS NOTED UNLESS OTHERWISE SPECIFIED
- 2) DESIGN LOADINGS:
  - A. AASHTO HS - 20 - 44, W/ IMPACT.
  - B. SOIL WEIGHT = 120 PCF
  - C. EQUIV. FLUID PRESSURE = 40 PCF.
  - D. 80 PSF LATERAL LIVE LOAD SURCHARGE
- 3) CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 6000 PSI (MIN.)
- 4) STEEL REINFORCEMENT: REBAR, ASTM A-775 GRADE 60
- 5) CEMENT: ASTM C-150 SPECIFICATIONS

**SHOP NOTES**

1. CONCRETE STRENGTH: 6000 PSI
2. CONCRETE FINISH: SMOOTH FINISH
3. 1500 PSI MINIMUM STRIPPING STRENGTH REQUIRED
4. BASE TO BE ROLLED AFTER STRIPPING

**BASE - BILL OF MATERIALS**

#	QTY	U/M	DESCRIPTION	ITEM #
1	4	EA	4 3/4" MBV6671 V-ANCHOR	8101920
2	21	EA	#5 COUPLER (EPOXY COATED)	8011350
3	42	EA	14" DOWEL MALE	8011230
	1.15	CY	6000 PSI TYPE I/II MIX	8501730
		CWT	#4 EPOXY COATED BAR	8010600

**PRODUCT WEIGHTS**

SECTION	WEIGHT (LBS)	VOLUME (CY)
BASE	4,661	1.15

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**DOUBLE VANE GRATE INLET**  
 SUBMITTAL DRAWING - DROP INLET 3  
 EISENHOWER TUNNEL  
 COLORADO

CUSTOMER  
**BARNARD INC**

DATE	SALES SF	DRAWN BS	ENGINEER	CHECKED	SALES ORDER
7/1/15					126090
DRAWING NUMBER				REVISION	SHEET
110-126090-DBL VANE_IN3				S & D 4	1 of 6

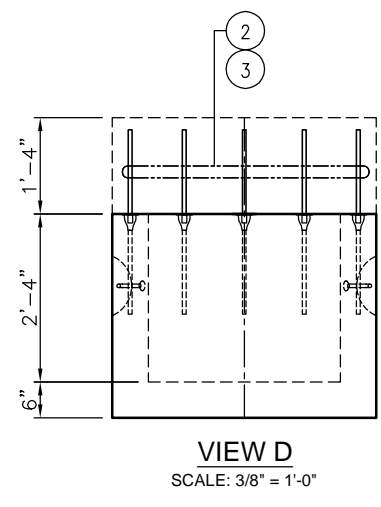
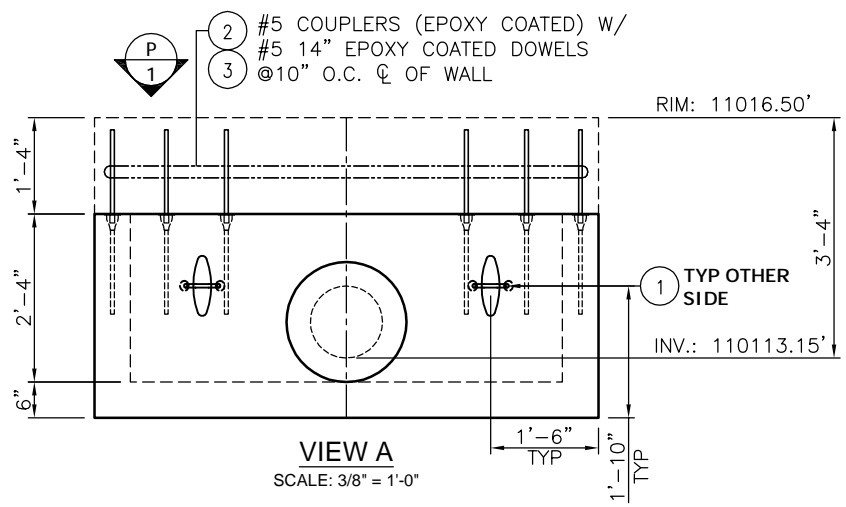
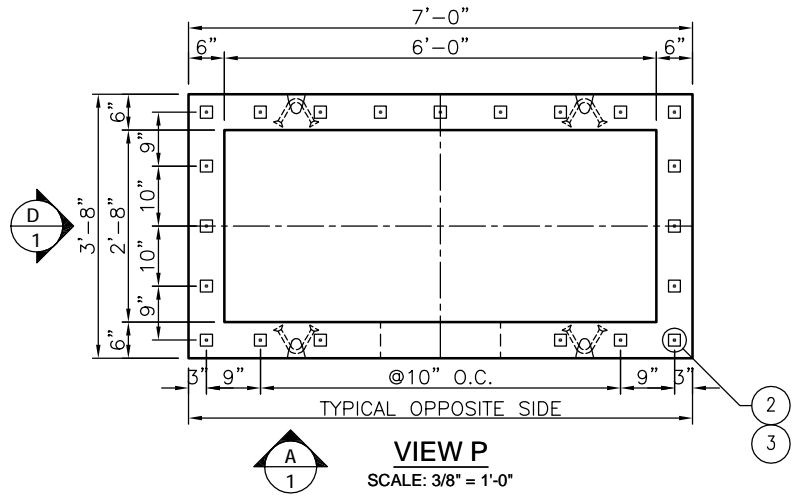


APPROVED W/ NO EXCEPTIONS TAKEN:

APPROVED AS NOTED:

REVISE AND RESUBMIT:

SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_



② #5 COUPLERS (EPOXY COATED) W/  
③ #5 14" EPOXY COATED DOWELS  
① @10" O.C.  $\phi$  OF WALL

### DESIGN NOTES

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- 2) DESIGN LOADINGS:
  - A. AASHTO HS - 20 - 44, W/ IMPACT.
  - B. SOIL WEIGHT = 120 PCF
  - C. EQUIV. FLUID PRESSURE = 40 PCF.
  - D. 80 PSF LATERAL LIVE LOAD SURCHARGE
- 3) CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 6000 PSI (MIN.)
- 4) STEEL REINFORCEMENT: REBAR, ASTM A-775 GRADE 60
- 5) CEMENT: ASTM C-150 SPECIFICATIONS

### SHOP NOTES

1. CONCRETE STRENGTH: 6000 PSI
2. CONCRETE FINISH: SMOOTH FINISH
3. 1500 PSI MINIMUM STRIPPING STRENGTH REQUIRED
4. BASE TO BE ROLLED AFTER STRIPPING

### BASE - BILL OF MATERIALS

#	QTY	U/M	DESCRIPTION	ITEM #
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2	21	EA	#5 COUPLER (EPOXY COATED)	8011350
3	42	EA	14" DOWEL MALE	8011230
	1.27	CY	6000 PSI TYPE I/II MIX	8501730
		CWT	#4 EPOXY COATED BAR	8010600

### PRODUCT WEIGHTS

SECTION	WEIGHT (LBS)	VOLUME (CY)
BASE	5,145	1.27

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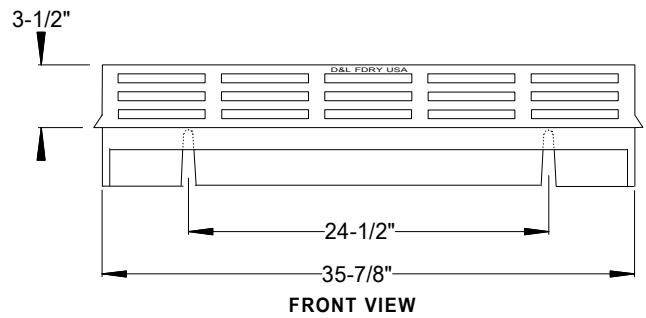
**DOUBLE VANE GRATE INLET**  
SUBMITTAL DRAWING - DROP INLET 4  
EISENHOWER TUNNEL  
COLORADO

CUSTOMER  
**BARNARD INC**

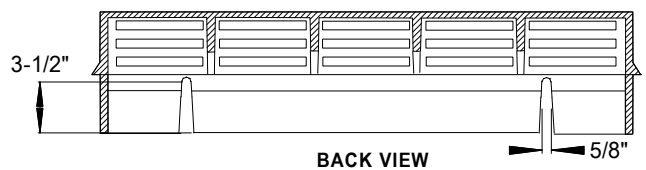
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7/1/15					126090
DRAWING NUMBER				REVISION	SHEET
110-126090-DBL VANE_IN4				S & D 4	1 of 7

# **Inlet Grate Product Data**

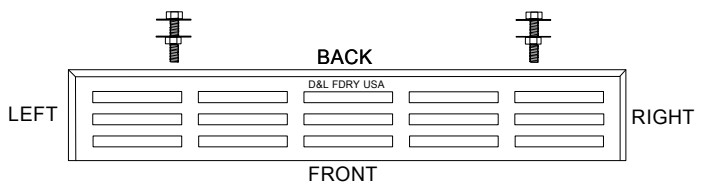
**Operations & Maintenance Manual  
December 2015**



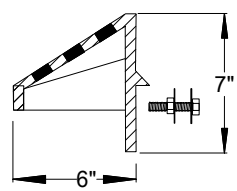
FRONT VIEW



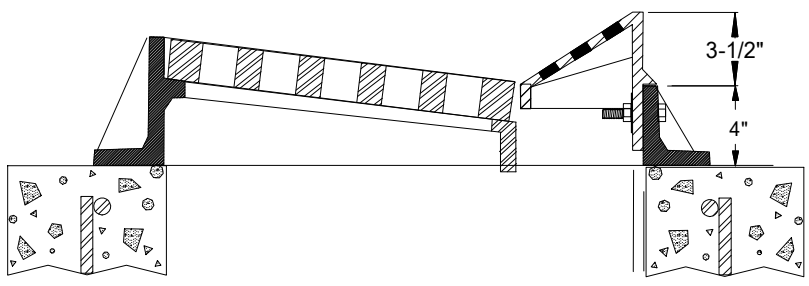
BACK VIEW



CURB HOOD PLATE (TOP VIEW)



SIDE VIEW



THE I-3516 CURB GRATE WILL INTERCHANGE INTO THE I-3520 FRAME

**CAST IRON** conforms to  
 ASTM A-48-93 Class 35B  
 Meets H-20 Wheel Loading

**D&L model No. I-3516-14**  
 Made in Moses Lake, WA. USA

Prepared by: Jesse Walker  
 D&L Foundry & Supply Inc. (not to scale)

Date:  
 January 2009

**D&L Foundry & Supply**

CA Sales: (707) 557-4525 Fax: (707) 557-4655  
 UT Sales: (801) 785-5015 Fax: (801) 785-0835  
 WA Sales: (509) 765-7952 Fax: (509) 765-8124

# I-3516

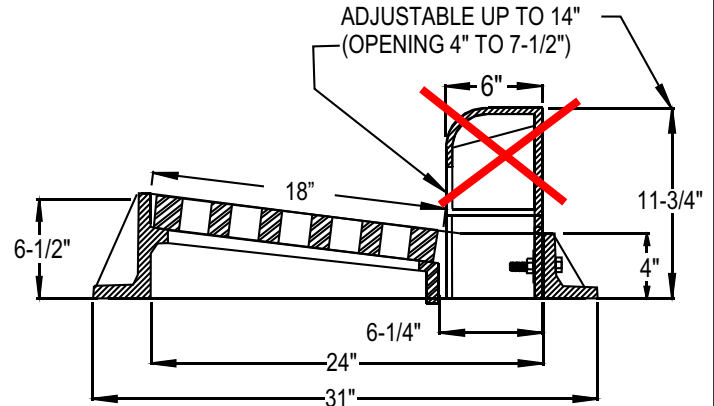
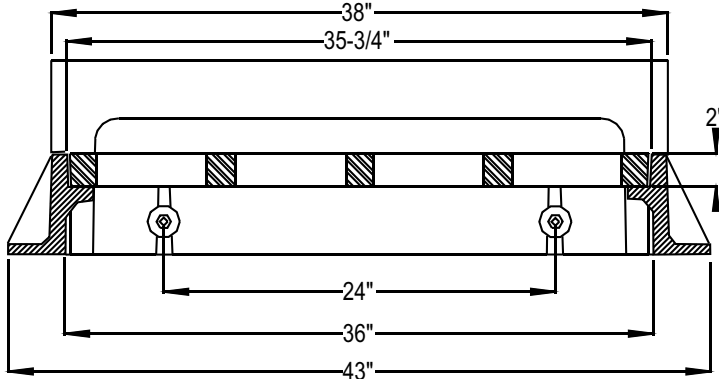
# I-3517

# I-3518

# I-3519

## Single Curb Inlet Frame, Grate, & Curb Hood

I-3516 FRAME & HOOD ARE USED WITH ALL 4 GRATES

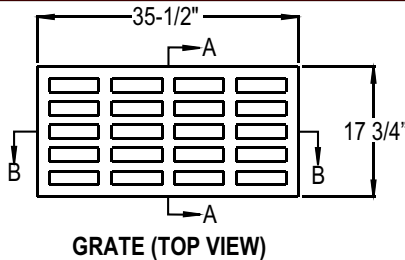


SEE A SUBMITTAL DRAWING FOR THE GRATES REQUIRED FOR FURTHER DETAILS

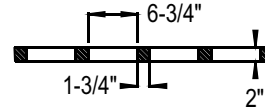
### I-3516

TYPE "A" GRATE

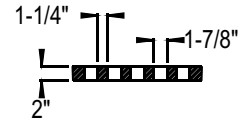
(BEST SUITED FOR BIKE SAFE AREAS)



GRATE (TOP VIEW)



GRATE (SECTION B - B)

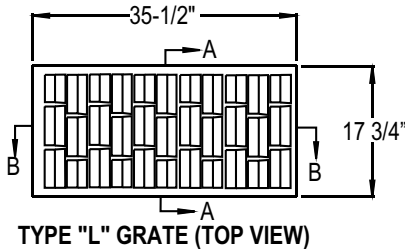


GRATE (SECTION A - A)

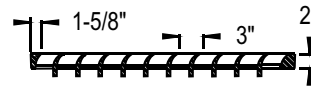
### I-3517

TYPE "L" GRATE

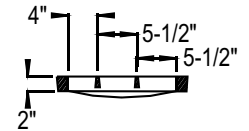
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TYPE "L" GRATE (TOP VIEW)



GRATE (SECTION B - B)

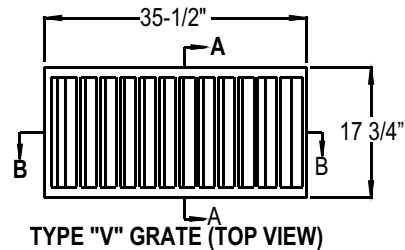


GRATE (SECTION A - A)

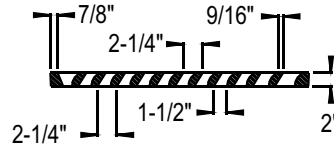
### I-3518

TYPE "V" GRATE  
"VANE GRATE"

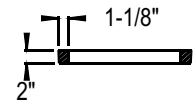
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TYPE "V" GRATE (TOP VIEW)



GRATE (SECTION B - B)

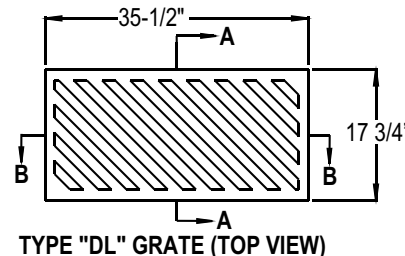


GRATE (SECTION A - A)

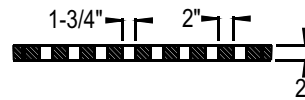
### I-3519

TYPE "DL" GRATE  
"DIRECTIONAL GRATE"

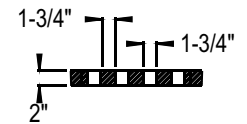
(BEST SUITED FOR HIGH WATER FLOW AREAS)



TYPE "DL" GRATE (TOP VIEW)



GRATE (SECTION B - B)



GRATE (SECTION A - A)

**CAST IRON conforms to**  
ASTM A-48-93 Class 35B  
Meets H-20 Wheel Loading

D&L model No. I-3516, I-3517, I-3518, I-3519

Estimated Weight of I-3516, I-3517, I-3518, I-3519  
565 lbs.

## D&L Foundry & Supply

CA Sales: (707) 557-4525 fax: (707) 557-4655  
UT Sales: (801) 785-5015 fax: (801) 785-0835  
WA Sales: (509) 765-7952 fax: (509) 765-8124

Designation:  
I-3516, 17, 18, 19

Date:  
November 2002

Prepared by:  
Jesse Walker

D&L Supply (not to scale)

# **ROMAC Coupler Product Data**

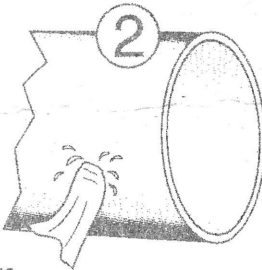
# INSTALLATION INSTRUCTIONS

Read installation instructions first before installing. Check parts to ensure that no damage has occurred during transit and that no parts are missing. Also check the diameter of the pipe and the range marked on the coupling to ensure you have the proper size.

## Style FC400 Steel Flanged Coupling

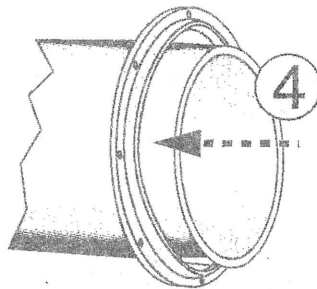
**Step 1** • Check the flanged coupling parts to insure that no damage has occurred during transit and that no parts are missing.

**Step 2** • Clean pipe end for a distance of 2" greater than the length of the flanged coupling.

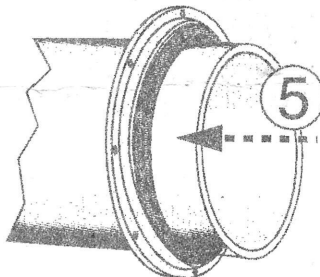


**Step 3** • Check area where gaskets will seat on pipe and flange faces to make sure there are no dents, projections, gouges, etc. that will interfere with the gasket seals. Welds must be ground flush.

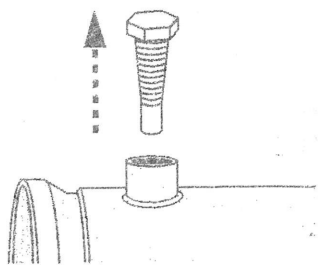
**Step 4** • Place end ring on pipe end.



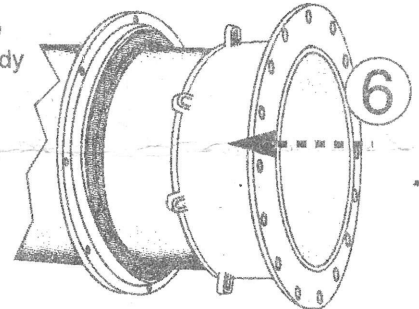
**Step 5** • Clean the gasket. Lubricate the gasket and pipe surface with a suitable gasket lubricant. Place gasket next to end ring with beveled edge toward the pipe end.



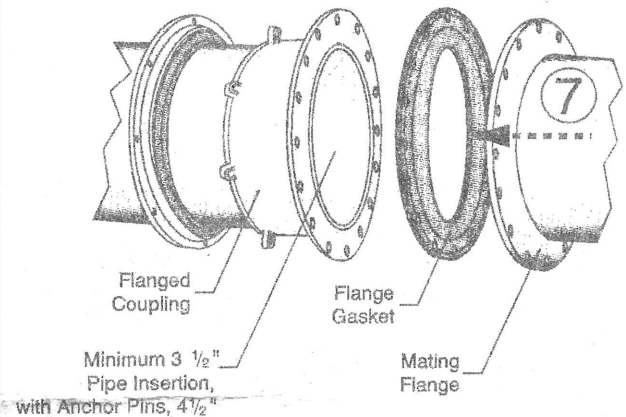
**If using Anchor Pins,** remove the anchor pins from the half couplings on the flanged coupling body.



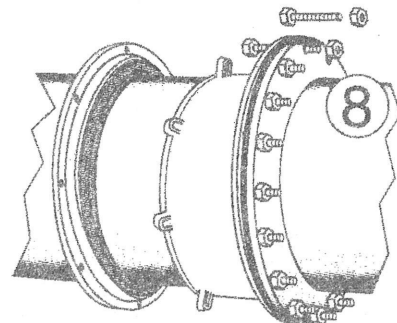
**Step 6** • Slide the flanged coupling body onto the pipe end.



**Step 7** • Using a flange gasket, position the flanged coupling against the mating flange, making sure there is a minimum 3 1/2" of pipe insertion. If using Anchor Pins, the minimum pipe insertion is 4 1/2".



**Step 8** • Assemble the flanged joint using flange bolts.

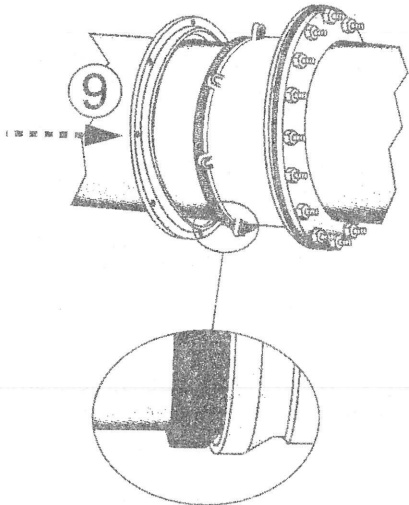


Installation Instructions continued on back

# INSTALLATION INSTRUCTIONS

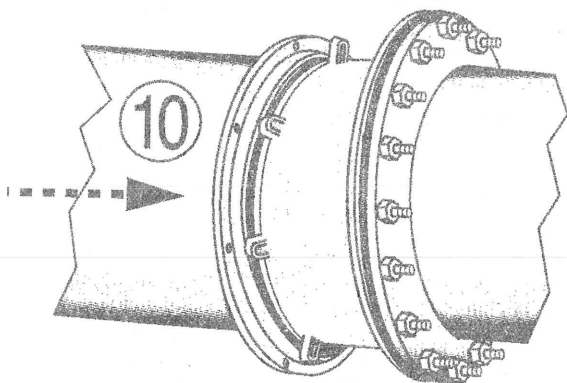
## Style FC400 (continued from front)

**Step 9** • Slide the ring gasket into position with the beveled edge engaging the flared end of the flanged coupling body.

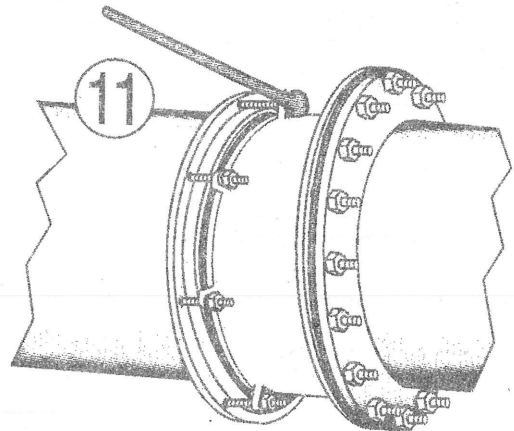


Make sure the beveled edge of the gasket engages the flared end of the flanged coupling body.

**Step 10** • Slide the end ring into position against the gasket. Be sure to match weld in end ring with weld in body.



**Step 11** • Insert the bolts through the end ring into the anchor loops and tighten. Bolt tightening should be done evenly, alternating to diametrically opposite positions to bring bolts to recommended tightness. (60-70 ft-lbs. for 5/8" bolts and 85-95 ft-lbs. for 3/4" bolts.)



### STEP 12 - IF USING ANCHOR PINS

1. Remove Anchor Pins from flanged coupling body.
2. Slide the flanged coupling body onto the pipe end.
3. Position the flanged coupling against the mating flange. Assemble the flanged joint.
4. Thread a short pipe nipple into the threaded Anchor Pin hole. Using the largest drill bit that will fit into the pipe nipple, drill a center mark on the pipe. Do not drill through. Remove the pipe nipple.
5. Use a 5/16" diameter drill to drill through the center mark made in step 4.
6. Complete the hole by drilling through the pipe with drill size per the table below.
7. Install the Anchor Pins. Apply a suitable thread sealant and tighten to prevent leakage.

Pin Size	Thread Size	Drill Size for Pipe	Torque (ft-lbs.)
7/8"	3/4" NPT	29/32"	80
1"	1" NPT	1 1/32"	100

For best results, after pipe is pressurized check for leakage and re-torque as necessary.

# **Sewer Room Clean-Out Product** **Data**

**Operations & Maintenance Manual**  
**December 2015**



# JCM INDUSTRIES

P. O. Box 1220, Nash, TX 75569-1220

Phone 800-527-8482 or 903-832-2581

Fax 800-874-9524 or 903-838-6260

[www.jcmindustries.com](http://www.jcmindustries.com)

## Typical Specification

### JCM 412 Fabricated Tapping Sleeve – Shop Coat Primer, Epoxy Coated Alloy Hardware

Tapping Sleeves shall be the high strength type having a wide body, made of a minimum material strength of ASTM 285 Grade C, ASTM A-36 Steel or equal, which conforms to and reinforces the pipe. The sleeve shall have as a minimum 7/8" wide gasket of Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000 with hydromechanical activated lip, captured in a recessed groove around the outlet; 3/4" corrosion resistant, high strength low alloy oval neck track head bolt per ASTM A242/ANSI 21.11/AWWA C-111 and heavy hex nut per A563 epoxy coated and a 3/4" forged steel test outlet. Flanged outlet shall be AWWA C207 Class D, ANSI 150 lb. drilling, recessed for tapping valve per MSS-SP60, outlets 2" – 12" rated for 175 PSI\* maximum operating pressure. Tapping Sleeve shall be furnished with corrosion resistant shop coat paint primer.

For outlet sizes 14" and larger, the gasket groove must be consistently positioned about throat of tapping waterway. Inside diameter of the gasket groove must be set back a minimum of 1" from the waterway to allow dispersal of forces generated by gasket compression. Gasket grooves machined in a circle and formed to an elliptical shape will not be an accepted equal.

Nominal pipe sizes 36" and larger shall be of the heavy duty type. Tapping Sleeves shall be JCM 412 or approved equal.

\*Higher test and working pressure ratings available upon request, contact JCM Industries.

JCM 400 Series Tapping Sleeves are ANSI/NSF Standard 61 and Standard 61 Annex G Certified.

JCM 400 Series Tapping Sleeves meet MSS-SP124 and ANSI/AWWA Standard C223 Fabricated Steel and Stainless Steel Tapping Sleeves as applicable.



JCM 412 Tapping Sleeve  
Image reflects 6" x 4"

*This typical specification, provided by JCM Industries, is a proposed guideline for use by specifying agencies to ensure significant design and material features of this product are included within the agencies' individual specifications.*



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 Fax 800-874-9524 or 903-838-6260  
[www.jcmindustries.com](http://www.jcmindustries.com)

## Material Specification

### JCM 412 Fabricated Tapping Sleeve – Shop Coat Primer, Epoxy Coated Alloy Hardware

**Body:** ASTM 283 Grade C, ASTM 285 Grade C, ASTM A-36 Steel or equal.

**Flange:** AWWA C207 Class D, ANSI 150 lb. Drilling, recessed for tapping valve per MSS-SP60. Optional flanges available upon request.

**Gasket:** Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000. Molded virgin rubber with a pressure activated hydromechanical design. Gasket is bonded into a cavity for internal and external retention. Gasket temperature range -40°F to 212°F (-40°C - 100°C) Gasket suitable for water, salt solutions, mild acids, bases, and sewage. Optional gasket materials available.

**Bolts:** Corrosion resistant, high strength low alloy oval neck track head bolt per ASTM A242/ANSI 21.11/AWWA C-111 and heavy hex nut per A563 epoxy coated, Powercron 590-534.

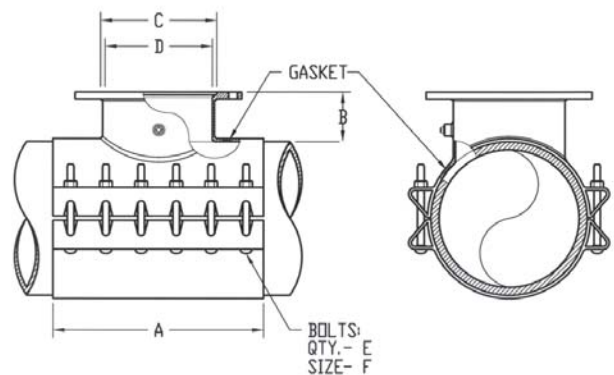
**Finish:** Heavy coat of corrosion resistant shop coat primer.

**Service**

**Rating:** 2" to 12" Outlets: 175 PSI. Higher service rating available for specific applications and sizes.

Flange Size*	A	B	C	D	E	F
3	12	5	4-1/32	3-1/2	6	3/4
4	12	5	5-1/32	4-1/2	6	3/4
6	12	5	7-1/32	*6-1/2	6	3/4
8	16	5-1/8	9-1/32	8-1/8	8	3/4
10	20	5-1/2	11-1/16	10-1/4	10	3/4
12	24	5-3/4	13-1/16	12-1/4	12	3/4

\*On nominal pipe size 7-16 and smaller dimension B is 3-1/8"



# **Drainage Tank Level Sensor**

**Operations & Maintenance Manual  
December 2015**

# Model 924LS Liquid Sensor

SPECIFICATION SHEET

The 924LS is a stainless steel float-actuated sensor capable of detecting the presence of liquid in containment areas.

## Features

- Compatible with all 918 tank alarms and system interfaces
- 1/2" male NPT connection point to allow for rigid piping installations
- Balanced for increased stability when free-standing on flat containment surfaces
- 3/8" cable connector included

## Construction Details

- Teflon® coated wires in Teflon® coated jacket
- Fuel compatible Nitrophenyl float
- 304 Stainless steel shroud

## Applications

- Interstitial space of double wall tanks
- Containment sumps
- Dispenser pans
- Other applications requiring the detection of a liquid leak

## Liquid Detection Level

Normally Open (NO) 0.625 ± 0.125

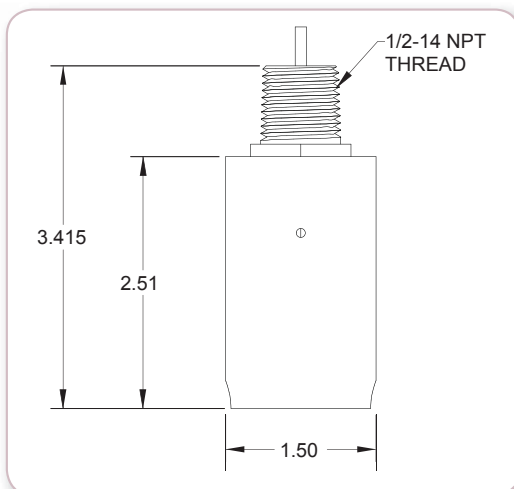
Normally Closed (NC) 0.125 + 0.125 / - 0.0

## Location Approval

UL Class I, Div 1, Group D (when used in conjunction with the model 918AC and model 918S/D/Q)



Item Number	Description	Weight (lbs)	List Price
924LS-0150 AS	Level sensor with 15' lead wire	.80	\$234.00
924LS-0250 AS	Level sensor with 25' lead wire	1.0	\$255.00



570 E. 7th Street, P.O. Box 238 | Dubuque, IA 52004-0238

t. 563.583.5701 | 800.553.4840 | f. 563.583.5028

www.morbros.com

# **Drainage Tank Backfill Pea Gravel** **Product Data**

**Operations & Maintenance Manual**  
**December 2015**



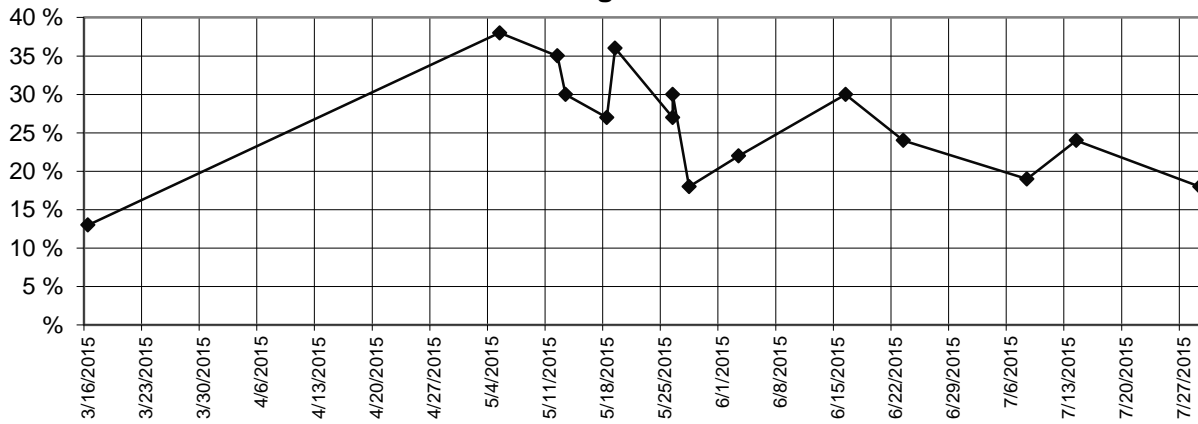
# Everist Materials, LLC

Maryland Creek Ranch Pit

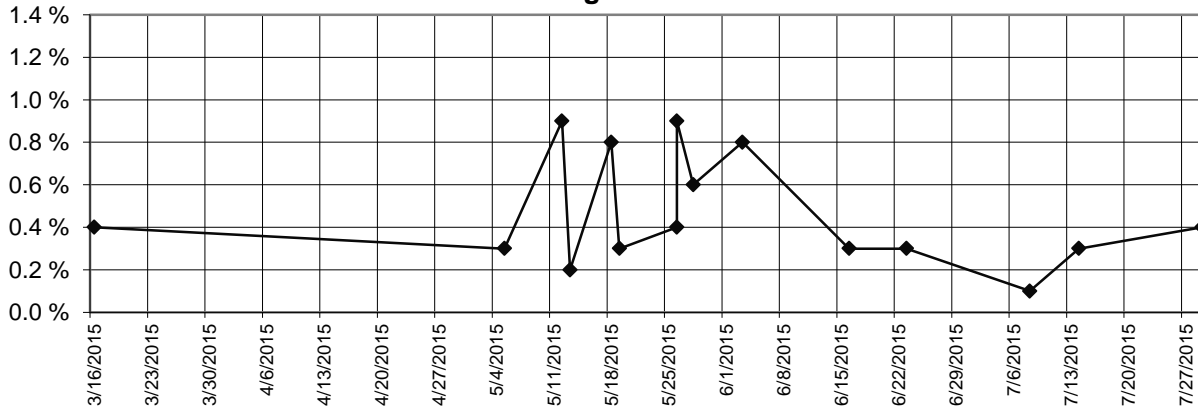
No. 8 Rock

Sieve	No. of Tests	HIGH	LOW	Std. Dev.	Average	Specs.
<b>1 1/2"</b>	15	100	100	0.00	<b>100</b>	
<b>1"</b>	15	100	100	0.00	<b>100</b>	
<b>3/4"</b>	15	100	100	0.00	<b>100</b>	
<b>1/2"</b>	15	100	100	0.00	<b>100</b>	<b>100</b>
<b>3/8"</b>	15	99	98	0.46	<b>99</b>	<b>85 - 100</b>
<b># 4</b>	15	38	13	7.29	<b>26</b>	<b>10 - 30</b>
<b># 8</b>	15	5	1	1.08	<b>2</b>	<b>0 - 10</b>
<b># 16</b>	15	2	0	0.53	<b>1</b>	<b>0 - 5</b>
<b># 200</b>	15	0.9	0.1	0.26	<b>0.5</b>	<b>0 - 1.5</b>

**% Passing #4 Sieve**



**% Passing #200 Sieve**



# **DRAINAGE TANK** **GEOTEXTILE FABRIC**

**Operations & Maintenance Manual**  
**December 2015**

## GEOTEXTILES

### Product Data Sheet

Issue: 01.TGT21 Date: 01.13 Page: 1 of 1

AASHTO Class M288			-	-	-	-	3	2	2	1	1
			TYPAR 3151	TYPAR 3201	TYPAR 3301	TYPAR 3341	TYPAR 3401	TYPAR 3501	TYPAR 3601	TYPAR 3801	TYPAR 3100
Mechanical (Marv) <sup>1</sup>											
Grab tensile strength	ASTM D4632	lbs	35	60	120	120	130	160	240	300	335
Grab elongation	ASTM D4632	%	60	60	60	60	60	60	60	60	61
Trapezoidal tear strength	ASTM D4533	lbs	15	25	35	40	60	60	90	95	74
Puncture strength	ASTM D4833	lbs	10	18	25	34	41	56	67	93	-
CBR Puncture	ASTM D6241	lbs	-	-	-	-	225	310	370	510	697
Endurance (MARV) <sup>1</sup>											
UV Resistance @ 500 hrs	ASTM D4355	%	-	-	-	70	70	70	70	70	-
Hydraulic (MARV) <sup>1</sup>											
Apparent opening size <sup>2</sup>	ASTM D4751	US Sieve	20/30	30	50	60	70	70	140	170	-
Permittivity	ASTM D4491	sec <sup>-1</sup>	1.5	1.0	0.8	0.7	0.7	0.5	0.1	0.1	0.123
Water flow rate	ASTM D4491	gal/min/ft <sup>2</sup>	235	190	95	85	60	50	15	8	-
Physical (Typical)											
Unit weight		oz/yd <sup>2</sup>	1.6	1.9	3.0	3.4	4.0	5.0	6.0	8.0	10
Roll diameter		in	7	7	8	8	9	10	10	12	-
Length		yd	100	100	100	100	100	100	100	100	-
Width		in	151	151	151	151	151	151	151	151	-
Roll area		yd <sup>2</sup>	419	419	419	419	419	419	419	419	-
Roll weight gross		lbs	50	58	87	97	113	138	165	218	-
Width		in	-	-	-	-	187	187	187	187	-
Roll area		yd <sup>2</sup>	-	-	-	-	519	519	519	519	-
Roll weight gross		lbs	-	-	-	-	142	175	209	275	-

20% Recycled Content

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**Eisenhower/Johnson Memorial Tunnel  
Fixed Fire Suppression System  
Design Build Project, NO. C 0703-360**

# **Supply and Drainage System Consumables**

The Supply and Drainage System and all associated components have no required consumables for normal operation, nor for any ongoing testing and maintenance operations.

# **Spare Parts**

**There are no recommended spare parts for the supply or drainage systems.**

**Operations & Maintenance Manual  
December 2015**