

FINAL REPORT



44 WEST 66TH STREET

NEW YORK, NY

TUNED SLOSHING DAMPER DETAILED PERFORMANCE ANALYSIS & DESIGN

RWDI #1600192

March 20, 2019

SUBMITTED TO

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- Appendix A – TSD Detailed Design Drawings
- Appendix B – TSD Design and Installation Guidelines



1 INTRODUCTION

RWDI has conducted a detailed performance analysis for the Tuned Sloshing Damper (TSD) system proposed for the 44 West 66th Street tower located in New York, NY. This report summarizes the predicted performance, responses and the resultant loads of the Structure-TSD system subjected to various wind and seismic loading conditions. This analysis is conducted to assess the system performance over the intended range of operating conditions.

Accompanying this report is a drawing package (Appendix A) containing the information necessary to design and fabricate the TSD components and the supporting structure. The specifications for various elements of the TSD system are included as notes within the drawing package. General design and installation guidelines for TSD systems are provided in Appendix B.

2 INITIAL INFORMATION AND ASSUMPTIONS

For the purpose of the TSD performance assessment, structural loading time histories were obtained from wind tunnel data measured during the high-frequency force-balance (HFFB) wind tunnel testing. The supplemental damping system concept design and performance analysis are based on the following information and assumptions:

- Structural dynamic properties received on May 7, 2018, with nominal structural periods of 6.13, 5.66, and 3.90 seconds (frequencies of 0.163, 0.177, and 0.256 Hz);
- Assumed inherent structural damping ratio of 1.5% of critical;
- Site-specific design spectrum parameters and seismic structural properties provided by the structural engineer on May 7, 2018; and,
- A possible as-built frequency variation of -5% and +20% on the nominal structural frequencies.

3 DESCRIPTION OF TSD SYSTEM

A tuned sloshing damper is a supplementary damping system (SDS) that utilizes a sloshing liquid to absorb and dissipate structural vibrational energy. A TSD is essentially a tank, partially filled with liquid (typically water) and located near the top of a structure. By selecting the proper TSD tank dimensions and fluid depth, the natural frequency of the sloshing motion can be “tuned” to a natural frequency of the structure. As the structure experiences a resonant response, the fluid in the TSD tank will begin to slosh. Vibrational energy is thereby transferred from the structure to the TSD, where it can be dissipated by damping mechanisms in the tank. RWDI typically employs paddles in the tank which produce fluid drag forces and add turbulence in the sloshing fluid which contribute to the structural vibration energy dissipation.



A TSD system consists of the following major components:

1. **TSD Tank:** The rigid TSD tank is typically constructed of concrete and is the main component of the system. The internal tank dimensions and liquid depth are selected to provide the desired sloshing frequency. Prior to the tanks being poured, as-built period measurements must be conducted at approximately the 90% complete stage of construction as described in Appendix B. Based on our experience, the following are some important considerations related to the waterproofing aspects of the tank(s):
 - a. Retention of expert advice from an experience and reputable waterproofing consultant;
 - b. Placement of cold joints away from the bottom of the tank (preferably above the quiescent water level);
 - c. Good sealing of penetrations etc.; and,
 - d. High quality waterproofing (see Section 2 of Appendix B for additional discussion of waterproofing).
2. **Paddles:** Within the TSD tank, paddles extend from the ceiling. As the liquid sloshes within the tank, the paddles create fluid drag, which dissipates sloshing energy. The drawing package included in Appendix A contains the details necessary for paddle fabrication.
3. **Tank Access Hatch:** The TSD tank is equipped with an access hatch situated above the quiescent liquid level. This watertight hatch provides interior access to the tank for periodic inspection and maintenance of the TSD.

Further information on the TSD system, including general design and installation guidance, is provided in Appendix B.

4 DYNAMIC ANALYSIS OF SYSTEM

This section outlines the methodology that has been employed to model and analyze the complicated structure-damper system.

4.1 Structural Model

The equations of motion for the coupled structure-damper system can be represented in the general matrix formulation shown below:

$$[M]\ddot{x} + [C]\dot{x} + [K]x = \{F_{SDS}(x)\} + \{F_{env}(t)\}$$

where:

- x is the vector representing the floor-by-floor translation (x_n and y_n), and rotation (r_{zn}) coordinates;
- $[M]$ is a matrix which contains the mass and mass moment of inertia of the structure, arranged in accordance with vector x ;
- $[C]$ is a diagonally banded matrix, typical for a lumped mass system, which represents appropriate structural damping properties for the building structure;
- $[K]$ is a diagonally banded matrix, similar to the damping matrix, which represents restoring force characteristics of the building structure;
- $\{F_{SDS}(x)\}$ is a vector which represents the nonlinear SDS coupling damping forces developed between the SDS floor and the SDS, as an instantaneous function of x ; and,
- $\{F_{env}(t)\}$ is the external excitation force vector which takes a different form depending on whether wind or seismic excitation is being considered in the analysis.

For wind excitation, the generalized forces, i.e. the external excitation forces for each mode of vibration, are calculated based on the time series of the fluctuating wind forces measured in the wind tunnel. For seismic excitation, analytically-simulated strong ground motions are used as input motions at the base of the structure.

4.2 Sloshing Water Model

Water sloshing in a tank has an inherently nonlinear response. As a result, a simple “linearized” sloshing model employed at the concept design stage is not suitable for assessing the performance of the TSD when the building is subjected to moderate or strong winds/earthquake. Therefore, RWDI employs nonlinear multimodal models to determine the sloshing response when the tank is subjected to a base acceleration (due to the motion of the tower)^{1,2}. Using this modelling, the nonlinear coupling among several sloshing mode shapes is determined, where the sloshing mode shapes are representations of the shape of the water free surface (waves). By superimposing the response of all sloshing mode shapes, the total sloshing response is determined. The images shown below illustrate the typical sloshing mode shapes that will exist for a nearly-square tank. With the sloshing modes known, the general form of the equations to describe the modal response of the water is:

$$\ddot{X}_s P_m + \omega_m^2 \beta_m + Q_m + \ddot{\beta}_m + D_{m,rs}^{(1)} \ddot{\beta}_r \beta_s + D_{m,rst}^{(2)} \ddot{\beta}_r \beta_s \beta_t + D_{m,rstu}^{(3)} \ddot{\beta}_r \beta_s \beta_t \beta_u + T_{m,rs}^{(0)} \dot{\beta}_r \dot{\beta}_s + T_{m,rst}^{(1)} \dot{\beta}_r \dot{\beta}_s \beta_t + T_{m,rstu}^{(2)} \dot{\beta}_r \dot{\beta}_s \beta_t \beta_u = 0$$

¹ Love, J.S. and M.J. Tait, (2010). “Nonlinear simulation of a tuned liquid damper with damping screens using a modal expansion technique.” *Journal of Fluids and Structures* 26(7-8): 1058-1077.

² Love, J.S. and M.J. Tait, (2013). “Parametric depth ratio study on tuned liquid dampers: fluid modelling and experimental work.” *Computers and Fluids* 79: 13-26.

where \ddot{X} is the acceleration of the tank (i.e. building floor acceleration) in the x-direction, β_m is the response of the m^{th} sloshing mode, a dot above a variable denotes a time derivative, ω_m is the natural angular frequency of the m^{th} sloshing mode, ζ_m is the nonlinear damping ratio of the m^{th} sloshing mode, and P , D , and T are constants that are calculated from the shape of the tank. After the fluid response is determined, the x-forces imparted to the structure by the SDS, in this case a TSD, are

$$F_{TSD} = -m_w \left(\ddot{X} + \frac{L}{\pi^2 h} \sum_{m=1}^N \ddot{\beta}_m(t) \frac{1}{m^2} [1 + (-1)^{m+1}] \right)$$

where m_w is the total water mass, L is the tank length, and h is the water depth. A corresponding set of equations exists for the TSD response and forces in the y-direction. The TSD force is a function of both the tank acceleration (inertial forces), as well as the sloshing response (sloshing forces). The above forces are applied at each time step to the structure to counteract the external wind excitation forces.

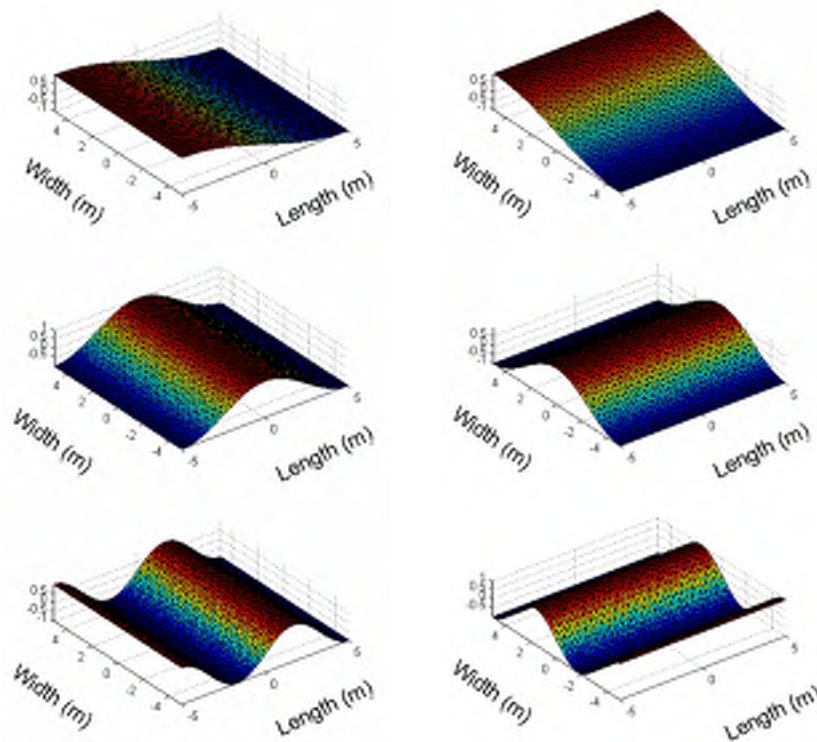


Illustration of typical sloshing mode shapes of a TSD tank



4.3 Statistical Modelling of Wind Climate

The methodology outlined in Sections 4.1 and 4.2 is used to generate the response of the system when subjected to a specified wind speed from a specified wind direction. These computations are completed for 36 wind directions, and a wide range of wind speeds for each wind direction. The pertinent response quantities (peak accelerations, peak forces, etc.) are tabulated for each wind speed and direction. RWDI's wind climate modelling is employed to ascertain the probability of each wind speed and wind direction occurring. This probability of wind occurrence is subsequently combined with the tabulated response data using the "upcrossing method"³ to predict the expected response associated with a specified mean recurrence interval.

5 SIMULATION RESULTS

The TSD is designed to provide a desired amount of acceleration reduction under wind excitation for both the 1-year and 10-year return period wind events. However, knowledge of the pressures and loads applied to the TSD roof, walls, slab, and paddles must be determined to ensure the system is properly designed against all credible forms of strong external excitation. In this case, the system is designed using the anticipated loading from the 50-year and 500-year wind events as well as the 2500-year (2% probability of exceedance in 50-years) seismic event.

5.1 Wind Response

As mentioned in Section 4.3, the response due to wind excitation, both with and without the SDS, was simulated for 36 directions spaced evenly around the building. The acceleration and loads in each of the X- and Y-axes are predicted.

Acceleration Reduction: The TSD has been designed to perform optimally at the 1-year return period winds. Due to nonlinearities associated with the SDS, the performance at other return periods is expected to be slightly less. Figures 1-3 show the anticipated peak accelerations for various return period wind events for the nominal, 5% lower, and 20% higher structural frequencies, respectively. The results indicate that the TSD will achieve both the 1-year and 10-year occupant comfort criteria for residential occupancy.

TSD Loads: To determine the loads that need to be resisted by the TSD components and the local structure, detailed analyses are conducted using the 700-year return period wind event. In addition, 50-year service loads are provided for fatigue design, since the TSD loads due to wind are fully reversible.

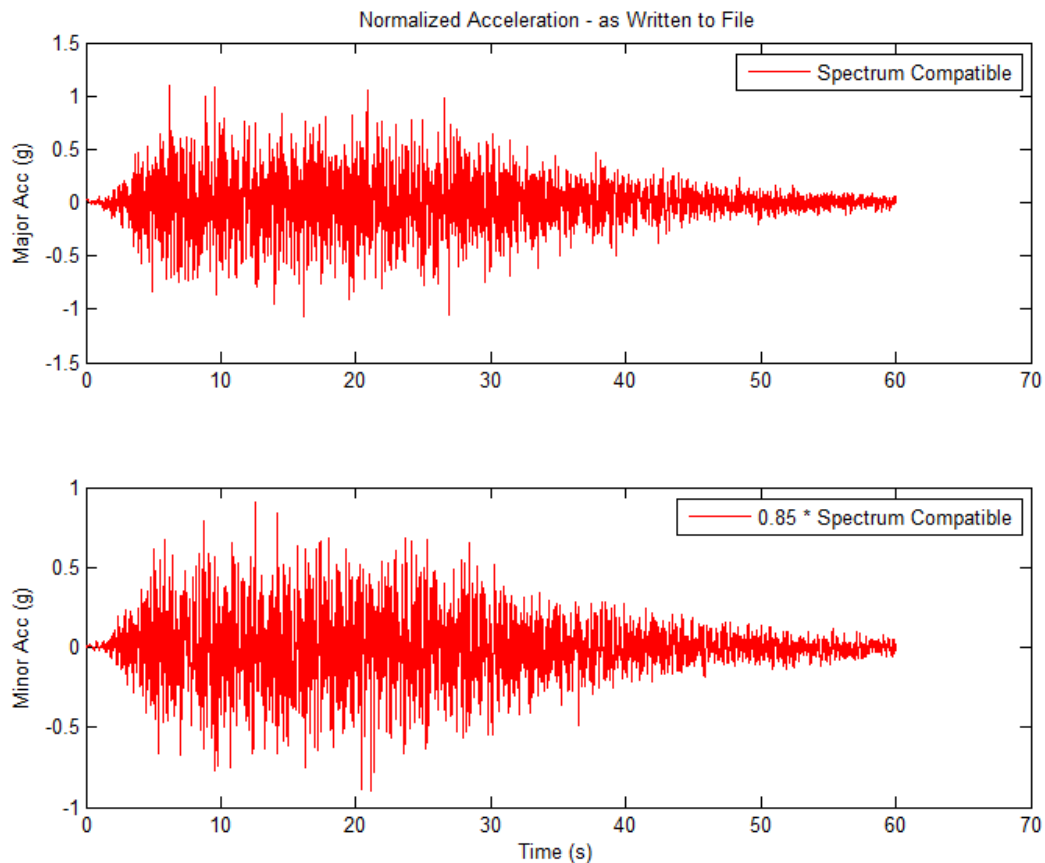
The load table in the drawings package submitted with this report provides the recommended TSD design loads. Additional information on load application for structural design can be found in Section 7 of Appendix B.

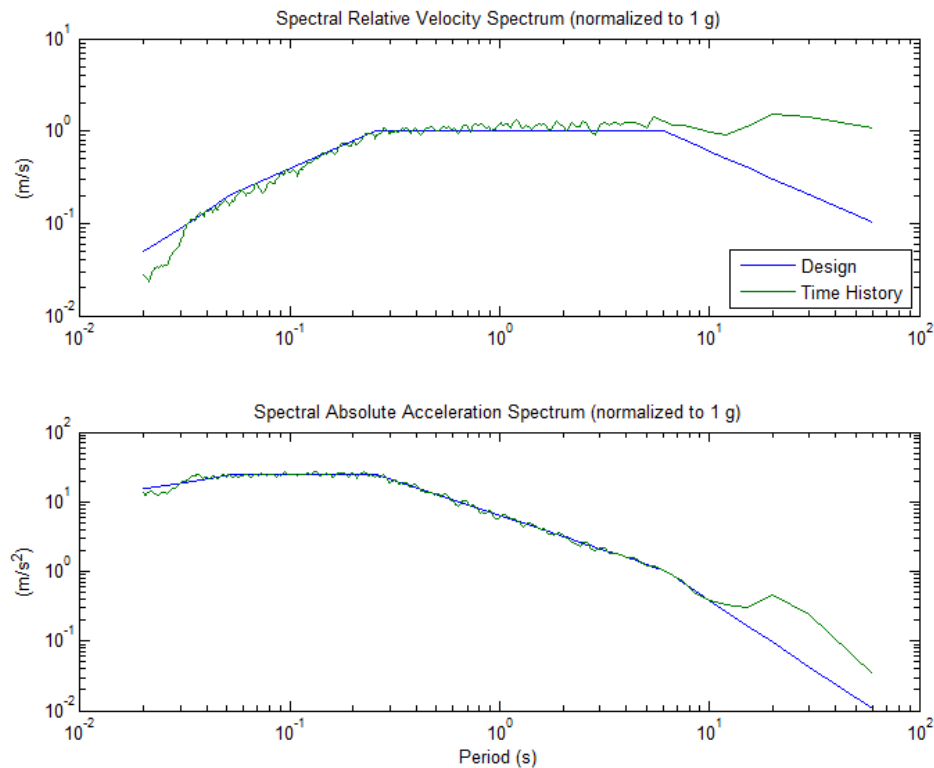
³ Lepage, M.F. and Irwin, P.A. (1985). "A Technique for Combining Historical Wind Data with Wind Tunnel Tests to Predict Extreme Wind Loads." Proceedings of the 5th U.S. National Conference on Wind Engineering, Lubbock, Texas.



5.2 Seismic Response

TSD Loads: The TSD is designed to avoid damaging the structure and TSD components during seismic events. Seismic analysis is performed using the 2500-year return period seismic event. Seven artificial accelerograms are created using the design spectrum parameters and seismic structural properties provided by the structural engineer on June 7, 2018. Based on this information, analytically-simulated accelerograms were constructed to match the seismic design spectrum for site B in New York, as provided by the structural engineer. The figures below show typical accelerograms (Major corresponds to the primary direction of attack, while Minor corresponds to the motion in the orthogonal direction) and their corresponding velocity and acceleration spectra (normalized to 1g peak ground acceleration). Each accelerogram is applied to the structure in 15° rotation angle increments between 0° and 180°.





Typical ground motions (normalized) applied to structure

6 CONCLUDING REMARKS AND RECOMMENDATIONS

RWDI has conducted a detailed performance analysis of the proposed Tuned Sloshing Damper (TSD) system. The TSD has been designed to perform optimally at the 1-year return period wind event for an as-built frequency variation of -5% to +20% relative to the nominal frequencies provided by the structural engineer. The TSD system has been found to reduce the structural accelerations to acceptable levels for a residential occupancy at both the 1-year and 10-year wind events.

Extensive time-domain response analyses were conducted to evaluate the performance of the TSD. The loading imparted to the structure and TSD components during the design wind and seismic events were determined. The recommended loads for the design of tank walls, TSD supporting structure and paddle embed are provided in drawing D02 of Appendix A.

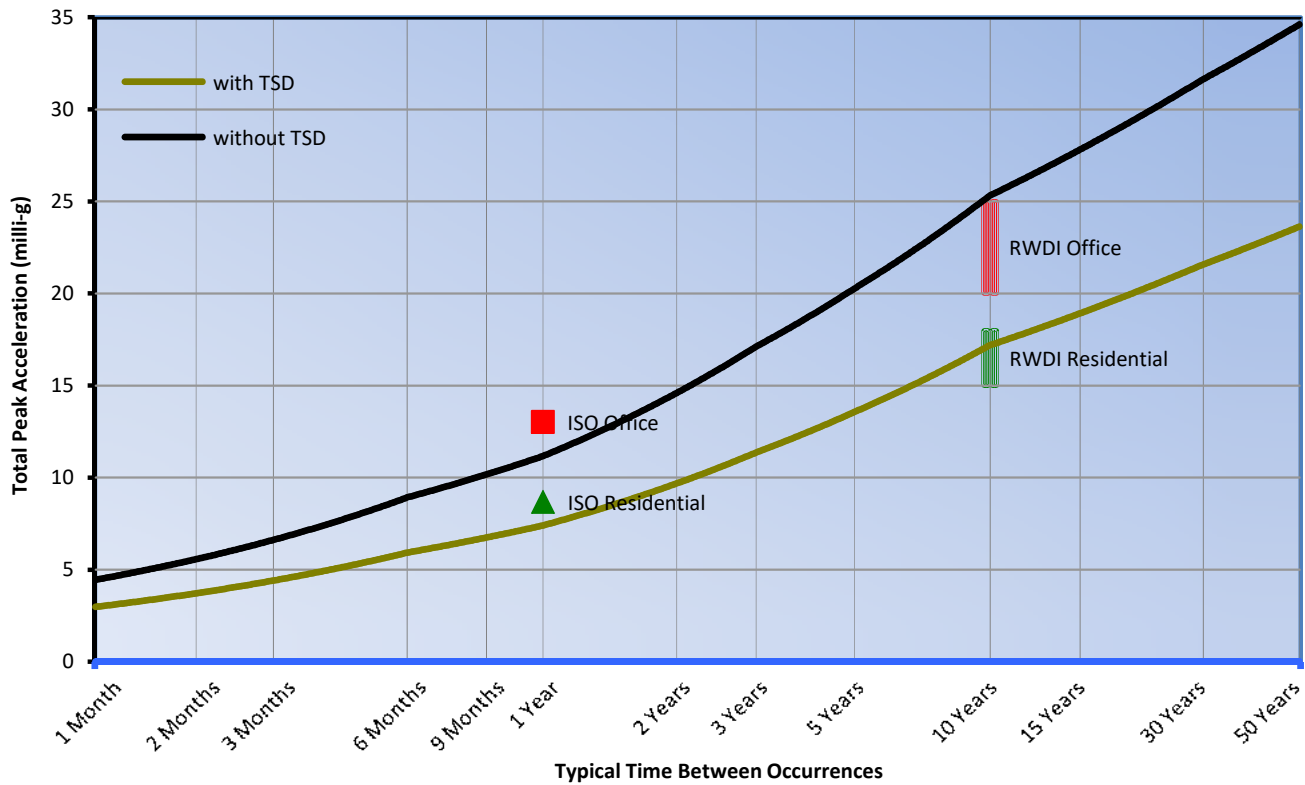


Near 90% completion of the building, or approximately one month prior to the TSD tank being poured, RWDI will conduct the first round of the frequency measurements to determine the trend of the tower frequencies in the as-built condition as outlined in Appendix B. If the building frequencies are trending significantly different from the nominal frequencies, it will be necessary to modify the tank length to achieve the optimal performance of the TSD. The assessment of the trend of the as built frequencies will require the structural engineer to provide frequency predictions at an equivalent stage of construction completion.

It is RWDI's understanding that the water within these tanks may be employed for fire suppression. The water volume contained in each tank is dependent upon the final as-built structural frequencies. However, based on the lower limit of the tuning range (5% less than nominal frequencies), the minimum anticipated water volume in the NE tank is 23,900, while the minimum anticipated water volume in each SW tank is 12,800 gallons.

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FIGURES

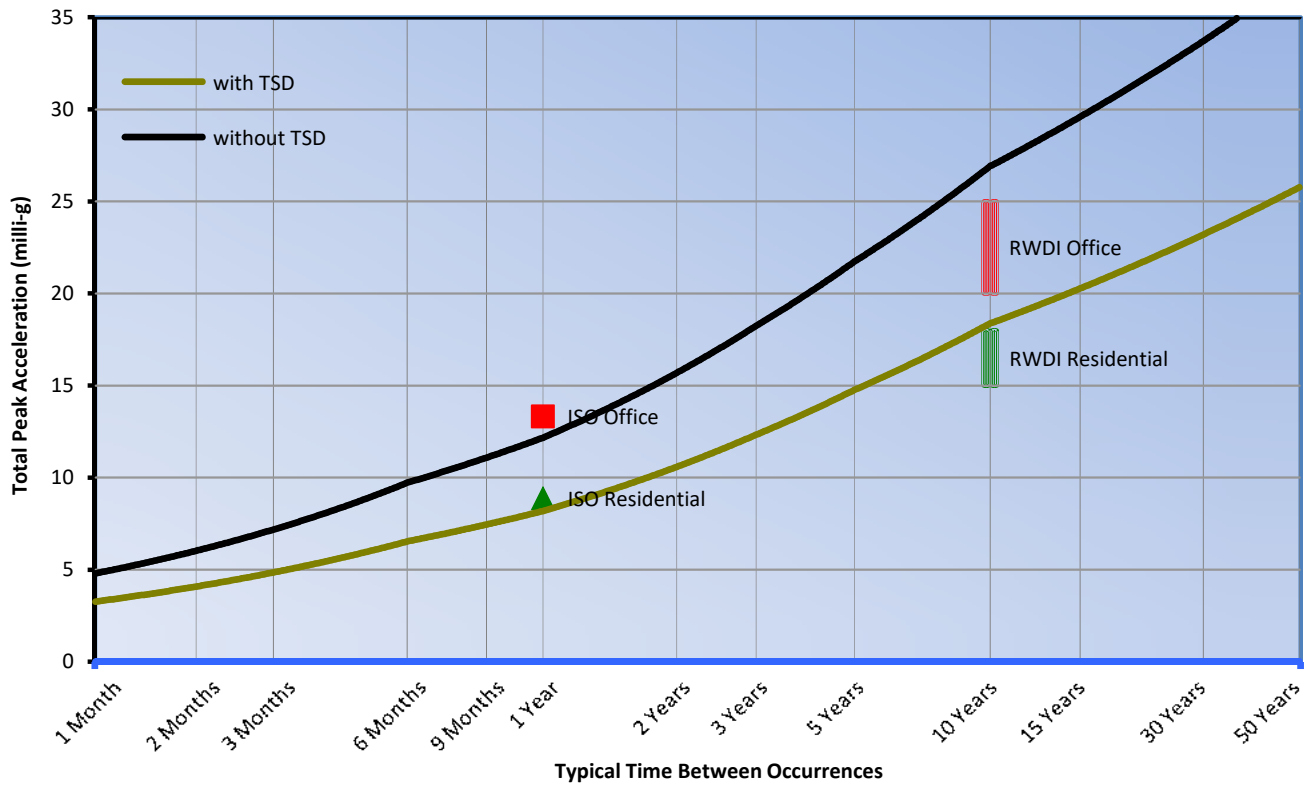


Return Period (Years)	Peak Accelerations ⁽²⁾ (milli-g) Total - [X, Y and torsional components]		Peak Torsional Velocities (milli-rads/sec)		
	without TSD	with TSD	without TSD	with TSD	CTBUH ⁽⁵⁾ Criteria
1	11 - [5.9, 11, 3.3]	7.4 - [4.1, 6.5, 3.3]	1.7	1.7	1.5
5	20 - [10, 19, 6.0]	14 - [7.0, 12, 6.0]	3.1	3.1	-
10	25 - [12, 24, 7.5]	17 - [8.7, 15, 7.5]	3.9	3.9	3

Notes:

- (1) An inherent damping ratio of 1.5% of critical was used, along with frequencies of 0.1632, 0.1767, and 0.2562 Hz.
- (2) Accelerations are predicted at Structural Level '39' (703.31 ft above Structural Level '1') at a radial distance of 43.4 ft from the central axis of the tower.
- (3) ISO is the International Organization for Standardization, and the current standard (ISO 10137:2007) provides acceleration criteria for buildings at the 1-year return period. The criteria plotted on the graph have been generated based on a response-weighted interpretation of the individual modal component of the ISO criteria.
- (4) RWDI's criteria for residential and office buildings are based on research, experience and surveys of existing buildings, and is in agreement with general practice in North America.
- (5) The Council on Tall Buildings and Urban Habitat (CTBUH) provides tentative torsional velocity criteria for the 1- and 10-year return periods.


Predicted Peak Accelerations and Torsional Velocities 180327 Str. Properties - Nominal Frequencies - with and without TSD	Figure No. 1	
	44 West 66th Street - New York, NY	

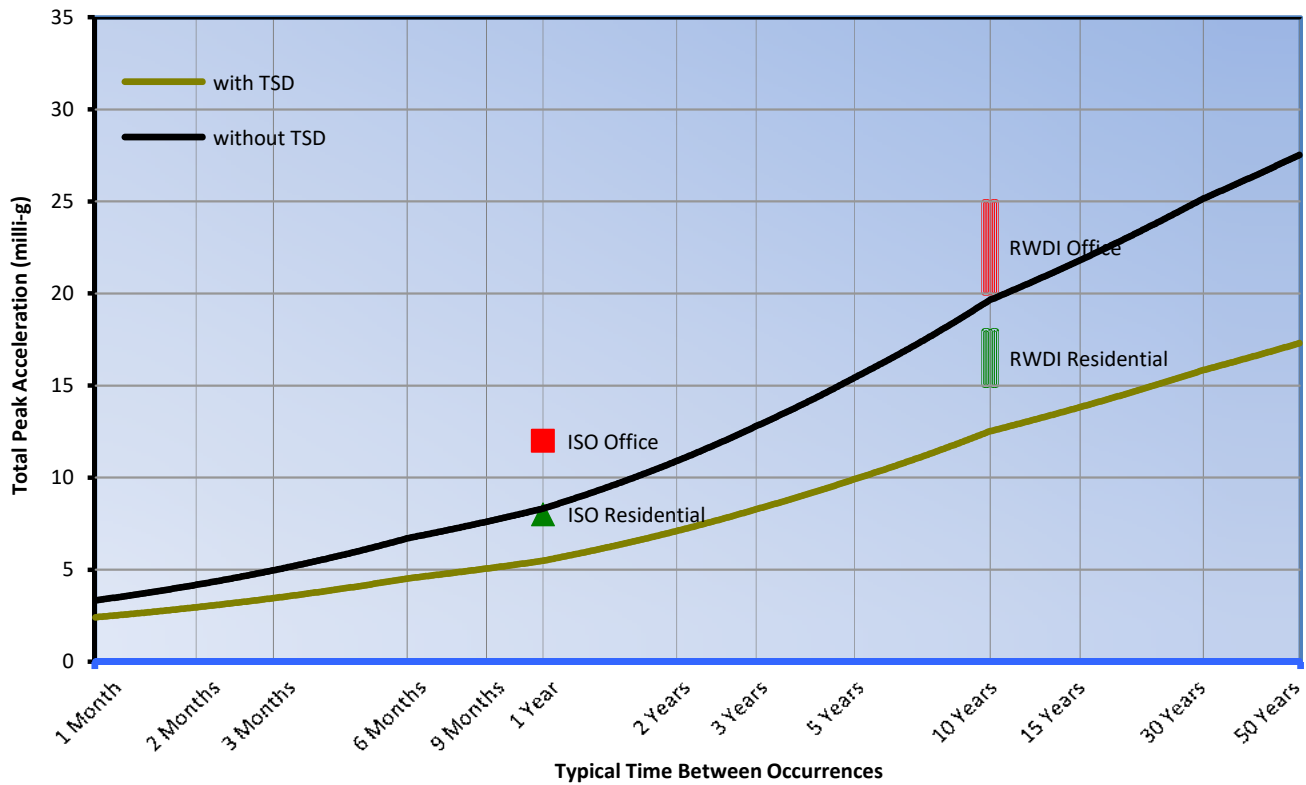


Return Period (Years)	Peak Accelerations ⁽²⁾ (milli-g) Total - [X, Y and torsional components]		Peak Torsional Velocities (milli-rads/sec)		
	without TSD	with TSD	without TSD	with TSD	CTBUH ⁽⁵⁾ Criteria
1	12 - [6.4, 12, 3.6]	8.2 - [4.4, 7.2, 3.6]	2.0	2.0	1.5
5	22 - [11, 21, 6.5]	15 - [7.6, 13, 6.5]	3.5	3.5	-
10	27 - [13, 26, 8.0]	18 - [9.4, 16, 8.0]	4.4	4.4	3

Notes:

- (1) An inherent damping ratio of 1.5% of critical was used, along with frequencies of 0.1551, 0.1678, and 0.2434 Hz.
- (2) Accelerations are predicted at Structural Level '39' (703.31 ft above Structural Level '1') at a radial distance of 43.4 ft from the central axis of the tower.
- (3) ISO is the International Organization for Standardization, and the current standard (ISO 10137:2007) provides acceleration criteria for buildings at the 1-year return period. The criteria plotted on the graph have been generated based on a response-weighted interpretation of the individual modal component of the ISO criteria.
- (4) RWDI's criteria for residential and office buildings are based on research, experience and surveys of existing buildings, and is in agreement with general practice in North America.
- (5) The Council on Tall Buildings and Urban Habitat (CTBUH) provides tentative torsional velocity criteria for the 1- and 10-year return periods.

Predicted Peak Accelerations and Torsional Velocities 180327 Str. Properties - 5% Less than Nominal Freqs. - with and without TSD	Figure No. 2	
	44 West 66th Street - New York, NY	



Return Period (Years)	Peak Accelerations ⁽²⁾ (milli-g) Total - [X, Y and torsional components]		Peak Torsional Velocities (milli-rads/sec)		
	without TSD	with TSD	without TSD	with TSD	CTBUH ⁽⁵⁾ Criteria
1	8.3 - [4.7, 7.9, 2.3]	5.5 - [3.2, 4.9, 2.3]	1.0	1.0	1.5
5	15 - [8.1, 15, 4.6]	9.9 - [5.4, 8.7, 4.6]	2.0	2.0	-
10	20 - [10, 19, 5.9]	12 - [6.6, 11, 5.9]	2.5	2.5	3

Notes:

- (1) An inherent damping ratio of 1.5% of critical was used, along with frequencies of 0.1959, 0.2120, and 0.3075 Hz.
- (2) Accelerations are predicted at Structural Level '39' (703.31 ft above Structural Level '1') at a radial distance of 43.4 ft from the central axis of the tower.
- (3) ISO is the International Organization for Standardization, and the current standard (ISO 10137:2007) provides acceleration criteria for buildings at the 1-year return period. The criteria plotted on the graph have been generated based on a response-weighted interpretation of the individual modal component of the ISO criteria.
- (4) RWDI's criteria for residential and office buildings are based on research, experience and surveys of existing buildings, and is in agreement with general practice in North America.
- (5) The Council on Tall Buildings and Urban Habitat (CTBUH) provides tentative torsional velocity criteria for the 1- and 10-year return periods.

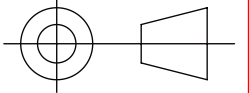
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APPENDIX A

NOMINAL FREQUENCIES ARE 0.1632 Hz (X), 0.1767 Hz (Y), AND 0.2562 Hz (TORSION)



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REV.	DATE	REVIEW	ECN #
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REVISIONS

DASH NO.	NEXT HIGHER ASSEMBLY
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SURF TEXTURE SYM

COMMON	MICRO INCH
~	500
▽	250
∇∇	125
∇∇∇	32
∇∇∇∇	16

TOLERANCE UNLESS NOTED

X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

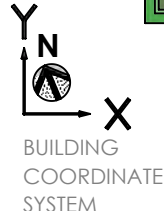
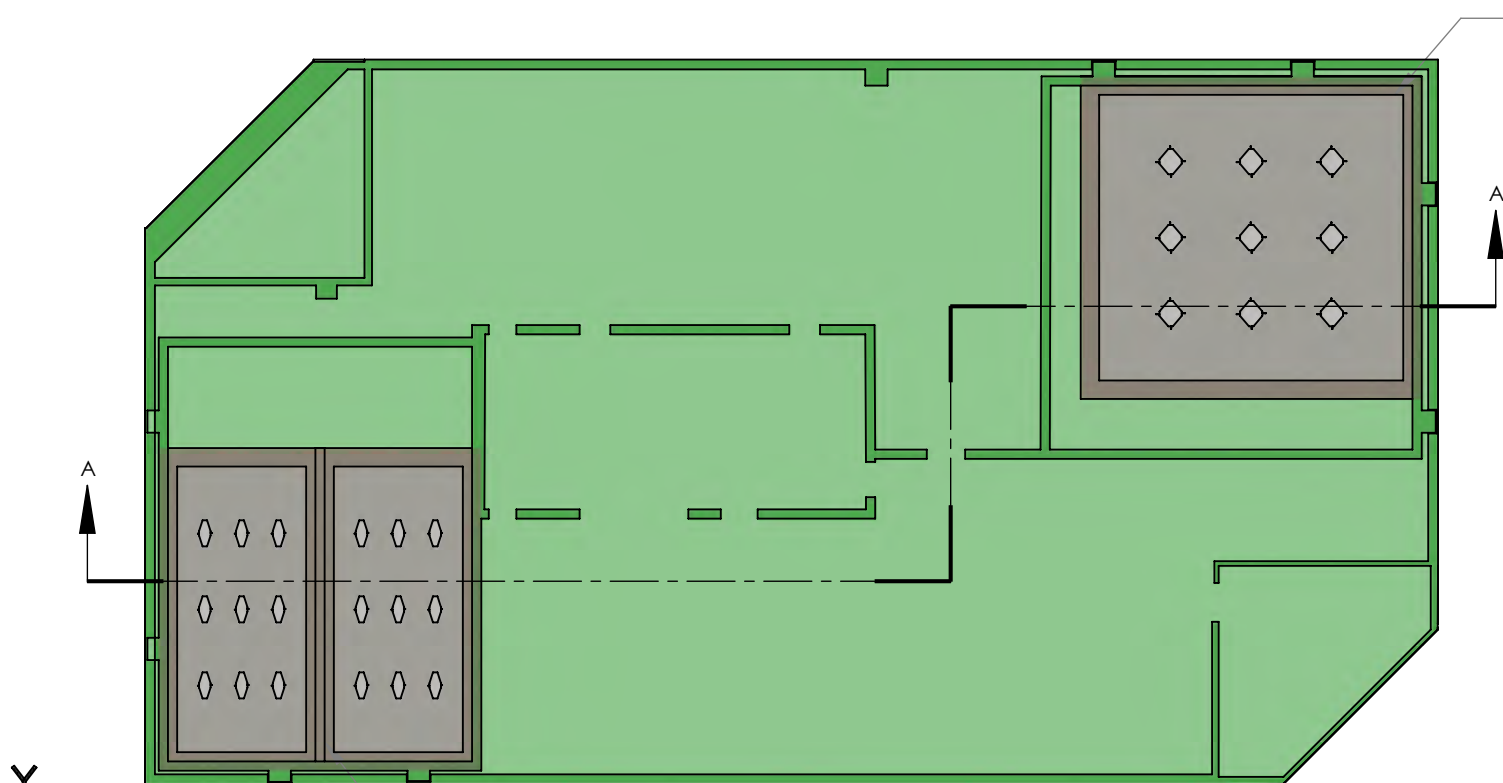
ALL DIMENSIONS IN INCHES UNLESS NOTED

PROJECT NAME:
**44 WEST 66TH STREET,
NEW YORK, NY**

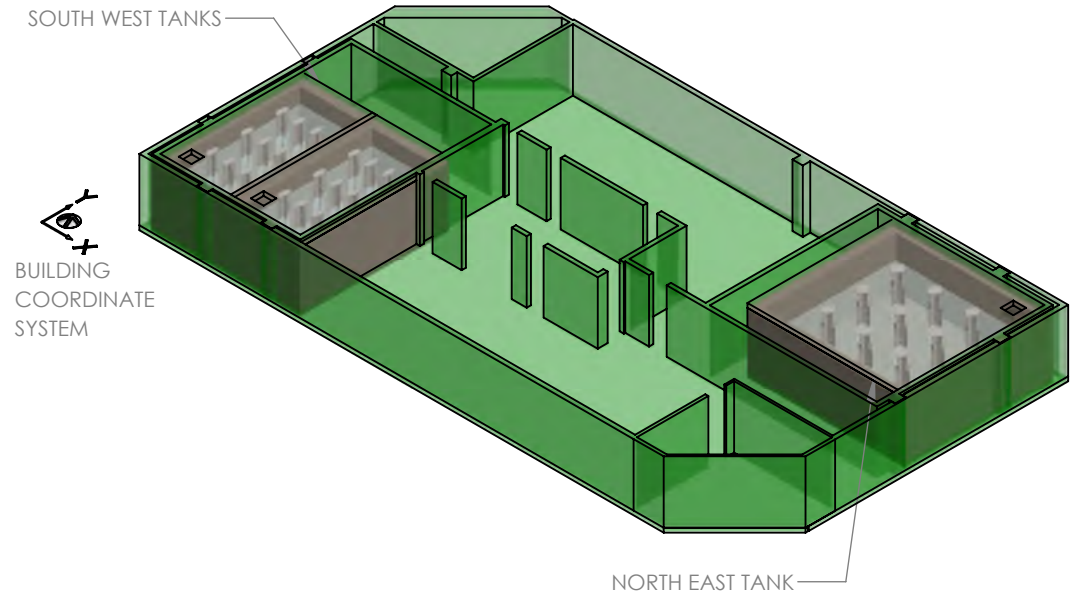
DRAWING LIST	
D00	TSD OVERVIEW AND GENERAL NOTES
D01	NORTH EAST TSD TANK LAYOUT
D02	SOUTH WEST TSD TANK LAYOUT
D03	NORTH EAST TSD DESIGN LOADS
D04	SOUTH WEST TSD DESIGN LOADS
D05	NORTH EAST TSD PADDLE ASSEMBLY
D06	SOUTH WEST TSD PADDLE ASSEMBLY
D07	NORTH EAST TSD PADDLE WELDMENT
D08	SOUTH WEST TSD PADDLE WELDMENT
D09	NORTH EAST TSD PADDLE COMPONENTS
D10	SOUTH WEST TSD PADDLE COMPONENTS

DESIGN	INIT.	DATE
JSL	JSL	2018-06-04
JB	JB	2018-06-20
AW	AW	2018-06-25

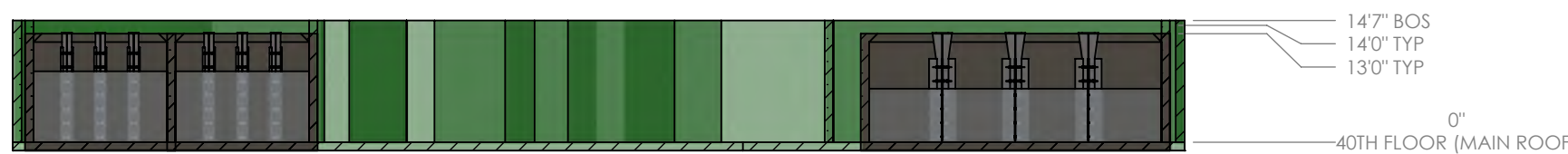
TITLE:	
TUNED SLOSHING DAMPER OVERVIEW AND GENERAL NOTES	
PROJECT #	SHEET #
1600192	1 OF 1
DRAWING NO.	REV. NO.
D00	-



TSD PLAN VIEW
(CEILING AND TANK LIDS REMOVED FOR CLARITY)



BUILDING COORDINATE SYSTEM



SECTION A-A

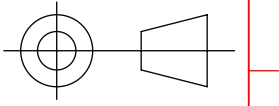
- GENERAL NOTES:
- THIS DRAWING PACKAGE MUST BE USED IN CONJUNCTION WITH RWDI'S "TUNED SLOSHING DAMPER GENERAL DESIGN AND INSTALLATION GUIDELINES." CONTACT RWDI IF THIS DOCUMENT HAS NOT BEEN INCLUDED.
 - STRUCTURAL DESIGN AND DETAILING OF THE CONCRETE TANK(S), PADDLE EMBEDS AND TSD SUPPORTING STRUCTURE TO BE COMPLETED BY STRUCTURAL ENGINEER.
 - PLUMBING AND ELECTRICAL REQUIREMENTS TO BE DESIGNED AND SPECIFIED BY THE MEP.
 - TANK WATERPROOFING REQUIREMENTS TO BE SPECIFIED BY THE WATERPROOFING CONSULTANT.
 - SAFETY PROCEDURES AND PROVISIONS (E.G. FALL ARREST, CONTROLLED TANK ACCESS THROUGH LOCKOUT TAGOUT, CONFINED SPACE, APPROPRIATE SIGNAGE ETC.) TO BE COMPLETED AS REQUIRED BY APPLICABLE CODE(S).
 - ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.

8 7 6 5 4 3 2 1

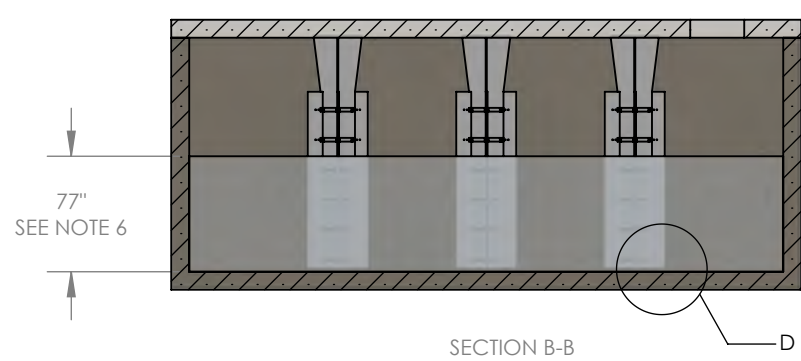
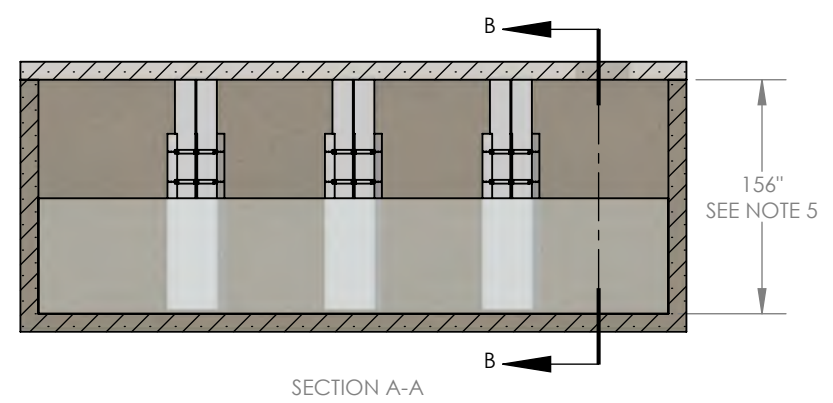
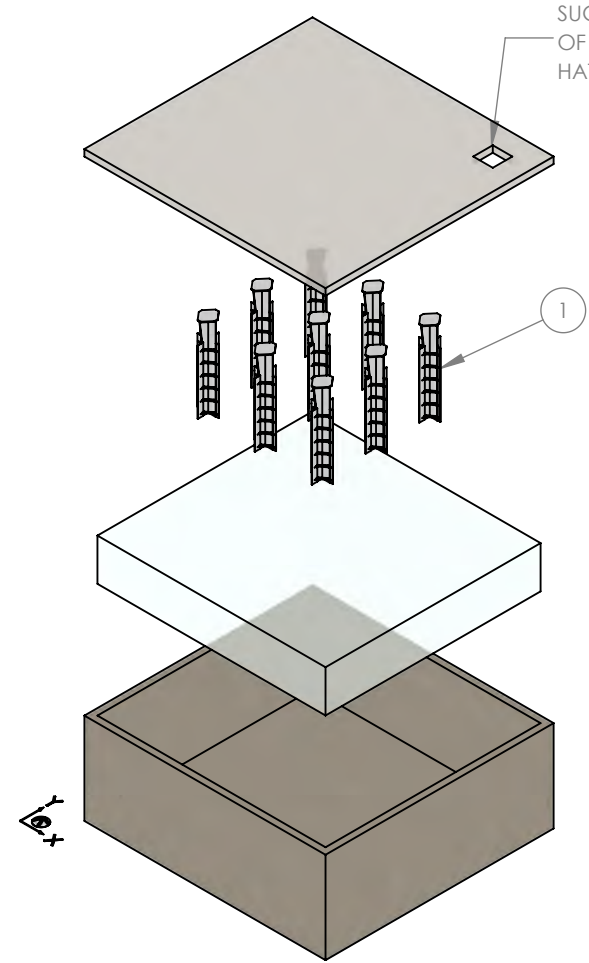
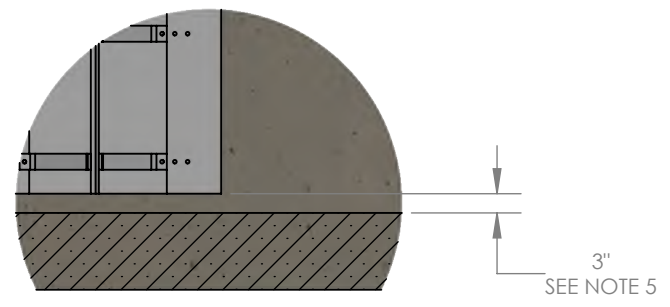
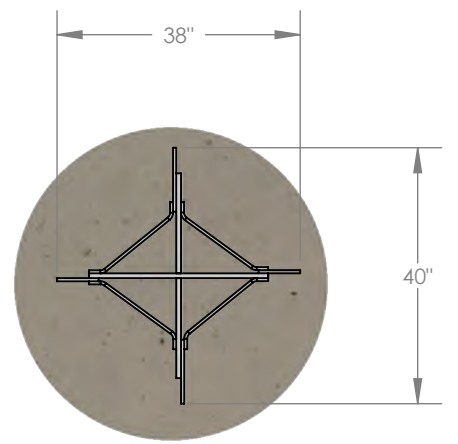
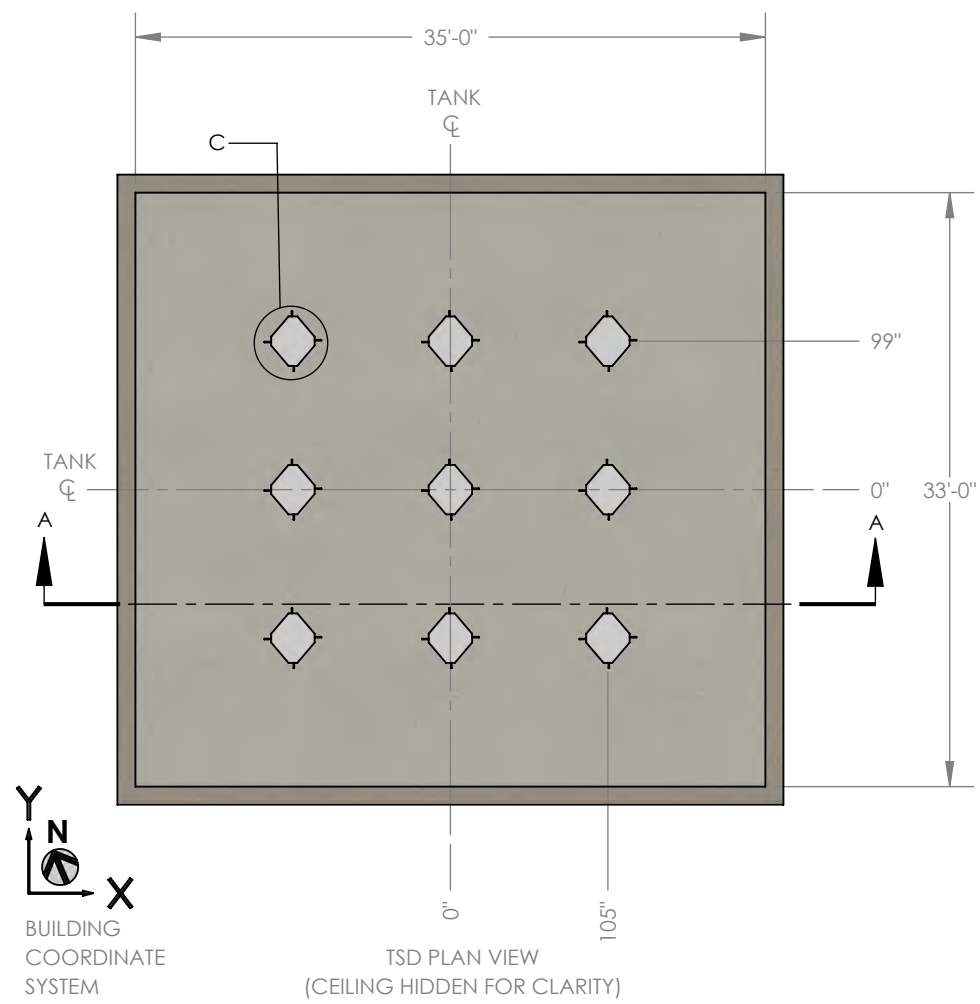
ITEM NO.	QTY.	PART NUMBER	DESCRIPTION	WEIGHT (lb)
1	9	D05-01	PADDLE ASSEMBLY	2644



400 SOUTHGATE DRIVE
GUELPH, ONTARIO, CANADA N1G 4P6
TEL: 519-823-1311 FAX: 519-823-1316
Website: www.rwdi.com



SUGGESTED SIZE OF ACCESS HATCH IS 3' X 3'



- NOTES:
1. THIS DRAWING PACKAGE MUST BE USED IN CONJUNCTION WITH RWDI'S "TUNED SLOSHING DAMPER GENERAL DESIGN AND INSTALLATION GUIDELINES." CONTACT RWDI IF THIS DOCUMENT HAS NOT BEEN INCLUDED.
 2. TANK LENGTH TO BE FINALIZED BY RWDI AFTER CONDUCTING STRUCTURAL FREQUENCY MEASUREMENTS AT 90% CONSTRUCTION COMPLETION.
 3. DEVIATION OF CENTER POINT AT THE BOTTOM OF THE PADDLE TO BE NO MORE THAN 1" FROM PLUMB.
 4. ANGULAR MISALIGNMENT OF PADDLE EMBED TO BE NO MORE THAN 2 DEGREES FROM THE TANK SIDEWALL.
 5. CONFIRM TANK HEIGHT TO MAINTAIN THE SPECIFIED CLEARANCE BETWEEN PADDLE AND FLOOR SLAB.
 6. MAXIMUM WATER DEPTH. FINAL DEPTH TO BE DETERMINED BY RWDI DURING COMMISSIONING.

REV.	DATE	REVIEW	ECN #
REVISIONS			

DASH NO.	NEXT HIGHER ASSEMBLY

SURF TEXTURE SYM	
COMMON	MICRO INCH
~	500
▽	250
▽▽	125
▽▽▽	32
▽▽▽▽	16

TOLERANCE UNLESS NOTED	
X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

ALL DIMENSIONS IN INCHES UNLESS NOTED

PROJECT NAME:
44 WEST 66TH STREET,
NEW YORK, NY

DESIGN	INIT.	DATE
JSL	JSL	2018-06-04
DRAWN	JB	2018-06-20
REVIEW	AWS	2018-06-25

TITLE:
NORTH EAST TUNED SLOSHING DAMPER TANK LAYOUT

PROJECT #	SHEET #
1600192	1 OF 1
DRAWING NO.	REV. NO.
D01	-

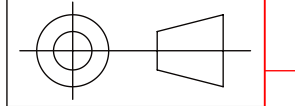
8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION	WEIGHT (lb)
1	9	D06-01	PADDLE ASSEMBLY	1508



400 SOUTHGATE DRIVE
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TEL: 519-823-1311 FAX: 519-823-1316
Website: www.rwdi.com



REV.	DATE	REVIEW	ECN #
REVISIONS			

DASH NO.	NEXT HIGHER ASSEMBLY

COMMON	MICRO INCH
~	500
▽	250
∇∇	125
∇∇∇	32
∇∇∇∇	16

TOLERANCE UNLESS NOTED	
X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

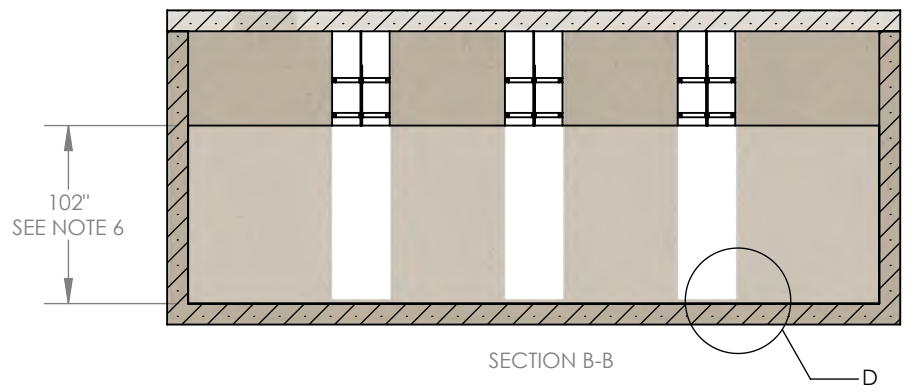
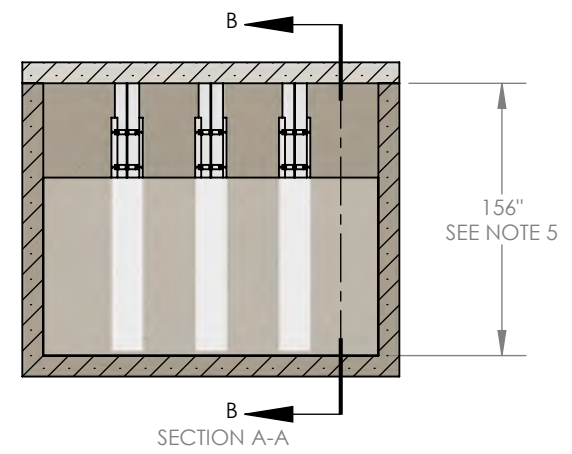
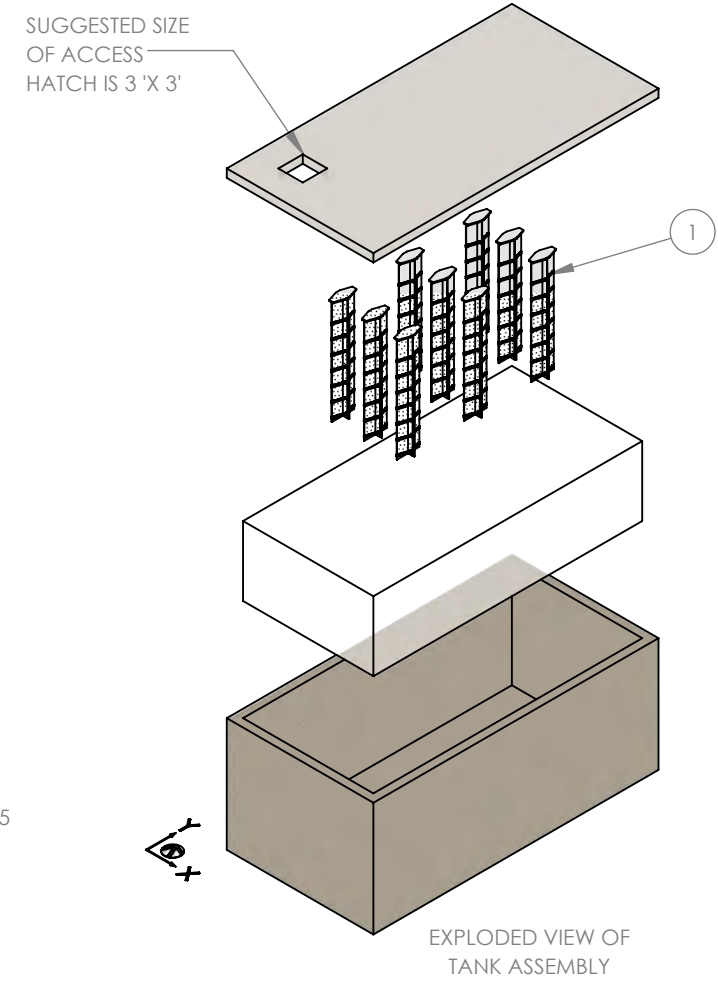
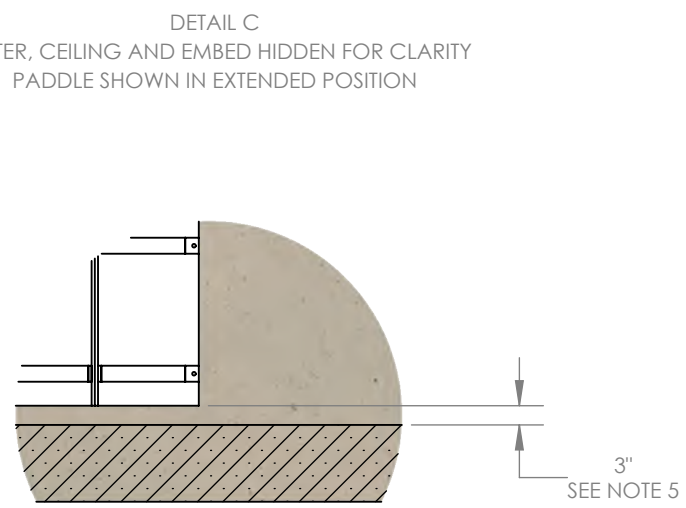
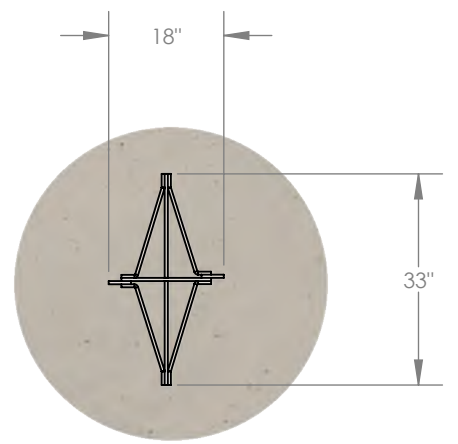
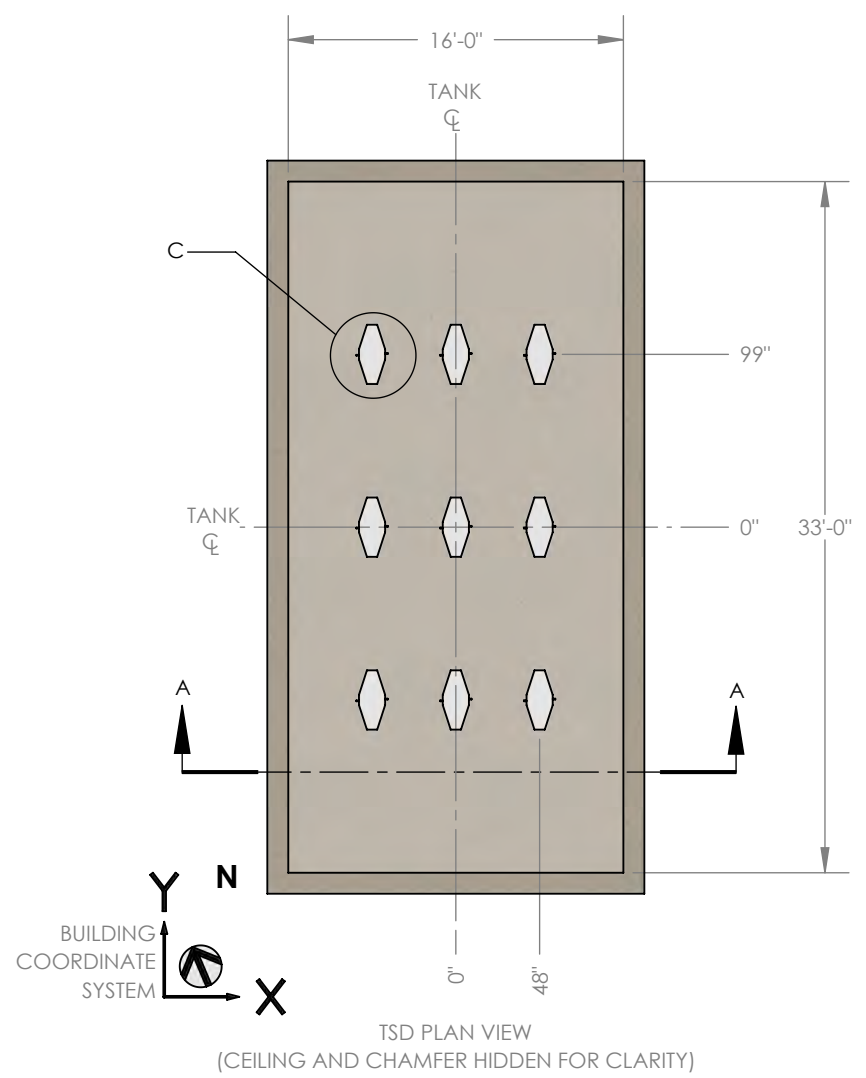
ALL DIMENSIONS IN INCHES UNLESS NOTED

PROJECT NAME:
**44 WEST 66TH STREET,
NEW YORK, NY**

	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JB1	2018-06-20
REVIEW	AWS	2018-06-25

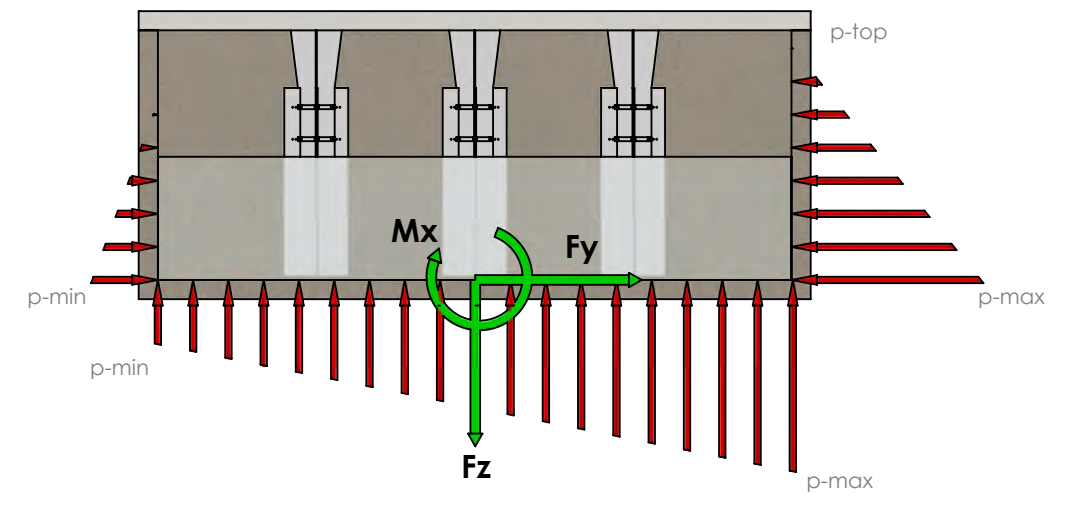
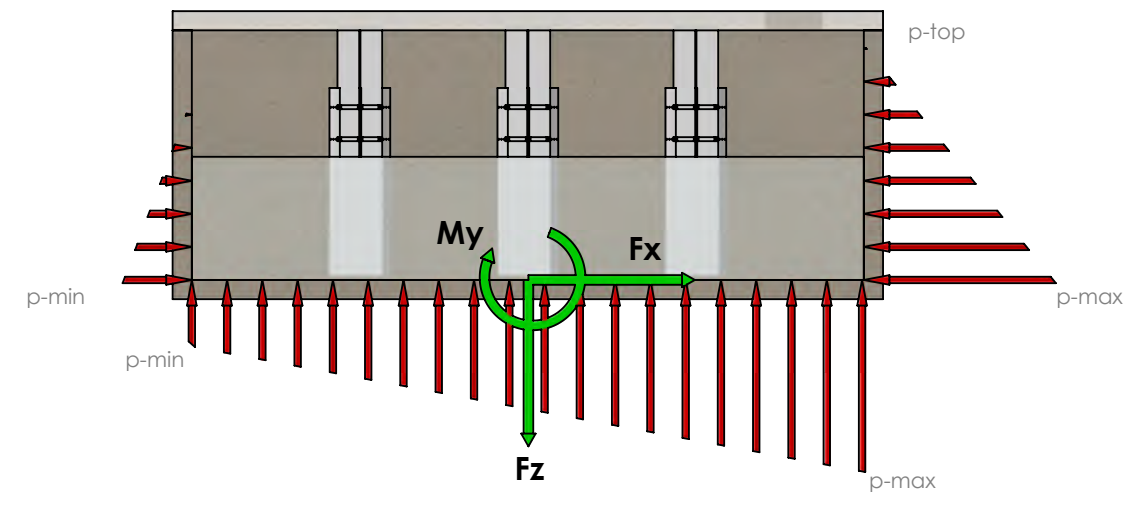
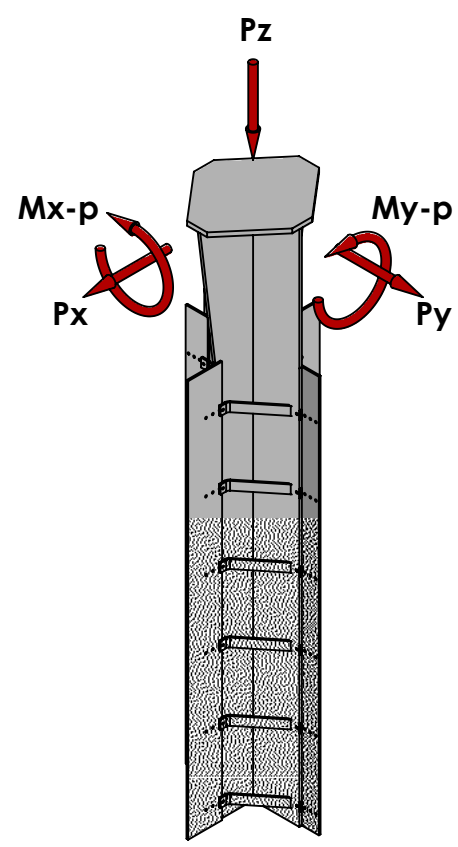
TITLE:
SOUTH WEST TUNED SLOSHING DAMPER TANK LAYOUT

PROJECT #	SHEET #
1600192	1 OF 1
DRAWING NO.	REV. NO.
D02	-



- NOTES:
- THIS DRAWING PACKAGE MUST BE USED IN CONJUNCTION WITH RWDI'S "TUNED SLOSHING DAMPER GENERAL DESIGN AND INSTALLATION GUIDELINES." CONTACT RWDI IF THIS DOCUMENT HAS NOT BEEN INCLUDED.
 - TANK LENGTH TO BE FINALIZED BY RWDI AFTER CONDUCTING STRUCTURAL FREQUENCY MEASUREMENTS AT 90% CONSTRUCTION COMPLETION.
 - DEVIATION OF CENTER POINT AT THE BOTTOM OF THE PADDLE TO BE NO MORE THAN 1" FROM PLUMB.
 - ANGULAR MISALIGNMENT OF PADDLE EMBED TO BE NO MORE THAN 2 DEGREES FROM THE TANK SIDEWALL.
 - CONFIRM TANK HEIGHT TO MAINTAIN THE SPECIFIED CLEARANCE BETWEEN PADDLE AND FLOOR SLAB.
 - MAXIMUM WATER DEPTH. FINAL DEPTH TO BE DETERMINED BY RWDI DURING COMMISSIONING.

8 7 6 5 4 3 2 1



NORTH EAST TANK WATER PRESSURES			
LOAD TYPE	p-min (psi)	p-max (psi)	p-top (psi)
DEAD SERVICE	2.8	2.8	0.0
50-YR SERVICE WIND (FATIGUE)	-1.4	2.0	0.0
700-YR ULTIMATE WIND	-1.5	2.5	0.0
2500-YR ULTIMATE SEISMIC	-0.4	0.9	0.0

THE SIMPLIFIED PEAK PRESSURE DISTRIBUTIONS SHOWN ABOVE ARE TO BE USED TO DESIGN THE TANK SLABS AND WALLS ONLY. THE X AND Y DIRECTION LOADING SHOULD BE CONSIDERED INDEPENDENTLY. AS A RESULT OF THE SIMPLIFICATION MADE TO THE PRESSURE DISTRIBUTION, THE RESULTING OVERALL FORCES AND MOMENTS MAY NOT MATCH THE OVERALL LOADS SHOWN IN THE TANK INTERFACE LOADS TABLE BELOW.

NORTH EAST TANK-STRUCTURE INTERFACE LOADS					
LOAD TYPE	Fx (kip)	Fy(kip)	Fz (kip)	Mx (kip-ft)	My (kip-ft)
DEAD (WATER) SERVICE	0	0	454	0	0
50-YR SERVICE WIND (FATIGUE)	31.2	52.7	0	970	665
700-YR ULTIMATE WIND	53.7	69.1	0	1216	1029
2500-YR ULTIMATE SEISMIC	36.3	36.7	0	639	642

THE OVERALL LOADS SHOWN ABOVE ARE TO BE USED TO DESIGN THE TANK SUPPORTING STRUCTURE

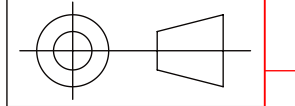
NORTH EAST PADDLE-TANK INTERFACE LOADS					
LOAD TYPE	Px (kip)	Py (kip)	Pz (kip)	Mx-p (kip-ft)	My-p (kip-ft)
DEAD SERVICE	0	0	2.7	0	0
50-YR SERVICE WIND (FATIGUE)	2.5	3.4	0	37.4	27.6
700-YR ULTIMATE WIND	5.9	5.5	0	56.9	66.4
2500-YR ULTIMATE SEISMIC	1.4	1.3	0	12.0	13.5

NOTES:

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- APPROPRIATE LOAD FACTORS SHALL BE APPLIED TO GIVEN SERVICE LOADS.
- RECOMMENDED LOAD CASES FOR EACH LOAD COMBINATION:
 - +Fz +My +Fx +Mx +Fy
 - +Fz +My +Fx -Mx -Fy
 - +Fz -My -Fx +Mx +Fy
 - +Fz -My -Fx -Mx -Fy
- FATIGUE LOADS TO BE CONSIDERED AS LOADS ARE FULLY REVERSING.
- IF MULTIPLE TSD TANKS ARE PRESENT, LOADS SHOWN APPLY TO ALL TANKS SIMULTANEOUSLY
- IF TANKS ARE ALLOWED TO BECOME COMPLETELY FULL, LARGER LOADS THAN THOSE GIVEN MAY RESULT (BOTH VERTICALLY AND Laterally). OVERFILL PROTECTION DEVICES ARE RECOMMENDED.
- LOADS SHOWN REPRESENT MAXIMUM LOADS FOR THE SPECIFIED RETURN PERIODS.



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REV.	DATE	REVIEW	ECN #
REVISIONS			

DASH NO. NEXT HIGHER ASSEMBLY

SURF TEXTURE SYM	
COMMON	MICRO INCH
~	500
▽	250
▽▽	125
▽▽▽	32
▽▽▽▽	16

TOLERANCE UNLESS NOTED

X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

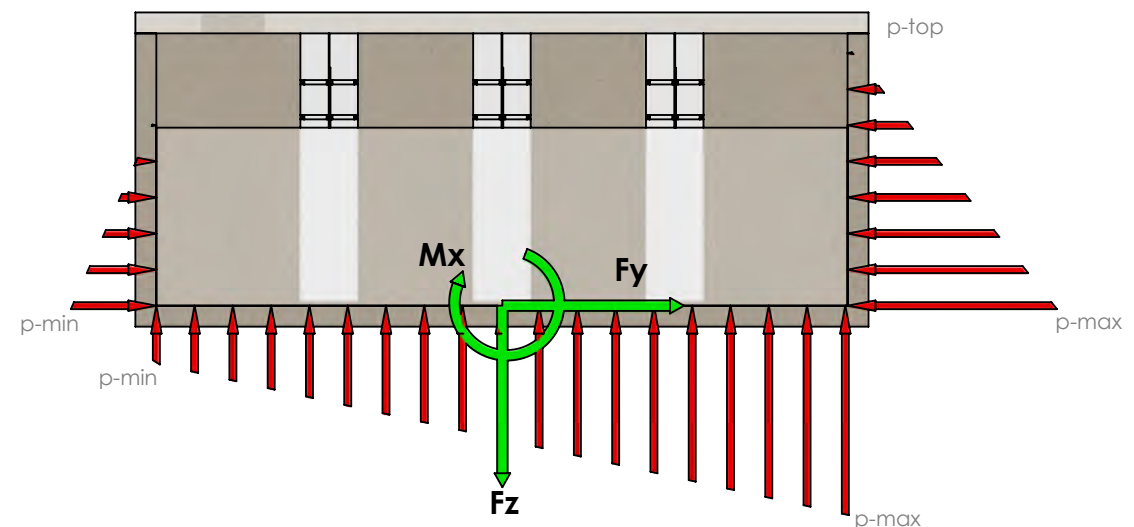
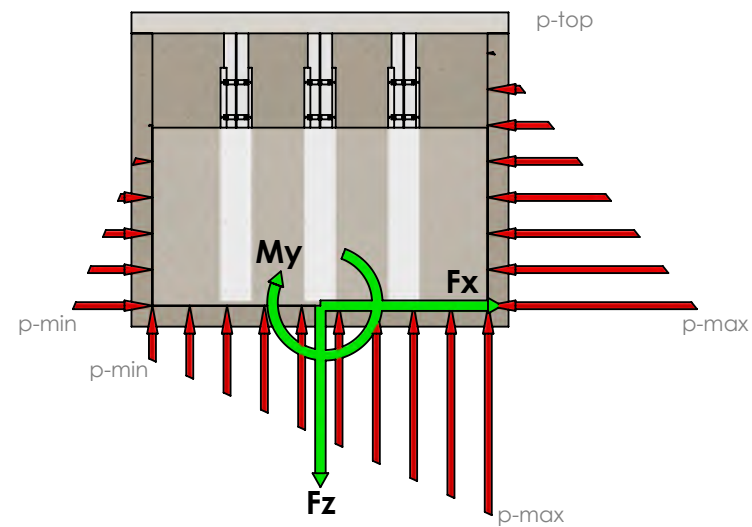
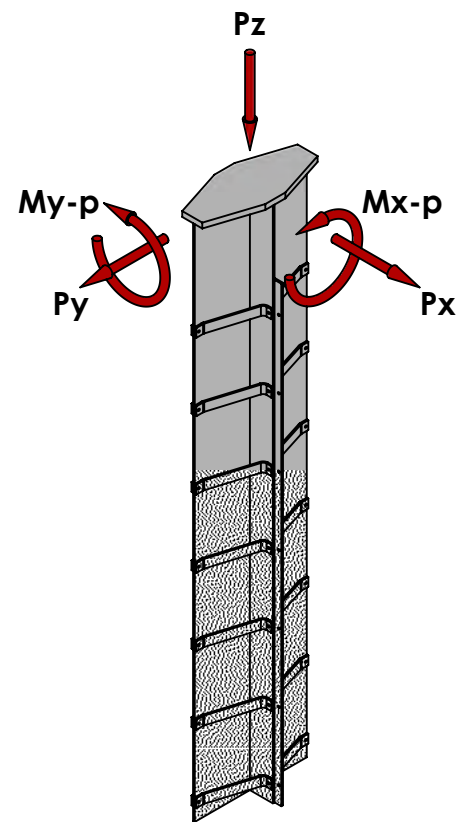
ALL DIMENSIONS IN INCHES UNLESS NOTED

PROJECT NAME:
**44 WEST 66TH STREET,
NEW YORK, NY**

	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JBI	2018-06-20
REVIEW	AWS	2018-06-25

TITLE:
NORTH EAST TUNED SLOSHING DAMPER DESIGN LOADS

PROJECT #	1600192	SHEET #	1 OF 1
DRAWING NO.	D03	REV. NO.	-



SOUTH WEST TANK WATER PRESSURES			
LOAD TYPE	p-min (psi)	p-max (psi)	p-top (psi)
DEAD SERVICE	3.7	3.7	0.0
50-YR SERVICE WIND (FATIGUE)	-1.2	1.6	0.0
700-YR ULTIMATE WIND	-1.4	2.3	0.0
2500-YR ULTIMATE SEISMIC	-0.3	0.8	0.0

THE SIMPLIFIED PEAK PRESSURE DISTRIBUTIONS SHOWN ABOVE ARE TO BE USED TO DESIGN THE TANK SLABS AND WALLS ONLY. THE X AND Y DIRECTION LOADING SHOULD BE CONSIDERED INDEPENDENTLY. AS A RESULT OF THE SIMPLIFICATION MADE TO THE PRESSURE DISTRIBUTION, THE RESULTING OVERALL FORCES AND MOMENTS MAY NOT MATCH THE OVERALL LOADS SHOWN IN THE TANK INTERFACE LOADS TABLE BELOW.

SOUTH WEST TANK-STRUCTURE INTERFACE LOADS					
LOAD TYPE	Fx (kip)	Fy(kip)	Fz (kip)	Mx (kip-ft)	My (kip-ft)
DEAD (WATER) SERVICE	0	0	282.5	0	0
50-YR SERVICE WIND (FATIGUE)	9.9	26.0	0	686	104
700-YR ULTIMATE WIND	17.3	35.6	0	917	163
2500-YR ULTIMATE SEISMIC	30.9	27.2	0	528	197

THE OVERALL LOADS SHOWN ABOVE ARE TO BE USED TO DESIGN THE TANK SUPPORTING STRUCTURE

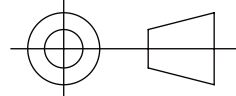
SOUTH WEST PADDLE-TANK INTERFACE LOADS					
LOAD TYPE	Px (kip)	Py (kip)	Pz (kip)	Mx-p (kip-ft)	My-p (kip-ft)
DEAD SERVICE	0	0	1.5	0	0
50-YR SERVICE WIND (FATIGUE)	0.1	1.6	0	17.4	0.6
700-YR ULTIMATE WIND	0.1	3.0	0	32.7	1.0
2500-YR ULTIMATE SEISMIC	0.2	0.7	0	5.5	1.8

NOTES:

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- APPROPRIATE LOAD FACTORS SHALL BE APPLIED TO GIVEN SERVICE LOADS.
- RECOMMENDED LOAD CASES FOR EACH LOAD COMBINATION:
 - +Fz +My +Fx +Mx +Fy
 - +Fz +My +Fx -Mx -Fy
 - +Fz -My -Fx +Mx +Fy
 - +Fz -My -Fx -Mx -Fy
- FATIGUE LOADS TO BE CONSIDERED AS LOADS ARE FULLY REVERSING.
- IF MULTIPLE TSD TANKS ARE PRESENT, LOADS SHOWN APPLY TO ALL TANKS SIMULTANEOUSLY
- IF TANKS ARE ALLOWED TO BECOME COMPLETELY FULL, LARGER LOADS THAN THOSE GIVEN MAY RESULT (BOTH VERTICALLY AND Laterally). OVERFILL PROTECTION DEVICES ARE RECOMMENDED.
- LOADS SHOWN REPRESENT MAXIMUM LOADS FOR THE SPECIFIED RETURN PERIODS.



400 SOUTHGATE DRIVE
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Website: www.rwdi.com



REV.	DATE	REVIEW	ECN #
REVISIONS			

DASH NO.	NEXT HIGHER ASSEMBLY

SURF TEXTURE SYM

COMMON	MICRO INCH
~	500
▽	250
▽▽	125
▽▽▽	32
▽▽▽▽	16

TOLERANCE UNLESS NOTED

X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

ALL DIMENSIONS IN INCHES UNLESS NOTED

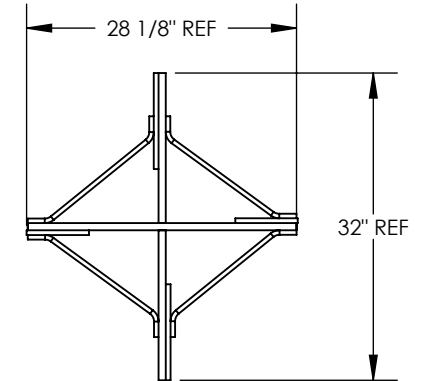
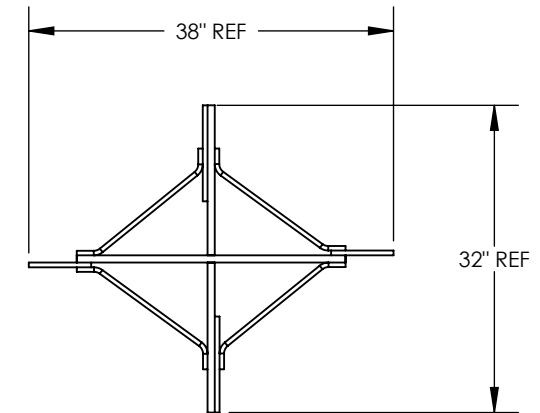
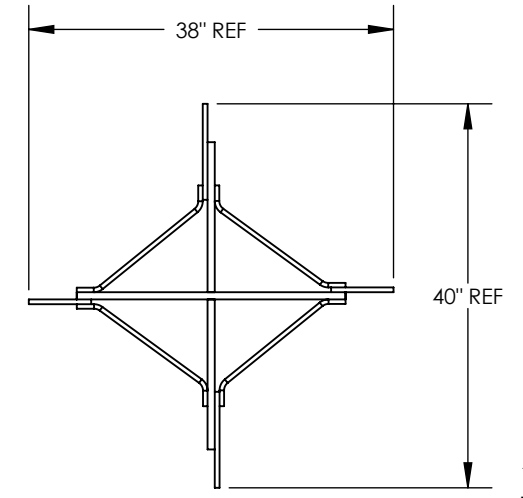
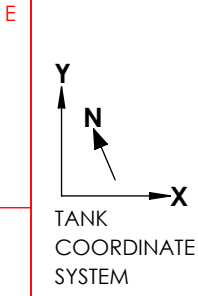
PROJECT NAME:
**44 WEST 66TH STREET,
NEW YORK, NY**

	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JBI	2018-06-20
REVIEW	AWS	2018-06-25

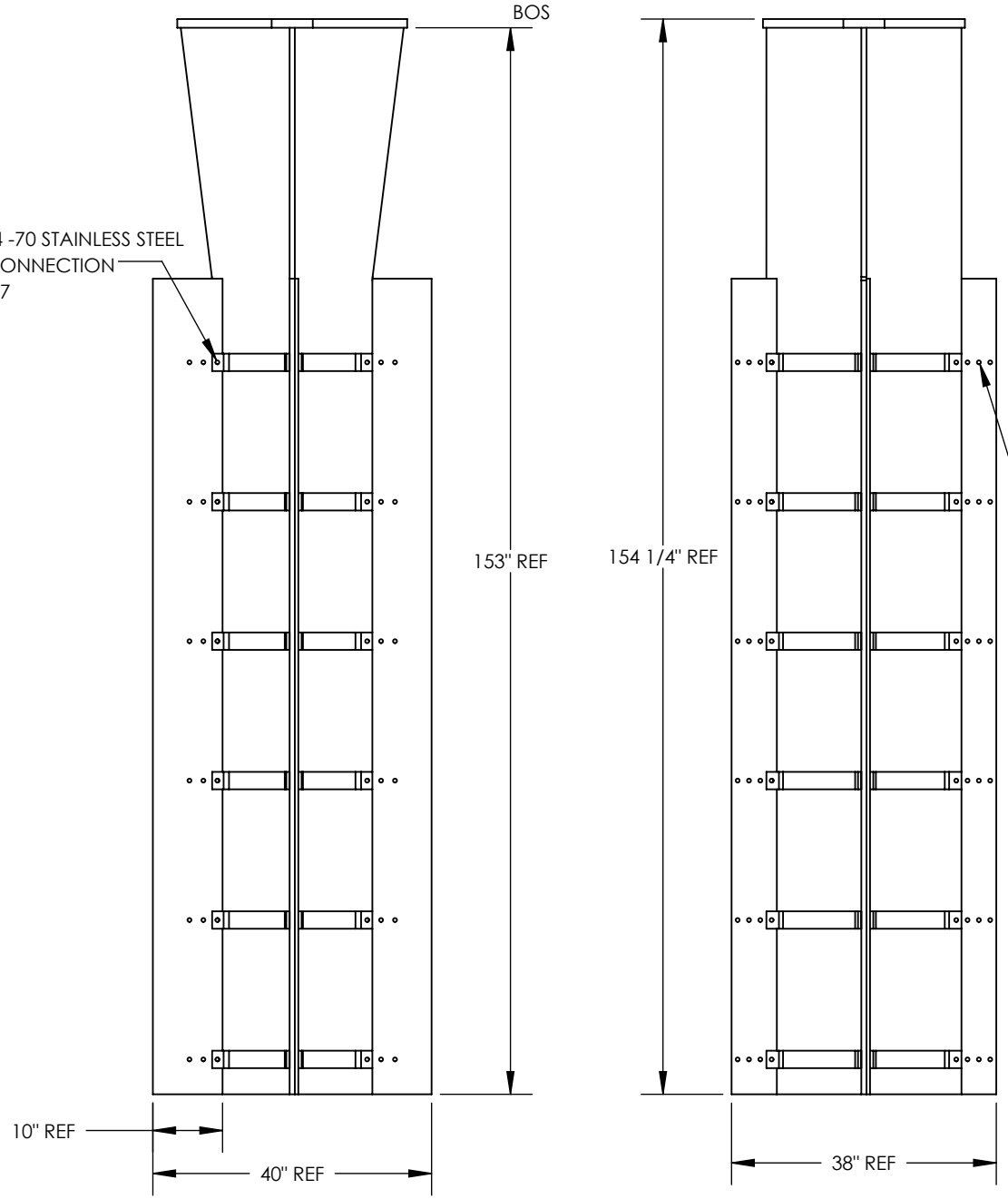
TITLE:
SOUTH WEST TUNED SLOSHING DAMPER DESIGN LOADS

PROJECT #	1600192	SHEET #	1 OF 1
DRAWING NO.	D04	REV. NO.	-

8 7 6 5 4 3 2 1



1/2"-13 A4-70 STAINLESS STEEL BOLTED CONNECTION SEE NOTE 7

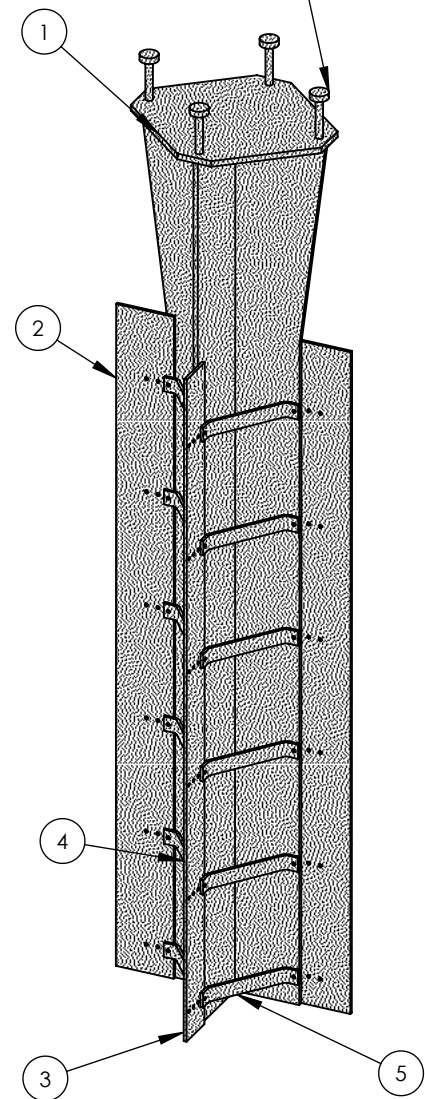


BOLTING HARDWARE NOT INCLUDED IN BOM

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	D07-01	PADDLE WELDMENT
2	2	D09-50	X BLADE
3	2	D09-51	Y BLADE
4	12	D09-52	CROSS BRACE A
5	12	D09-53	CROSS BRACE B

EMBED PLATE CONNECTION TO THE CEILING TO BE DESIGNED AND DETAILED BY STRUCTURAL ENGINEER. COORDINATE WITH RWDI.

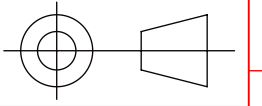
1/2"-13 A4-70 STAINLESS STEEL BOLTED CONNECTION SEE NOTE 7



-01
TUNED SLOSHING DAMPER PADDLE ASSEMBLY
WEIGHT: 2614 lbs.



400 SOUTHGATE DRIVE
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Websites: www.rwdi.com



REV.	DATE	REVIEW	ECN #
------	------	--------	-------

REVISIONS

-01	D01
DASH NO.	NEXT HIGHER ASSEMBLY
SURF TEXTURE SYM	
COMMON	MICRO INCH
~	500
▽	250
▽▽	125
▽▽▽	32
▽▽▽▽	16

TOLERANCE UNLESS NOTED	
X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

PROJECT NAME:
44 WEST 66TH STREET,
NEW YORK, NY

	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JBI	2018-06-20
REVIEW	AWS	2018-06-25

TITLE:
NORTH EAST TUNED SLOSHING DAMPER PADDLE ASSEMBLY

PROJECT #	1600192	SHEET #	1 OF 1
DRAWING NO.	D05	REV. NO.	-

FABRICATION NOTES:

- THIS DRAWING PACKAGE MUST BE USED IN CONJUNCTION WITH RWDI'S "TUNED SLOSHING DAMPER GENERAL DESIGN AND INSTALLATION GUIDELINES." CONTACT RWDI IF THIS DOCUMENT HAS NOT BEEN INCLUDED.
- SEE DRAWING D00 FOR GENERAL NOTES.
- BREAK ALL SHARP EDGES 1/16".
- ALL BILL OF MATERIAL QUANTITIES ARE PER ASSEMBLY.
- PADDLE EXTENSION DIMENSIONS TO BE DETERMINED DURING TUNING AND COMMISSIONING.
- TORQUE BOLTS TO 27 ft*lb DRY OR 36 ft*lb LUBRICATED.

8 7 6 5 4 3 2 1

A

A

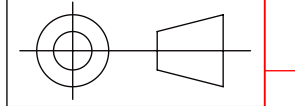
8 7 6 5 4 3 2 1

**BOLTING HARDWARE
NOT INCLUDED IN
BOM**

ITEM NO.	QTY.	PART NUMBER	DESCRIPTION
1	1	D08-01	PADDLE WELDMENT
2	2	D10-50	BLADE
3	14	D10-51	CROSS BRACE A
4	14	D10-52	CROSS BRACE B



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REV.	DATE	REVIEW	ECN #
REVISIONS			
-01		D02	

DASH NO.	NEXT HIGHER ASSEMBLY

COMMON	MICROMETER
~	12.7
▽	6.35
▽▽	3.2
▽▽▽	0.8
▽▽▽▽	0.4

TOLERANCE UNLESS NOTED	
X	±1.5
X.X	±0.5
X.XX	±0.25
X.XXX	±0.1
X.XXXX	±0.025
ANGULAR	±0.5°

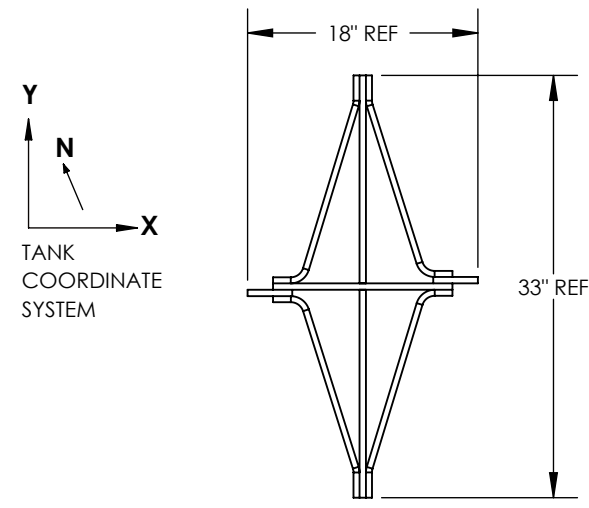
ALL DIMENSIONS IN INCHES UNLESS NOTED

PROJECT NAME:
**44 WEST 66TH STREET,
NEW YORK, NY**

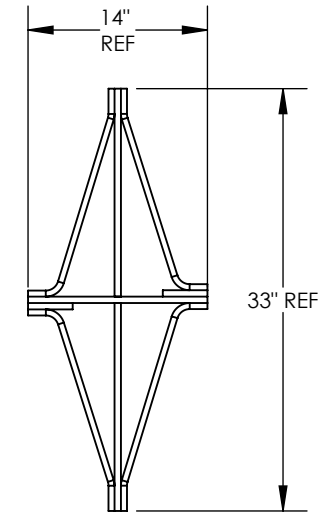
	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JBI	2018-06-20
REVIEW	AWS	2018-06-25

TITLE:
SOUTH WEST TUNED SLOSHING DAMPER PADDLE ASSEMBLY

PROJECT #	SHEET #
1600192	1 OF 1
DRAWING NO.	REV. NO.
D06	-

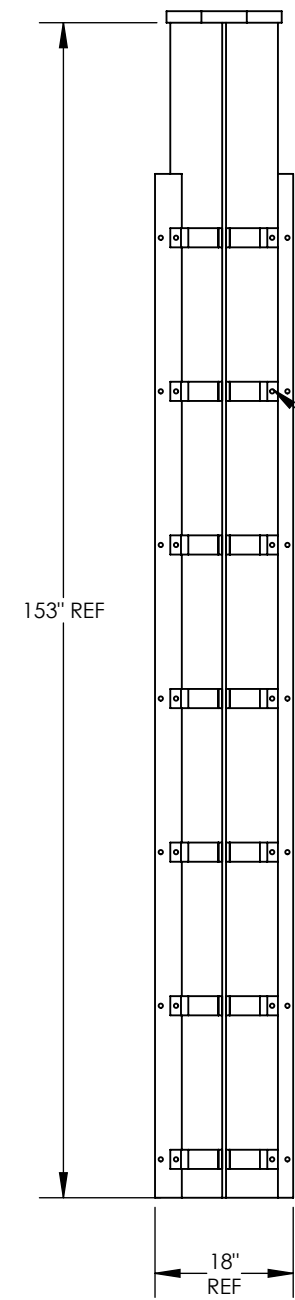
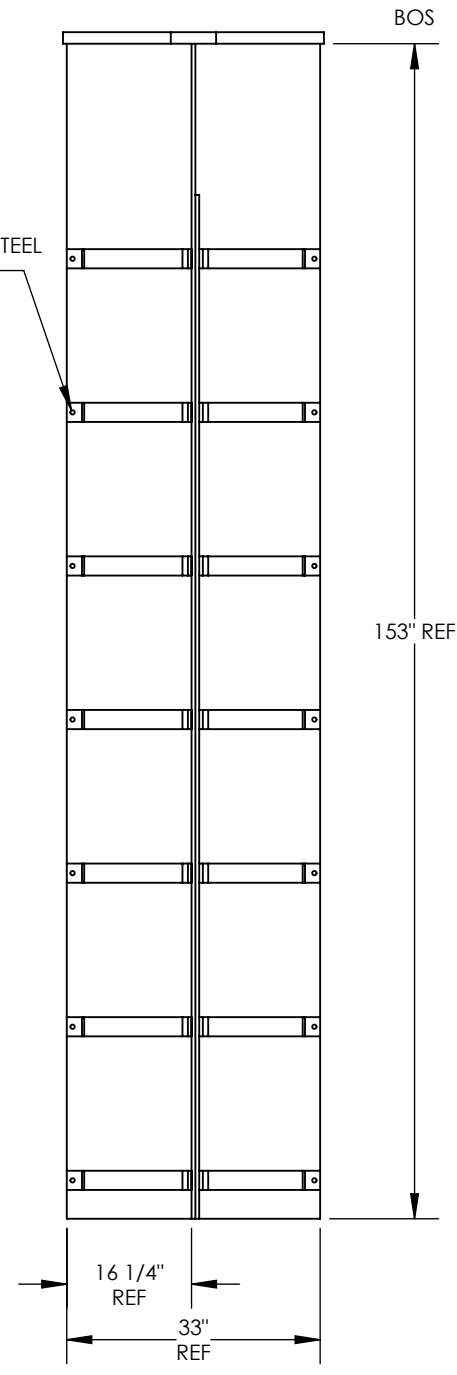


PADDLE FULLY EXTENDED AND NOMINAL CONFIGURATION
SEE NOTE 5
(EMBED REMOVED FOR CLARITY)



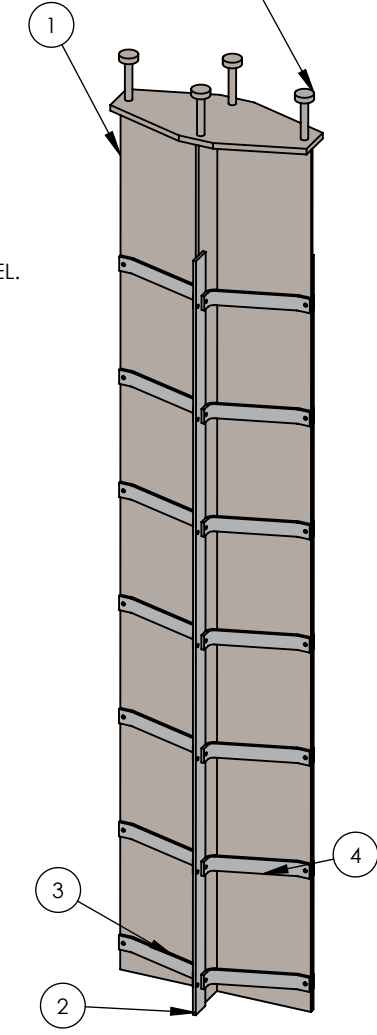
PADDLE FULLY RETRACTED CONFIGURATION
SEE NOTE 5
(EMBED REMOVED FOR CLARITY)

1/2"-13 A4-70 STAINLESS STEEL
BOLTED CONNECTION
SEE NOTE 7



EMBED PLATE CONNECTION TO THE
CEILING TO BE DESIGNED AND DETAILED
BY STRUCTURAL ENGINEER.
COORDINATE WITH RWDI.

1/2"-13 A4-70 STAINLESS STEEL.
BOLTED CONNECTION
SEE NOTE 7



-01
TUNED SLOSHING DAMPER
PADDLE ASSEMBLY
WEIGHT: 1508 lbs.

FABRICATION NOTES:

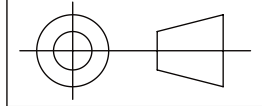
- THIS DRAWING PACKAGE MUST BE USED IN CONJUNCTION WITH RWDI'S "TUNED SLOSHING DAMPER GENERAL DESIGN AND INSTALLATION GUIDELINES." CONTACT RWDI IF THIS DOCUMENT HAS NOT BEEN INCLUDED.
- SEE DRAWING D00 FOR GENERAL NOTES.
- BREAK ALL SHARP EDGES 1/16".
- ALL BILL OF MATERIAL QUANTITIES ARE PER ASSEMBLY.
- PADDLE EXTENSION DIMENSIONS TO BE DETERMINED DURING TUNING AND COMMISSIONING
- TORQUE BOLTS TO 27 ft*lb DRY OR 36 ft*lb LUBRICATED.

8 7 6 5 4 3 2 1

ITEM NO.	QTY.	DESCRIPTION	MATERIAL	WEIGHT (lbs)
1	1	PADDLE EMBED PLATE	AISI 316L STAINLESS STEEL	106
2	1	PADDLE THRU PLATE	AISI 316L STAINLESS STEEL	931
3	2	PADDLE PLATE	AISI 316L STAINLESS STEEL	388



400 SOUTHGATE DRIVE
GUELPH, ONTARIO, CANADA N1G 4P6
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REV.	DATE	REVIEW	ECN #
REVISIONS			
-01		D05	

DASH NO. NEXT HIGHER ASSEMBLY

SURF TEXTURE SYM

COMMON	MICRO INCH
~	500
▽	250
▽▽	125
▽▽▽	32
▽▽▽▽	16

TOLERANCE UNLESS NOTED

X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

ALL DIMENSIONS IN INCHES UNLESS NOTED

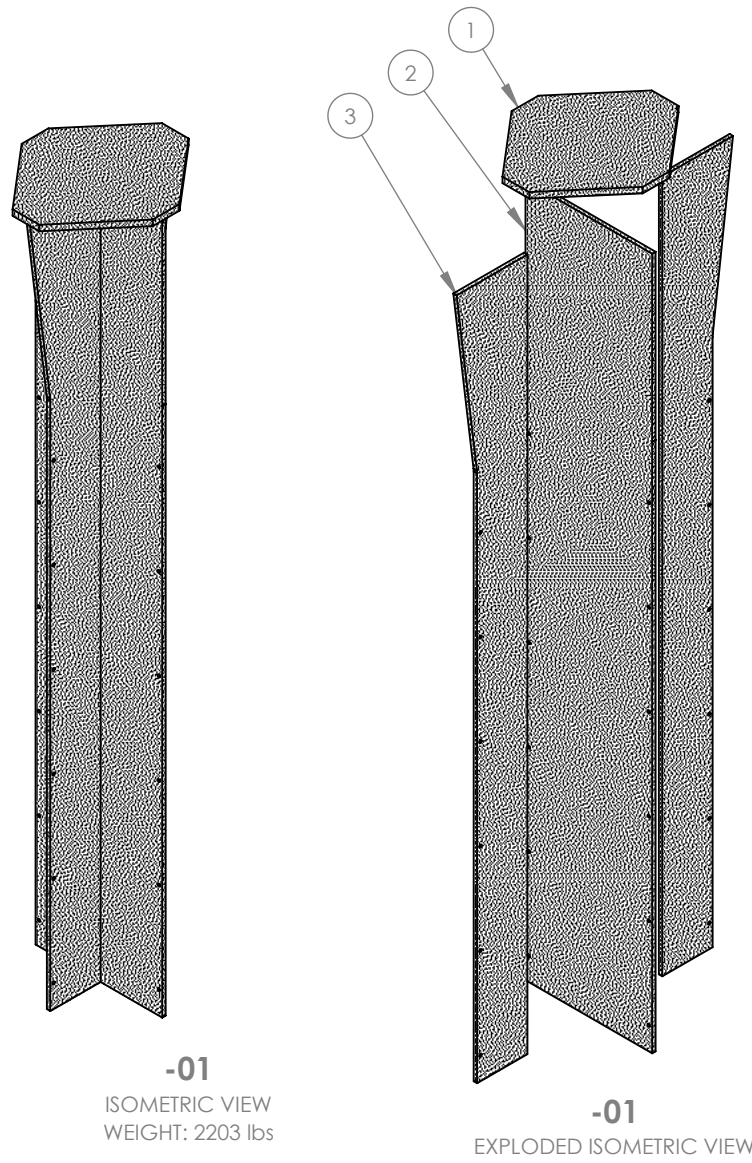
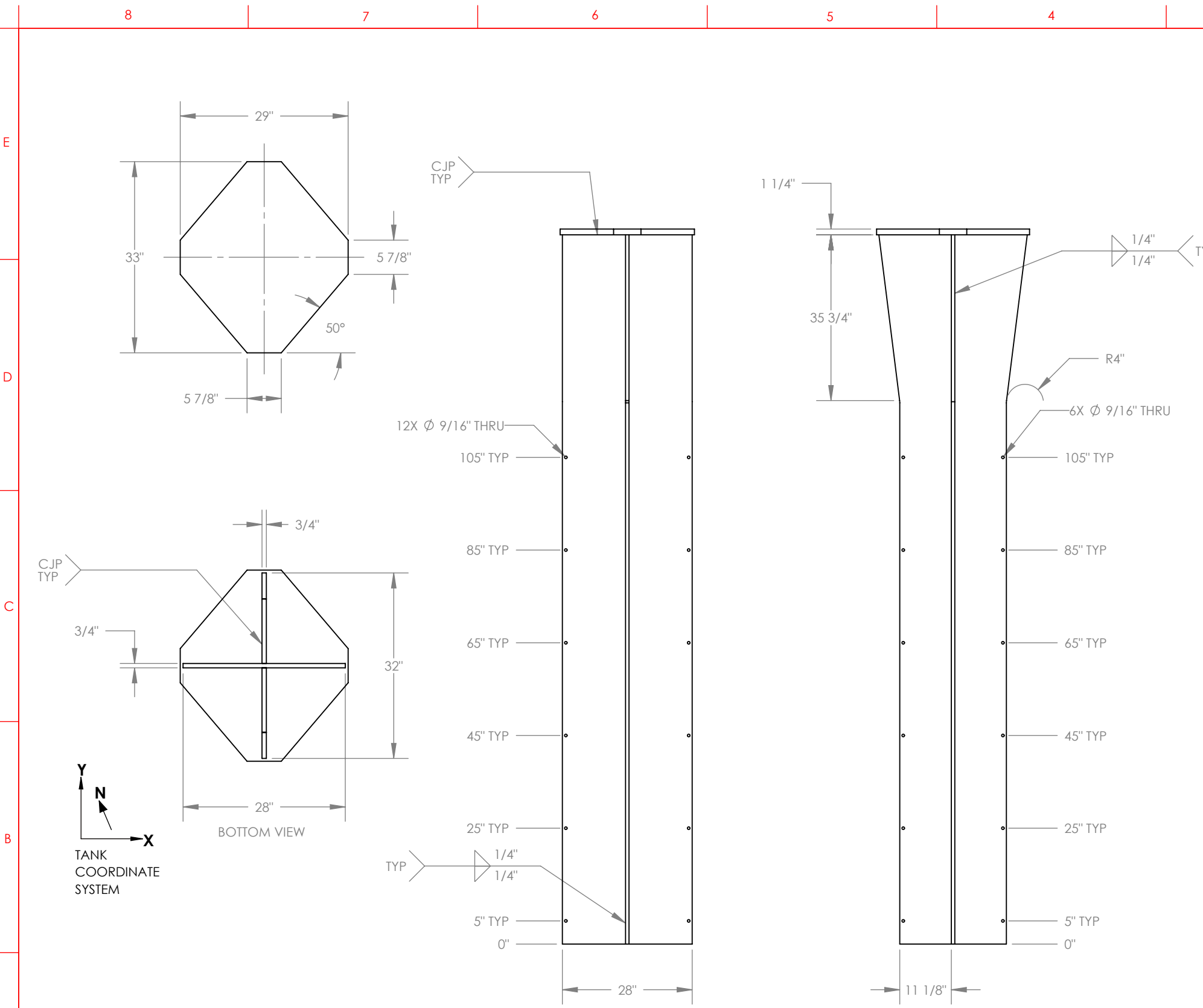
PROJECT NAME:

44 WEST 66TH STREET,
NEW YORK, NY

	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JB	2018-06-20
REVIEW	AWS	2018-06-25

TITLE:
NORTH EAST TUNED
SLOSHING DAMPER
PADDLE WELDMENT

PROJECT #	1600192	SHEET #	1 OF 1
DRAWING NO.	D07	REV. NO.	-

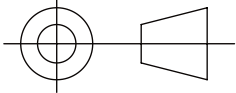


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 - SEE DRAWING D03 FOR GENERAL FABRICATION NOTES.
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 - ALL COMPLETE JOINT WELDS TO BE ULTRASONICALLY OF RADIOGRAPHICALLY TESTED TO ENSURE THE WELD ACHIEVES ACCEPTANCE REQUIREMENTS OF SECTIONS 6.12.2 OR 6.13.2 OF AWS D1.1/D1.1M OR EQUIVALENT.

ITEM NO.	QTY.	DESCRIPTION	MATERIAL	WEIGHT (lbs)
1	1	PADDLE EMBED PLATE	AISI 316L STAINLESS STEEL	106
2	1	PADDLE THRU PLATE	AISI 316L STAINLESS STEEL	637
3	2	PADDLE PLATE	AISI 316L STAINLESS STEEL	354



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REV.	DATE	REVIEW	ECN #
REVISIONS			
-01			D06

DASH NO. NEXT HIGHER ASSEMBLY

SURF TEXTURE SYM

COMMON	MICRO INCH
~	500
▽	250
▽▽	125
▽▽▽	32
▽▽▽▽	16

TOLERANCE UNLESS NOTED

X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

ALL DIMENSIONS IN INCHES UNLESS NOTED

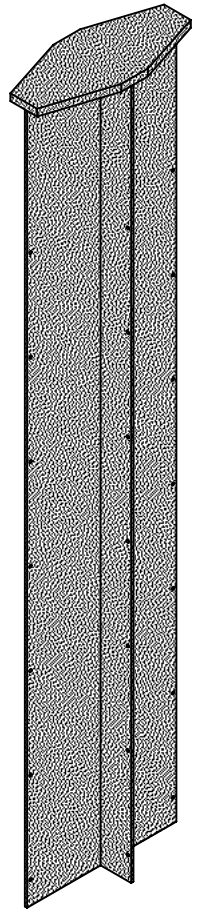
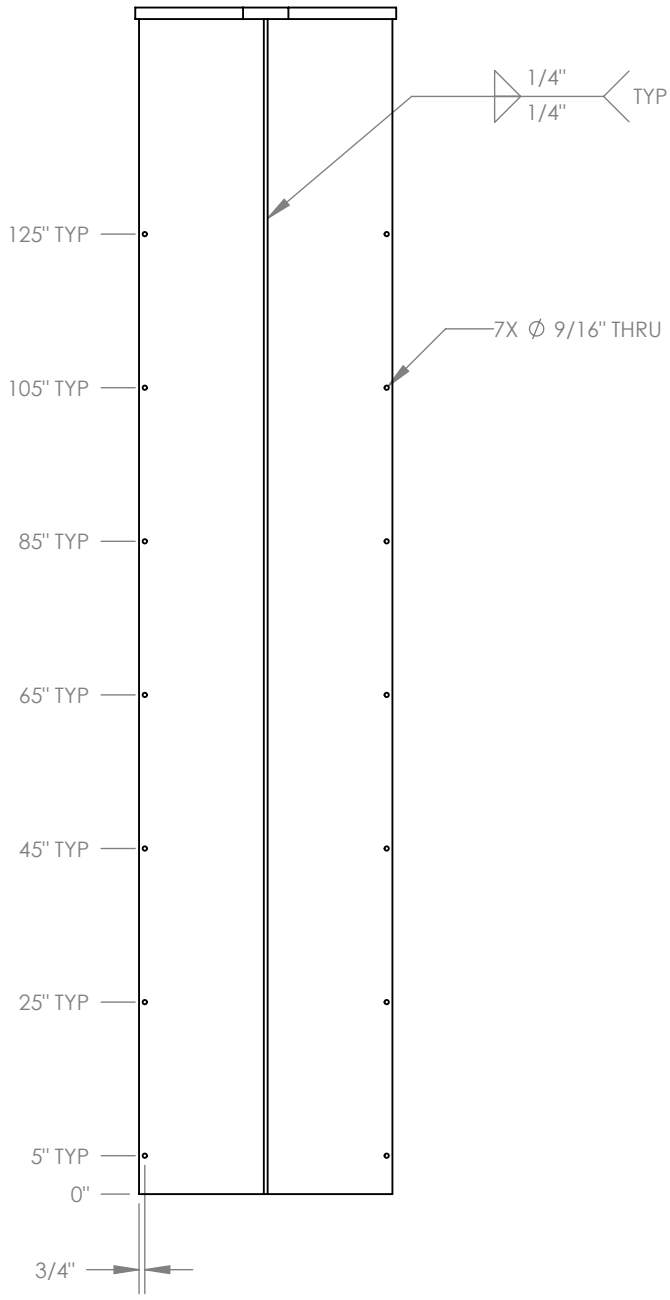
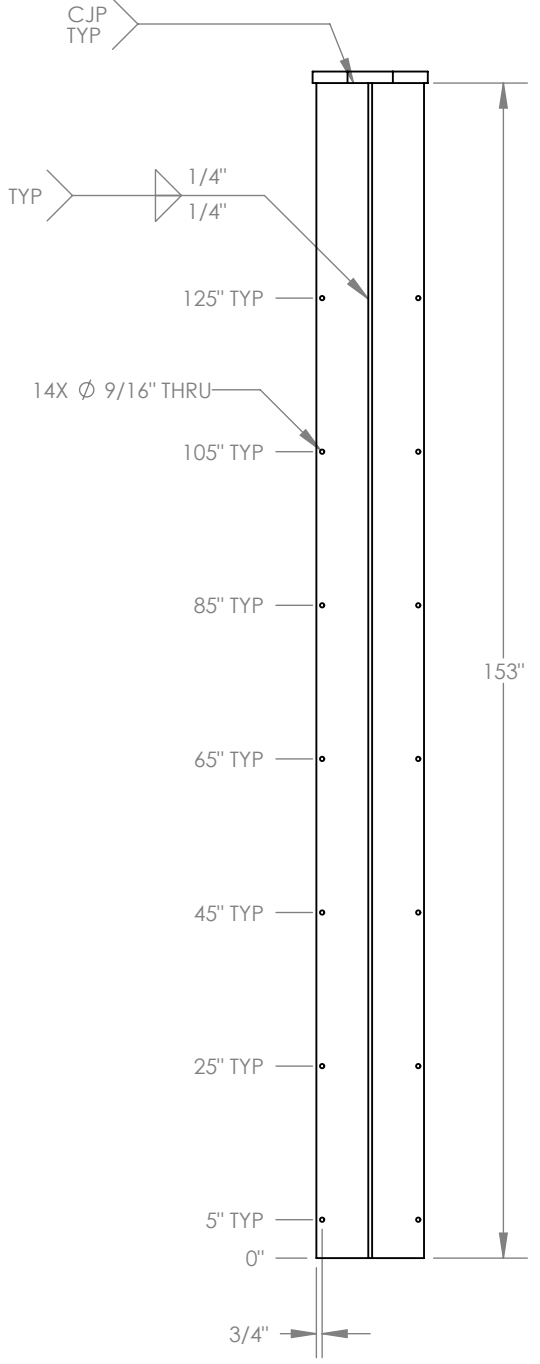
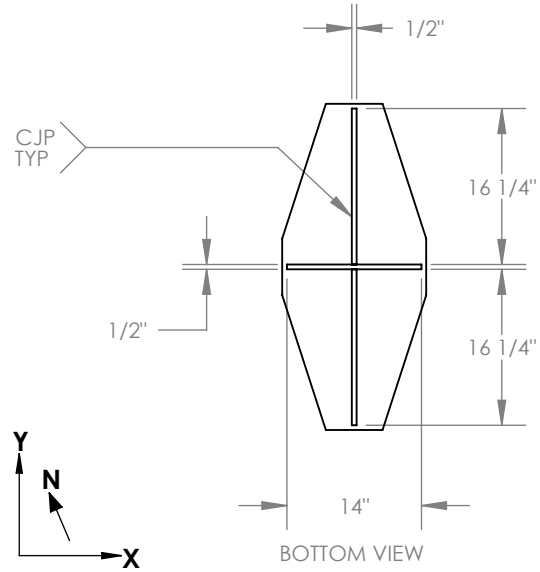
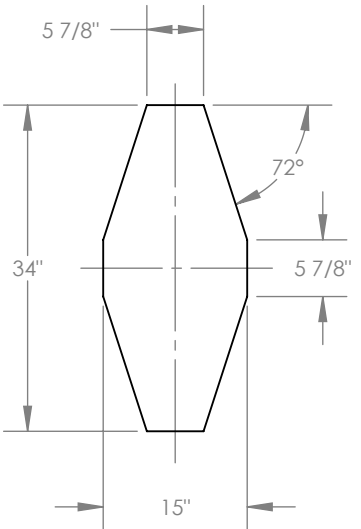
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44 WEST 66TH STREET,
NEW YORK, NY

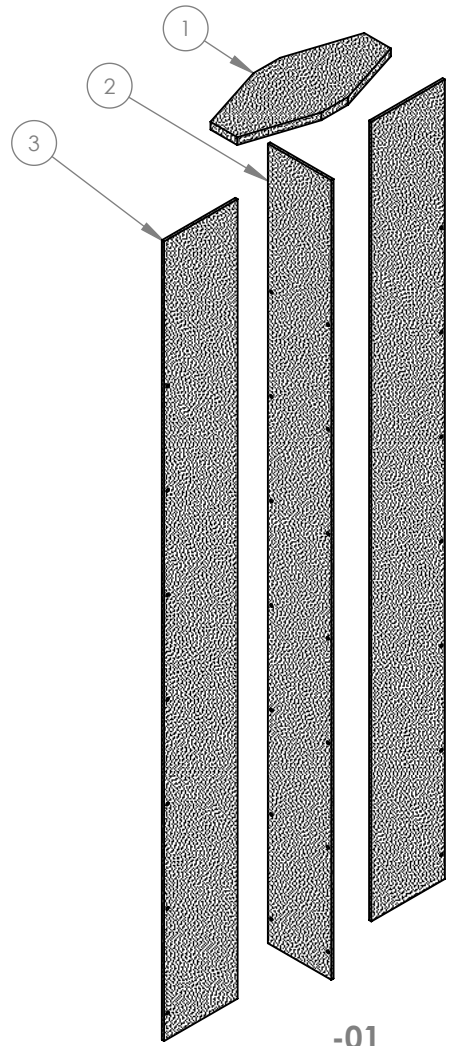
	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JBI	2018-06-20
REVIEW	AWS	2018-06-25

TITLE:
SOUTH WEST TUNED
SLOSHING DAMPER
PADDLE WELDMENT

PROJECT #	1600192	SHEET #	1 OF 1
DRAWING NO.	D08	REV. NO.	-



-01
ISOMETRIC VIEW
WEIGHT: 1197 lbs

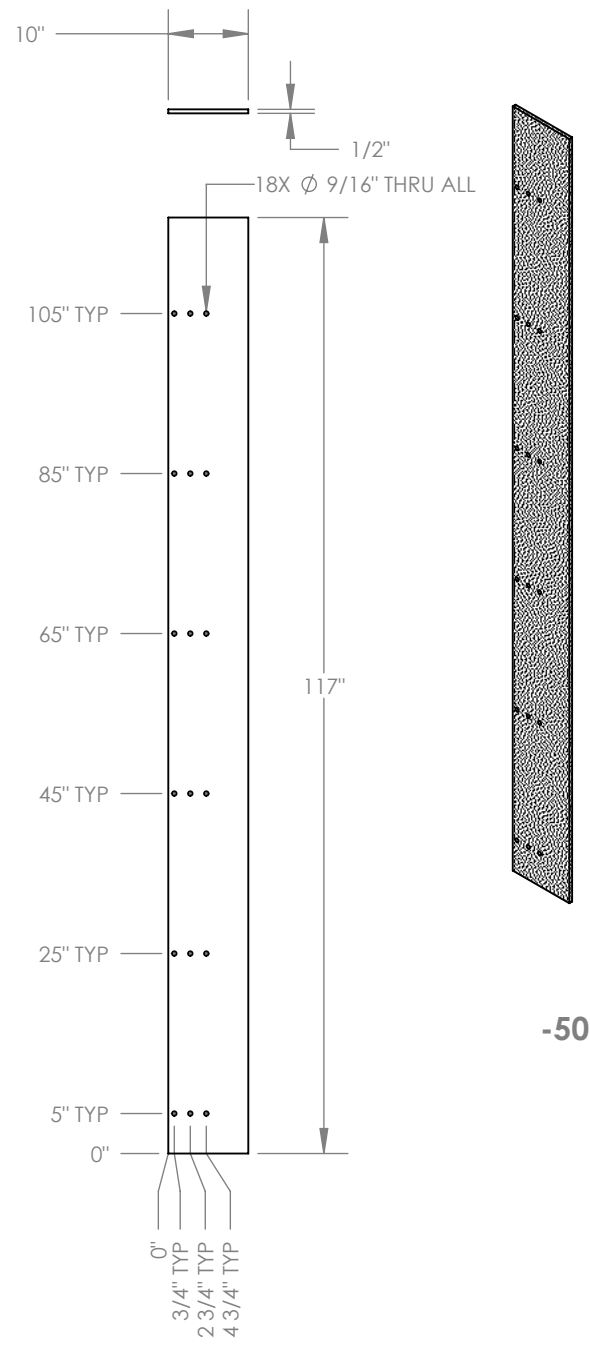


-01
EXPLODED ISOMETRIC VIEW

FABRICATION NOTES:

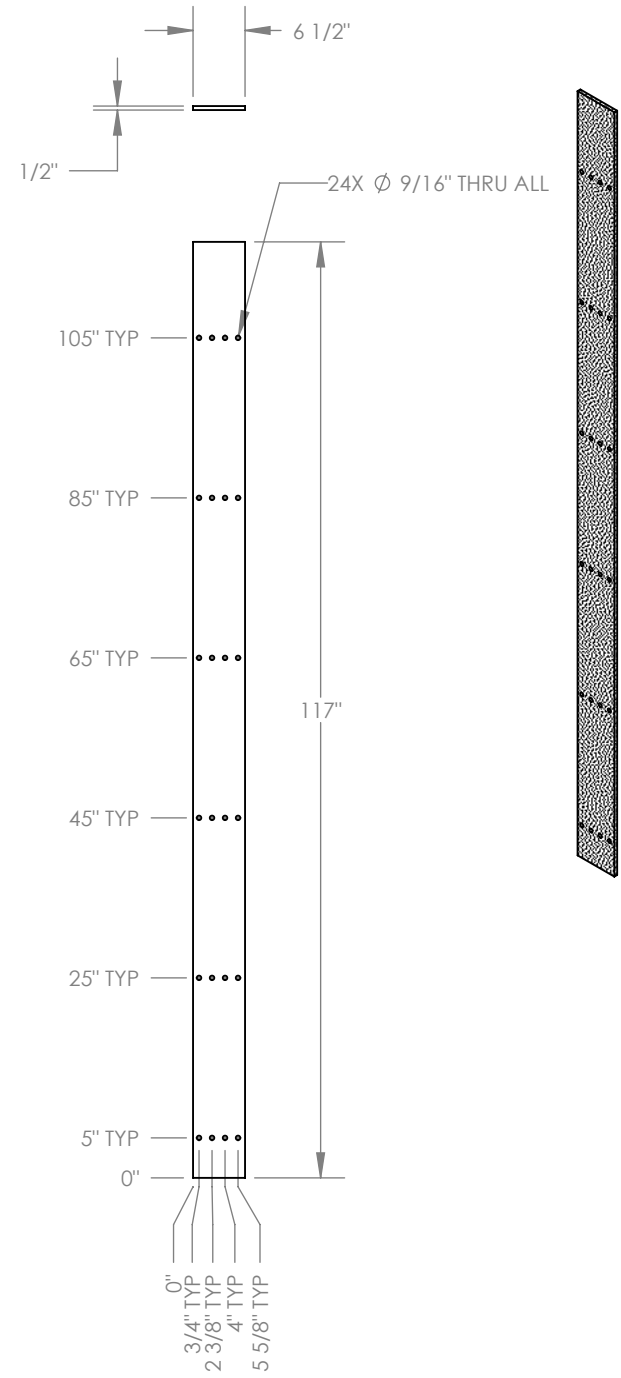
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- SEE DRAWING D03 FOR GENERAL FABRICATION NOTES.
- PLATE EDGE TOLERANCES +0/-1/16".
- ALL COMPLETE JOINT WELDS TO BE ULTRASONICALLY OF RADIOGRAPHICALLY TESTED TO ENSURE THE WELD ACHIEVES ACCEPTANCE REQUIREMENTS OF SECTIONS 6.12.2 OR 6.13.2 OF AWS D1.1/D1.1M OR EQUIVALENT.

PART NUMBER	DESCRIPTION	MATERIAL	STOCK SIZE	WEIGHT (lbs)
D09-50	X BLADE	AISI 316L STAINLESS STEEL	117" X 10" X 1/2"	169



-50

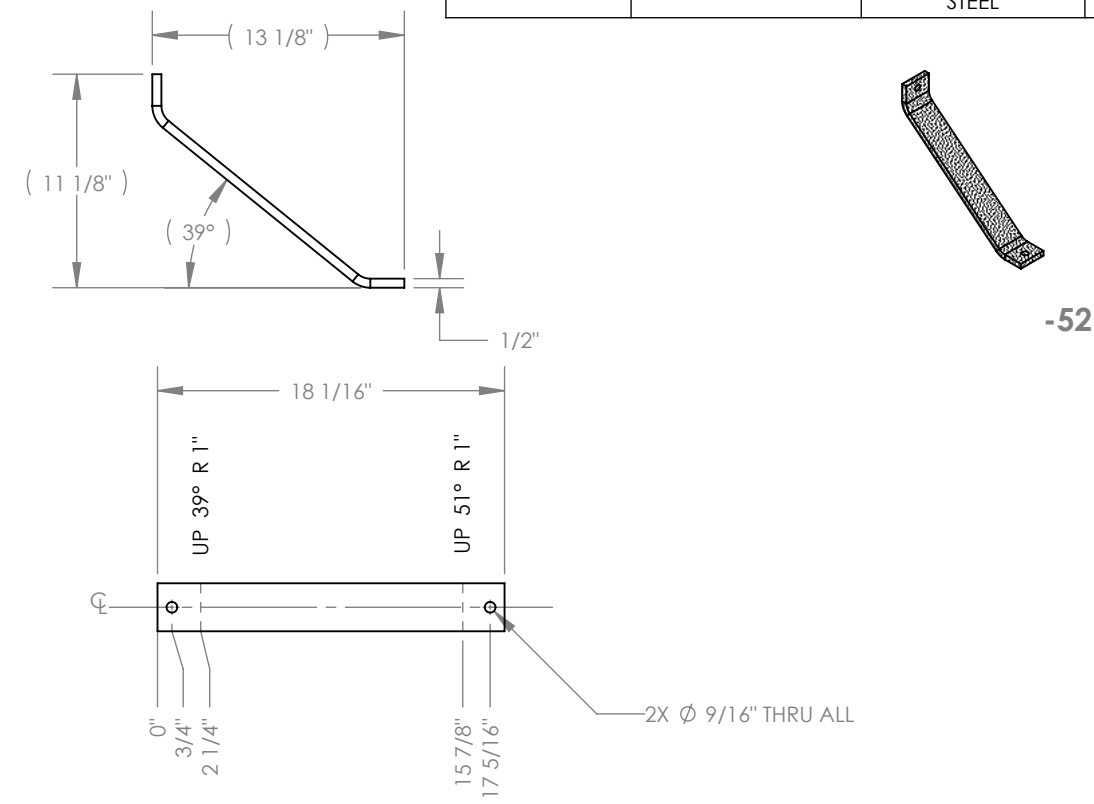
PART NUMBER	DESCRIPTION	MATERIAL	STOCK SIZE	WEIGHT (lbs)
D09-51	Y BLADE	AISI 316L STAINLESS STEEL	117" X 6 1/2" X 1/2"	109



-51

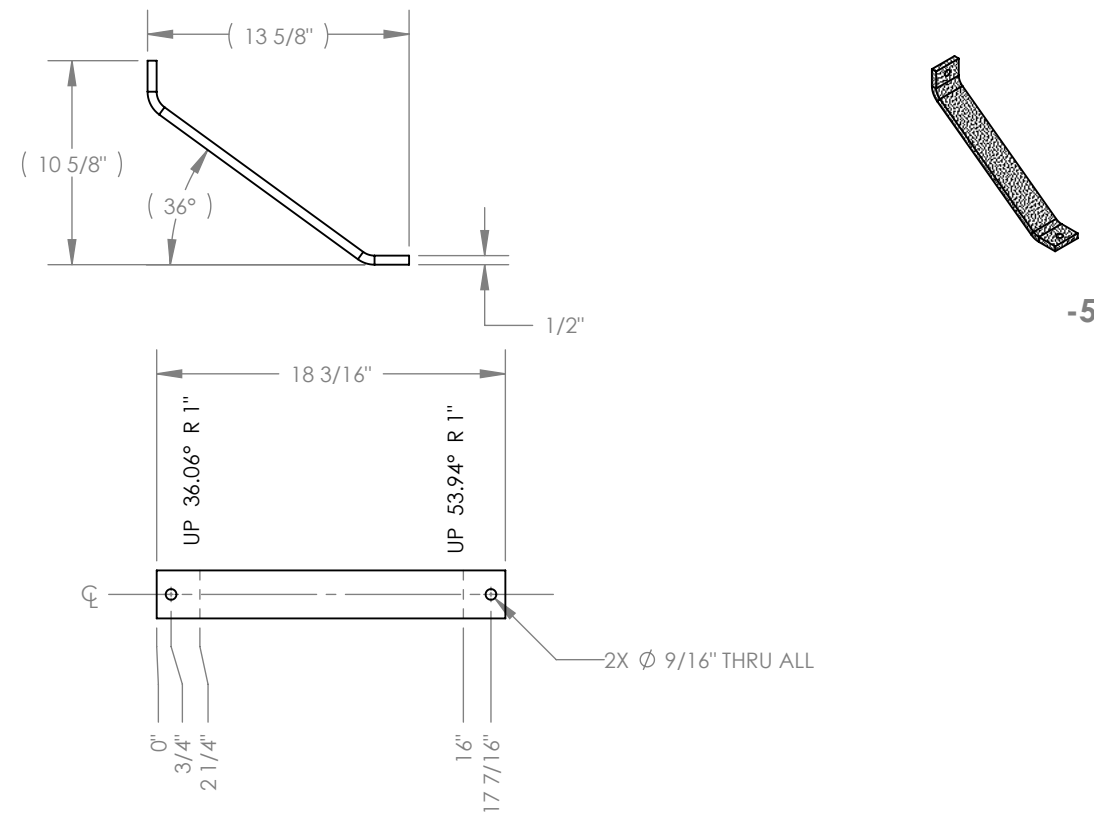
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 - SEE DRAWING D05 FOR GENERAL NOTES ON FABRICATION.
 - PLATE EDGE CUT TOLERANCES +0/- 1/16".

PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT (lbs)
D09-52	CROSS BRACE A	AISI 316L STAINLESS STEEL	6.12



-52

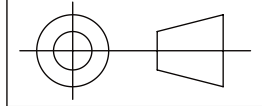
PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT (lbs)
D09-53	CROSS BRACE B	AISI 316L STAINLESS STEEL	6.15



-53



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REV.	DATE	REVIEW	ECN #
REVISIONS			
00-51-52-53			D07

DASH NO.	NEXT HIGHER ASSEMBLY
	SURF TEXTURE SYM
COMMON	MICRO INCH
~	500/
▽	250/
▽▽	125/
▽▽▽	32/
▽▽▽▽	16/

TOLERANCE UNLESS NOTED	
X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

ALL DIMENSIONS IN INCHES UNLESS NOTED

PROJECT NAME:
44 WEST 66TH STREET,
NEW YORK, NY

	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JB	2018-06-20
REVIEW	AW	2018-06-25

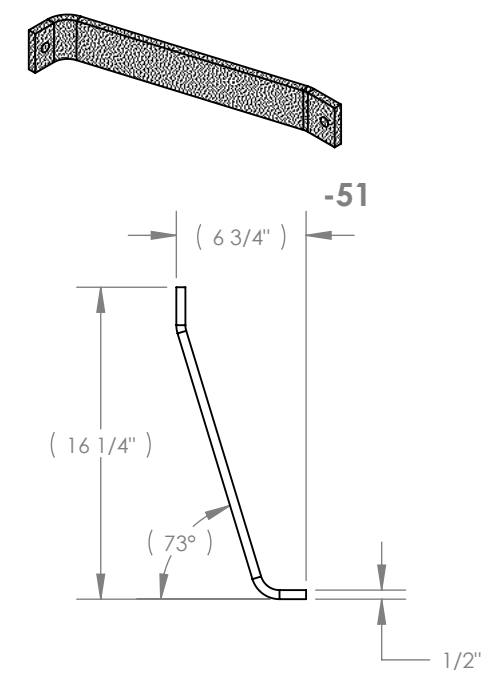
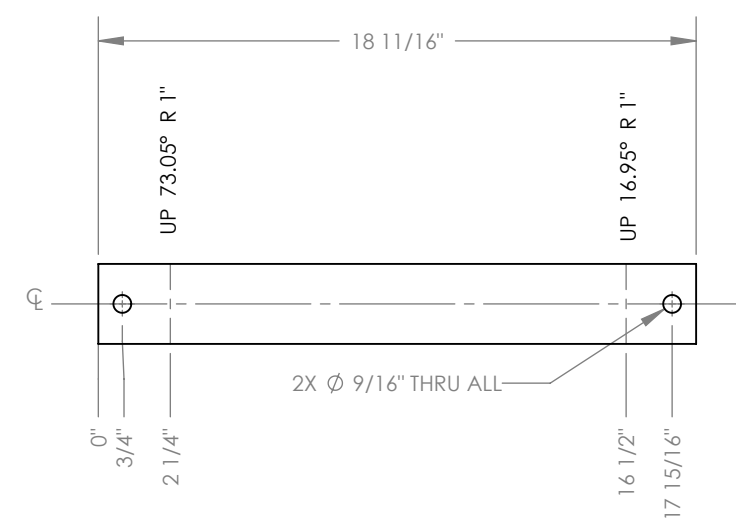
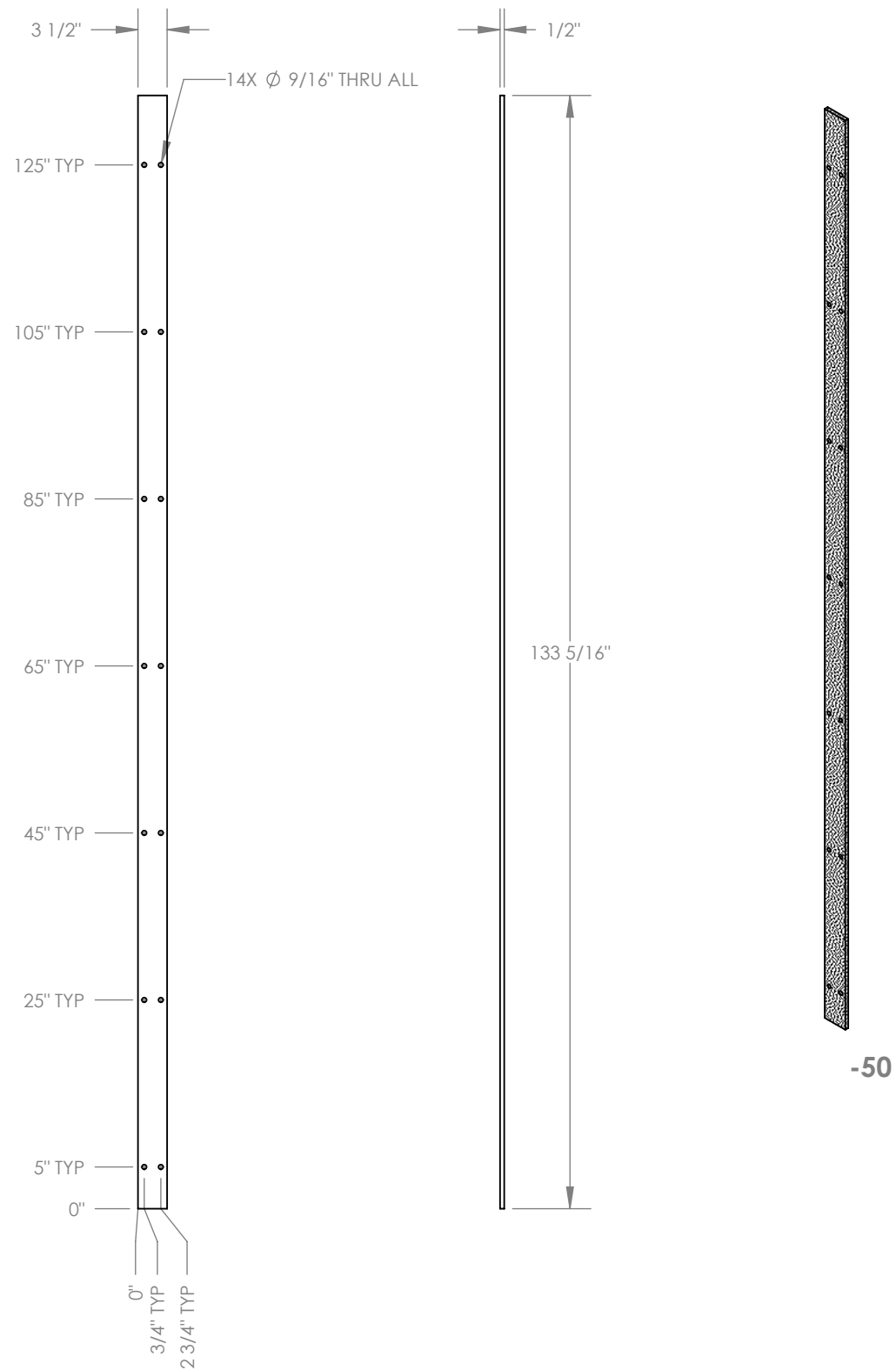
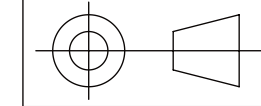
TITLE:	
NORTH EAST TUNED SLOSHING DAMPER PADDLE COMPONENTS	
PROJECT #	SHEET #
1600192	1 OF 1
DRAWING NO.	REV. NO.
D09	-

PART NUMBER	DESCRIPTION	MATERIAL	STOCK SIZE	WEIGHT (lbs)
D10-50	BLADE	AISI 316L STAINLESS STEEL	133 5/16" X 3 1/2" X 1/2"	67

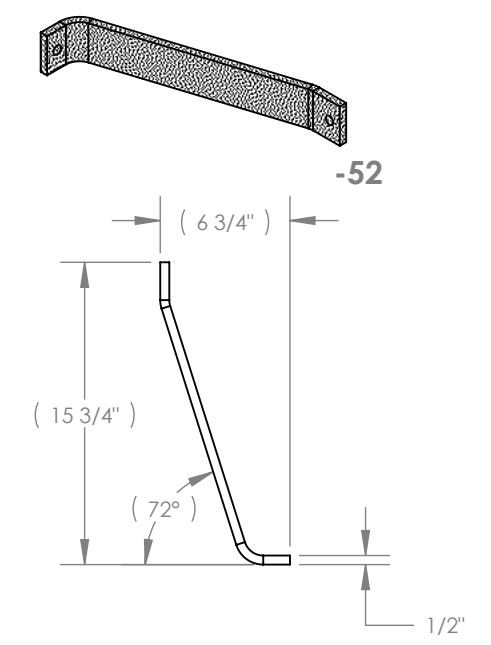
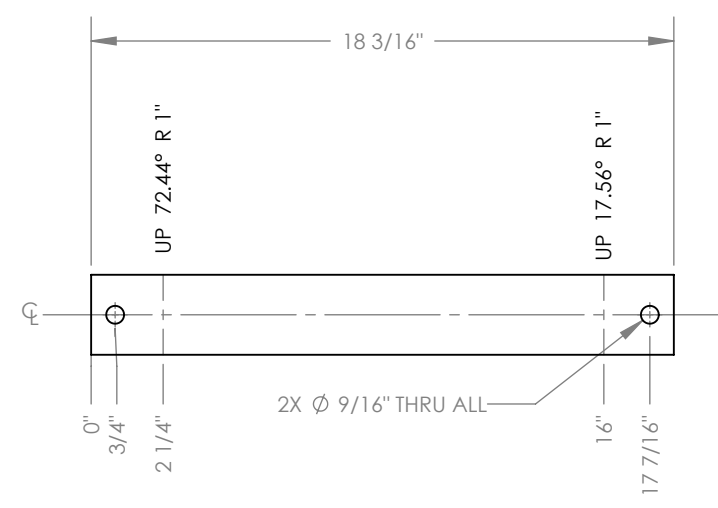
PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT (lbs)
D10-51	CROSS BRACE A	AISI 316L STAINLESS STEEL	2.87



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PART NUMBER	DESCRIPTION	MATERIAL	WEIGHT (lbs)
D10-52	CROSS BRACE B	AISI 316L STAINLESS STEEL	2.80



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REV.	DATE	REVIEW	ECN #
REVISIONS			
-50,-51,-52		D06	

DASH NO.	NEXT HIGHER ASSEMBLY

COMMON	MICRO INCH
~	500
▽	250
▽▽	125
▽▽▽	32
▽▽▽▽	16

TOLERANCE UNLESS NOTED	
X.X	±0.02"
X.XX	±0.01
X.XXX	±0.005
X.XXXX	±0.001
FRACTION	±1/16
ANGULAR	±0.5°

ALL DIMENSIONS IN INCHES UNLESS NOTED

PROJECT NAME:
44 WEST 66TH STREET,
NEW YORK, NY

	INIT.	DATE
DESIGN	JSL	2018-06-04
DRAWN	JBI	2018-06-20
REVIEW	AWS	2018-06-25

TITLE:	
SOUTH WEST TUNED SLOSHING DAMPER PADDLE COMPONENTS	
PROJECT #	SHEET #
1600192	1 OF 1
DRAWING NO.	REV. NO.
D10	-

The background features a large, light grey curved shape on the right side, and a blue curved shape on the left side, separated by a white curved line.

APPENDIX B

TUNED SLOSHING DAMPER

GENERAL DESIGN AND INSTALLATION GUIDELINES

All information contained herein and provided by RWDI to the design team is considered confidential and proprietary. The information may not be reproduced, published or distributed to, or for, any other parties without the express prior written consent of RWDI.



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VERSION HISTORY

Rev.	Comments	Prepared	Date	Reviewed	Date
-	Original issue	JSL	2015/11/20	BMM	2015/11/30
1	Updated waterproofing recommendations	JSL	2016/09/28	BMM	2016/11/23
2	Expanded range of ultimate wind return periods	TCH	2017/07/28	BMM	2017/07/28
3	Additional details on waterproofing, hatches, and corrosion protection	JSL	2017/12/08	AWS	2018/02/15



1 INTRODUCTION

RWDI has designed and commissioned numerous Tuned Sloshing Damper (TSD) systems throughout the world. During these projects, RWDI has obtained considerable experience on many of the practical aspects of TSD design and installation. This document is meant to summarize lessons of experience, and provide practical guidelines to those involved in TSD installations. This document contains RWDI's general recommendations to assist the third parties involved in the TSD design or spec development, however, the final design decisions and recommendations are to be made by the relevant third parties.

This document should be circulated to all parties who may be affected by the TSD implementation, including (but not limited to) the:

- Architect,
- Structural Engineer,
- General Contractor,
- Mechanical, Electrical, Plumbing Subcontractor,
- Miscellaneous Metals Subcontractor,
- Waterproofing Consultant,
- Fire Suppression Systems Consultant (if TSD tanks are also used for fire suppression).

2 WATERPROOFING

It is critical that TSD tanks are properly waterproofed to prevent leakage. The following sub-sections represent a non-exhaustive list of considerations related to waterproofing. It is often good practice to utilize several of the techniques concomitantly to further reduce the risk of leakage. The final selection of the tank waterproofing requirements should be conducted by the **Waterproofing Consultant** in coordination with the Architect and the General Contractor.

2.1 Interior/Exterior Tank Linings

Interior tank linings are recommended to prevent leakage. RWDI typically recommends Kemperol 2K-PUR which is a fleece-reinforced polyurethane resin used for waterproofing. Detailed technical information on Kemperol 2K-PUR product and its application procedures can be found in the attached sheet. CIM Industries and Soprema Alsan RS230 also provide interior waterproofing membranes, and these have been used on existing installations. However, some of these materials require very diligent concrete surface preparation before application, and the



fumes produced during application are noxious. These installation considerations should be discussed with the Waterproofing Consultant, General Contractor and installer before a product is selected. Several data sheets for interior tank lining products are attached at the end of this document.

To facilitate easy installation of the interior tank lining, the TSD paddles are suspended from the tank ceiling and have a 75mm (3 inch) gap between the bottom of the tank and the bottom of the paddles. Wherever possible, penetrations below the quiescent water depth are avoided to minimize the risk of leakage around the penetrations.

Exterior tank membranes can be installed on the surfaces of the tank that could lead into the building. For example, if a TSD tank is being constructed on the roof of a building, a waterproof lining can be installed on the roof before the tank is poured. If the tank were to leak, the lining would prevent the water from entering the structure, and the water would instead remain on the roof.

2.2 Concrete Admixtures

Concrete admixtures, such as XYPEX or PENETRON can be used to waterproof the concrete slabs and walls (see attached cut sheets). This admixture reacts with by-products of the concrete hydration process to generate a non-soluble product that fills the concrete pores and cracks to prevent water penetration. If an admixture is used in conjunction with a membrane, ensure the products are compatible.

2.3 Tank Positioning

In some situations, it may be possible to locate the tank in an environment in which leakage would only minimally affect the building. For instance, RWDI has been involved in a TSD installation in which the tank was installed a few feet above the roof level. If a leak were to ever develop, the TSD liquid would fall onto the roof, where it would be removed by the roof rainwater drains. In other situations, it may be possible to position the tanks in locations in which any water could be directed to a drain before it affects the building.

2.4 Leak Detection

Alarm systems can be installed to alert maintenance if a leak occurs. Such a system could consist of a probe mounted internally within the tank to detect a drop in the water level. An internal probe must be designed to accommodate the wave action that will occur within the tank; a device that takes a time-averaged reading of the water depth over several minutes should be sufficient. Alternatively, a sensor could be placed below or beside the tanks to detect if water is present on these surfaces.



2.5 Cold Concrete Joints

Cold joints in concrete (areas in which one batch of concrete has partially or fully set before another is poured) are at a higher risk of water leakage. To minimize this risk, if cold concrete joints are necessary, preferably they should be above the maximum expected quiescent water depth. If cold joints below the quiescent water level are unavoidable, it is critical that the joints are specially waterproofed using waterstops such as CETCO Waterstop-RX or Sika (see cut sheets) or other suitable technology.

2.6 Waterproof Testing

Prior to the arrival of RWDI staff for the final tuning and commissioning of the TSD, the waterproofing of the TSD tank(s) must be tested. During this testing, the tanks are filled to the maximum expected quiescent water depth as indicated in RWDI's TSD drawing package. The tanks must then be visually inspected for signs of leakage. Any leaks detected must be corrected prior to the tuning and commissioning.

3 FREEZING PREVENTION

The water within the TSD tank must not be allowed to freeze. Freezing prevention measures are often required in climates where the air temperature (at the TSD tank elevation) can drop below freezing for extended periods of time. Water freezing may cause damage to the paddles, concrete, any interior waterproofing membrane and associated plumbing. If the tank is exposed to the weather and in a cold climate, with additional scope RWDI can provide analysis looking at the expected climate, tank details (e.g. exterior walls insulated, interior walls adjacent to climate controlled areas) and evaluate the risk of freezing and assist in mitigation strategies.

The selection of suitable freezing prevention measures is generally the responsibility of the **Mechanical, Electrical, and Plumbing** subcontractor. The following sub-sections represent a non-exhaustive list of considerations surrounding freezing prevention.

3.1 Piping

Pipes are particularly susceptible to freezing due to the ability of metal pipes to conduct and radiate heat, and the relatively large radiating surface area of the pipe to the total volume of fluid contained within. The risks associated with pipe cracking makes pipe freezing particularly important. Any piping exposed to a sub-freezing environment should either be drained, heated, or filled with a suitable anti-freeze mixture.



3.2 Heating

Heating can be applied to the water to prevent freezing. In conjunction with heating, it may be beneficial to add insulation to exterior tank surfaces to minimize heat loss and reduce total heating requirements. Heating of the water may be accomplished through a system as simple as a residential water heater and a recirculation pump. A thermostat should be used to monitor the TSD water temperature, and an alarm to signal if the temperature approaches freezing may be warranted. Alternatives include an immersion heater such as the Chromalox FXTH system (see attached cut sheet).

3.3 Anti-freeze

Anti-freeze has been used to prevent freezing on several TSD projects. Propylene glycol is a non-toxic anti-freeze that is frequently used in HVAC systems and since it is food grade, it can be disposed of in the greywater system (but not the storm water system in most municipalities). When propylene glycol concentrations are greater than 25%, microbial growth is inhibited.

One of the major concerns with anti-freeze is the storage of the liquid when the TSD tank(s) are drained during periodic maintenance or inspection. While the disposal of some anti-freezes (such as propylene glycol) is typically straightforward, it can be costly to replenish the anti-freeze when the tanks are to be re-filled. However, it may be possible to temporarily store the anti-freeze mixture on site. Since the liquid within TSD tanks must be allowed to slosh, the tanks are not completely full. Therefore, in TSD systems where multiple tanks are used, it may be possible to temporarily pump the anti-freeze/water mixture from the tank being drained into another TSD tank. Upon completion of the inspection or maintenance, the anti-freeze/water mixture can then be pumped back into the original tank. Such a procedure could greatly reduce the amount of anti-freeze that must be disposed of and repurchased. If this procedure is to be used, the TSD tanks must be designed to be able to support the additional weight when storing liquid from a drained tank. Alternatively, if sufficient floor space is available near the TSD(s), large drums or similar storage tanks can be used for temporary storage. In this case, the structural engineer must confirm that the floor structure can support the additional gravity load from the water filled drums or temporary storage tanks.

4 INTERIOR TANK ACCESS

Access to the tank interior will be required for periodic inspection and maintenance. An access hatch is therefore required and should be coordinated by the **Architect**. Whenever possible, the access hatch should be located in the ceiling of the tank, preferably close to a tank wall. If a ceiling hatch is not possible, the hatch must be located above the maximum expected quiescent liquid depth, so that anyone opening the hatch will not inadvertently release a large volume of water. Side-mounted access hatches must also be marine-grade hatches that can resist



the tank wall hydrostatic pressures provided on RWDI's pressure distribution diagrams. On most projects, the side-mounted hatch is 3' x 3'. However, the design team should confirm whether these dimensions satisfy the local design code requirements.

RWDI is aware of TSD installations that have used the access hatches listed below. Cut sheets for these hatches are attached at the end of this document.

Nystrom:

Water Tight Diamond Tread Well Hatch, 625 PSF:

(<https://www.nystrom.com/products/floor-doors/well-hatch>)

Bilco:

Type J-AL – Channel Frame – 300 PSF

(<https://www.bilco.com/Store/ProductDetailPage/1J-AL/Type J-AL - Channel Frame - 300 PSF>)

Presray:

Hinged Watertight Door with Mechanical Seal – D3C

(<http://www.presray.com/watertight-products/hinged-watertight-door-d3c>)

Standard Equipment Company Inc.:

Watertight Hatch with Drop Bolts (modified with stiffeners to resist 2 PSI internal pressure)

(<https://www.secclosures.com/marine-closures-products/3/15/watertight-hatches-with-drop-bolts/>)

Walz & Krenzer, Inc.:

Individually dogged Watertight Door

(<http://www.floodbarriers.com/watertight-flood-protection/watertight-airtight-doors/wk-model-wt-fd-i-2>)

If the hatch is located on the tank sidewall, or on the ceiling close to a sidewall, then it will be possible to cast ladder rungs into the interior concrete wall to facilitate entry and exit from the tank. Alternatively, a portable ladder may be used when entering the tank. If a portable ladder is used, the access hatch must be sized to accommodate the ladder. Moreover, care must be taken by workers to ensure the waterproofing lining is not damaged by the ladder during entry and exit.

Signage at the access hatch must clearly indicate the safety procedures required when entering the tank. These safety provisions may include (but are not necessarily limited to): fall arrest, lockout-tagout, and confined space entry. Electrical outlets should be located near the access hatch to allow temporary lighting or small power tools to be used inside the tank when inspections and maintenance are performed.



5 DRAINAGE, FILL AND TREATMENT PROVISIONS

The TSD tanks contain large volumes of water that must be drained and filled during periodic inspection and maintenance. Drainage and fill of the TSD occurs relatively infrequently (perhaps on the order of once every five years). Drainage, fill, and treatment provisions are typically the responsibility of the **Mechanical, Electrical, and Plumbing** subcontractor.

5.1 Drainage Provisions

TSD tanks can be drained either through the use of permanent plumbing lines at the base of the tank, or a temporary submersible pump. If a permanent line is installed at the base of the tank, special care must be given to the waterproofing of this penetration. Since drainage occurs relatively infrequently (perhaps once every five years), many TSD installations employ a temporary submersible pump for drainage, as this is generally the simplest option.

Drainage lines must be appropriately sized to allow the tanks to be emptied within a reasonable period of time (e.g. a few hours). If the TSD drainage line is connected into normal building plumbing, the drain should be sized to not pose an unreasonable interference with the building's plumbing system. If the TSD drainage flow is too large, the TSD water may overwhelm the building's plumbing and cause water to backflow. Some TSD installations have independent drainage lines for the TSD.

If anti-freeze is used to prevent liquid freezing, consideration must be given to the safe temporary storage or disposal of the liquid when the tanks are drained (see also subsection 3.2).

5.2 Fill Provisions

The TSD tanks must be capable of being filled during a reasonable period of time (e.g. several hours) to make occasional maintenance practical. Tank filling can be completed using independent lines devoted to the tank. The outlets of these lines should be installed above the quiescent fluid depth to minimize the risks of leaks associated with penetrating the waterproofing layer. Alternatively, a temporary hose (e.g. a fire hose) can be used to fill the tank through the tank access hatch. Since the TSD requires filling relatively infrequently, many TSD installations employ a temporary hose for filling, as this is generally the simplest option.

Care must be taken to ensure the tank is filled to the depth specified by RWDI. If the tank is filled too much or too little, the TSD will not function properly. For most TSDs, the actual depth should be within ½" of RWDI's specified fill depth. The depth can be visually verified using a dip stick or similar means or can be tied into the Building Management System (BMS) using a time-averaging sensor, as described in subsection 2.4. Provisions should be in place to prevent accidental overfilling of the tank. Overfilling the tank will result in additional gravity loads and



lateral loads for which the structure may not have been designed. Interior high-water alarms may be used to alert building staff if the fill hose has been left on. Alternatively, overflow protection (such as a standpipe) may be used to drain away water if the fill line is left on. Any overflow protection must be capable of draining the water faster than the fill line can supply water. The valve on any permanent filling provisions should be chained and locked to prevent accidental overfilling or filling during inspections and maintenance.

If anti-freeze is used to prevent freezing, consideration must be given to getting the anti-freeze to the TSD elevation, since a considerable volume of anti-freeze is generally required. Anti-freeze may be lifted to the TSD level using the crane, and stored in the TSD tanks until the building is completed and water is added during the final tuning and commissioning of the TSD.

5.3 Treatment Provisions

The TSD water should be treated to control its quality. If chemical treatment is used, the product used must be compatible with the finishes and waterproofing lining of the TSD tank(s).

If propylene glycol is used as an anti-freeze in concentrations greater than 25%, microbial growth is inhibited. Alternatively, the tanks may be chemically treated, or “shocked” periodically using chlorine or other appropriate agents. Note that waterproofing membranes may have limits on the exposure time to the chemical agents.

RWDI is aware of one installation in which a recirculating pump with a UV disinfectant system was used to treat the TSD water. An example of such a system is provided as an attachment to this document.

6 MULTI-PURPOSE TANKS

TSD tanks have been used for other functions, including fire suppression and domestic water supply. When the tanks will be multi-purpose, it is critical that RWDI is made aware of these requirements so the design can be coordinated with the other interested parties.

6.1 Fire Suppression

If TSD tanks are also used as part of the fire suppression system of the building, it is critical that RWDI is made aware of this design consideration early in the TSD design process, so the design can be coordinated with the project’s **Fire Protection Systems consultant**. The following issues are often encountered when the TSD tanks are also used for fire protection.



6.1.1 Redundancy

Fire protection systems generally require redundancy; therefore, more than one tank is typically required. If multiple tanks are planned as part of the TSD system, this requirement may already be satisfied. If a single, unidirectional TSD tank is planned (that is, the tank controls motion of the building in only one direction, e.g. north-south), it may be possible to subdivide the tank along the primary direction of building motion to create two separate compartments within the single tank to satisfy the redundancy requirement.

6.1.2 Minimum Water Volume Requirements

The minimum water volume requirements for the tanks are specified by the Fire Protection Systems consultant according to the applicable fire code. There may also be maximum water volume requirements for some fire codes, which define the maximum volume of water than can be stored in each tank. The final depth of water required by RWDI will not be known until the time of final tuning and commissioning, which occurs after the building is complete (including the interior finishes). As a result, RWDI can only provide a range of possible fluid depths until the building is complete. After this tuning and commissioning is completed, the static water depth will remain unchanged. For this reason, RWDI must coordinate closely with the Fire Protection Systems consultant to ensure the tanks satisfy the minimum and maximum water requirements.

The hydraulic requirements of the fire suppression system generally require that the tanks used for fire suppression are at the same elevation, and filled to a common depth. This requirement can typically be satisfied by RWDI without the sacrifice of much performance. RWDI must be made aware of this design requirement early in the design process as this will affect the performance analysis of the TSD.

6.2 Domestic Water Supply

TSD tanks have been used for domestic water supply. If the tanks are used for domestic water supply, it is critical that from the beginning the TSD design is coordinated with the **Mechanical, Electrical, and Plumbing subcontractor**.

6.2.1 Minimum Water Volume Requirements

TSD tanks employed for domestic water supply will have minimum water volume requirements. The final depth of water required by RWDI will not be known until the time of final tuning and commissioning, which occurs after the building is complete (including the interior finishes). As a result, RWDI can only provide a range of possible fluid depths until the building is complete. After this tuning and commissioning is completed, the static water depth will remain unchanged. For this reason, RWDI must coordinate closely with the **specialty consultant** to ensure the tanks satisfy the minimum water requirements.



6.2.2 Food Grade Finishes

If the tanks are used for domestic water supply, all finishes in the tank must be appropriate for this usage. Therefore, the **Waterproofing Consultant** must select products that are acceptable for this usage, and the paddles must be coated with a corrosion protection product that is acceptable. Using stainless steel as the paddle construction material may avoid issues associated with food-grade-compatible corrosion protection of the paddles their connections to the tank.

6.2.3 Water Depletion and Replenishment

The TSD tanks must have the proper water depth to function properly as dampers. At the tuning and commissioning stage, the final water depth will be determined and set for each tank, and the depths are ideally unchanged from those levels. Since domestic water systems will have continual draws on the tanks, it is important that the filling pumps are designed to refill the TSD tanks such that the static water level does not fluctuate considerably. The acceptable amount of water depth fluctuation varies for each project, but a fluctuation of \pm few inches from the recommended static water depth may be a reasonable initial estimate for projects in which a variable water depth is unavoidable. This may necessitate that the fill pumps are turned on and off more frequently than the MEP is accustomed to for domestic water supply tanks.

The water level gauges used to turn the refill pumps on and off must be designed to accommodate the uncertainty of the final tank fill depths. The acceptable range for the water depth will not be known until the final tuning and commissioning of the TSD tanks, which will not occur until the building is completed. Moreover, the tanks are designed to slosh; that is, there will be wave action within the tanks. The water level gauges must accommodate this wave action, possibly by taking an average reading over several minutes to determine the mean water level.

7 STRUCTURAL DESIGN

RWDI provides effective static loading diagrams, which show the predicted water-induced loads acting on the TSD tanks. The paddles are designed and engineered by RWDI, however, the design and detailing of the concrete tanks, paddle embeds and TSD system supporting structure are the responsibility of the **Structural Engineer**.

7.1 Loads Tables

RWDI provides loads tables that indicate the dead loads produced by the water in the TSD tanks, as well as the loads induced by wind and seismic excitation. The dead loads provided do not account for the self-weight of the TSD tanks and their accessories. Loads are provided at the Service level winds (50-year mean recurrence interval),



as well as the Ultimate level winds (500-year, 700-year, 1000-year, 1700-year or 2500-year mean recurrence interval as applicable). Where applicable, loads are also provided for the Ultimate seismic event (typically 2500-year mean recurrence interval). If the TSD system consists of multiple tanks, the peak load of each tank should be applied simultaneously unless otherwise indicated by RWDI.

If it is possible that the tank could accidentally be overfilled - that is, filled to a level greater than that shown in the TSD drawings package - the tank must be designed to support this additional dead load.

The tank interface loads table provides water gravity loads, as well as the peak total base shear forces and overturning moments that the sloshing water will produce. These loads must be used to design the TSD system supporting structure.

The TSD paddles are cantilevered from the ceiling of the tank. The paddle interface loads table provides the self-weight of the paddle, as well as the peak shears and moments that will be experienced at the paddle embed. It is the **responsibility of the Structural Engineer** to design the embed plate and its connection to the tank slab using the loads provided in the paddle loads table.

Since the loads are fully reversing, the tank, paddles, embeds and supporting structure must be designed for fatigue as well as strength. It is RWDI's typical practice to design all damper components to have an infinite fatigue life at the 50-year Service loads.

7.2 Pressure Diagrams and Tables

Representative pressure diagrams are supplied to facilitate design of the TSD floor slab, walls, and ceiling. The pressure diagrams provided only account for the pressures produced by the sloshing fluid. The pressure diagrams are produced to provide the Structural Engineer with the peak pressures that will be experienced by the tank floor slab, walls, and ceiling (ceiling pressures may be produced if the waves may become large enough to impact with the tank ceiling). Two pressure distributions are shown; one corresponding to a cut along the xz-plane, another corresponding to a cut along the yz-plane. These pressure distributions correspond to two distinct load cases; that is, these pressures are not additive.

For practical design purposes, simplifications have been applied to represent the pressure distributions as linear. As a result, the forces and moments that could be calculated from these pressure diagrams are not to be used for the structural design of the supporting structure, as they will not produce the correct overall interface shears and moments. The pressure diagrams are only for the tank slab, wall, and ceiling design. The loading provided in the tank interface loads table must be used to design the tank supporting structure.



8 PADDLES

RWDI conducts the mechanical design of the paddles that are used to increase the drag forces in the tank. As shown in the TSD design drawings, each tank typically contains nine paddles that are arranged in a grid within the tank.

8.1 Fabrication

The paddles are simple welded and/or bolted assemblies that can be manufactured by many steel fabricators. Paddle fabrication often becomes the responsibility of the **Miscellaneous Metals subcontractor**. Our TSD drawing package contains the information sufficient for the fabrication of the paddles. The drawing notes specify the materials that are to be used, as well as the finishes that are to be applied for corrosion protection. Note that if the tanks are to be used for domestic water supply, the **Mechanical, Electrical, and Plumbing subcontractor** must confirm that the specified finish is appropriate for domestic water usage.

Stainless steel paddles may be employed to eliminate the need for applying and maintaining a finish to the paddles. The fabricator should consult and coordinate with RWDI if stainless steel paddles are to be used, as the paddles may need to be redesigned to ensure they are sufficiently strong.

8.2 Corrosion Prevention

The paddles will be fully submerged in water, and must therefore be designed to avoid corrosion. The strategies to prevent corrosion may be differentiated based upon whether the paddle design requires slip-critical connections. If the tanks are also employed for potable water, any coatings and materials used must comply with local potable water standards.

8.2.1 Slip-Critical Connections NOT Required

As slip-critical connections are not required for typical RWDI paddle designs, many corrosion prevention strategies are available.

The risk of corrosion can be eliminated if the paddles are fabricated from stainless steel. If stainless steel paddles are used, no additional corrosion protection is generally necessary. It is important that stainless steel hardware is used. Regular (carbon steel) fasteners used with stainless steel paddles will corrode rapidly. To prevent galling (cold welding) of the stainless bolt and nut, a stainless steel compatible anti-seize compound needs to be applied and tightening must be done by hand (no air or impact tools).



Carbon steel paddles will require corrosion protection. There are a variety of protective coatings (paints and epoxies) that can be applied to the paddles. The following coatings have been employed on RWDI TSD projects:

- Sherwin Williams Macropoxy 646
- Sherwin Williams Zinc Clad II LV
- PPG Amercoat 370
- PPG 97-946 with the following recommendations: Steel surface to be coated should be blasted SSPC SP5 white metal, Apply two coats of 4.0 to 6.0 mils dry per coat.

Cut sheets for these products are attached to the end of this document. Other corrosion prevention products are also acceptable provided they are suitable for continuous immersion in water.

RWDI typically does not recommend hot-dip galvanizing paddles. The TSD wave action may wash away the protective passive scales that are formed by the zinc, which exposes more layers of zinc underneath and accelerates corrosion. Also water hardness can have a significant impact on the longevity of the coating. Therefore, the longevity of galvanized paddles is uncertain.

8.2.2 Slip-Critical Connections ARE Required

Some paddle designs will require slip-critical connections, which ensures that bolted connections will not slip and wear under the dynamic action of waves within the tank. When RWDI's drawings indicate slip-critical connections, stainless steel paddles cannot be used, as it is not possible to obtain a slip-critical connection with stainless steel hardware.

Carbon steel must be employed with specialized corrosion protective coatings that allow slip-critical connections. Products that have been used in previous TSD paddle applications requiring slip-critical connections are:

- Sherwin Williams Zinc Clad II LV
- PPG Amercoat 370

Cut sheets for these products are attached at the end of this document. Other products are also acceptable provided they are suitable for continuous immersion in water, and achieve Class A (0.33) slip coefficient requirements.



8.3 Installation

The simplest paddle installation sequence is generally to use the crane to lower the paddles into the tank such that they may be cast in place when the tank ceiling is poured. Temporary blocks may be used to keep the bottom of the paddles 3" off the floor of the tank. The bolted connections need not be fully torqued at this stage, as the paddles are designed to have several configurations. The final configuration will not be known until the final tuning and commissioning of the TSD, which is completed after construction is largely completed.

9 TUNING AND COMMISSIONING

There are two stages to the tuning and commissioning of a TSD: 90% construction completion frequency measurements, and final tuning and commissioning. These stages will require input from the General Contractor, as well as the **Structural Engineer**. RWDI should be notified at least a month prior to the measurements being conducted to coordinate the site visit.

9.1 90% Complete Frequency Measurements

The first round of frequency measurements are conducted when the structure is approximately 90% complete. These measurements should be conducted as late as possible in the construction process, but prior to the TSD tanks being poured. Typically, the measurements are taken when construction is two-to-four floors below the TSD tanks. The purpose of these measurements is to predict the final as-built structural frequencies. By completing these measurements prior to the tanks being poured, it is possible to adjust the TSD design in the unexpected event that the as-built structural frequencies are outside of the TSD tuning range specified by RWDI at the completion of the detailed design phase of the TSD system.

To complete these measurements, RWDI will require access to a floor near the top of the building for approximately one day. RWDI will then measure the frequencies of the building under ambient conditions. Typically, construction activities can continue while the measurements are occurring, however this must be coordinated with the **General Contractor**.

RWDI's measurements will determine what the natural frequencies of the building were on the day the measurements were conducted. It is critical that the **Structural Engineer** update the structural model of the building to an identical state of construction completion and determine the natural frequencies at that state of completion. The measured natural frequencies of the building are typically higher than those predicted by the structural model. Using these frequency measurements and the structural model predictions, RWDI can extrapolate to the final anticipated as-built frequencies of the building.



9.2 Final Tuning and Commissioning

The last stage of the TSD installation process is to conduct the final tuning and commissioning. This stage should be initiated when the building is complete and ready for occupancy. Final tuning and commissioning occurs in three stages:

- 1) RWDI will return to site to complete final frequency measurements on the completed structure when the tanks are empty, or only partially filled with water/glycol if necessary. RWDI will require access to a floor near the top of the building. These measurements will typically be completed in one day; however, if there are only light winds on the day of the measurements, additional time may be required. Using the frequency measurements, the final paddle widths and quiescent water depth of the TSD tanks are established.
- 2) In the second stage, the paddles are set to the proper position (width) as determined by RWDI, and water is added to the TSD tanks. It may be necessary to temporarily halt tank filling while RWDI completes more measurements to verify the behavior of the structure and TSD. Depending on the number and size of the TSD tanks, this stage may be expected to last one or two days.
- 3) When all TSD tanks are filled to the proper level, additional acceleration measurements will be conducted on the structure to verify the operation of the system. Ultrasonic probes or other sensors may also be employed to monitor the wave heights as part of the system verification. These measurements may require a day to complete, although more time may be required if there are only very light winds during the measurements. If possible, 75mm (3 inch) holes are included in the tank ceiling to enable the ultrasonic wave probes to measure the TSD waves during commissioning. These holes are plugged when the ultrasonic wave probes are not being used.

The background features a large, light grey curved shape on the right side, and a blue curved shape on the left side, separated by a white curved line.

WATERPROOFING

Product Information

KEMPEROL® 2K-PUR

Work pack includes:

Component A: Cream Formulation, Component B: Dark Brown Formulation

Product Description

KEMPEROL® 2K-PUR is a two-component, UV-stable, “odor-free,” solvent free, Low VOC, high performance cold liquid-applied waterproofing and roofing resin.

KEMPEROL® 2K-PUR reinforced membrane system can be surfaced with traffic coatings, reflective coatings, aggregate surfacing coatings and other granular materials to achieve a desired function and appearance.

Composition & Materials

A monolithic membrane is created in the field by combining the KEMPEROL® 2K-PUR two-part, cold liquid-applied reactive-cure polyurethane resin with KEMPEROL® polyester reinforcing fleece. Membrane may be applied using standard fleece available in 4, 8, 10, 13, 20, 27, and 41-inch nominal widths.

Use

KEMPEROL® 2K-PUR membrane is suitable for a wide range of interior and exterior applications including roofs, plazas, planters, foundations, mechanical rooms and other waterproofing applications.

Limitations

Interior or exterior applications of KEMPEROL® 2K-PUR membrane exposed to UV-light may yellow or discolor. Use of a coating or aggregate surfacing systems are recommended where color-fast applications are required.

KEMPEROL® 2K-PUR may be applied when the ambient temperature is 41 °F (5 °C) and rising, and the substrate temperature is a minimum of 5 degrees above the dew point. The maximum application temperature is approximately 90 °F (32 °C).

Note: Viscosity increases with falling temperature. For temperatures below 50 °F (10 °C), KEMPEROL® A 2K-PUR Accelerator should be added to component A to reduce set time.

Yield

Using 165 Fleece: 38 ft² (3.53 m²) per 12.5 kg work pack.
Using 120 Fleece: 45 ft² (4.20 m²) per 12.5 kg workpack.

Note: All yields are approximate and may vary depending upon smoothness and absorbency of substrate.

Storage

Always store in cool and dry location. Do not store in direct sunlight or in temperatures below 35 °F (1.7 °C) or above 80 °F (27 °C). Approximate shelf life 12 months with proper storage.

For best use, 24 hours before application, the material is to be acclimated at temperatures between 65-70 °F (18-21 °C).

Precautions

Review Safety Data Sheets before handling, available online at kempersystem.net.

Surface Preparation

All surfaces must be free from gross irregularities, loose, unsound or foreign material such as dirt, ice, snow, water, grease, oil, release agents, lacquers, or any other condition that would be detrimental to adhesion of the primer and membrane. This requires careful preparation of existing horizontal and vertical substrates; cracks are filled, expansion joints are prepared, flashings are removed or modified, and termination points are determined. Substrates and penetrations are prepared to rigorous industry standards, and may require scarifying, sandblasting or grinding in some cases to achieve a suitable substrate.

Priming

After substrate preparation, temporary watertightness may be achieved with the application of KEMPERTEC® D Primer or EP Primer and temporary joint filler. Alternatively, the use of quick-dry KEMPERTEC® R or EP5 Primer may allow same-day membrane application. Refer to the appropriate KEMPERTEC® primer data sheet for application instructions.

Headquarters: **Kemper System America, Inc.** | 1200 North America Drive | West Seneca, NY 14224
Customer/Technical Service: Phone (800) 541-5455 | Fax (201) 767-4304 | inquiry@kempersystem.net

Sustainability Information	
Rapidly Renewable Resource	80%
Recycled Content % (post / pre)	0 / 0
Manufacture Location	Buffalo, NY, USA

Allow primer to cure completely prior to application of the KEMPEROL® membrane.

Note: Prior to opening the containers of KEMPEROL® 2K-PUR Resin, wear appropriate safety glasses and protect hands and wrists by wearing gauntlet-type neoprene gloves.

Mixing of Resin

Step 1: Mix resin Component A (cream formulation) with a spiral agitator until the liquid is a uniform cream color.

Step 2: If the ambient temperature is below 50°F (10°C), A2K-PUR Accelerator, a cold weather additive, should be mixed into the Component A. The accelerator should be mixed with the spiral agitator for 2 minutes or until both liquids are thoroughly blended.

Step 3: Add hardener Component B (dark brown formulation) to Component A and mix with a spiral agitator for 2 minutes or until both liquids are thoroughly blended.

NOTE: DO NOT break down workpacks into smaller quantities – mix the entire workpack.

Application (165 Fleece)

Step 1: After the Resin is mixed, using a Kemperol roller nap or brush apply 2/3 of the resin liberally and evenly onto the surface in even stroke. Covering one working area at a time, between 10 - 15 ft².

Step 2: Roll the Kemperol Fleece directly into the Resin, making sure the SMOOTH SIDE IS FACING UP (natural unrolling procedure), avoiding folds and wrinkles. Use the roller or brush to work the resin into the fleece, saturating from the bottom up. The appearance of the fleece should be light opaque yellow/gray with no white spots. White spots are indications of unsaturated fleece or lack of adhesion. It is important to correct these areas before proceeding.

Step 2: Roll the Kemperol Fleece directly into the Resin, making sure the SMOOTH SIDE IS FACING UP (natural unrolling procedure), avoiding folds and wrinkles. Use the roller or brush to work the resin into the fleece, saturating from the bottom up. White spots are indications of unsaturated fleece or lack of adhesion. It is important to correct these areas before proceeding.

Surfacing

KEMPEROL® 2K-PUR Membrane accepts a wide variety of KEMPERDUR® topcoats and aggregate surfacings for aesthetic or mechanical wear. The KEMPEROL® 2K-PUR membrane must be surfaced within 16-48 hours of membrane application to ensure proper bond between the membrane and surfacing. After the 48 hour window the membrane will require surface abrasion.

Disposal

Cured 2K-PUR resin may be disposed of in standard landfills. This is accomplished by thoroughly mixing all components. Note: Uncured 2K-PUR resin is considered a hazardous material and must be handled as such, in accordance with local, state and federal regulations. Do not throw uncured resin away.

Ordering Information

KEMPEROL® 2K-PUR Work pack:	Size:
Item#: 327-47-025	0.51 US GAL (1.93L) • 2.5 kg
327-47-055	1.03 US GAL (3.90L) • 5.0 kg
327-47-105	2.41 US GAL (9.12L) • 12.5 kg

Membrane Properties		
Physical Property	Test Method	Value
Color		Yellow-Gray
Physical State		Cures to Solid
Thickness (165 Fleece)		80 mils
VOC Content		6 g/l
Peak Load @ 73 °F, avg.	D5147	>70 lbf/in
Elongation	D5147	Min 30%
Tearing Strength	D5147	90 lbf
Puncture resistance	D5602	56 lbs.
Dimensional stability	D1204	0.15%
Water absorption	D570	>1%
Impact Resistance	D2240	Shore A:75
Water vapor transmission	E96	0.08 Perms
Crack spanning		2 mm/0.08 inch
Short-term temperature resistance		250 °C/482 °F
Usage time*		30 minutes
Water resistant after*		2 hours
Solid to walk on after*		24 hours
Can be driven on after*		48 hours
Apply coating/surfacing after*		16-48 hours
Apply overburden after*		48 hours
Completely hardened*		3 days

** values obtained at 73°F, 50% relative humidity, may vary depending upon air flow, humidity and temperature.*

DISCLAIMER: NO WARRANTY, EXPRESS OR IMPLIED, IS MADE IN THIS DOCUMENT. THE PRODUCT IS NOT CLAIMED TO BE MERCHANTABLE OR FIT FOR ANY PARTICULAR PURPOSE. User and certified Kemper System America, Inc. (KSA) applicators determine suitability only. See individual KSA product data sheets, MSDS sheets, guide specifications and details for complete information regarding the suitability, application and handling of KSA products.

OVERVIEW

DESCRIPTION CIM 1000 is a liquid applied urethane coating that cures in hours to form a tough elastomeric coating that adheres to most substrates, forming a chemical and abrasion resistant barrier for waterproofing, corrosion protection, and containment of water and most aqueous chemicals.

ADVANTAGES CIM 1000 has over 30 years of proven performance in demanding environments. It remains flexible and resilient and provides exceptional service in a broad range of applications.

- Ideal for coating concrete.
- Forms a tough elastomeric liner able to bridge cracks.
- Tested to ANSI 118.10-199, "Standard Specification for Load Bearing, Bonded, Waterproof Membrane for Thin-Set Ceramic Tile and Dimension Stone Installation".
- Impervious to water and most aqueous chemicals, providing a long lasting tank and pond liner.
- Asphalt extended urethane formula provides superior wear and weatherability for parking decks and containment areas.
- Adheres to and bridges between common construction materials such as concrete, steel and other metals, asphalt pavement, glass, wood, and most coatings.
- Environmentally sound, complying with the toughest VOC regulations.
- Can be repaired when damaged.
- Excellent abrasion resistance for severe wear applications.
- UV stable.
- Liquid, two-component urethane can be applied to complex shapes, multiple penetrations or to most geotextiles.

SURFACE PREPARATION

GENERAL: Substrates must be **clean and dry** with no oils, grease or loose debris. CIM Bonding Agent is recommended on all non-porous substrates. Perform adhesion tests to confirm adequacy of surface preparation. See C.I.M. Industries' specific substrate Instruction Guide for specific guidelines.

CONCRETE: ICRI-CSP 4-6 surface profile exposing aggregate. Concrete must exhibit minimum 3,000 psi compressive strength and be free of release agents and curing compounds. The substrate must be clean and dry (see CIM Instruction Guide IG-2), and free of contaminants.

STEEL: Minimum 3 mil profile.
Immersion service – SSPC-SP10 / NACE No. 2 Near White Blast.
Non-Immersion service – SSPC-SP6 / NACE No. 3 Commercial Blast.
Use CIM Bonding Agent for greater adhesion.

OTHER METALS: SSPC-SP1 solvent clean and abrasive blast to roughen and degloss the surface. Use CIM Bonding Agent for greater adhesion.

GLASS: Thoroughly clean. CIM Bonding Agent must be used for increased adhesion. For immersion service roughen the surface.

WOOD: Substrate must be clean, dry and free of surface contamination.

PREVIOUS COATINGS AND LININGS: CIM 1000 may be applied over some existing coatings and linings and achieve acceptable performance. CIM Bonding Agent is recommended for greater adhesion. Finished system results vary due to a variety of project specific factors, including the service conditions to which the system is exposed. Therefore, C.I.M. Industries does not accept responsibility for determining the suitability of an existing coating and lining as a substrate for CIM products. Owner shall perform adhesion tests on any existing coating or lining to determine suitability.

EARTH: Use CIM Scrim.

COLOR CIM 1000 is initially shiny black, turning dull over 3 to 6 months when exposed to direct sunlight. For a colored or reflecting surface finish, see C.I.M. Industries' Instruction Guide, "Topcoats" (IG-7) for further instructions.

SOLIDS BY VOLUME 88% (1413 dry mils x sq. ft./gal.)

VOC 92 g/l (0.76 lb./gal.). CIM 1000 complies with the toughest VOC regulations.



CIM 1000

HIGH PERFORMANCE COATINGS AND LININGS

All information presented in this publication is believed to be accurate, but it is not to be construed as a guarantee of minimum performance. Test performance results are obtained in a controlled laboratory environment using procedures that may not represent actual operating environments.

TYPICAL PROPERTIES

Abrasion Resistance—Wt. Loss, Taber Abraser CS-17 Wheel 1000 gr./1000 rev. ASTM D4060	1.2 mg. Loss	Liner Performance Crack Bridging 10 cycles @ -15°F After heat aging	greater than $\frac{1}{8}$ " greater than $\frac{1}{4}$ "
Adhesion to Concrete (dry) Elcometer	350 psi	Liner Weight (60 mil wet film thickness)	31 lbs./100 sq. ft.
Deflection Temperature ASTM D648	below -60°F	Mix Ratio Weight Volume	7:1 9:1
Density (Approx.) Premix Activator Mixed & Cured	8.0 lbs./gal. 10.1 lbs./gal. 8.3 lbs./gal.	Mullen Burst Strength ASTM D751, 50 mil	150 psi
Elastomeric Waterproofing ASTM C836 ASTM C957	exceeds all criteria exceeds all criteria	Permeability to Water Vapor ASTM E96 Method E, 100°F, 100 mil sheet	0.03 perms
Extension to Break ASTM D412	400%	Recovery from 100% extension: after 5 minutes after 24 hours	98% 100%
Flammability ASTM D2859 UL790	pass/combustible substrate Class A ¹	Salt Spray ASTM B117 Service Temperature	pass 2000 hrs. -60°F to 220°F
Flooring and Shower Lining UPC/IBC ANSI 118.10	Pass	Softening Point, Ring & Ball ASTM D36	>325°F
Green Roof Membrane/Root Barrier FLL, 2002	Pass	Tear Strength ASTM D624 (Die C)	150 lbs./in.
Hardness, Shore A ASTM D2240 @ 77°F	60	Tensile Strength ASTM D 412, 100 mil sheet	900 psi
Jet Fuel Resistance FS SS-S-200D	pass for joints	Weathering ASTM D822	pass 5000 hrs.

¹Contact C.I.M. Industries for details regarding UL fire ratings

CHEMICAL RESISTANCE

CIM 1000 is resistant to a broad range of acids and alkalis. Consult C.I.M. Industries for additional information regarding chemical resistance after reviewing CIM 1000 Chemical Resistance Chart.

THE INFORMATION PRESENTED IN THIS PUBLICATION IS SUBJECT TO CHANGE WITHOUT NOTICE.
CONTACT C.I.M. INDUSTRIES FOR CURRENT INFORMATION.
www.cimindustries.com

GENERAL APPLICATION INFORMATION

FOR PROFESSIONAL USE ONLY.

- PRECAUTIONS** Avoid contamination with water or moisture. Keep all pails and jugs tightly closed until ready for use. All equipment, air supplies, and application substrates must be **ABSOLUTELY DRY**. Do not apply in wet weather or when rain is imminent or when the CIM 1000 or the substrate may become wet within 4 hours after coating. Use caution when applying CIM 1000 in confined spaces. See C.I.M. Industries' Instruction Guide, "Applying CIM Within Confined Spaces" (IG-9).
- TEMPERATURE** Surface should be at least 50°F (10°C) and must be 5°F (3°C) above the dew point. **DO NOT APPLY WHEN THE SUBSTRATE OR AMBIENT TEMPERATURE IS RISING OR COATING IS IN DIRECT SUNLIGHT.** CIM 1000 should be at least 60°F (15°C) when mixed and applied. CIM 1000 may be preheated to facilitate application at low temperatures, but working time will be reduced. See C.I.M. Industries' Instruction Guide "Applying CIM Coatings in Cold Weather" (IG-11).
- EQUIPMENT** Spray equipment requires large diameter hose and air supplied mastic gun or plural component spray equipment. See "Spray Application of CIM" (IG-12) or contact C.I.M. Industries for specific recommendations. Roller, squeegee, and trowel may also be used.
- POT LIFE** About 30 minutes. Working time depends on temperature and method of application. Working time for spray application will be significantly shorter.
- PRIMING** Porous substrates such as wood and concrete may be primed with CIM 61BG Epoxy Primer to minimize outgassing. The maximum recoat window for CIM 61BG Epoxy Primer is 48 hours. See CIM 61BG Epoxy Primer Technical Data Sheet for additional information. Perform adhesion tests to confirm adequacy of adhesion to primer.
- MIXING** **DO NOT THIN. DO NOT HAND MIX.** Begin mixing each pail (4.5 gal.) of CIM 1000 Premix using a power mixer (e.g. $\frac{1}{2}$ " drill and an eight inch mud mixer). Do not draw air into the mix. While mixing, slowly add one jug (0.5 gal.) of CIM 1000 Activator to the pail. Once the CIM 1000 Activator has been added, mix thoroughly for **3 FULL MINUTES**. The proportions are premeasured. **DO NOT ESTIMATE.** Mixing Jigs and Timers from C.I.M. Industries help eliminate mixing errors and increase productivity on the job. See C.I.M. Industries' Instruction Guide, "Mixing CIM Premix and Activator" (IG-8).
- APPLICATION** Apply CIM 1000 directly to a clean and dry substrate. Vertical surfaces will require multiple coats. See C.I.M. Industries' specific substrate Instruction Guide for additional guidelines.
- RECOATING** CIM 1000 may be recoated in 1 hour and must be recoated soon after the coating no longer comes off on polyethylene (typically within 4 hours of mixing). If the liner has cured longer than this time, the surface must be severely abraded using surface grinder or other mechanical means, and be free of dust and debris. Use CIM Bonding Agent for better adhesion. For immersion conditions, all coats shall be applied within 4 hours of each other, except at joint lines.
- RECOMMENDED MINIMUM THICKNESS** Recommended minimum thickness of the coating is 60 wet mils. Contact C.I.M. Industries for detailed cure time information. Refer to CIM 1000 Coverage Chart for coverage rates.
- CURING TIME** CIM 1000 may be placed in service within 24 hours for non-aggressive service. Severe service applications may require a cure time of 72 hours or more. Contact C.I.M. Industries for specific recommendations.
- CLEAN-UP** Use mineral spirits for clean-up of uncured material. Spray equipment must be flushed regularly during application to prevent material from setting up in the hose and pump. Cured material is very difficult to remove. Soaking in solvent will soften the material and may assist in its removal.

CONTACT C.I.M. INDUSTRIES FOR SPECIFIC RECOMMENDATIONS AND INSTRUCTION GUIDES.

www.cimindustries.com



CIM 1000

HIGH PERFORMANCE COATINGS AND LININGS

SHIPPING, STORAGE AND SAFETY DATA

WARNING Flammable. Use only in well ventilated areas. Do not store or use near open flame, sparks or hot surfaces. Keep tightly closed. Avoid contact with moisture or water. Keep out of reach of children.

SAFETY INFORMATION This product contains petroleum asphalt, petroleum distillates, amine compounds and/or other chemical ingredients. Adequate health and safety precautions should be observed during the storage, handling, application and curing. Refer to C.I.M. Industries' Material Safety Data Sheets for further details regarding the safe use of this product.

PACKAGING CIM 1000 is available in mixed units of 5 gallons. Each unit consists of a container of premix and a smaller container of activator. Quantities have been premeasured to provide the proper mixing ratio, leaving sufficient room in the premix container to facilitate adequate mixing. **Do not estimate proportions.**

SHIPPING	Premix	Activator
Weights		
5.0 gallon units	40 lb/pail	5.5 lb/jug (33 lb/case of 6)
Properties		
Flash Point	101°F	>400°F
Shipping Name	Coating Solution	Not Regulated
DOT Class	Class 3, UN1139, PG III	Not Regulated
STORAGE		
Temperature	20°F to 110°F	70°F to 95°F
Shelf Life	2 years	6 months
NFPA	Class II	Class III B

WARRANTY & LIMITATION OF SELLER'S LIABILITY

C.I.M. Industries Inc. (C.I.M.) warrants that for a period of five (5) years from the date of shipment to the initial purchaser, the products, when mixed in proper ratios for the proper length of time, (a) will not become brittle or crack and (b) will provide a water barrier. Due to application variables beyond C.I.M.'s control which may affect results, C.I.M. makes no warranty of any kind, expressed or implied, including that of merchantability, other than that the products conform to C.I.M.'s current quality control standards at time of manufacture. If breach of warranty is established, the buyer's exclusive remedy shall be repayment of the purchase price of the non-conforming CIM membrane product or, at C.I.M.'s option, resupply of conforming product to replace the non-conforming product. The buyer expressly waives any claim to additional damages, including consequential damages.

THE INFORMATION PRESENTED IN THIS PUBLICATION IS SUBJECT TO CHANGE WITHOUT NOTICE.

CONTACT C.I.M. INDUSTRIES FOR CURRENT INFORMATION.

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ALSAN RS 230 FLASH

TECHNICAL DATA SHEET
160310SCAN2E
(supersedes 141128SCAN1E)

DESCRIPTION

ALSAN RS 230 FLASH is a two-component polymethyl methacrylate-based (PMMA) liquid membrane. **ALSAN RS 230 FLASH** is combined with fleece fabric to form a monolithic, self flashing and self-adhering reinforced field membrane designed for use in interior and exterior new, tear-off and recovery applications.

COLOUR: **ALSAN RS 230 FLASH** is supplied in a standard colors of Pebble Grey and Traffic White.

RECOMMENDED SUBSTRATES

Without primer: metal surfaces

With primer: Consult **ALSAN RS 276 PRIMER** Technical Data Sheet (TDS).

SURFACE PREPARATION

Surfaces must be dry, clean and free of loose particles, formwork, curing products, irregularities, slurry, etc.

APPLICATION

MIXING: Using a slow-speed (200 to 400 rpm) mechanical agitator, thoroughly mix the entire container of resin for two minutes before each use, and prior to pouring off resin into a second container if batch mixing. Catalyze, with **ALSAN RS Catalyst Powder**, only the amount of material that can be used within 10-15 minutes. Add pre-measured catalyst (**ALSAN RS Catalyst Powder**) to the resin component, stir for two minutes and apply to substrate. Refer to Catalyst Mixing Chart for additional information. **To complete the installation, please refer to ALSAN RS FLEECE technical data sheet.**

Summer Formulation			
Catalyst Mixing Chart			
Catalyst dosage per 12 kg container of resin used			
Temperature range	Catalyst activation	kg	tbsp*
15 °C to 18 °C (59°F to 64°F)	4 %	0.48	48
18 °C to 40 °C (64°F to 104°F)	2 %	0.24	24
Catalyst dosage per each 1 liter (1.2 kg) of resin used			
Temperature range	Catalyst activation	kg	tbsp*
15 °C to 18 °C (59°F to 64°F)	4 %	0.048	5
18 °C to 40 °C (64°F to 104°F)	2 %	0.024	2.5

Winter Formulation			
Catalyst Mixing Chart			
Catalyst dosage per 12 kg container of resin used			
Temperature range	Catalyst activation	kg	tbsp*
-5 °C to 10 °C (23 °F to 50 °F)	4 %	0.48	48
10 °C to 20 °C (50 °F to 68 °F)	2 %	0.24	24
Catalyst dosage per each 1 liter (1.2 kg) of resin used			
Temperature range	Catalyst activation	kg	tbsp*
-5 °C to 10 °C (23 °F to 50 °F)	4 %	0.048	5
10 °C to 20 °C (50 °F to 68 °F)	2 %	0.024	2.5

*Each 0.01 kg of **ALSAN RS Catalyst Powder** equals approximately to a level 1-tablespoon size scoop (**ALSAN RS** Measuring Spoon) supplied with the packaged product.

APPLICATION: After mixing, apply resin to clean and prepared substrate at the required consumption using rollers, brushes or notched squeegees. The resin should be spread evenly onto the surface. See individual system specifications for specific guidelines regarding application of primer, membrane, topcoat and/or slip-resistant protective surfacing.

Summer Formulation: **ALSAN RS 230 FLASH** can be applied at substrate temperature between 15 °C (59 °F) and 50 °C (122 °F) and ambient temperature between 15 °C (59 °F) and 40 °C (104 °F).

Winter Formulation: **ALSAN RS 230 FLASH** can be applied at substrate temperature between -5 °C (23 °F) and 20 °C (68 °F) and ambient temperature between -5 °C (23 °F) and 20 °C (68 °F).

ALSAN RS 230 FLASH

TECHNICAL DATA SHEET
160310SCAN2E
(supersedes 141128SCAN1E)

APPLICATION

Reaction Times		
Ambient temperature	at 20 °C (68 °F) (W.F.)	at 20 °C (68 °F) (S.F.)
Pot life	20 minutes	15 minutes
Rain proof after	45 minutes	30 minutes
Set time / walked on / next layer	90 minutes	60 minutes
Fully cured	6 hours	3 hours

W.F. - Winter Formulation
S.F. - Summer Formulation
Pot life is dependent on ambient temperatures and will be reduced at higher temperatures. minimum set times are approximate and may vary. Actual set times and cure times should be established in the field, based on actual field conditions.

COVERAGE

Coverage Rates				
	Coverage		Thicknesses	
	kg / m ²	kg / ft ²	wet mm	wet mils
Minimum total consumption	3.0	0.28	1.8 - 2.2	72 - 86
Base coat consumption	2.0	0.19	1.3 - 1.5	50 - 60
Top coat consumption	1.0	0.09	0.6 - 0.7	22 - 26

- Coverage rates may vary depending on substrate conditions.
- Wet and dry thicknesses are always equivalent.
- Thickness rate does not take into account polyester fleece reinforcement thickness; measurement is for liquid resin only.

* Coverage per pail: 4 m² (43 ft²)

PROPERTIES

Property	Test method	ALSAN RS 230 FLASH
Membrane thickness	ASTM D 5147 Sec 5	2.9 mm (115 mils)
Peak load @ 23 °C (73 °F), avg.	ASTM D 5147 Sec 6	12.3 kN/m (70 lbf/in)
Elongation @ peak load, avg.	ASTM D 5147 Sec 6	42 %
Peak load @ 23 °C (73 °F), avg.	ASTM D 412 (dumbbell)	15.8 kN/m (90 lbf/in)
Elongation @ peak load, avg.	ASTM D 412 (dumbbell)	55 %
Shore A hardness, avg.	ASTM D 2240	81
Water absorption, (Method I) (24h @ 23 °C (73 °F))	ASTM D 570	0.41 %
Water absorption, (Method II) (48h @ 50 °C (122 °F))	ASTM D 570	1.57 %
Low temperature flexibility	ASTM D 5147 Sec 11	-25 °C (-13 °F)
Dimensional stability (maximum movement)	ASTM D 5147 Sec 10	-0.063 %
Tear strength	ASTM D 5147 Sec 7	0.5 kN (107 lbf)

(All values are nominal)
Values based on reinforced ALSAN RS Systems at a coverage rate of 3.3 kg/m².

PACKAGING

ALSAN RS 230 FLASH resin is supplied in a 12-kg resealable container with locking ring.

STORAGE & HANDLING

Shelf life: 12 months, properly stored in original unopened containers. For more information, refer to instruction on the label of the can and to relevant Material Safety Data Sheet (MSDS).



ADMIX C-500

07160 | CEMENTITIOUS CRYSTALLINE

Concrete Waterproofing

Description

Xypex is a unique chemical treatment for the waterproofing, protection and improvement of concrete. XYPEX ADMIX C-500 is added to the concrete mix at the time of batching. Xypex Admix C-500 consists of Portland cement, very fine treated silica sand and various active, proprietary chemicals. These active chemicals react with the moisture in fresh concrete and with the by-products of cement hydration to cause a catalytic reaction which generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete. Thus the concrete becomes permanently sealed against the penetration of water or liquids from any direction. The concrete is also protected from deterioration due to harsh environmental conditions.

Xypex Admix C-Series

The Admix C-Series has been specially formulated to meet varying project and temperature conditions. **Xypex Admix C-500** is specifically formulated to meet modern concrete practices that incorporate additives such as fly ash and slag. For most concrete mix designs adding the Admix C-500 will have minimal or no effect on setting time. **Xypex Admix C-1000** is designed for typical Portland cement-rich concrete, where normal to a mild retarded set is desired. **Xypex Admix C-2000** is designed for projects where extended retardation is required due to high ambient temperatures or long ready-mix delivery times. See Setting Time and Strength for more details. Consult with a Xypex technical services representative for the most appropriate Xypex Admix for your project.

Recommended for:

- Reservoirs
- Sewage and Water Treatment Plants
- Secondary Containment Structures
- Tunnels and Subway Systems
- Underground Vaults
- Foundations
- Parking Structures
- Swimming Pools
- Precast Components

Advantages

- Resists extreme hydrostatic pressure from either positive or negative surface of the concrete
- Becomes an integral part of the substrate

- Highly resistant to aggressive chemicals
- Can seal static hairline cracks up to 0.4 mm
- Allows concrete to breathe
- Non-toxic
- Less costly to apply than most other methods
- Permanent
- Added to the concrete at time of batching and therefore is not subject to climatic restraints
- Increases flexibility in construction scheduling

Packaging

Xypex Admix C-500 is available in 50 lb. (22.7 kg) bags and in cartons containing 10 lb. (4.5 kg), 12 lb. (5.5 kg), and 15 lb. (6.8 kg) soluble bags. For specific projects, contact the manufacturer for availability of custom sized packaging.

Storage

Xypex products must be stored dry at a minimum temperature of 45°F (7°C). Shelf life is one year when stored under proper conditions.

Dosage Rates

Xypex Admix C-500:

2% - 3% by weight of cement

Xypex Admix C-500 NF (No Fines Grade):

1% - 1.5% by weight of cement

NOTE: Under certain conditions, the dosage rate for No Fines Grade may be as low as 0.8% depending on the quantity and type of total cementitious materials. The maximum use level is 2% by weight of cement for potable water applications.

Consult with Xypex's Technical Services Department for assistance in determining the appropriate dosage rate and for further information regarding enhanced chemical resistance, optimum concrete performance, or meeting the specific requirements and conditions of your project.

Test Data

PERMEABILITY

U.S. Army Corps of Engineers CRD C48-73, "Permeability of Concrete", Aviles Engineering Corp., Houston, USA

Two concrete samples containing Xypex Admix at 3% and 5% respectively, and an untreated control sample

were tested for water permeability. Both the treated and untreated samples were subjected to a pressure of 150 psi (350 ft. water head). Results showed moisture and permeated water throughout the untreated sample after 24 hours. However, the Xypex Admix samples showed no leakage, and water penetration of only 1.5 mm after 120 hours (5 days).

***U.S. Army Corps of Engineers CRD C48-73,
"Permeability of Concrete", Setsco Services, Pte Ltd.,
Singapore***

Six Xypex Admix-treated and six untreated concrete samples were tested for water permeability. Pressure was gradually increased over five days and then maintained at 7 bars (224 ft. water head) for 10 days. While the six reference samples showed water leakage beginning on the fifth day and increasing throughout the test period, the Xypex Admix samples showed no water leakage at any time during the test.

***DIN 1048, "Water Impermeability of Concrete",
DICTU S.A., Dept. of Engineering and Construction Mgt.,
Santiago, Chile***

Concrete samples 120 mm thick containing Xypex Admix were tested with the same size reference samples for water impermeability. Samples were subjected to hydrostatic pressure for 28 days. Water totally permeated the untreated samples but no water penetration was detected in any of the Xypex Admix-treated samples.

COMPRESSIVE STRENGTH

***ASTM C 39, "Compressive Strength of Cylindrical
Concrete Specimens", HBT Agra, Vancouver, Canada***

Concrete samples containing Xypex Admix at various dosage rates (1%, 2% and 5%) were tested against an untreated concrete control sample. Compressive strength test results after 28 days indicated a significant strength increase in the samples incorporating Xypex Admix. The compressive strength increase varied between 5% and 20% (depending on the Xypex Admix dosage rate) over that of the reference sample.

***ASTM C 39, "Compressive Strength of Cylindrical
Concrete Specimens", Kleinfelder Laboratories,
San Francisco, USA***

At 28 days, the compressive strength test of the concrete containing Xypex Admix measured 7160 psi as compared to the reference sample at 6460 psi (a 10% increase).

CHEMICAL RESISTANCE

***JIS, "Chemical Durability Test", Japanese Utility
Company, In-house Test Report, Tokyo, Japan***

Concrete samples containing Xypex Admix were tested against five samples containing other admixtures and against a control sample, to determine resistance to corro-

sion and deterioration caused by contact with aggressive chemicals. All samples were soaked in a 5% sulfuric acid solution at 20°C for six months. Various evaluations and measurements were assessed every month during the test period, including: photographic comparisons, relative dynamic modulus of elasticity, percentage change in length, weight and flexural rigidity. Although the Xypex Admix sample was subjected to acid conditions well outside its published range, the results confirmed Xypex with the best performance among the seven samples tested.

***"Sulfuric Acid Resistance Test",
Aviles Engineering Corporation, Houston, USA***

Concrete samples containing Xypex Admix at different dosage rates (3%, 5% and 7%) were tested against untreated control samples for sulfuric acid resistance. After immersion in the sulfuric acid, each sample was tested for weight loss on a daily basis until a weight loss of 50% or a definite response trend was obtained. The percentage weight loss of the samples containing Xypex Admix tested significantly lower than the control samples.

***"Sulphate Resistance Test",
Taywood Engineering Ltd., Perth, Australia***

Xypex Admix-treated concrete samples were immersed in an ammonium-sulphate solution and tested for "resistance in a harsh environment". The performance of the Xypex crystalline technology was compared with five other concretes, including one containing a sulphate-resistant cement. Each of the test samples was cured for seven days and then placed in an ammonium-sulphate solution (132 g/litre) for 180 days. The rate of corrosion was determined by measuring weight loss, and length change was noted on a weekly basis. The Xypex crystalline technology substantially improved concrete performance as compared to the reference concrete and tested very similar to the sulphate-resistant concrete. The Xypex Admix-treated samples also provided the highest level of protection as measured by change in length.

FREEZE/THAW DURABILITY

***ASTM C 666, "Freeze/Thaw Durability",
Independent Laboratory, Cleveland, USA***

After 300 freeze/thaw cycles, the Xypex Admix-treated samples indicated 94% relative durability.

POTABLE WATER EXPOSURE

***NSF 61, "Drinking Water System Component-Health
Effects", NSF International, Ann Arbor, USA***

Exposure testing of potable water in contact with Xypex-treated samples indicated no harmful effects.

Directions for Use

Xypex Admix C-500 must be added to the concrete at the time of batching. The sequence of procedures for addition will vary according to the type of batch plant operation and equipment:

1. READY MIX PLANT - DRY BATCH OPERATION Add Xypex Admix in powder form to the drum of the ready-mix truck. Drive the ready-mix truck under the batch plant and add the balance of the materials in accordance with standard concrete batching practices. Mix materials for a minimum of 5 minutes to ensure that the Xypex Admix has been thoroughly dispersed throughout the concrete.

2. READY MIX PLANT - CENTRAL MIX OPERATION Mix Xypex Admix with water to form a very thin slurry (e.g. 15 - 20 lb./6.75 - 9 kg of powder mixed with 3 U.S. gallons/ 13.6 litres of water). Pour the required amount of material into the drum of the ready-mix truck. The aggregate, cement and water should be batched and mixed in the plant in accordance with standard practices (taking into account the quantity of water that has already been placed in the ready-mix truck). Pour the Admix slurry into the truck and mix for at least 5 minutes to ensure even distribution of the Xypex Admix throughout the concrete.

3. PRECAST BATCH PLANT Add Xypex Admix to the rock and sand, then mix thoroughly for 2 - 3 minutes before adding the cement and water. The total concrete mass should be blended using standard practices.

NOTE:

i. It is important to obtain a homogeneous mixture of Xypex Admix with the concrete. Therefore, do not add dry Admix powder directly to wet concrete as this may cause clumping and thorough dispersion will not occur.

ii. Concrete containing the Xypex Admix does not preclude the requirement for design of crack control, construction joint detailing and measures for repairing defects in concrete (i.e. honeycombing, tie holes, cracks beyond specified limits).

For further information regarding the proper use of Xypex Admix for a specific project, consult with a Xypex technical services representative.

Setting Time and Strength

The setting time of concrete is affected by the chemical and physical composition of ingredients, temperature of the concrete and climatic conditions. Xypex Admix C-500 is specifically formulated to meet modern concrete practices that incorporate additives such as fly ash and slag. For most concrete mix designs adding the Xypex Admix

C-500 will have minimal or no effect on setting time. Concrete containing the Xypex Admix C-500 may develop higher early and ultimate strengths than plain concrete particularly where fly ash and slag are used. Trial mixes should be carried out under project conditions to determine the setting time and strength of the concrete dosed with Xypex Admix C-500. Consult with a Xypex technical services representative for the most appropriate Xypex Admix for your project.

Limitations

When incorporating Xypex Admix, the temperature of the concrete mix should be above 40°F (4°C).

Technical Services

For more instructions, alternative installation methods, or information concerning the compatibility of the Xypex treatment with other products or technologies, contact the Technical Services Department of Xypex Chemical Corporation or your local Xypex representative.

Safe Handling Information

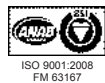
Xypex is alkaline. As a cementitious powder or mixture, Xypex may cause significant skin and eye irritation. Directions for treating these problems are clearly detailed on all Xypex pails and packaging. The Manufacturer also maintains comprehensive and up-to-date Material Safety Data Sheets on all its products. Each sheet contains health and safety information for the protection of workers and customers. The Manufacturer recommends you contact Xypex Chemical Corporation or your local Xypex representative to obtain copies of Material Safety Data Sheets prior to product storage or use.

Warranty

The Manufacturer warrants that the products manufactured by it shall be free from material defects and will be consistent with its normal high quality. Should any of the products be proven defective, the liability to the Manufacturer shall be limited to replacement of the product ex factory. The Manufacturer makes no warranty as to merchantability or fitness for a particular purpose and this warranty is in lieu of all other warranties expressed or implied. The user shall determine the suitability of the product for his intended use and assume all risks and liability in connection therewith.



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PENETRON ADMIX[®]

CRYSTALLINE WATERPROOFING ADMIXTURE

DESCRIPTION

PENETRON ADMIX[®] (integral crystalline waterproofing admix) is added to the concrete mix at the time of batching. PENETRON ADMIX[®] consists of Portland cement and various active, proprietary chemicals. These active chemicals react with the moisture in fresh concrete and with the by-products of cement hydration to cause a catalytic reaction, which generates a non-soluble crystalline formation throughout the pores and capillary tracts of the concrete. Thus, the concrete becomes permanently sealed against the penetration of water or liquids from any direction. The concrete is also protected from deterioration due to harsh environmental conditions. PENETRON ADMIX[®] has been specially formulated to meet varying project and temperature conditions (see **Setting time and strength**). Consult with a Penetron technical representative for additional detailed support on your project.

APPLICATIONS

- Reservoirs
- Sewage and water treatment plants
- Secondary containment structures
- Tunnels and subway systems
- Underground vaults
- Foundations
- Parking structures
- Swimming pools
- Precast, cast-in-place and shotcrete applications

ADVANTAGES

- Resists extreme hydrostatic pressure from either positive or negative surface of the concrete slab
- Becomes an integral part of the concrete
- Highly resistant to aggressive chemicals
- Can seal hairline cracks up to 1/64" (0.4 mm)
- Allows concrete to breathe
- Non-toxic (NSF 61 certified for potable water applications)
- Less expensive than traditional methods
- Permanent
- Added to the concrete at the time of batching and therefore not subject to climatic restraints
- Reduces construction scheduling time
- Improves durability of concrete
- Permeability Reducing Admixture for Hydrostatic conditions (PRAH)
- Zero VOC – PENETRON powdered products contain zero volatile organic compounds and are safe for use both outdoors and in confined indoor spaces
- Exceeds requirements of ASTM C494-S (Specific Performance Admixtures)

DIRECTIONS FOR USE

Dosage rate:

0.8-1.0% by weight of cement. Consult with Penetron's Technical Department for assistance in verifying the appropriate dosage rate and for further information regarding enhanced chemical resistance and optimum concrete performance for your project.

Mixing:

PENETRON ADMIX[®] must be added to the concrete at the time of batching.

The sequence of procedures for addition will vary according to the type of batch plant operation and equipment. The following are some typical mixing guidelines. For more detailed information on dosing procedures, contact your Penetron representative.

Ready mix plant - Dry batch operation: Add PENETRON ADMIX[®] in powder form to the drum of the ready-mix truck. Drive the truck under the batch plant and add 60%-70% of the required water, along with 300-500 lb (136-227 kg) of aggregate. Mix the materials for 2-3 minutes to ensure the PENETRON ADMIX[®] is distributed evenly throughout the mix water. Add the balance of materials to the ready-mix truck in accordance with standard batching practices.

Ready mix plant - Central mix operation: Mix PENETRON ADMIX[®] with water to form a very thin slurry (e.g. 40 lb (18 kg) of powder mixed with 6 gallons (22.7 l) of water). Pour the required amount of material into the drum of the ready-mix truck. The aggregate, cement, sand and water should be batched and mixed in the plant in accordance with standard practices (taking into account the quantity of water that has already been placed in the ready-mix truck). Pour the concrete into the truck and mix for at least 5 minutes to ensure even distribution of PENETRON ADMIX[®] throughout the concrete.

Precast batch plant: Add PENETRON ADMIX[®] to the rock and sand, then mix thoroughly for 2-3 minutes before adding the cement and water. The total concrete mass should be blended using standard practices.

NOTE: It is important to obtain a homogeneous mixture of PENETRON ADMIX[®] with the concrete. Therefore, do not add dry PENETRON ADMIX[®] powder directly to wet concrete as this may cause clumping and thorough dispersion will not occur. For further information regarding the proper use of PENETRON ADMIX[®] for a specific project, consult with a Penetron technical representative.

Setting time and strength:

The setting time of concrete is affected by the chemical and physical composition of ingredients, temperature of the concrete and climatic conditions. Retardation of set may occur when using PENETRON ADMIX[®]. The amount of retardation will depend upon the concrete mix design and

PENETRON ADMIX®

the dosage rate of PENETRON ADMIX®. However, under normal conditions, PENETRON ADMIX® will provide a normal set concrete. Concrete containing PENETRON ADMIX® may develop higher ultimate strengths than plain concrete. Trial mixes should be carried out under project conditions to determine setting time and strength of the concrete.

Concrete treated with PENETRON ADMIX® should be placed and finished in accordance with good concrete practices. ACI guidelines and recommendations should be observed.

SPECIAL CONSIDERATIONS

When incorporating PENETRON ADMIX®, the temperature of the concrete mix should be above 40°F (4°C).

PACKAGING

PENETRON ADMIX® is available in 40 lb (18 kg) bags, 55 lb (25 kg) pails, and 6.6 lb (3 kg) soluble bags. For large projects, customized packaging is available.

STORAGE / SHELF LIFE

PENETRON products must be stored dry at a minimum temperature of 45°F (7°C). Shelf life is one year when stored under proper conditions.

TECHNICAL SERVICES

For more detailed instructions, alternative application methods, or information concerning the compatibility of the PENETRON treatment with other products or technologies, contact the Penetron Technical Department or your local Penetron representative.

SAFE HANDLING INFORMATION

PENETRON ADMIX® is alkaline. As a cementitious powder or mixture, PENETRON ADMIX® may cause significant skin and eye irritation. Penetron International, Ltd. also maintains comprehensive and up-to-date Safety Data Sheets on all its products. Each sheet contains health and safety information for the protection of your employees and customers. KEEP OUT OF REACH OF CHILDREN.

Contact Penetron International, Ltd. or your local Penetron representative to obtain copies of Safety Data Sheets prior to product storage or use.



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601 South Tenth Street, Unit 300
Allentown, PA 18103
08

PENETRON ADMIX
Crystalline Capillary Admixture
Water Resisting Admixture

Chloride content: < 0,10 % by mass

Alkali content: < 10,3 % by mass

Compressive strength: ≥ 85 % of control

Conventional dry material content: > 99,5 %

Air content in fresh concrete: ≤ 2 % by volume

Capillary Absorption (after 90 day curing): ≤ 60 % by mass

WARRANTY: PENETRON INTERNATIONAL, LTD. warrants that the products manufactured by it shall be free from material defects and will conform to formulation standards and contain all components in their proper proportion. Should any of the products be proven defective, the liability to PENETRON INTERNATIONAL, LTD. shall be limited to replacement of the material proven to be defective and shall in no case be liable otherwise or for incidental or consequential damages. **PENETRON INTERNATIONAL, LTD. MAKES NO WARRANTY AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED.** User shall determine the suitability of the product for its intended use and assume all risks and liability in connection therewith.

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WATERSTOP-RX®

EXPANDING CONCRETE JOINT WATERSTOP



WATERSTOP-RX® EXPANDING CONCRETE JOINT WATERSTOP

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SECTION 1 PRODUCT DESCRIPTION

WATERSTOP-RX is a flexible strip concrete construction joint waterstop that provides a permanent seal by expanding upon contact with water. WATERSTOP-RX is an active sodium bentonite based waterstop that is designed to replace conventional passive PVC dumbbell waterstops, thus eliminating the requirement of split-forming and product seam welding.

WATERSTOP-RX is manufactured in light weight, flexible coils that can be installed in both hot and cold weather. The product is adhered to concrete, steel, and PVC (pipes) with CETSEAL; at or exceeding the required minimum distance from the exterior concrete surface.

The key to WATERSTOP-RX is sodium bentonite. Sodium bentonite swells when in contact with water, forming an impermeable barrier. This swelling property allows WATERSTOP-RX to form a permanent pressure seal within the concrete joint, thus eliminating water migration over or along the waterstop (see Figure 1.1). In addition to forming a positive pressure seal, the product's expansion properties allow it to seal small cracks and void areas. WATERSTOP-RX has been successfully tested by independent testing firms to over 60 meters (200 feet) of hydrostatic water pressure, under both continuous emersion and wet/dry cycling.

WATERSTOP-RX is extruded in three sizes and shapes (see Figure 1.2). WATERSTOP-RX 101 is extruded in a rectangular shape measuring 25 mm x 19 mm x 5.03 m (1"x3/4"x16'8"). WATERSTOP-RX 101T is extruded in a trapezoidal shape measuring 31 mm x 12 mm x 6 m (1-1/4" x 1/2" x 20') with a reinforcing plastic scrim embedded in the top surface for high tensile strength. The patented trapezoidal shape distrib-

utes the expansive force over a greater area. WATERSTOP-RX 102 is extruded in half-circle (crescent) shape measuring 19 mm x 9 mm x 10 m (3/4" x 3/8" x 33' 4"). See Table 1.

CETSEAL is a multi-purpose, single component polyether moisture cure adhesive used to secure WATERSTOP-RX into position. Apply a continuous bead of CETSEAL to substrate then install WATERSTOP-RX before CETSEAL skins over and cures. Adhesive yeild will vary with use, substrate and application.

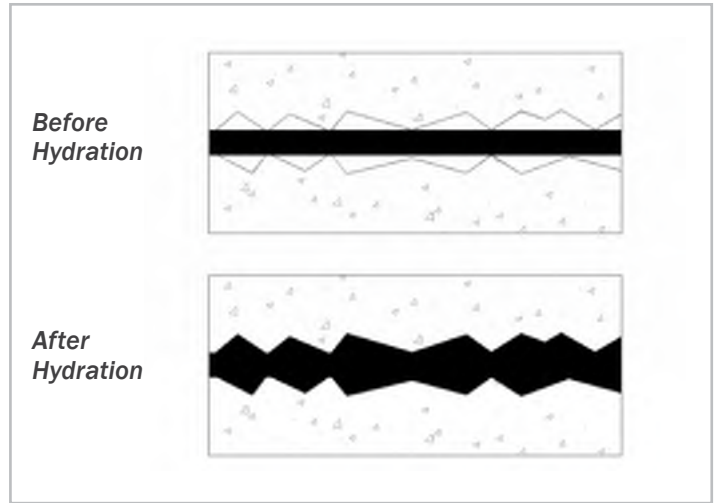


Figure 1.1 - Swelling property of WATERSTOP-RX

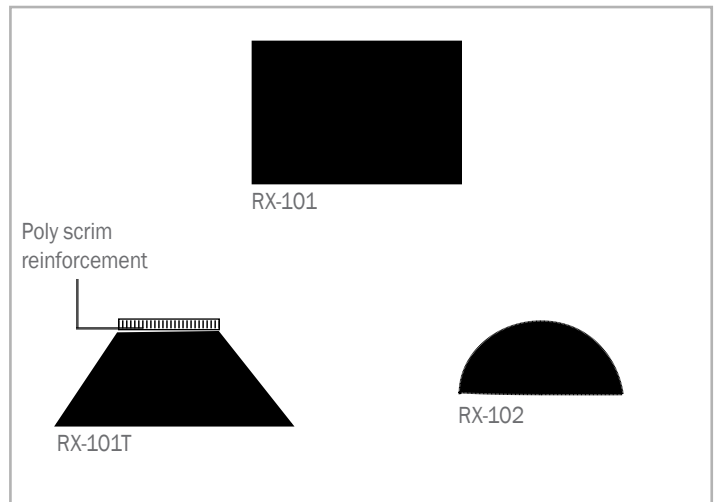


Figure 1.2 - Three sizes and shapes of WATERSTOP-RX

SECTION 2 GENERAL APPLICATIONS

WATERSTOP-RX applications include both vertical and horizontal concrete construction joints, new-to-existing construction, irregular surfaces, and around throughwall penetrations, such as plumbing and electrical conduit. WATERSTOP-RX is designed for both hydrostatic and non-hydrostatic conditions. WATERSTOP-RX is not designed, nor intended to function as an expansion joint sealant. Contact manufacturer for precast concrete applications, technical information and approval.

WATERSTOP-RX is designed for structural concrete with a minimum of 3000 psi. 101 and 101T, require a minimum 75 mm (3") of concrete coverage. WATERSTOP-RX 102 requires a minimum concrete coverage of 50 mm (2").

RX 101 and RX 101T are designed for vertical and horizontal reinforced concrete 200mm (8") thick or greater, with two rows of reinforcing steel (see Figure 2.1). RX 101T (trapezoidal) is recommended for shotcrete or gunite concrete construction, extreme hot weather and difficult applications. RX 102 is designed for vertical reinforced concrete 125 mm (5") thick or greater; and horizontal reinforced concrete 100 mm (4") thick or greater. RX 102 is designed primarily for concrete with one row of reinforcement, concrete curbs, planter walls, and light weight concrete.

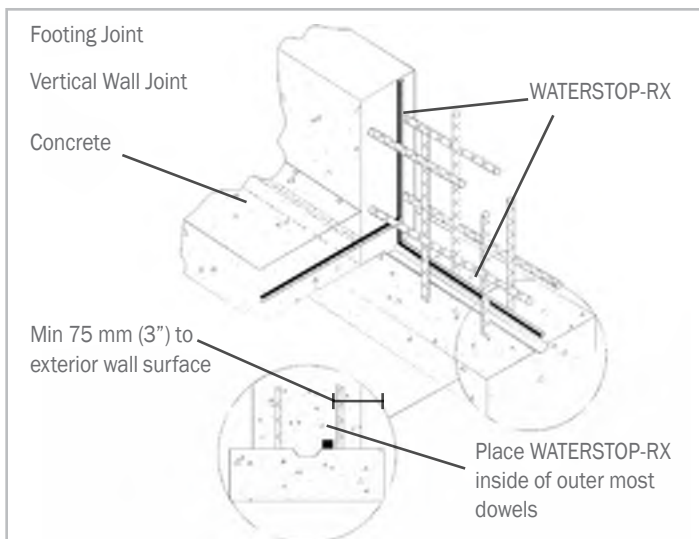


Figure 2.1 - Typical placement of WATERSTOP-RX at concrete construction joint

SECTION 3 GENERAL INSTALLATION

SURFACE PREPARATION

Surfaces should be clean and dry. Remove all dirt, rocks, rust or other debris. Do not install WATERSTOP-RX in standing water.

ADHESIVE

Apply a continuous bead of CETSEAL along the substrate where WATERSTOP-RX will be installed. Assure proper 75 mm (3") concrete coverage will be maintained. Keep the nozzle tip pressed against the concrete at a 45° angle during application.

INSTALLATION

After applying a continuous bead of CETSEAL, remove release paper, then firmly press the entire length of Waterstop-RX onto the adhesive. For vertical and overhead applications, firmly press a minimum of 15 seconds to assure adhesion. Apply WATERSTOP-RX within 30 minutes of adhesive installation; waterstop must be placed into adhesive prior to CETSEAL skinning over and curing. CETSEAL may be applied to damp surfaces, but not in standing water.

WATERSTOP-RX is not a self-adhering product. Use CETSEAL to adhere the product. Mechanical fasteners should not be used to secure product alone, but may be used in conjunction with CETSEAL.

Tightly butt coil ends together to form a continuous waterstop (do not overlap coil ends). Place in maximum practical lengths to minimize coil end joints. Where required, cut coils with knife or utility blade to fit coil ends together. Pour Concrete.

LIMITATIONS

WATERSTOP-RX is not designed, nor intended to function as an expansion joint sealant. RX-101 and RX 101T require a 75 mm (3") minimum concrete coverage to the exterior concrete surface (see Figure 3.1). RX 102 requires a 50 mm (2") minimum concrete coverage to the exterior concrete surface (see Figure 3.2).

Concrete work shall use conventional cast-in-place forms that produce a smooth surface. Do not use stay-in-place concrete forming; use removable forming products only.

For concrete or other construction techniques not covered herein, contact CETCO regarding product use and installation guidelines.

PRODUCT TABLE

PRODUCT	SIZE	SHAPE	LN FT/CARTON	MIN CONCRETE COVERAGE
RX-101	1" X 3/4" X 16'8"	Rectangle	100	75 mm (3")
RX-101T	1 1/4" x 1/2" x 20'	Trapezoid with poly reinforcement	120	75 mm (3")
RX-102	3/4" x 3/8" x 33' 4"	Half circle	200	50 mm (2")

WATERSTOP-RX®
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WATERSTOP-RX should not be prehydrated by submersion or remain in contact with water prior to concrete pour. If the product exhibits considerable swell prior to confinement in the joint, it must be replaced with new material.

In conditions where severe ground water chemical contamination exists, or is expected, consult with manufacturer for compatibility information and approval.

WATERSTOP-RX is recommended for installation outside of any formed keyway in poured-in-place concrete construction. WATERSTOP-RX can be installed in a formed keyway with the approval of the structural engineer. Consult manufacturer for recommendations on conditions not represented herein.

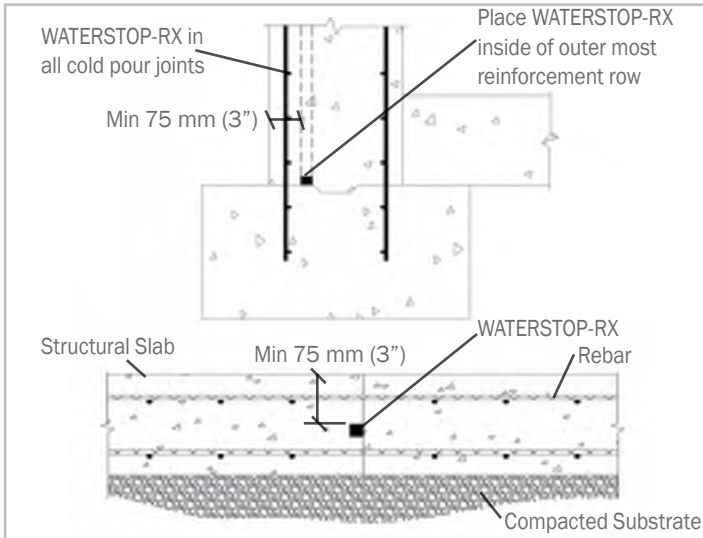


Figure 3.1 - Placement of WATERSTOP-RX 101 & 101T at typical construction joints with required 75 mm (3") concrete coverage.

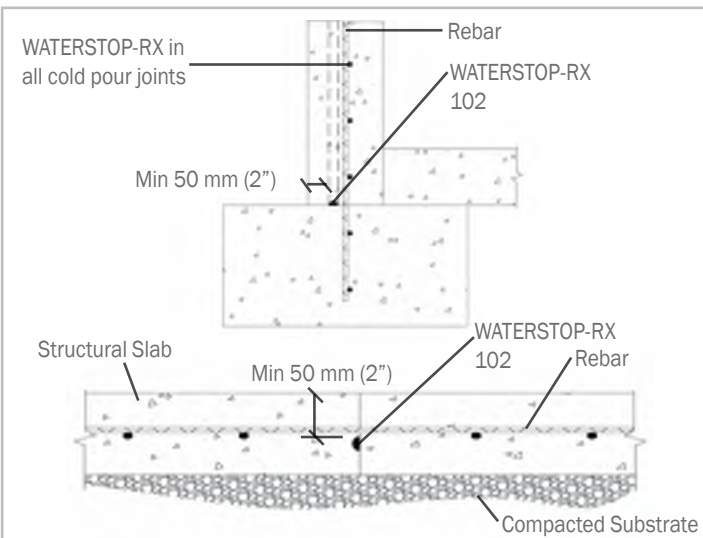


Figure 3.2 - Placement of WATERSTOP-RX 102 at typical construction joints with required 50 mm (2") concrete coverage.

SECTION 4
PENETRATIONS

Following the General Installation Procedures in Section 3, install WATERSTOP-RX® directly around all applicable single and multiple poured-in-place or sleeved pipe penetrations (see Figure 4.1).

Single Pipe Penetration: Install WATERSTOP-RX around outer diameter of the pipe (see Figure 4.2). WATERSTOP-RX 102 shall be installed around all polyvinyl chloride (PVC) pipes.

Multiple Pipe Penetrations: Install WATERSTOP-RX around each pipe, as well as, around any block out box construction joint. WATERSTOP-RX 102 shall be installed around penetrations with less than 4" (100mm) between penetrations (see Figure 4.3).

Sleeved Pipe Penetrations: Install WATERSTOP-RX around the outer diameter of the sleeve. Install another WATERSTOP-RX strip between the sleeve's inner diameter and the pipe, contacting both surfaces continuously (see Figure 4.4). When there is an excessive gap between the inner diameter of the sleeve and the pipe, it may be necessary to install two separate Waterstop- RX strips - one on the inner diameter and the other on the pipe. Then completely fill the void area between the sleeve and the pipe with non-shrink grout (see Figure 4.5).

Consult manufacturer for recommendations on conditions not represented herein.

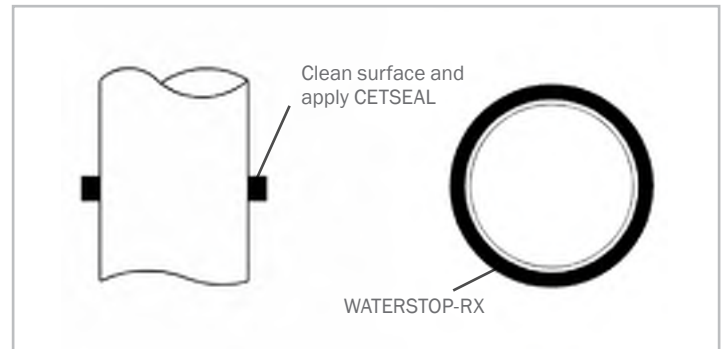


Figure 4.1 - WATERSTOP-RX installed around all applicable penetrations.

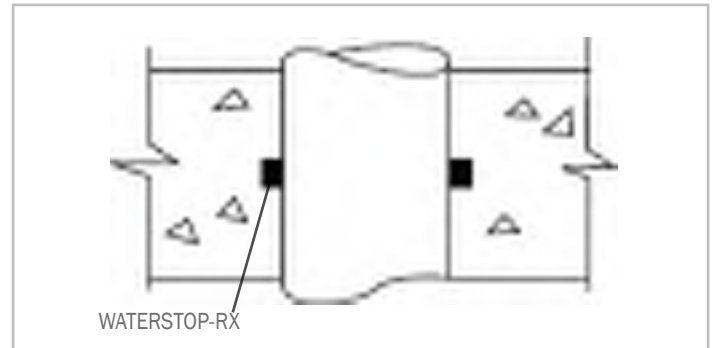


Figure 4.2 - Single pipe penetration

SECTION 5 PILE CAPS AND GRADE BEAMS

Following the General Installation Procedures in Section 3, install WATERSTOP-RX in all applicable concrete construction joints around or adjacent to pile caps and grade beams.

Install WATERSTOP-RX around pile caps and grade beams above the layer (not contacting) of exterior waterproofing to establish a separate waterstop layer (see Figure 5.3). Contour all I-beams extending outward from pile caps with WATERSTOP-RX (see Figure 5.1) or encircle all metal reinforcement rods extending out of pile caps (see Figure 5.2).

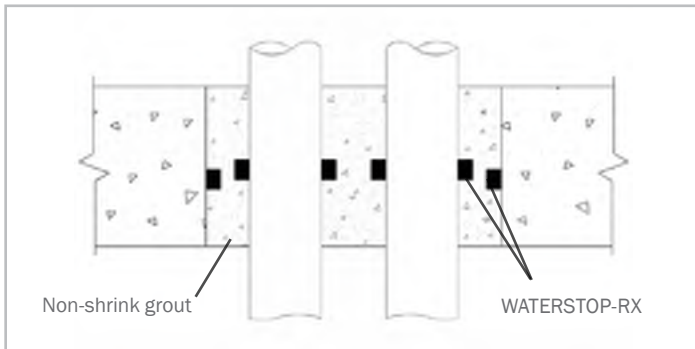


Figure 4.3 - Multiple pipe penetration

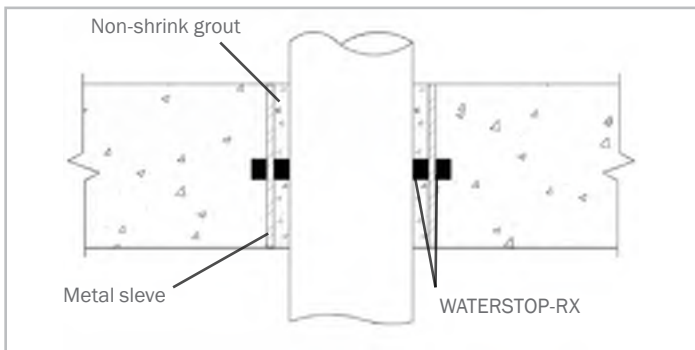


Figure 4.4 - Sleeved Pipe

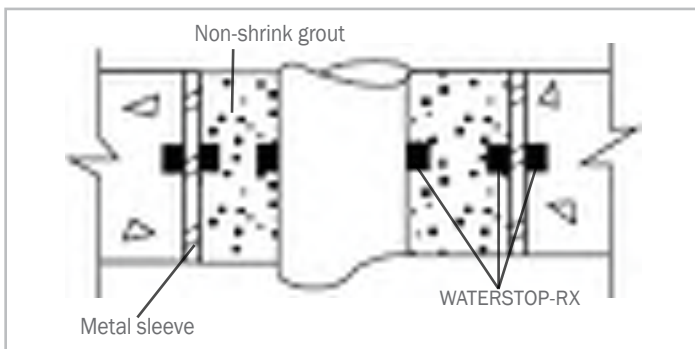


Figure 4.5 - Sleeved pipe (excessive gap)

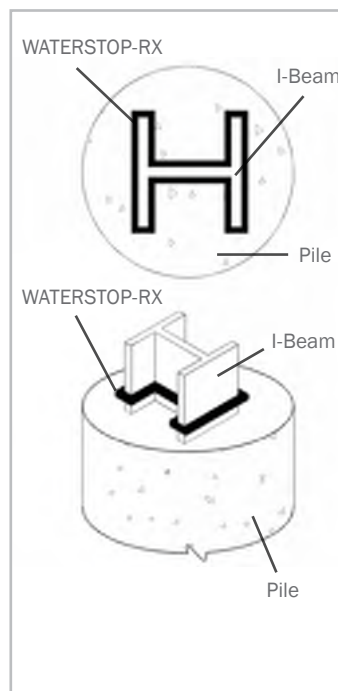


Figure 5.1 - WATERSTOP-RX encircling pile cap metal I-beam

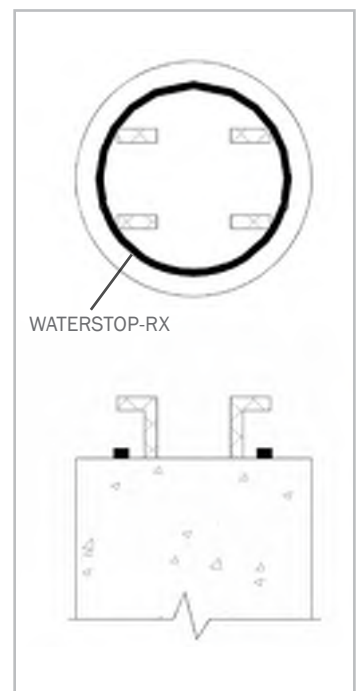


Figure 5.2 - WATERSTOP-RX encircling pile caps metal reinforcement

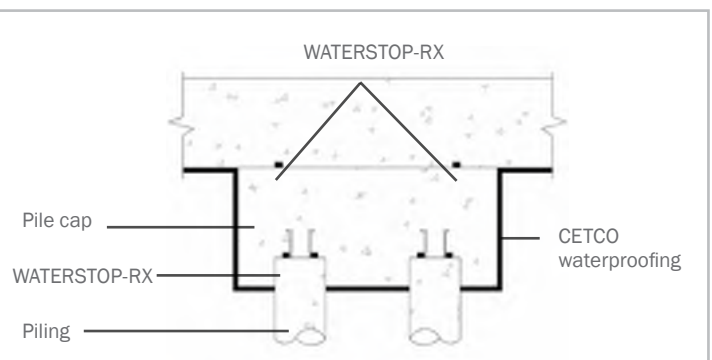
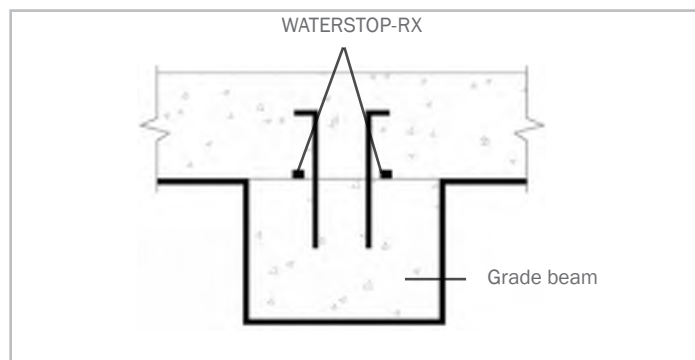


Figure 5.3 - WATERSTOP-RX at grade beams and pile caps

WATERSTOP-RX®
EXPANDING CONCRETE JOINT WATERSTOP

SECTION 6
PROPERTY LINE INSTALLATIONS

Following the General Installation Procedures in Section 3, install WATERSTOP-RX® in all applicable horizontal and vertical construction joints within the structural property line wall, including concrete interface joints with soldier piles.

Install WATERSTOP-RX directly to soldier piles when wood lagging is positioned outside the piles toward the retained earth or when the wood lagging is positioned adjacent to the pile's outer flange (see Figure 6.1).

Install WATERSTOP-RX within all applicable concrete construction joints when the wood lagging is positioned adjacent to the soldier piles inside flange (see Figure 6.2).

Install WATERSTOP-RX in all applicable concrete construction joints for metal sheet piling or concrete cassion construction. Install WATERSTOP-RX around all soldier pile tie-back boxes through wall construction joints (see Figure 6.3).

Use WATERSTOP-RX 101T (trapezoidal) for shotcrete or gunitite concrete construction. With shotcrete wall construction, a single strip of WATERSTOP-RX shall be installed in all shotcrete lift joints. For hydrostatic conditions, two strips of WATERSTOP-RX shall be installed in all shotcrete cold construction joints.

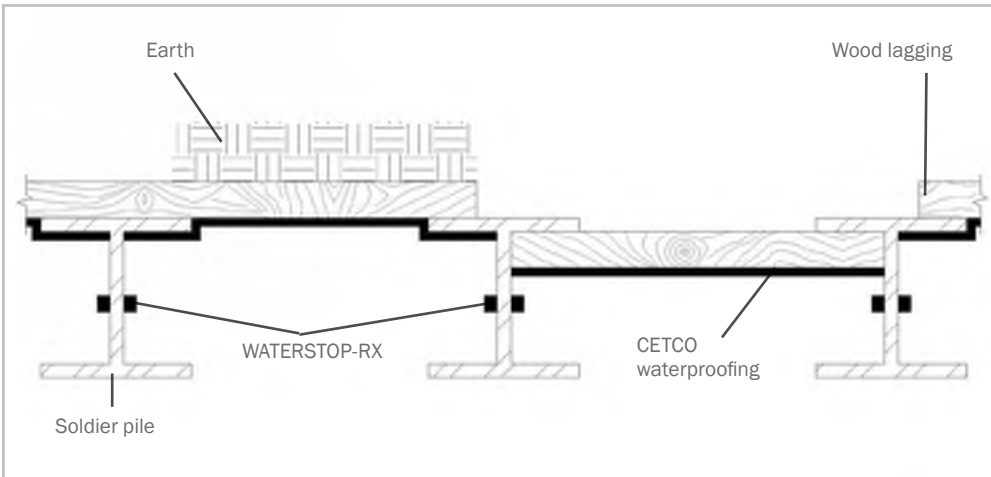


Figure 6.1 - WATERSTOP-RX installed when wood lagging is positioned outside the soldier piles or adjacent to piles outer flange

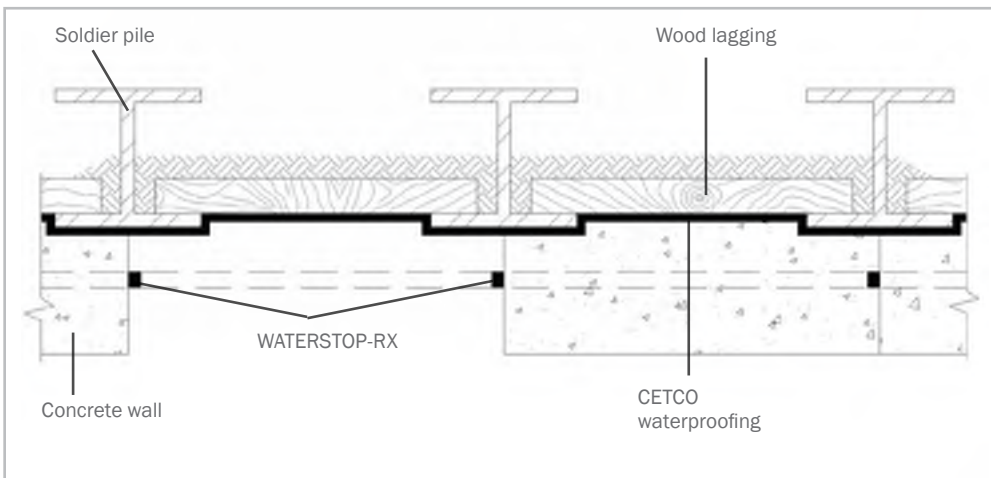


Figure 6.2 - WATERSTOP-RX installed when wood lagging is positioned adjacent to soldier piles inside flange

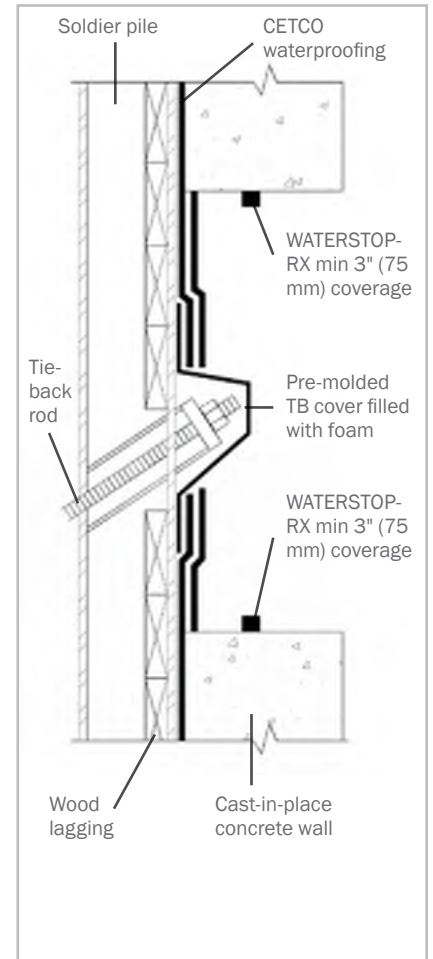


Figure 6.3 - Typical tie-back section detail prior to grouting

SECTION 7 IRREGULAR CONCRETE & STONE SURFACES

Following the General Installation Procedures in Section 3, install WATERSTOP-RX® to existing irregular concrete or stone surfaces.

Press WATERSTOP-RX continuously against irregular surface, contouring all rises and depressions (see Figure 7.1). Do not span cavities or cracks leaving a gap between the surface and the WATERSTOP-RX. In special conditions it may be necessary to install WATERSTOP-RX in an irregular path to circumvent deep depressions or cracks.

SECTION 8 JOINING WATERSTOP-RX TO PVC WATERSTOPS

Following the General Installation Procedures in Section 3, install WATERSTOP-RX on the exterior side of the PVC dumbbell waterstop (see Figure 8.1). WATERSTOP-RX should be in direct contact and overlap the passive PVC dumbbell waterstop by a minimum of 75 mm (3").

Consult manufacturer for recommendations on conditions not represented herein.

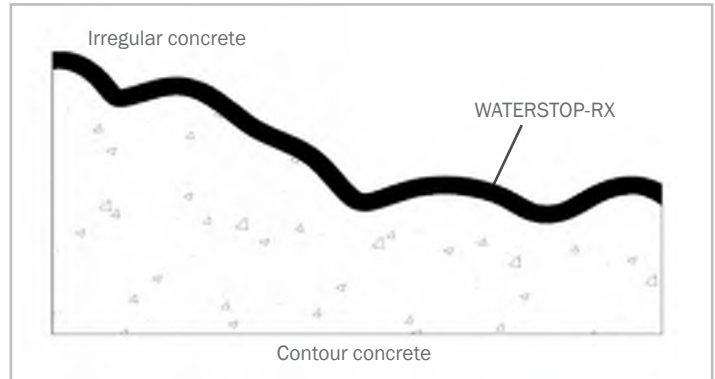


Figure 7.1 - WATERSTOP-RX installed on irregular concrete

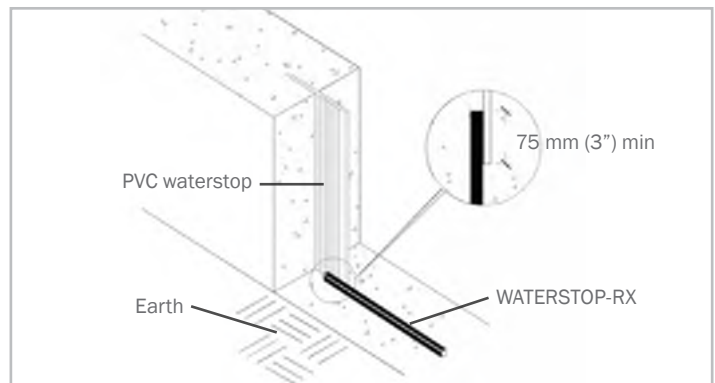


Figure 8.1 - Overlapping dumbbell waterstop

LIMITED WARRANTY

The information and data contained herein is believed to be accurate and reliable. Specifications and other information contained herein supersede all previously printed material and are subject to change without notice.

Manufacturer's warranty of installed system is available. Contact seller for terms and sample documents including all limitations.

All goods sold by seller are warranted to be free from defects in material and workmanship.

The foregoing warranty is in lieu of and excludes all other warranties not expressly set forth herein, whether expressed or implied by operation of law or otherwise including but not limited to any implied warranties of merchantability or fitness.

Seller shall not be liable for incidental or consequential losses, damages or expenses, directly or indirectly arising from the sale, handling or use of the goods, or from any other cause relating thereto, and seller's liability hereunder in any case is expressly limited to the replacement (in the form originally

shipped) of goods not complying with this agreement or at seller's election, to the repayment of, or crediting buyer with, an amount equal to the purchase price of such goods, whether such claims are for breach of warranty or negligence.

Any claim by buyer with reference to the goods sold hereunder for any cause shall be deemed waived by buyer unless submitted to seller in writing within thirty (30) days from the date buyer discovered or should of discovered, any claimed breach.

Materials should be inspected and tested by purchaser prior to their use if product quality is subject to verification after shipment. Performance guarantees are normally supplied by the applicator.

Note: WATERSTOP-RX is not an expansion joint material. Expansion joints shall be the responsibility of Others.



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ABOUT AMCOL INTERNATIONAL CORPORATION

Founded in 1927, AMCOL International Corporation is a leading producer and marketer of diverse specialty materials with a core expertise in minerals and polymer science. Through four business segments—Performance Materials, Construction Technologies, Energy Services, and Transportation—AMCOL creates solutions that enhance the quality, efficiency and sustainability of our customers' products and services in a growing global marketplace.


Amcol holds more than 375 worldwide patents, and our focus on research and development empowers us to be industry leaders. Technical expertise, coupled with unparalleled customer relationships and supported by more than 2,400 employees in more than 26 countries, makes us trusted partners in major end markets.



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UPDATED: NOVEMBER 2013

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Sika® Greenstreak® PVC Waterstops

PVC waterstops to seal construction and expansion joints in concrete structures

Description Sika® Greenstreak® PVC Waterstops are the industry's most comprehensive collection of waterstop products and solutions used to seal construction and expansion joints in concrete structures. Sika® Greenstreak® PVC Waterstops are available in a number of different sizes, types, design and dimensions according to their use.

Where to Use

- Used to seal construction and expansion joints in water retaining structures such as reservoirs, water towers, dams, spillways, canals, swimming pools, sewage tanks.
- Use to keep water out of concrete structures such as basements, underground car parks, tunnels, subways retaining walls etc.

Advantages

- Multi-ribbed sections provide optimum sealing characteristics.
- High quality PVC for long durability.
- Manufactured by Sika Greenstreak from only prime resins and all virgin raw materials.
- Suitable for high water pressure.
- Great inherent elasticity.
- Heat weldable, avoiding flames and fixings.
- Factory-produced cross sections available.
- Suitable for above or below grade applications.
- Broad selection to accommodate design demands.
- Available in Artic Grade.
- Resistant to many waterborne chemicals.
 - permanent: water, seawater, sewage, road salt solutions.
 - temporary: diluted inorganic alkalis, mineral acids and mineral oils.

Standards & Results Independent laboratory tests are available for the following applicable standards:

- Corps of Engineers CRD-C572-74
- Bureau of Reclamation C902

Technical Data	
Packaging	Refer to Sika Greenstreak Waterstop brochure
Colour	Off-white
Shelf Life	Store in unopened, undamaged and sealed original packaging, Store in dry conditions at temperatures not exceeding 30°C (86°F). Protect from UV light.
Properties at 23°C (73°F) and 50% R.H. (unless otherwise specified)	
Specific Gravity ASTM D792	1.4 kg/L
Tensile Strength ASTM D638	> 13.8 MPa (2000 psi)
Ultimate Elongation ASTM D638	> 350%
Stiffness in Flexure ASTM D747	> 4.85 MPa (700 psi)
Hardness Shore A ASTM D2240	80±3
Water Absorption ASTM D570	0.15% Max.
Low Temperature ASTM D746	Pass
<i>brittleness @ -37°C (-35°F)</i>	
Tensile Strength After Accelerated extraction CRD C572	> 9.54 MPa (1600 psi)
Alkali Resistance CRD-C-572	
• weight change	
• hardness change	.20% +/-5 Pts.
Tear Resistance ASTM D624	52.5kN/m (395 lb/in)
<i>Product properties are typically averages, obtained under laboratory conditions. Reasonable variations can be expected on-site due to local factors, including environment, preparation, application, curing and test methods.</i>	



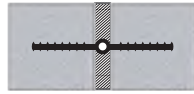
How to Use

Application

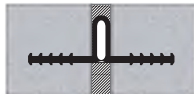
General Selection Criteria

The selection of a suitable waterstop is governed by the type of joint to be sealed, the grade of concrete and its thickness, the positioning of reinforcement, anticipated movement (expansion/shear) and the water pressure to which it is to be exposed.

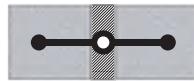
Selecting Waterstop Profile - Movement joints are typically designed to accommodate significant movement due to drying shrinkage, temperature changes, settlement, creep, or live load deflections. The waterstop profile selected must have the ability to accommodate anticipated joint movement, typically achieved through the use of a centre-bulb, tear web, or other suitable waterstop geometry designed to tolerate joint movement. Movement joints typically include contraction joints, expansion joints, and isolation joints. The following profiles are suitable for movement joints:



Ribbed with Centre-bulb profiles are the most versatile type of waterstops available. The centre-bulb accommodates lateral, transverse, and shear movement. Larger centre-bulbs will accommodate greater movement.



Tear Web profiles accommodate large movements. When joint movement occurs, the tear web ruptures and allows the U-bulb to deform without putting the material in tension.



Dumbbell with Centre-bulb profiles accommodate lateral, transverse, and shear movement. Larger centre-bulbs will accommodate greater movement. **Consider using Ribbed with Centre-Bulb for better sealing characteristics.**



Base Seal with Tear Web profiles accommodate lateral, transverse, and shear movement. Larger centre-bulbs will accommodate greater movement. **Base Seal waterstops have some limitations with transitions and intersections.**

Non-moving joints typically have 100% bonded steel reinforcement continuous through the joint, and subject the waterstop to negligible or no movement. Flat waterstop profiles without a centre-bulb or tear web are suitable for non-moving joints. Other waterstop materials may be considered for non-moving joints as well, such as strip-applied or injectable-hose waterstops. Examples of waterstop profiles suitable for non-moving joints are as follows:



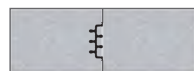
Flat Ribbed profiles are preferred for non-moving joints and provide the best sealing characteristics.



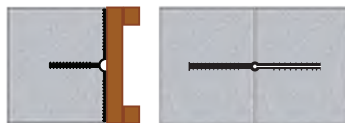
Dumbbell profiles are an alternate profile for non-moving joints. **Consider ribbed shapes for better sealing characteristics.**



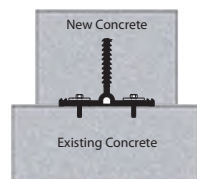
Base Seal profiles are ideal for slab-on-grade joints or backfilled walls and are easy to form. **Base Seal waterstops have some limitations with transitions and intersections.**



Labyrinth profiles are primarily used in vertical joints. Labyrinth profiles create a keyed joint and do not require split bulkheads. **Labyrinth can be difficult to use in horizontal joints and there are some limitations with transitions and intersections.**



Split Flange profiles can simplify forming. The split flange is opened and attached to the bulkhead for placement of the first concrete element. After stripping the bulkhead, the flange is closed and anchored for placement of the adjoining element. **Split waterstops are suitable for straight runs only. Transitions and intersections are not practical with these profiles.**



Waterstops for Retrofit Applications seal joints where new construction meets an existing structure and can be suitable for moving joints. Systems include stainless steel batten bars and fasteners for anchoring to the existing structure with the aid of Sikadur® 31 Hi-Mod Gel^{CA}



PVC waterstops are installed prior to placing concrete to ensure proper positioning and concrete consolidation around the waterstop. The center-line of the waterstop should be aligned with the center of the joint. Size and style of the waterstop determine permissible variation from the center-line.

Split formwork is generally required for slab-to-slab, slab-to-wall, and wall-to-wall joints where ribbed or dumbbell style waterstops are used. The split form should firmly hold the waterstop in position to prevent misalignment during concrete placement. A tight fit between the waterstop and the form is also necessary to prevent leakage of concrete paste, which could lead to honeycombing of the concrete.

PVC waterstops must be properly secured prior to placing concrete. This is accomplished with factory-applied grommets or pre-punched holes, or field-applied 'hog' rings placed at 300 mm (12 in) centers between the two outermost ribs of the waterstop. Factory-applied grommets and pre-punched holes are not available for dumbbell style waterstop profiles. Alternatively, field-applied 'hog' rings can be punched into the dumbbells. The wire is looped through the hog ring, grommet or punched hole and tied off to adjacent reinforcement. This adequately secures the waterstop to prevent any displacement or "folding over" of the waterstop during the placing of concrete.

Please see Sika Greenstreak Installation Guides for waterstops or contact Sika Canada for application information.

Limitations

- In cases of negative water pressure, external PVC waterstops cannot be used.
- Concrete voids adjacent to a waterstop can significantly compromise its water stopping ability.
- Always maintain adequate clearance between reinforcing steel and waterstops. Typical clearance should be twice the maximum aggregate size. Inadequate clearance can promote the formation of voids due to aggregate bridging.
- Waterstops should never be cut or modified to allow reinforcement to pass through the waterstop.
- Never place nails or screws through the body of the waterstop.

Health and Safety Information

Sika® Greenstreak® PVC Waterstops are non-reactive and fully cured. They do not require Material Safety Data Sheets. However, for information and advice on the safe handling, storage and disposal of chemical products, such as the Sikadur® 31Hi-Mod Gel^{CA} adhesive mentioned above, users should refer to the most recent **Material Safety Data Sheet** containing physical, ecological, toxicological and other safety-related data.

KEEP OUT OF REACH OF CHILDREN
FOR INDUSTRIAL USE ONLY

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Edmonton
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www.sika.ca

An ISO 9001 certified company
Pointe-Claire: ISO 14001 certified EMS

The background of the cover features a large, light gray circular shape on the right side, partially overlapping a solid blue triangular shape on the left. The text 'WATER HEATER' is centered in the gray area.

WATER HEATER

FXTH-B Flexible Tank Immersion Heater

- 12 - 40 Ft. Immersed Length (1, 2 or 3 Flexible Assemblies)
- 6 - 60 kW (20 - 204 Mbh)
- 240 and 480V, Three Phase (600V Available)
- Low Watt Density, High Wattage
- Installs through Manhole in Tank above or below ground. (14" Dia. Min.)
- Optional NEMA 4 (WCC) Control Center



Optional Control Panel³

Applications

Chromalox FXTH Immersion Heaters provide low watt density heating for such materials as asphalt, fuel oil, pitch and tar, liquid sugar, molasses, lube oils, linseed oil and other heat sensitive materials. FXTH heaters can be installed through the manhole opening in existing large tanks above or below ground without welding, cutting or cleaning. FXTH heaters can be used in steel, concrete and Fibreglas[®] tanks or in open top process tanks.

Features

No Tank Modification Required — Installs through normal manhole opening

No Hot Spots or Carbonization — Heat is evenly spread along the bottom of the tank

Weather Proof Terminal Enclosure contains process and overtemperature thermocouples. Overtemperature thermowell is attached to heater sheath (one per tube)

Basic Heater Assembly includes flexible pipe, terminal enclosure, 14 foot risers, two lifting cables and 4 inch high sludge legs

Optional Control Panel³ with weather proof (WCC) electrical enclosure completely wired with indicating electronic process control, fail- safe overtemperature controls, master circuit breaker, contactors, fuses, pilot lights, switches and 120V control transformer. Other control options include recorders, time clock, audible alarm and mounting legs.

Specifications and Ordering Information

kW	Manhole		No. Tubes	W/In ²	Model		Stock	Wt. (Lbs.)
	Size (In.)	Length (Ft.)			240V 3 Phase ¹	480V 3 Phase ¹		
6	14	12	1	4.1	FXTH-11206B-24	FXTH-11206B-48	NS	79
8	14	15	1	4.4	FXTH-11508B-24	FXTH-11508B-48	NS	97
10	14	15	1	5.4	FXTH-11510B-24	FXTH-11510B-48	NS	97
12	14	15	1	6.5	FXTH-11512B-24	FXTH-11512B-48	NS	97
10	14	20	1	4.1	FXTH-12010B-24	FXTH-12010B-48	NS	127
12	14	20	1	4.9	FXTH-12012B-24	FXTH-12012B-48	NS	127
15	14	20	1	6.1	FXTH-12015B-24	FXTH-12015B-48	NS	127
18	14	27	1	5.4	FXTH-12718B-24	FXTH-12718B-48	NS	170
21	14	30	1	5.7	FXTH-13021B-24	FXTH-13021B-48	NS	190
24	14	32	1	6.1	FXTH-13224B-24	FXTH-13224B-48	NS	205
27	14	35	1	6.3	FXTH-13527B-24	FXTH-13527B-48	NS	225
30	14	40	1	6.1	FXTH-14030B-24	FXTH-14030B-48	NS	250
12	18	12	2	4.1	FXTH-21212B-24	FXTH-21212B-48	NS	157
16	18	15	2	4.4	FXTH-21516B-24	FXTH-21516B-48	NS	194
20	18	15	2	5.4	FXTH-21520B-24	FXTH-21520B-48	NS	194
24	18	15	2	6.5	FXTH-21524B-24	FXTH-21524B-48	NS	194
20	18	20	2	4.1	FXTH-22020B-24	FXTH-22020B-48	NS	253
24	18	20	2	4.9	FXTH-22024B-24	FXTH-22024B-48	NS	253
30	18	20	2	6.1	FXTH-22030B-24	FXTH-22030B-48	NS	253
36	18	27	2	5.4	FXTH-22736B-24	FXTH-22736B-48	NS	340
42	18	30	2	5.7	FXTH-23042B-24	FXTH-23042B-48	NS	380
48	18	32	2	6.1	FXTH-23248B-24	FXTH-23248B-48	NS	405
54	18	35	2	6.3	FXTH-23554B-24	FXTH-23554B-48	NS	440
60	18	40	2	6.1	FXTH-24060B-24	FXTH-24060B-48	NS	500
18	24	12	3	4.1	FXTH-31218B-24	FXTH-31218B-48	NS	236
30	24	15	3	5.4	FXTH-31530B-24	FXTH-31530B-48	NS	291
36	24	15	3	6.5	FXTH-31536B-24	FXTH-31536B-48	NS	291
30	24	20	3	4.1	FXTH-32030B-24	FXTH-32030B-48	NS	370
36	24	20	3	4.9	FXTH-32036B-24	FXTH-32036B-48	NS	370
45	24	20	3	6.1	FXTH-32045B-24	FXTH-32045B-48	NS	370

Stock Status: S = stock NS = non-stock
To Order—Specify model, volts, phase, kW, options and quantity.

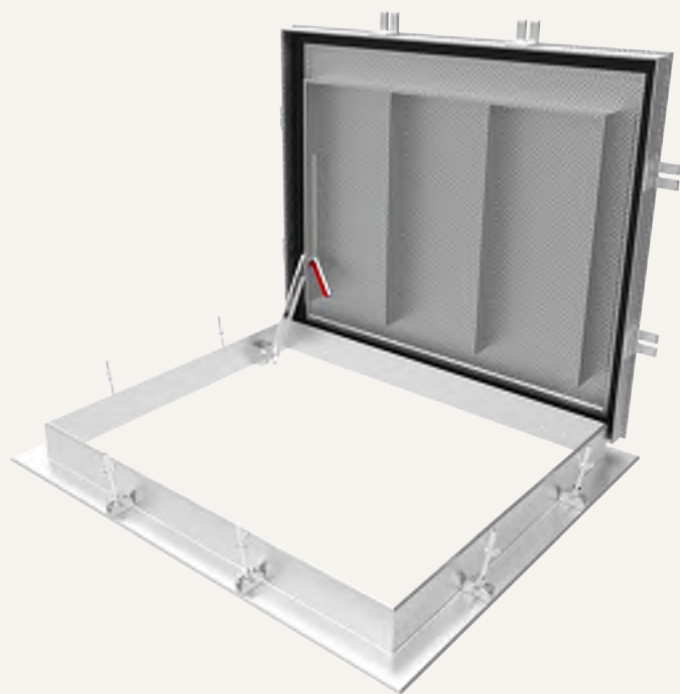
1. Other voltages available, contact your Local Chromalox Sales office.
2. Special ratings, extra riser height, terminal enclosure manhole adapters and separate low-temperature alarm contacts available.
3. Matching control panels (model WCC) available with a wide variety of options.

The background features a large, light grey curved shape on the right side, and a blue curved shape on the left side, separated by a white curved line.

TANK HATCHES

Water Tight

WELL HATCH, 625PSF



Nystrom's Water Tight Well Hatch is designed for water-tightness up to 10 foot water column and 625psf load capacity. With waterproof gaskets and pressure locks, this hatch design is ideal for wells and areas prone to flooding.

FEATURES

PRESSURE LOCKS Constructed with pressure lock latches with wing nuts to securely fasten the hatch lid closed.

GASKET A water and odor resistant, EPDM rubber gasket seal is applied around the perimeter of the cover.

DETAILS

LOAD 625psf live load

MATERIAL Aluminum: 1/4 inch, mill finish with gray primer on exterior frame

COVER Diamond tread plate

FRAME Angle

INSTALLATION Surface mount, mechanically fastened: field drilled by others

SPRING Coil Type 17-7 Stainless Steel enclosed in Type 316 Stainless Steel telescopic tubes

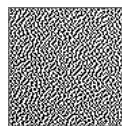
HINGES Heavy duty Type 316 Stainless Steel butt hinges

HOLD OPEN ARM Type 316 Stainless Steel automatic hold open arm locks cover in open position

LATCH Type 316 Stainless Steel pressure locks

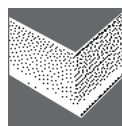
CERTIFICATION Tested to 10 foot hydrostatic pressure

MATERIALS



Aluminum

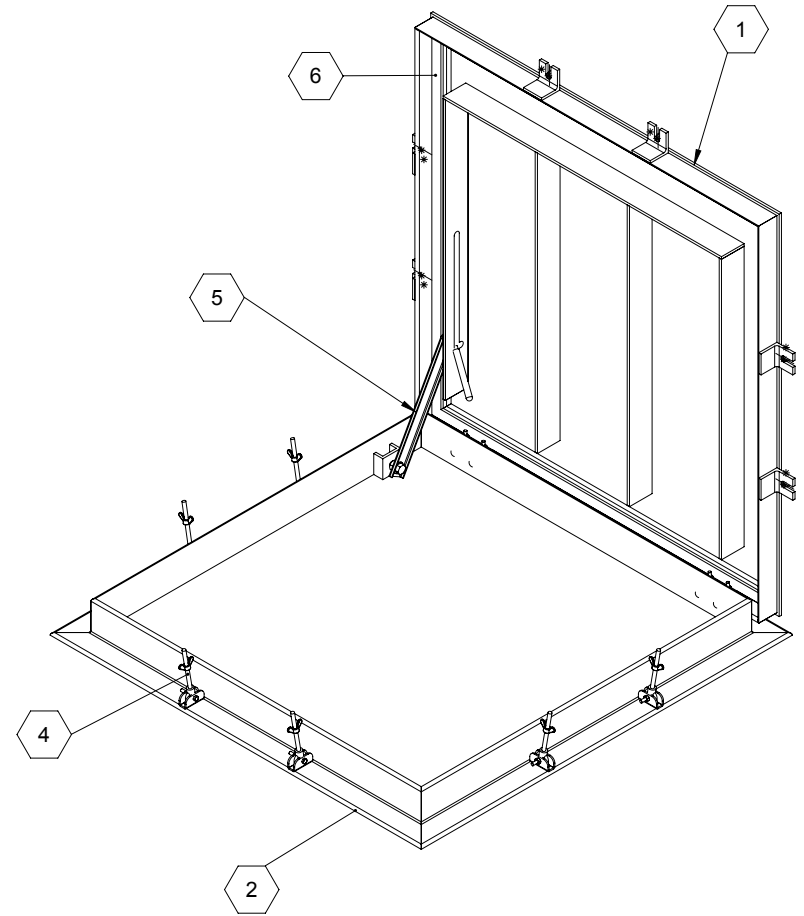
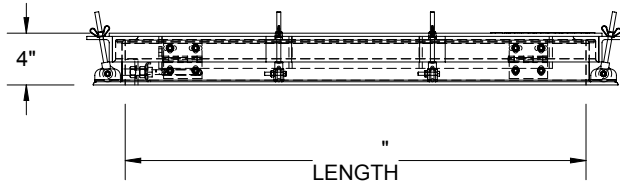
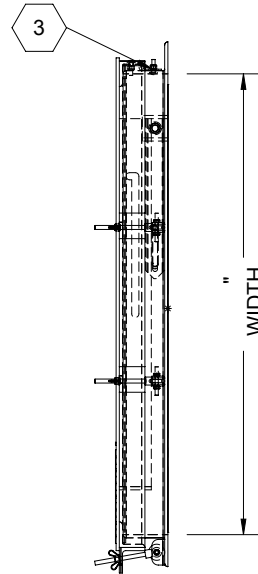
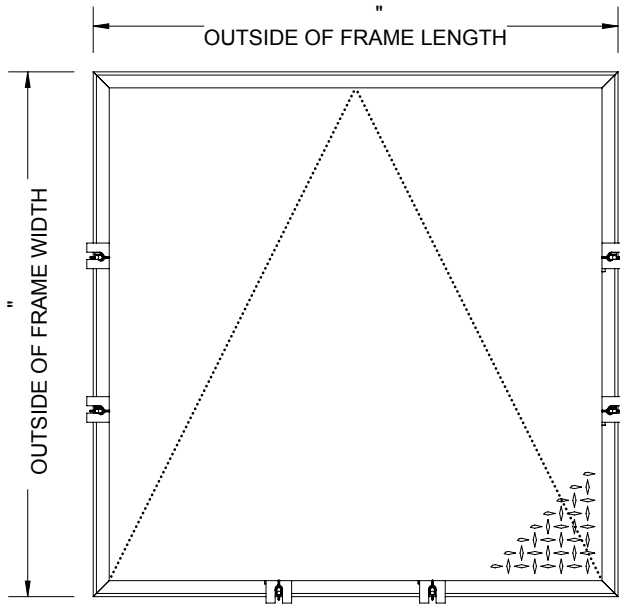
INSTALLATION



Surface Mount

ORDER GUIDE

MODEL	WIDTH	X	LENGTH	OPTIONS	
FDWTA		X		SSW	-
	Standard Sizes (W x L)				
	24" x 24"				Locks
	30" x 30"				Finishes
	30" x 36"				Gaskets
	36" x 36"				Operation
	42" x 42"				Safety
					Skirting
					Other




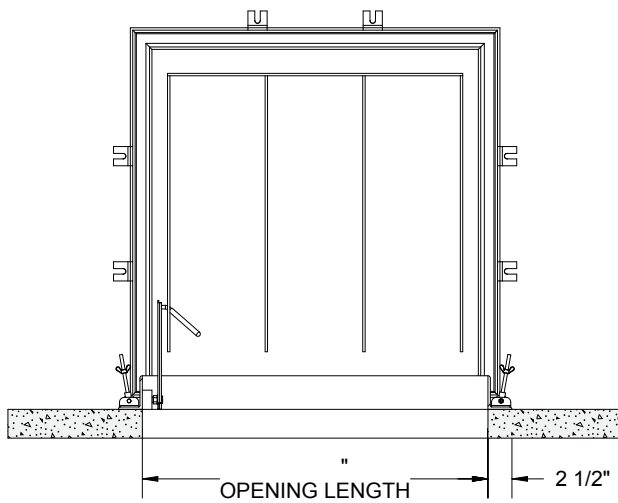
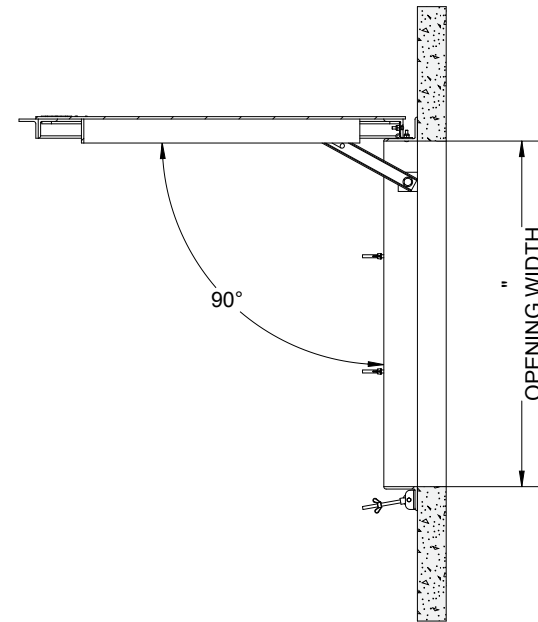
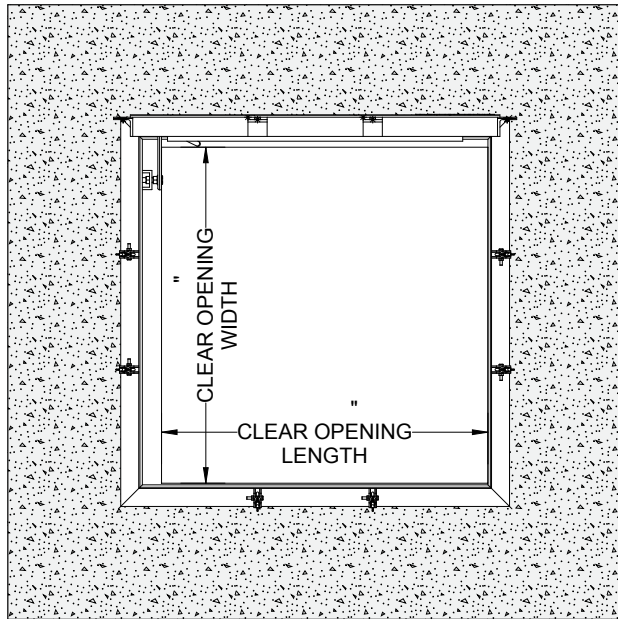
SPECIFICATIONS:

- ① **DOOR:** ALUMINUM, 1/4" DIAMOND PLATE, MILL FINISH WITH A LIVE LOAD OF 625 PSF WITH A MAXIMUM DEFLECTION OF L/160
- ② **FRAME:** ALUMINUM, 1/4" EXTRUSION, MILL FINISH
- ③ **HINGES:** TYPE 316 STAINLESS STEEL
- ④ **PRESSURE LOCK LATCHES:** TYPE 316 STAINLESS STEEL
- ⑤ **HOLD-OPEN ARM:** TYPE 316 STAINLESS STEEL WITH RED VINYL GRIP HANDLE

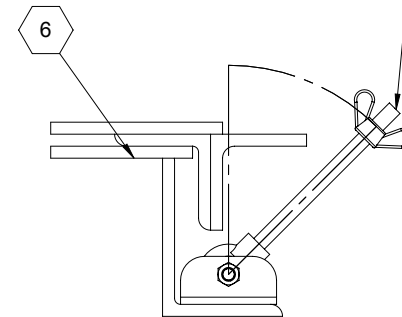
- ⑥ **WATER TIGHT GASKET:** EPDM, AROUND ENTIRE HATCH
- 7. **CERTIFICATIONS:** TESTED TO BE WATER TIGHT UNDER APPLIED PRESSURE OF A 10 FOOT COLUMN OF WATER
- FLOOR DOOR SIZE:**
" (WIDTH) x " (LENGTH)
- CLEAR UNOBSTRUCTED OPENING:**
" (WIDTH) x " (LENGTH)
- OPENING:**
" (WIDTH) x " (LENGTH)

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PROJECT:			
ARCHITECT:			
CONTRACTOR:			
QTY:			
PART#:		FDWTA X SSW	
		TITLE: Floor Door, Water Tight Series, Sngl Dr, 316 SST Hdw, Alum, Mill, 625 PSF, Bolt-In, Pressure Lock Latches	
9300 73rd Avenue North Minneapolis, MN 55428			
NAME	DATE	SIZE	DWG. NO.
DRAWN JE	04/18/11	A	FDWTA_X_SSW
RELEASED DWO	04/18/11	WEIGHT: Varies	SHEET 1 OF 2



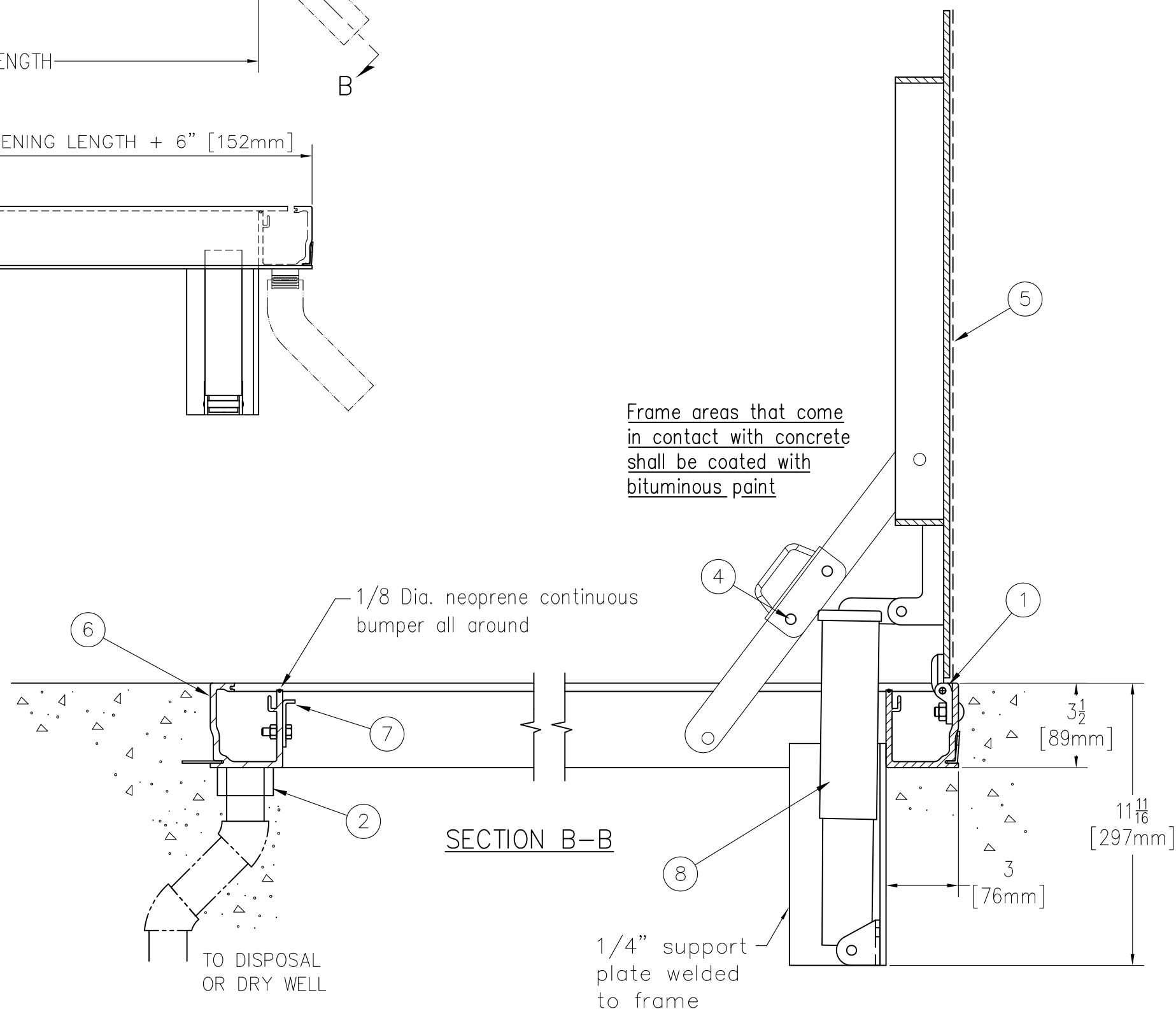
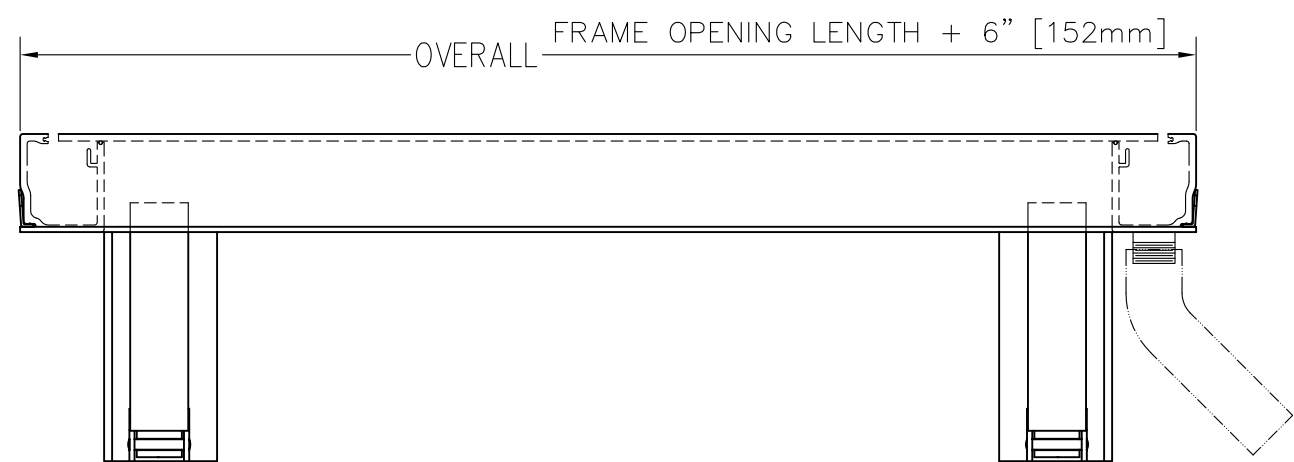
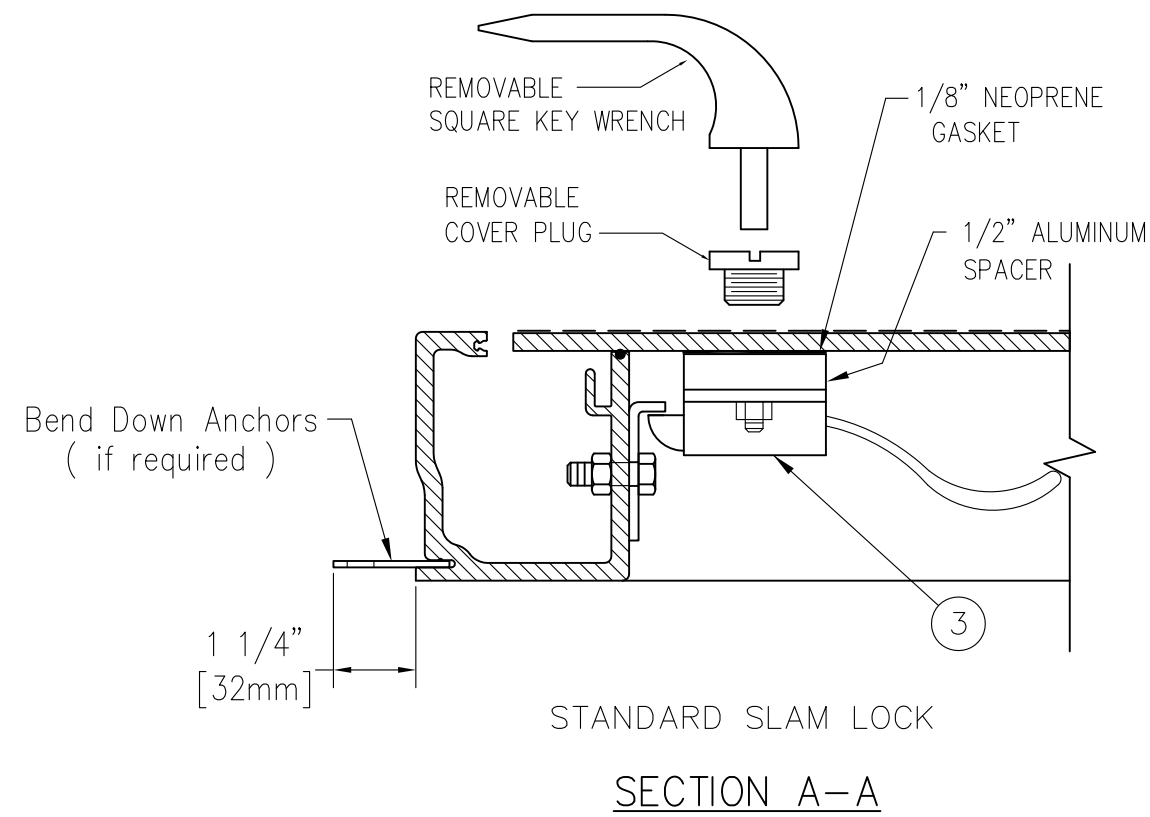
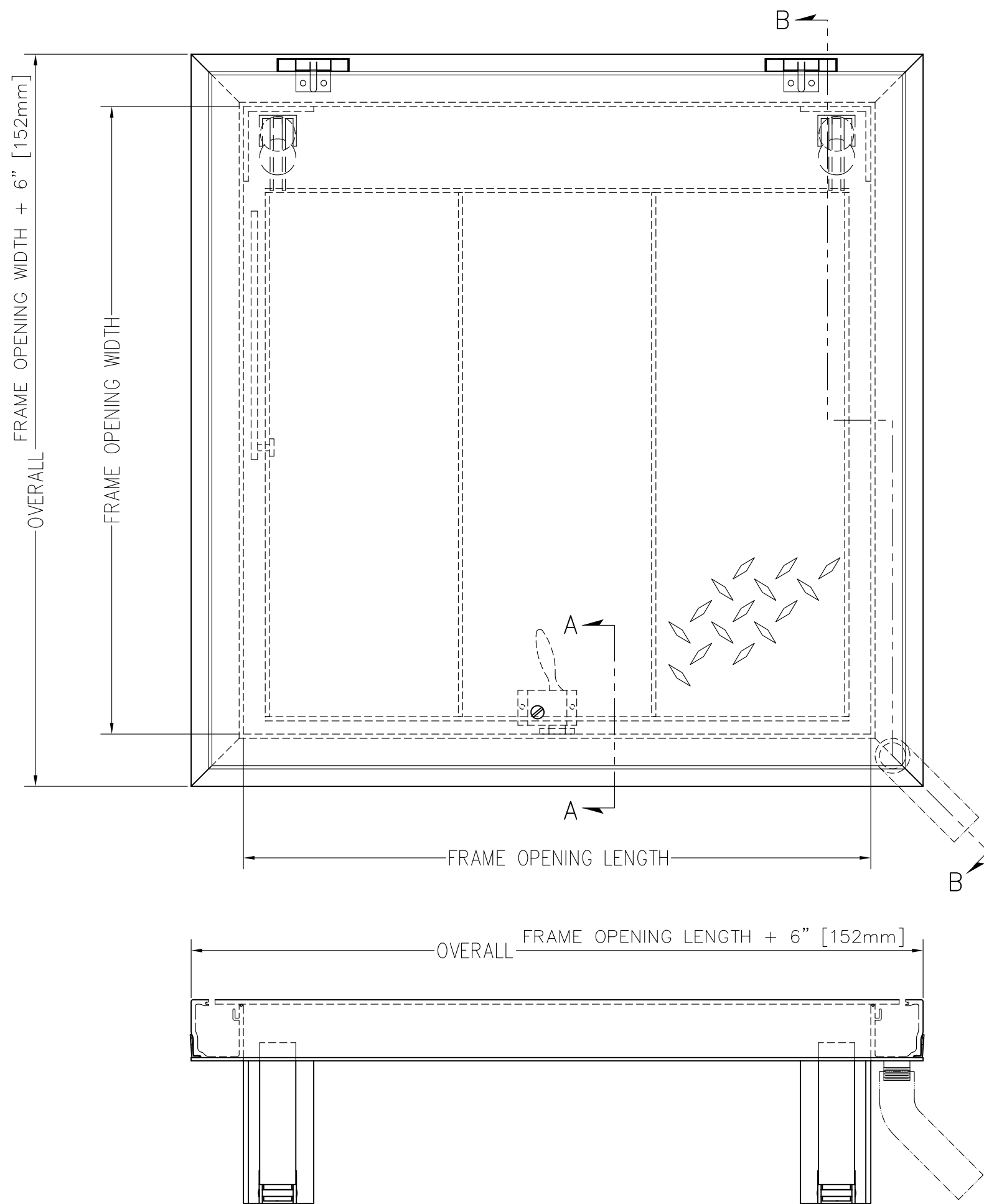
ROTATE INTO POSITION
AND TIGHTEN WING NUTS



PRESSURE LOCK LATCH DETAIL

				TITLE: Floor Door, Water Tight Series, Sngl Dr, 316 SST Hdw, Alum, Mill, 625 PSF, Bolt-In, Pressure Lock Latches	
9300 73rd Avenue North Minneapolis, MN 55428					
	NAME	DATE	SIZE	DWG. NO.	REV
DRAWN	JE	04/18/11	A	FDWTA_X_SSW	A
RELEASED	DWO	04/18/11	WEIGHT: Varies		SHEET 2 OF 2

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SPECIFICATIONS

1. Bilco heavy duty forged stainless steel hinges with stainless steel pins
2. 1-1/2" drain coupling
3. Standard slam lock
4. Bilco automatic hold open arm
5. 1/4" aluminum diamond pattern plate cover
6. Bilco 1/4" aluminum channel frame with recessed anchors
7. Stainless steel lock strike
8. Stainless steel spring lifting mechanism

SHOP FINISH:
 ALUMINUM: MILL FINISH
 HARDWARE: TYPE 316 STAINLESS STEEL
 (unless otherwise specified)

REINFORCED FOR 300 Lbs. PER Sq. Ft.
 (1464 kg. PER Sq. METER) LIVE LOAD

INSTALLER NOTES:

- A. Use caution. Cover is spring loaded. Do not remove safety shipping bolt until unit is to be installed and in normal horizontal operating position.
- B. Be sure unit is set on slight pitch toward drain corner.
- C. Before anchoring in place open and close door. Check to see that the door in the closed position rests on the frame all around. If not, shim under the frame at the proper corner.
- D. Do not reduce 1 1/2" drain pipe to dry well or disposal system.
- E. Bend down anchors if required

Customer:

P.O. N°

Job:

Sales Rep:

Manufacturers of Doors for Special Services
Bilco THE BILCO COMPANY
 New Haven, Connecticut 06505

SINGLE LEAF ACCESS DOOR
TYPE J-AL - INTERIOR/EXTERIOR
SIZE

QTY	TYPE	WIDTH x LENGTH
<input type="checkbox"/>	J-1AL	2'-0" x 2'-0" [610mm] x [610mm]
<input type="checkbox"/>	J-2AL	2'-6" x 2'-6" [762mm] x [762mm]
<input type="checkbox"/>	J-3AL	3'-0" x 2'-6" [914mm] x [762mm]
<input type="checkbox"/>	J-4AL	3'-0" x 3'-0" [914mm] x [914mm]
<input type="checkbox"/>	J-5AL	3'-6" x 3'-6" [1065mm] x [1065mm]

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Hinged Watertight Door with Mechanical Seal

D3C

Download Center:

[3-Part CSI Specs](#)

[Drawings](#)



This heavy-duty watertight door is ideal for openings with light traffic that need to be sealed quickly and easily in the event of flooding.

Because these doors are engineered for a mechanical seal, no air pressure or power is needed and maintenance requirements are minimal.

These doors are ideal for heavy industrial plants, utilities and civic facilities that must be secured and protected in the event of flooding.

FLOOD PROTECTION IN SECONDS

Door size dictates the number of handles/dogs, which are evenly spaced with stainless steel rollers to all evenly distribute the loads on the gasket compression. The handles of the watertight door are provided with an "o" ring seal and two oil-impregnated bronze flange bearings to maintain shaft alignment. When not in the dogged position, the handles are held in the stored position by disk springs. Each dog has an adjustment mechanism for ideal seal compression.

APPLICATIONS — THE D3C WATERTIGHT DOOR AT WORK

The D3C is ideal for a door that requires infrequent access and needs to be sealed around the entire perimeter. Common applications include mechanical rooms, auxiliary power units and storage rooms that must be kept dry in case of flooding. The D3C is virtually maintenance free.

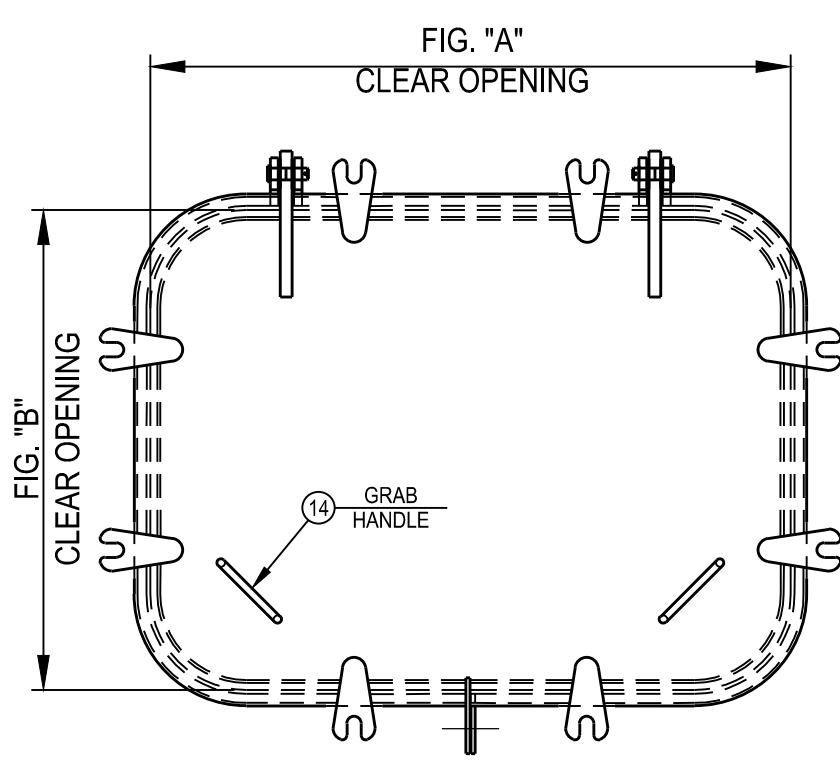


D3C Product Specifications

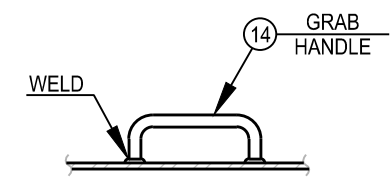
Size	Custom built to any dimensions
Seal	Type 25 Durometer fully-molded neoprene gasket
Panel	A36 Carbon Steel
Frame	A36 Carbon Steel
Hinges	Bronze oil-impregnated thrust bearing with stainless steel hinge pins
Handles	Evenly spaced dogs with stainless steel rollers
Finish	Blast cleaned per SSPCSP7 and primed with one coat

Image Gallery

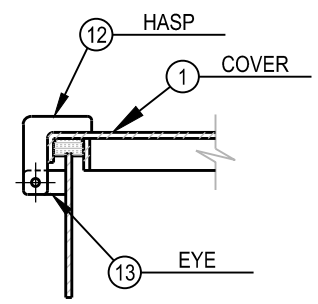




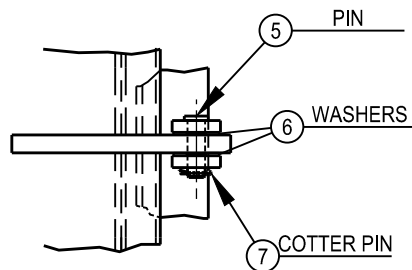
PLAN



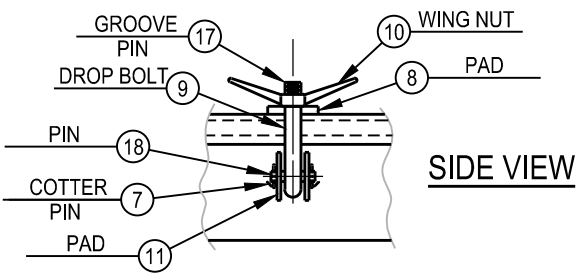
DETAIL OF GRAB HANDLE



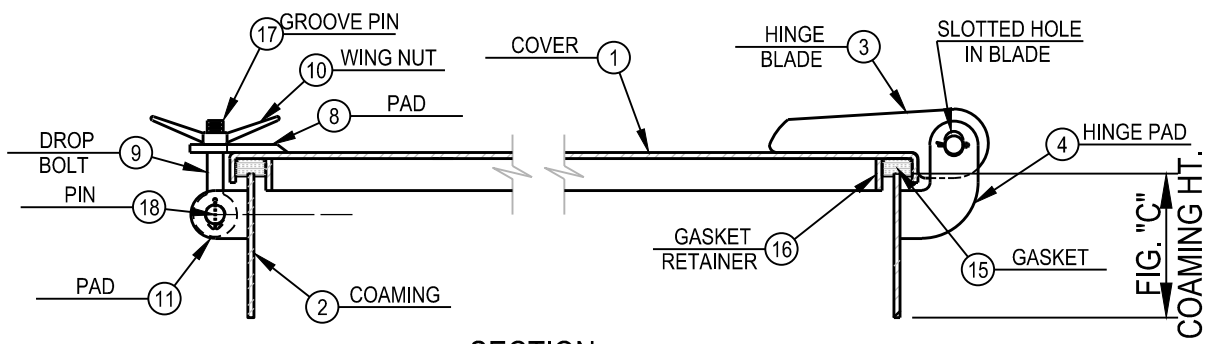
DETAIL OF HASP & EYE



DETAIL OF HINGE



SIDE VIEW

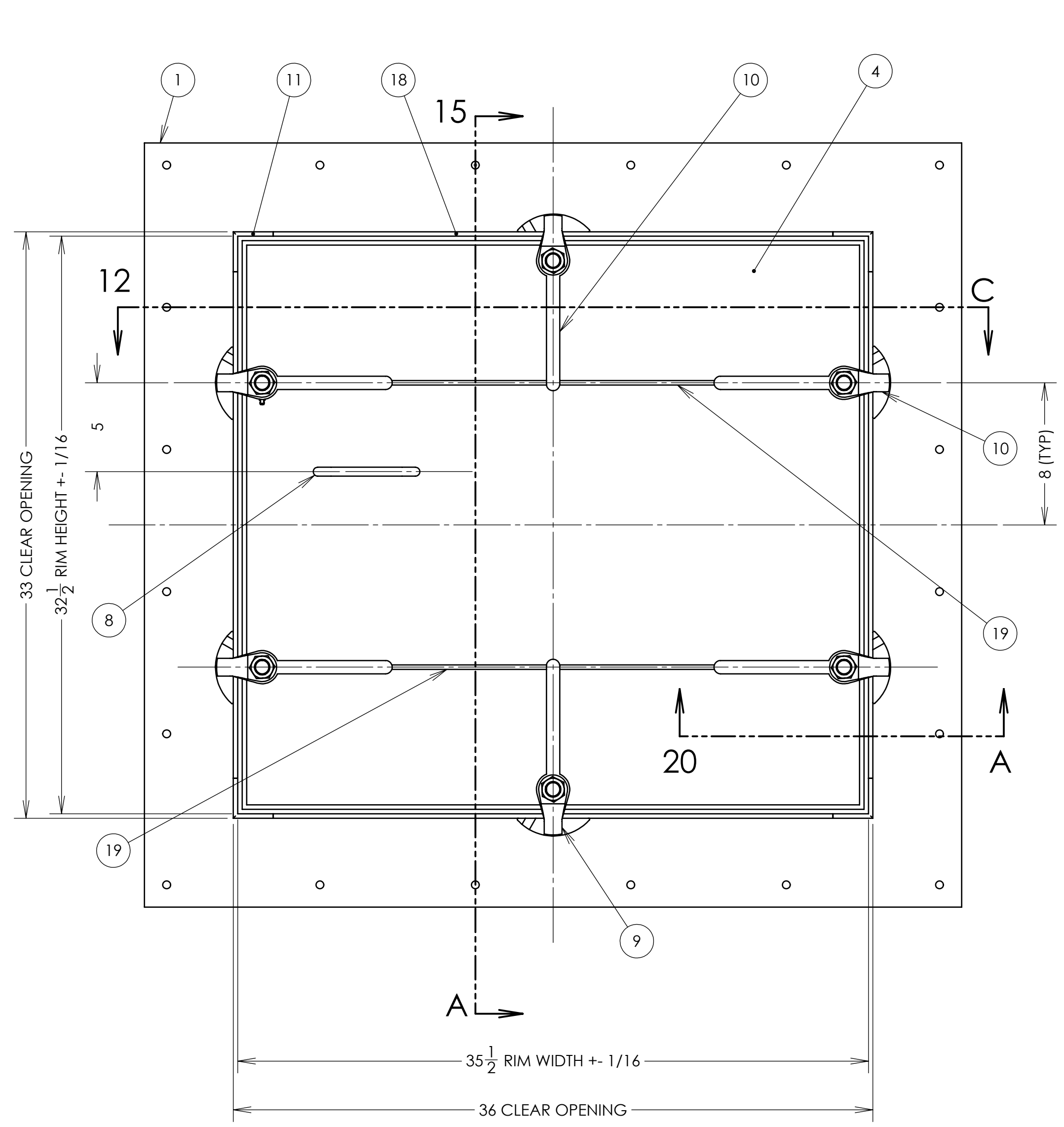


SECTION

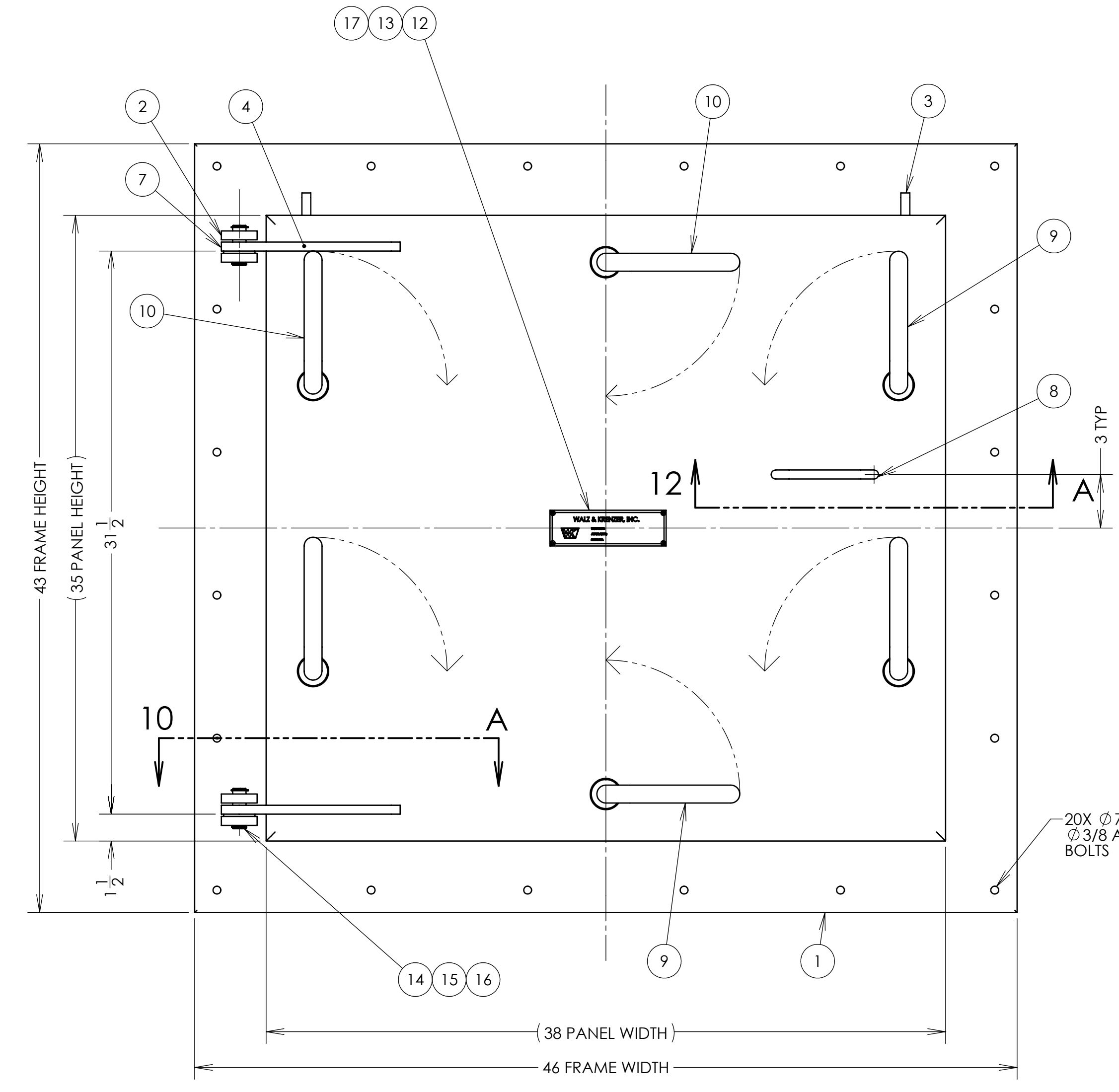
SCHEDULE OF MATERIALS		
PC.	MATERIAL	REMARKS
1	MILD STEEL	
2	MILD STEEL	
3	MILD STEEL	
4	MILD STEEL	
5	BRASS	
6	STAINLESS	
7	STAINLESS	
8	MILD STEEL	
9	BRONZE	
10	BRONZE	
11	MILD STEEL	
12	MILD STEEL	
13	MILD STEEL	
14	MILD STEEL	
15	NEOPRENE	
16	MILD STEEL	
17	STAINLESS	
18	BRASS	

STANDARD EQUIPMENT COMPANY INC.
 MOBILE, AL 36602 1-800-239-3442
 WATERTIGHT HATCH W/ DROP BOLTS
 DRAWING # 29

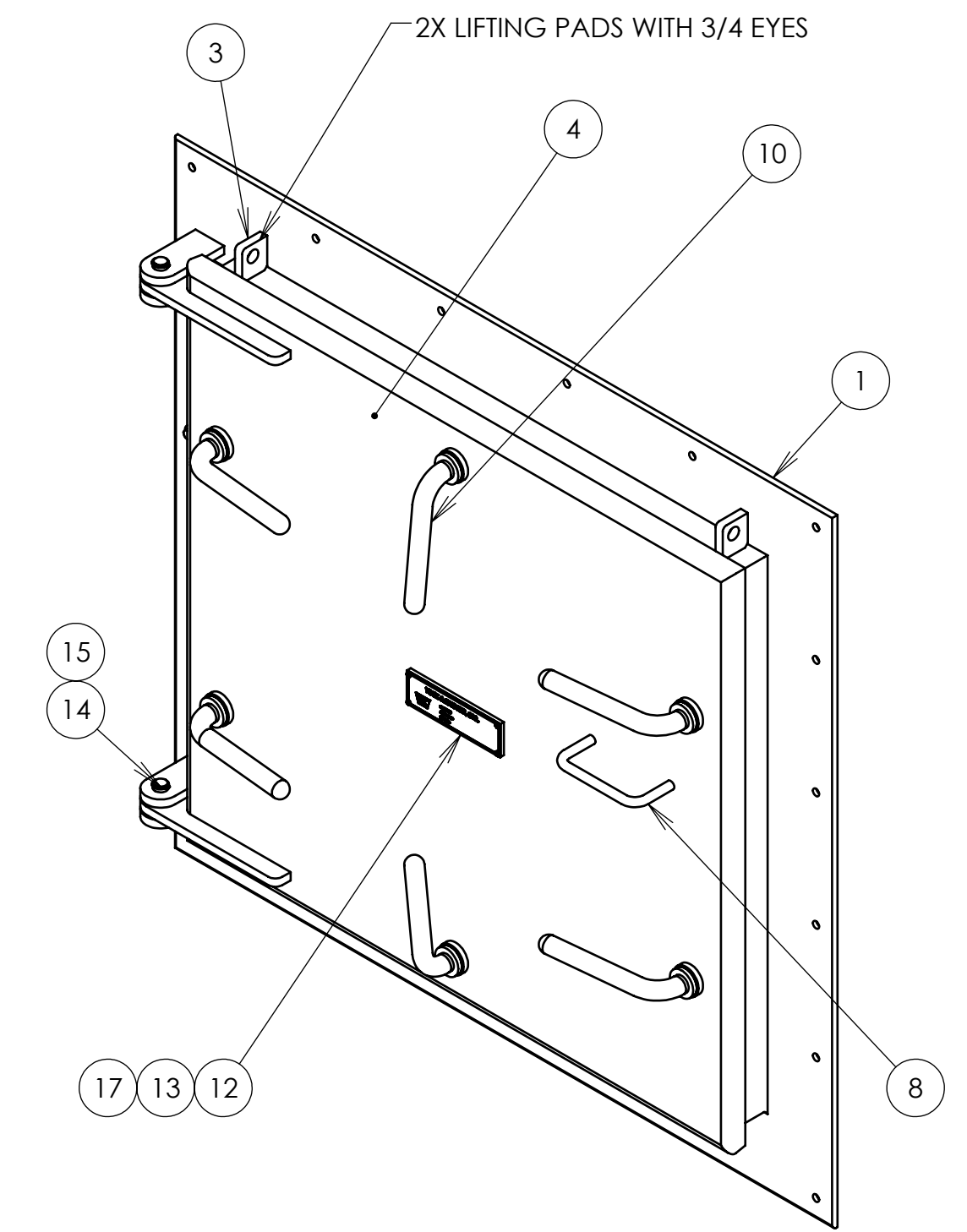
REVISION HISTORY				
REV.	DESCRIPTION	DATE	DRAWN	APPROVED
A	REDUCED DOOR HEIGHT	4/4/2016	B.P.	B.R.



ELEVATION VIEW
DOOR SHOWN CLOSED AND DOGGED
VIEW FROM DRY SIDE



ELEVATION VIEW
DOOR SHOWN CLOSED AND UNDOGGED
VIEW FROM FLOOD SIDE



ISOMETRIC VIEW
SCALE 1:8
DOOR SHOWN CLOSED & DOGGED

MANUFACTURING NOTES:

- DOOR IS DESIGNED TO WITHSTAND A 1.7 PSI SEATING LOAD ONLY W/ 2:1 FACTOR OF SAFETY BASED ON MATERIAL YIELD STRENGTH.
- FINISH
 - BLAST TO NEAR WHITE METAL AND PRIME WITH ONE COAT OF SHERWIN WILLIAMS DTM WASH PRIMER. FINISH PAINT WITH TWO COATS SHERWIN WILLIAMS MACROPOXY 646 FAST CURE EPOXY, COLOR: STRUCTURAL GRAY. FOLLOW PAINT MANUFACTURER'S RECOMMENDATIONS FOR SURFACE PREPARATION AND APPLICATION.
- TESTING:
 - SHOP OPERATIONAL, FLATNESS/DIMENSIONAL, AND CHALK TESTS REQUIRED.
 - LP TESTING OF ALL WELDS IN THE LEAK PATH REQUIRED PER ASME SECTION VIII, DIV 1, APP. 8.
- ALL WELDING TO AWS D1.1.
- ALL BUTT WELDS TO BE FULL PENETRATION WELDS.
- GRIND ALL WELDS SMOOTH IN WAY OF GASKET.
- GASKET SEATING SURFACE OF PANEL AND KNIFE EDGE OF FRAME TO BE FLAT WITHIN 1/16".
- GASKET SHALL BE GLUED TO GASKET CORNER WITH GOOP ADHESIVE.
- QUANTITY REQUIRED: TWO AS SHOWN.
- ESTIMATED WEIGHT:
 - PANEL ONLY: 200 LBS
 - ASSEMBLY: 300 LBS
- KNIFE EDGE TO BE GROUND TO A CONTINUOUS AND SMOOTH HALF ROUND PROFILE WITH A SURFACE ROUGHNESS OF 125 RMS OR SMOOTHER. SEE SECTION 17-C FOR DETAIL.
- APPLY REMOVABLE STRENGTH LOCTITE TO LABEL PLATE SCREWS AT ASSEMBLY.
- GLUE GASKET TO PANEL ASSY. USING SCOTCH GRIP #1300.

INSTALLATION NOTES:

- SEE MAINTENANCE MANUAL FOR INSTALLATION INSTRUCTIONS. FAILURE TO INSTALL PER MANUFACTURER'S INSTRUCTIONS MAY VOID WARRANTY.
- INSTALLATION, ANCHOR BOLTS, AND SILICONE SEALANT TO BE PROVIDED BY OTHERS.
- TWENTY ϕ 3/8 HEX HEAD ANCHOR BOLTS ARE REQUIRED FOR MOUNTING FRAME. WK RECOMMENDS POWERBOLT #5914.
- MOUNTING SURFACES NEED TO BE FLAT, PLUMB, AND STURDY. INSTALLER IS RESPONSIBLE FOR VERIFYING THAT MOUNTING STRUCTURES ARE CAPABLE OF WITHSTANDING THE HYDROSTATIC LOAD GENERATED WHEN FLOOD WATER PUSHES FLOOD DOOR INTO SURROUNDING STRUCTURE.
- A CONTINUOUS, LIBERAL COATING OF SILICONE SEALANT TO BE APPLIED BETWEEN FRAME AND ALL MOUNTING SURFACES. INSTALLER RESPONSIBLE FOR ENSURING A WATERTIGHT SEAL BETWEEN FRAME AND MOUNTING SURFACES.

PC.#	QTY.	DESCRIPTION	MATERIAL	DRAWING	REMARKS	WEIGHT
19	2	STIFFENER	ASTM A-36 STEEL		1/4X2 FLAT BAR	4.4
18	1	GASKET	NEOPRENE	WK-852-29	1/2X1-1/4, 25 DURO.	3.1
17	4	MACHINE SCREW, PAN HEAD	STAINLESS STEEL		#6-32UNC x 1/4 LG	0.3
16	2	THRUST WASHER	OILITE BRONZE		BEEMER# TT-1701	0.1
15	4	RETAINING RING, EXTERNAL	STAINLESS STEEL		3/4 NOMINAL	0.0
14	2	PIN	316 STAINLESS STEEL	WK-852-84	3/4 DIA, 2-1/4L	0.3
13	1	LABEL PLATE BACKING PLATE	304 STAINLESS STEEL	WK-852-17	1/4 THICK	0.9
12	1	LABEL PLATE	316 STAINLESS STEEL	WK-852-98	22 GA.	0.1
11	4	GASKET CORNER	NEOPRENE RUBBER	WK-769-38	25 DURO.	0.1
10	3	DOG ASSEMBLY, RH	VARIOUS	WK-836-17	C-RH-S	10.0
9	3	DOG ASSEMBLY, LH	VARIOUS	WK-836-17	C-LH-S	10.0
8	2	GRAB HANDLE	304 STAINLESS STEEL	WK-852-44	1/2 DIA.	0.6
7	2	HINGE BLADE	ASTM A-36 STEEL		1/2 THICK	1.7
6	1	GASKET RETAINER	304 STAINLESS STEEL		1/4 SQUARE BAR	2.4
5	1	RIM	ASTM A-36 STEEL		1/4X3 FLAT BAR	28.3
4	1	PANEL	ASTM A-36 STEEL		1/4 PLATE	102.0
3	2	LIFTING PAD	ASTM A-36 STEEL		1/2 THICK	0.4
2	4	HINGE PAD	ASTM A-36 STEEL		1/2 THICK	1.1
1	1	FRAME	ASTM A-36 STEEL		L5x3x1/4	82.6

BILL OF MATERIAL - QTY PER ASSEMBLY

TOLERANCES FOR WELDED CONSTRUCTIONS (UNLESS OTHERWISE NOTED) (IN INCHES)	
ALL WELDS TO BE PER ISO-13920, CLASS B:	
LINEAR DIMENSIONS:	
FROM 1/16 TO 1-3/16	± 1/32"
FROM 1-3/16 TO 15-3/4	± 5/64"
OVER 15-3/4 TO 39-3/8	± 1/8"
OVER 39-3/8 TO 78-3/4	± 5/32"
OVER 78-3/4 TO 157-1/2	± 1/4"
OVER 157-1/2 TO 315	± 5/16"
ANGULAR DIMENSIONS (LENGTH OF ANGLE):	
UP TO 15-3/4	± 45 MIN.
OVER 15-3/4 TO 39-3/8	± 30 MIN.
OVER 39-3/8	± 20 MIN.

TOLERANCES UNLESS OTHERWISE SPECIFIED MACHINED DIMENSIONS	
ALL DIMENSIONS IN INCHES	
TOLERANCES UNLESS OTHERWISE SPECIFIED	
MACHINED DIMENSIONS	
2 DECIMAL PLACES	± 0.01 IN
3 DECIMAL PLACES	± 0.005 IN
WHOLE NUMBERS OR FRACTIONS	± 1/64 IN
ANGLES	± 30 MIN.
ON OTHER DIMENSIONS	
SAW CUT	± 1/16 IN
MACHINE FLAME CUT	± 1/16 IN
MACHINED SURFACES TO BE 125 RMS UNLESS OTHERWISE SPECIFIED. VALUES EXPRESSED IN MICRO-INCHES.	

THIS DRAWING CONTAINS COMPANY PROPRIETARY AND CONFIDENTIAL INFORMATION AND IS NOT TO BE COPIED, DISCLOSED TO OTHERS OR USED IN ANY MANNER WITHOUT PRIOR PERMISSION OF WALZ & KRENZER, INC.

BY	DATE
DRAWN B.P.	3/25/16
CHECKED C.K.	3/28/16
APPROVED B.R.	3/28/16

WALZ & KRENZER, INC.
91 WILLENBROCK RD., UNIT B-4 OXFORD, CT. 06478
WEB SITE: www.wkdoors.com

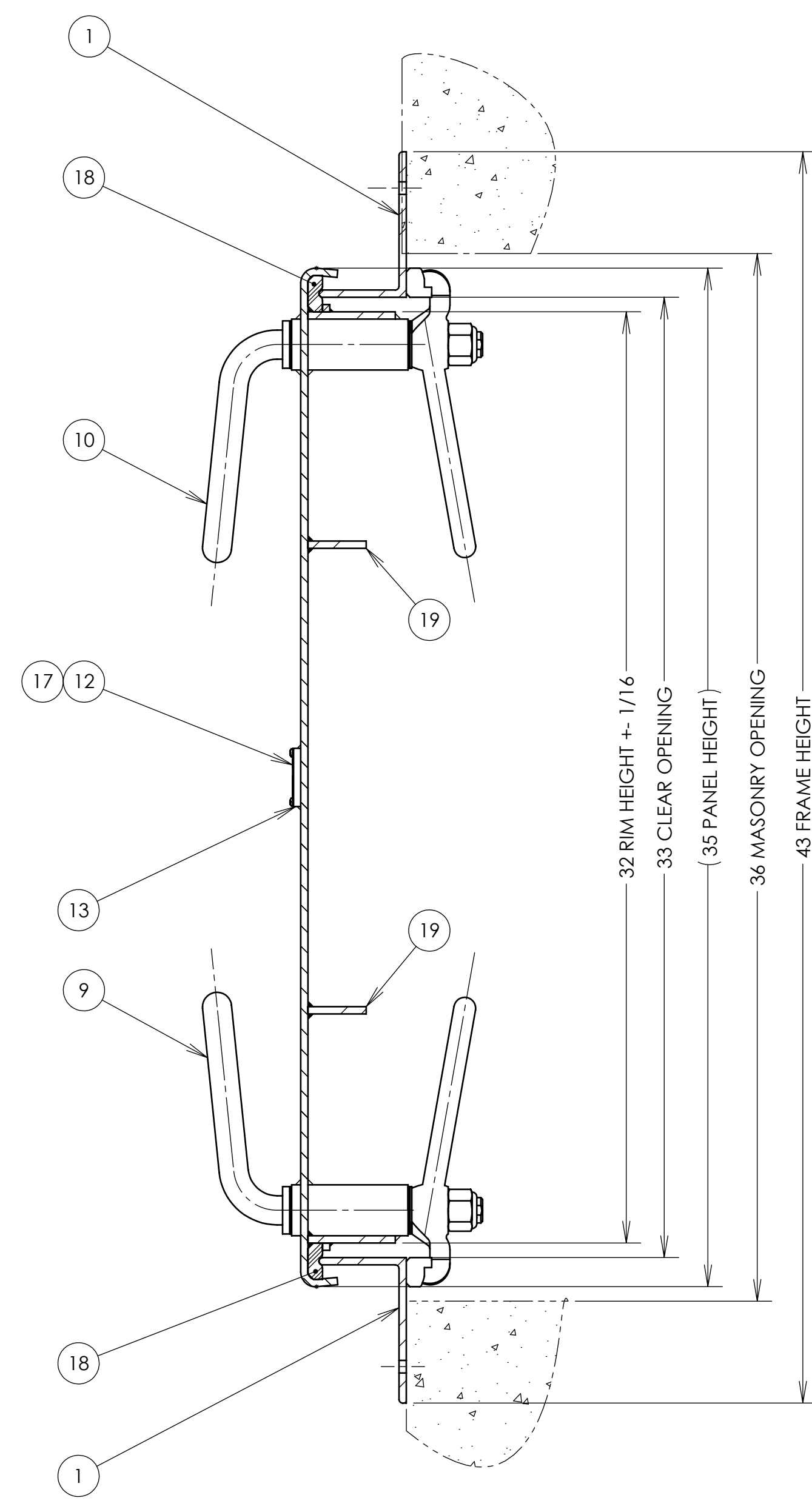
36"W x 33"H INDIVIDUALLY DOGGED WATERTIGHT DOOR

AMERICAN BUILDING SERV.	SIZE D	FSCM. NO. 87045	DWG. NO. WK-929-45	REV. A
WK JOB# 16-063	SCALE 3:16	SHEET NO. 1 OF 3		

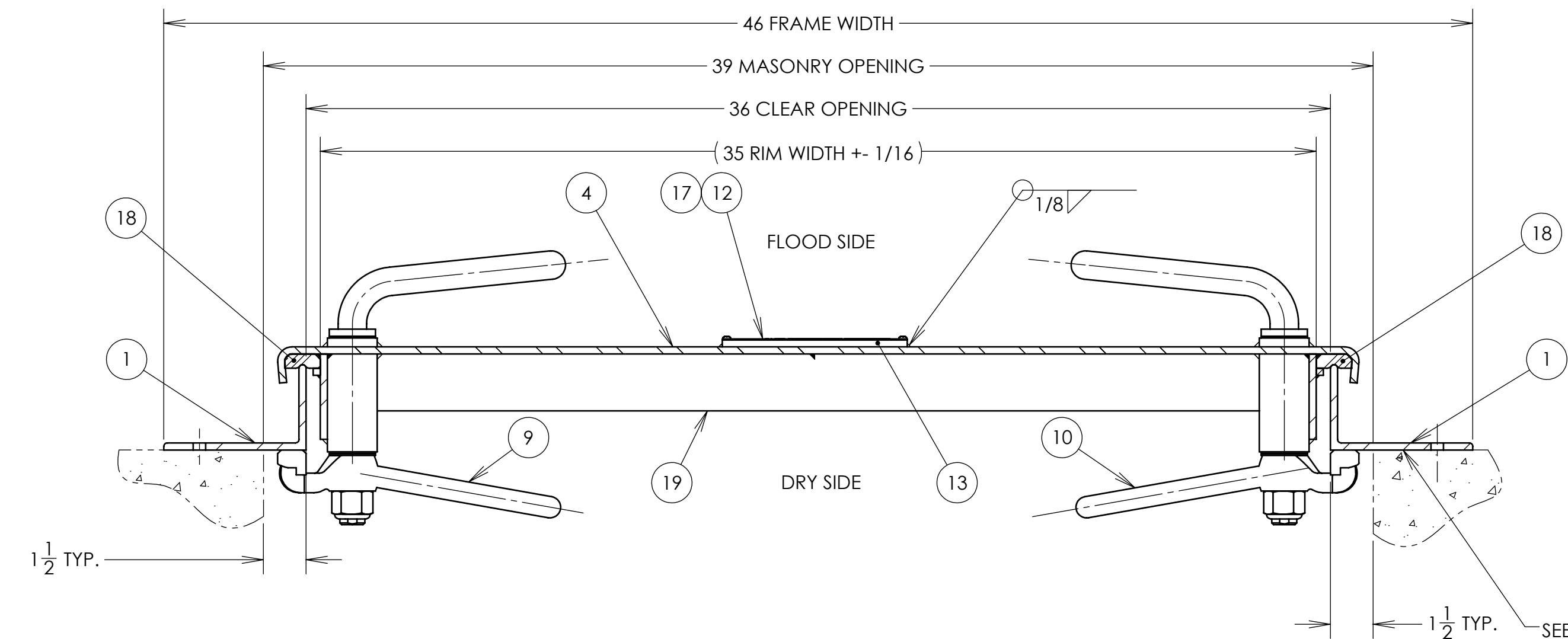
16 15 14 13 12 11 10 9

D
C
B
A

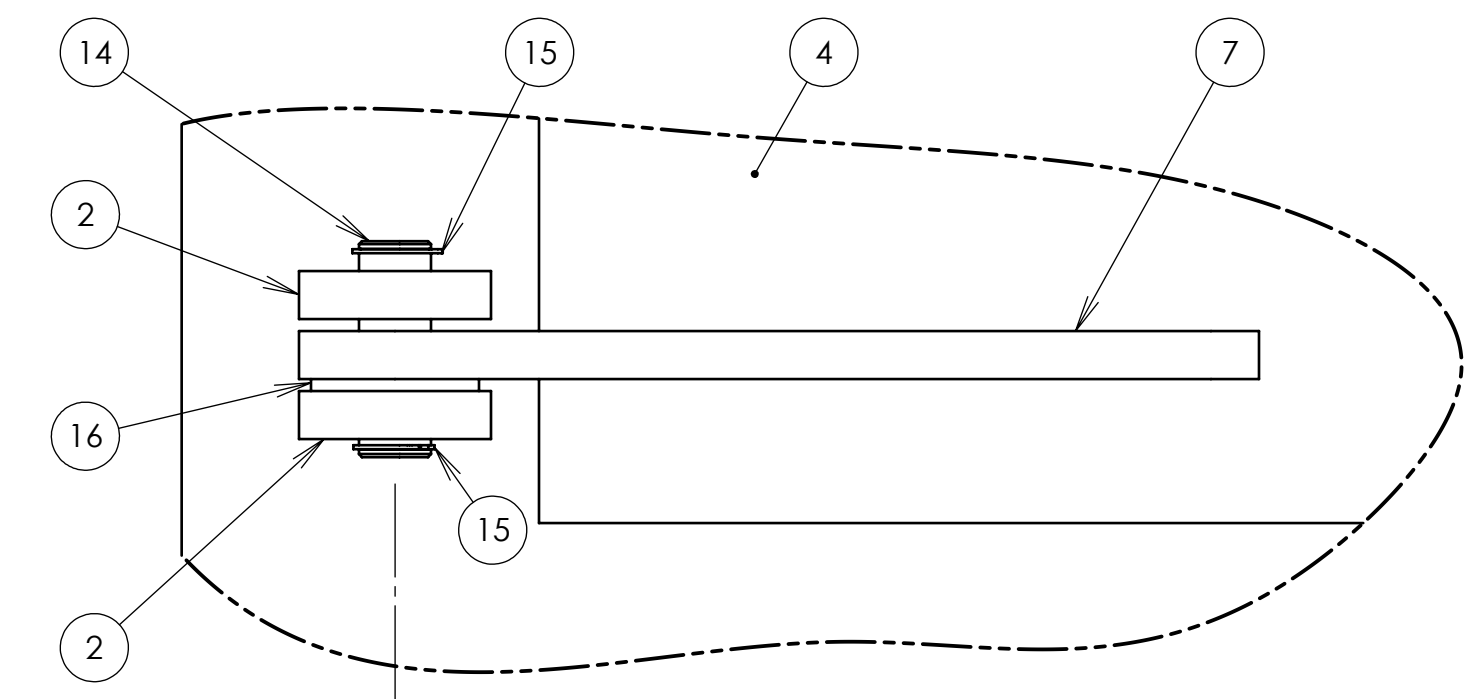
D
C
B
A



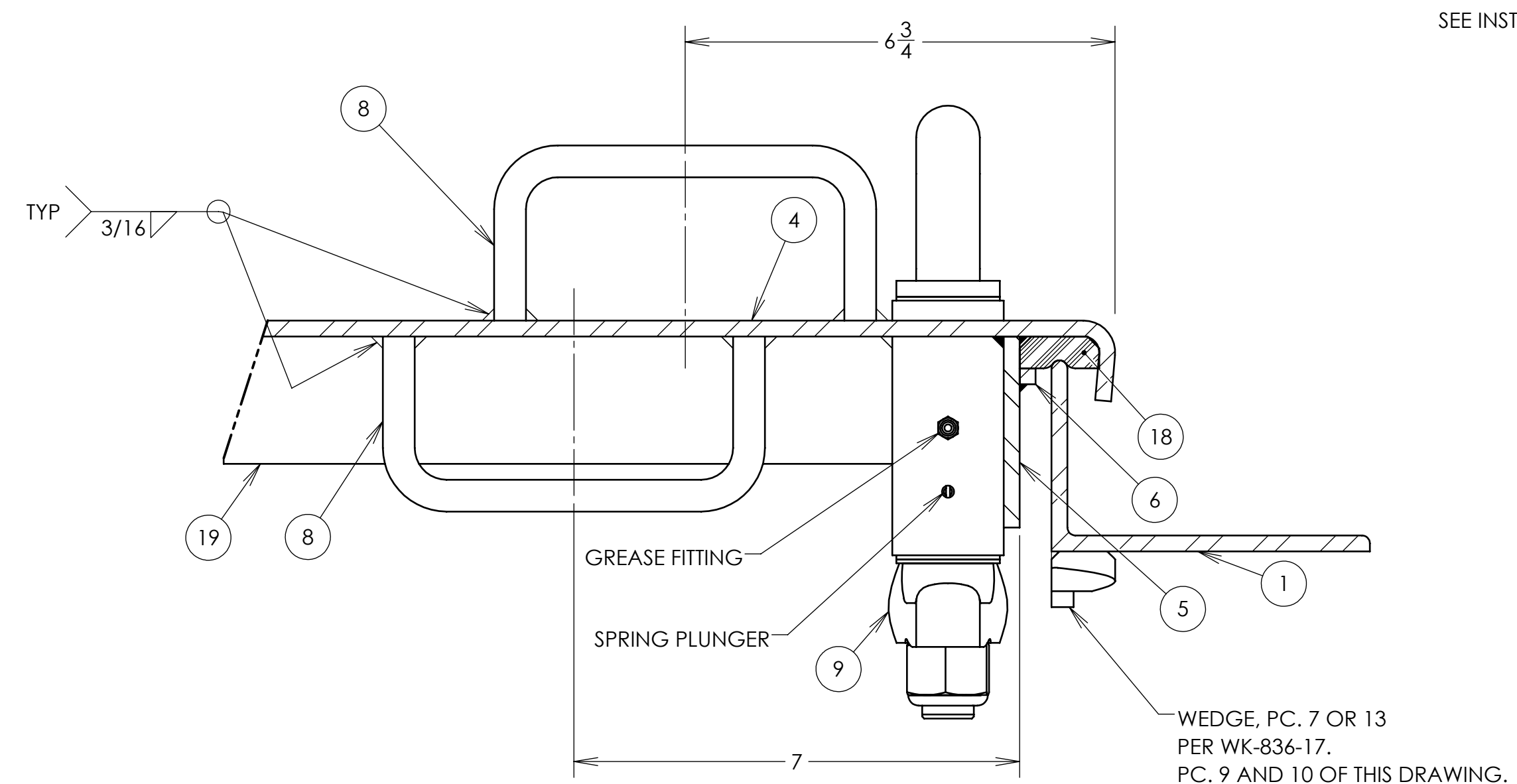
SECTION 15-A
SCALE 1:4



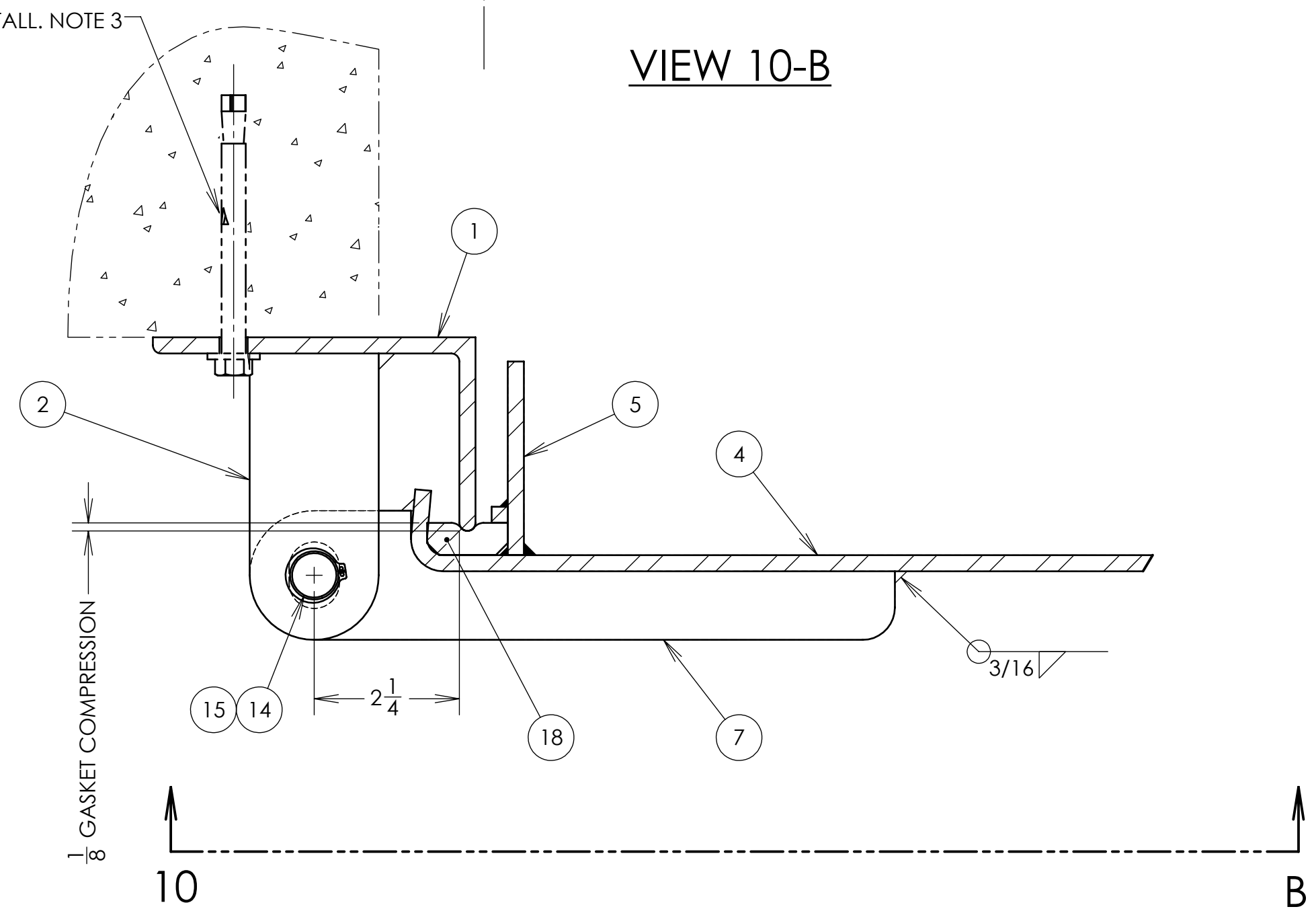
SECTION 12-C
SCALE 1:4



VIEW 10-B



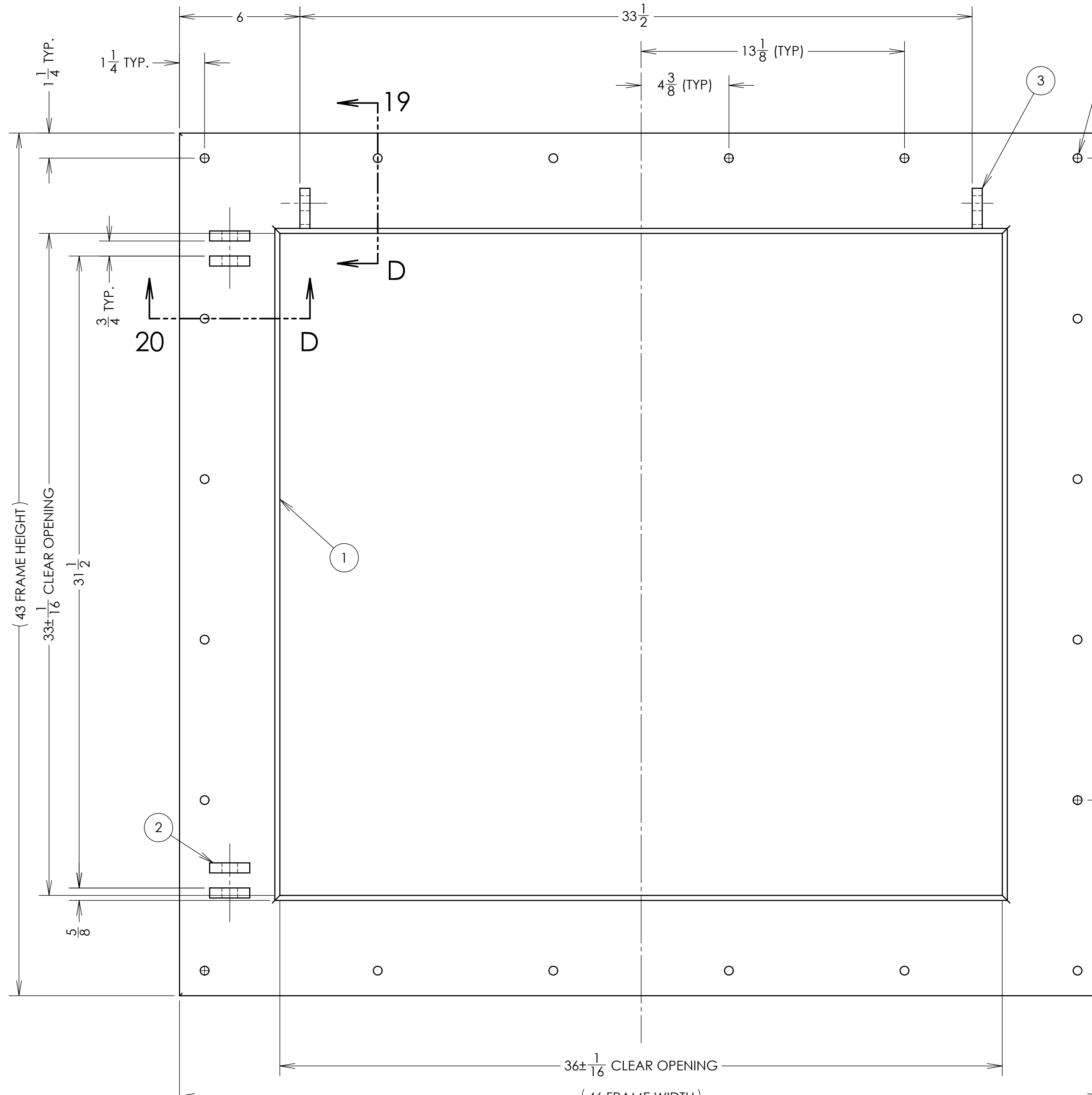
SECTION 12-A



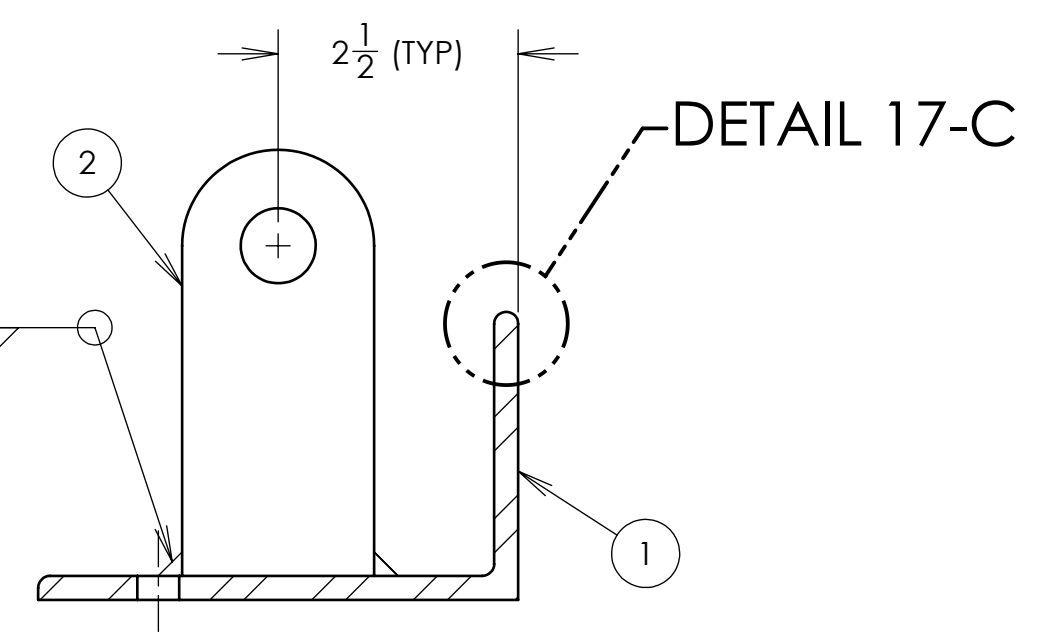
SECTION 10-A

SIZE D	FSCM. NO. 87045	DWG. NO. WK-929-45	REV. A
SCALE: 1:2		SHEET NO. 2 OF 3	

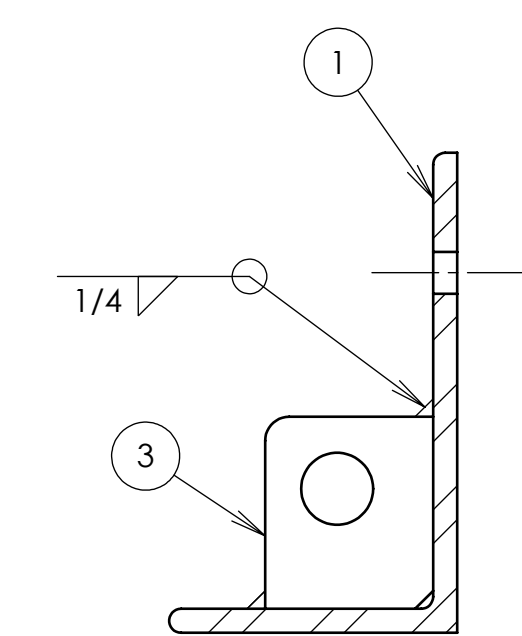
16 15 14 13 12 11 10 9



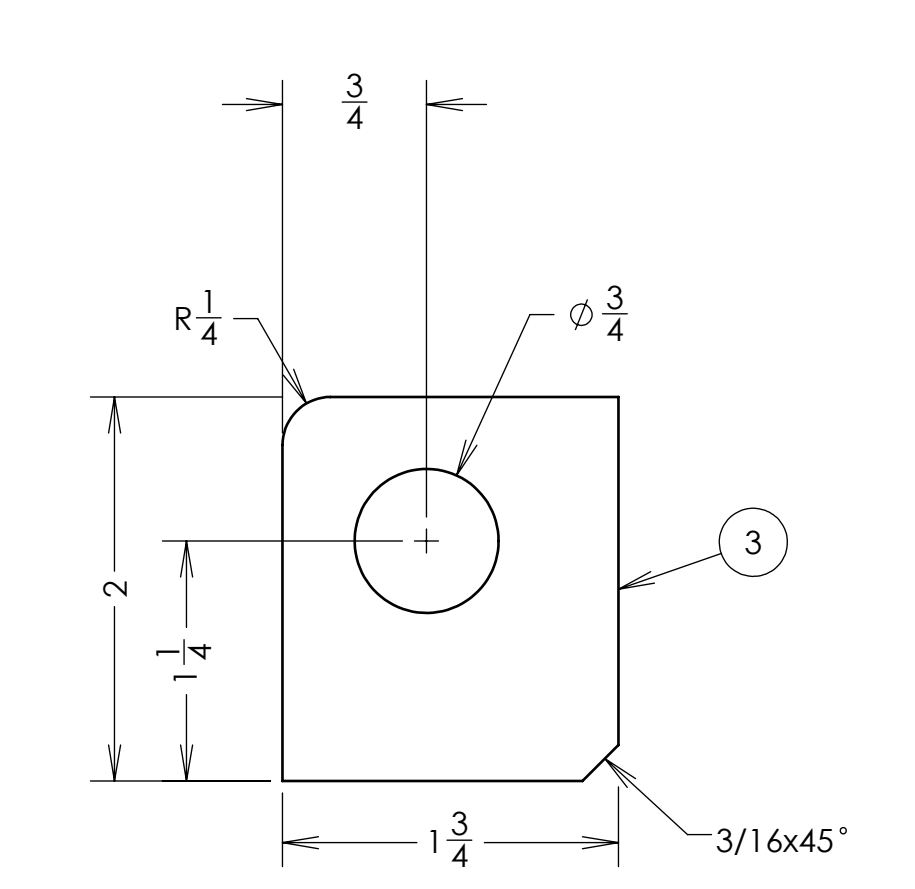
FRAME ASSEMBLY
 SCALE: 1:4



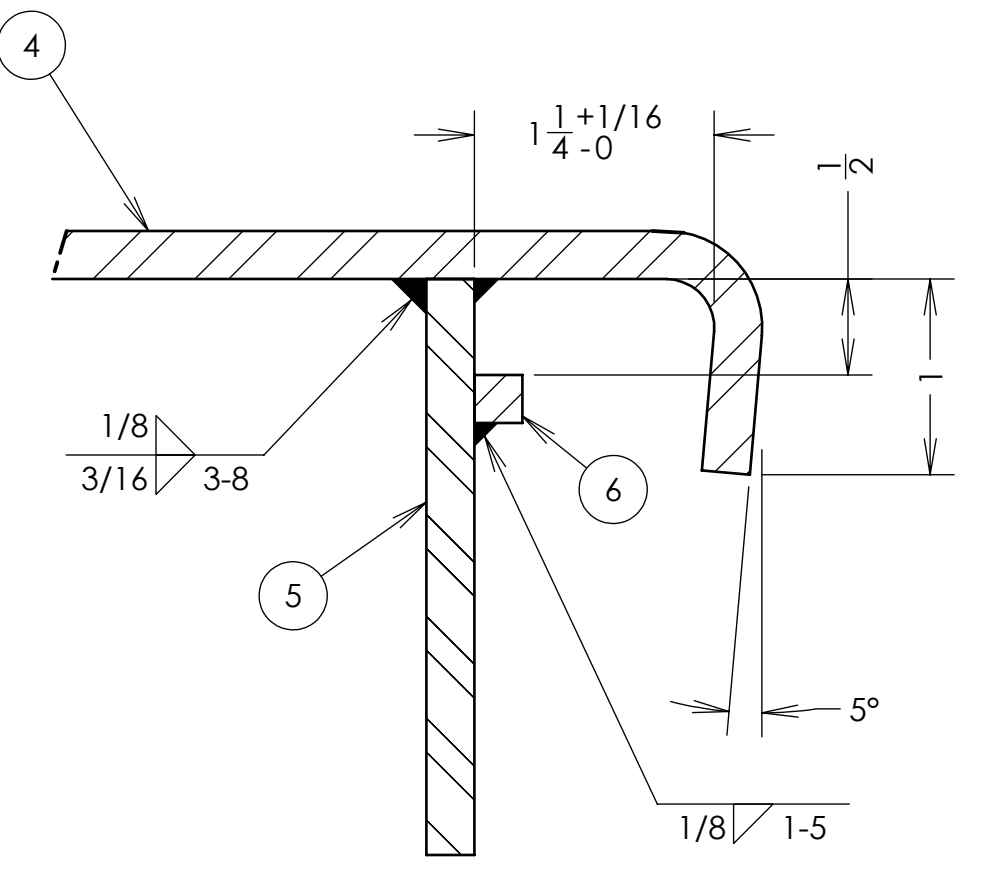
SECTION 20-D



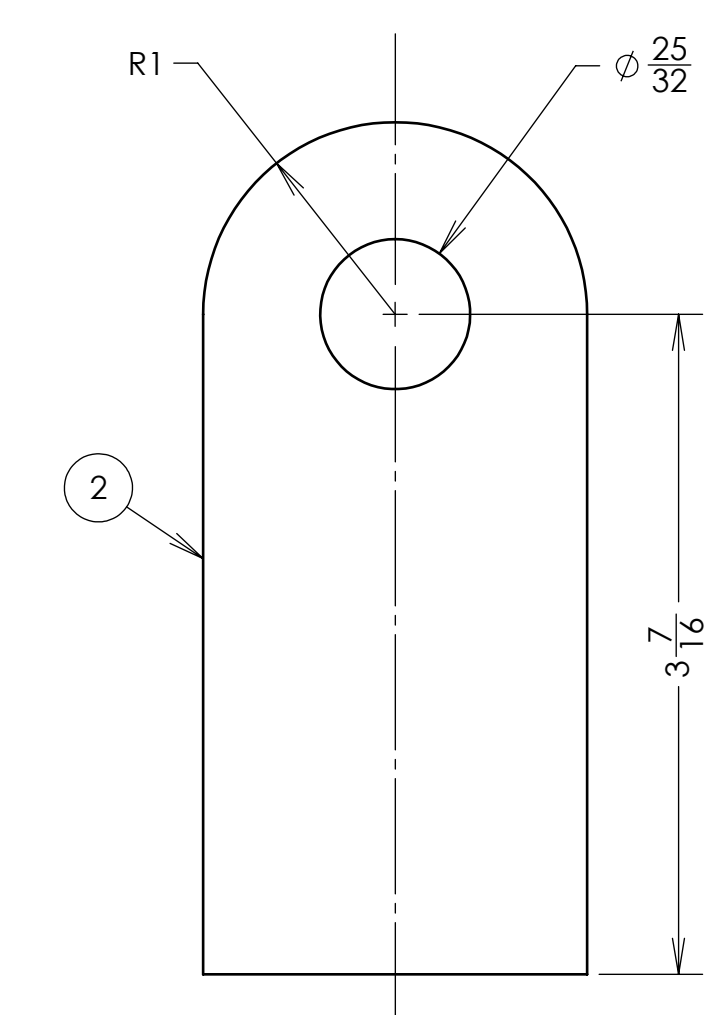
SECTION 19-D



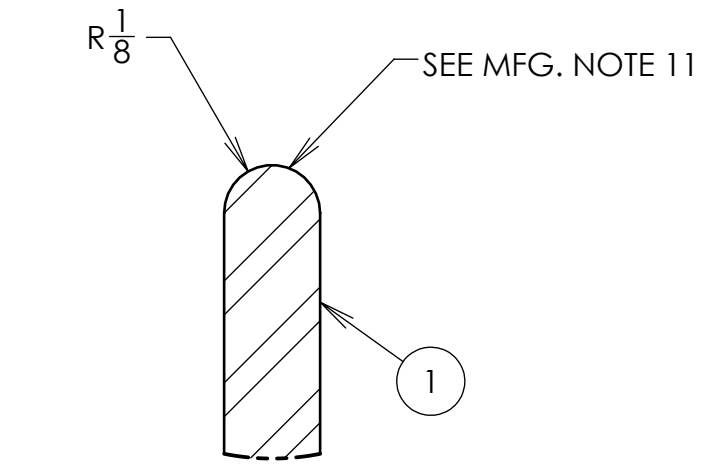
LIFTING PAD
 SCALE: 1:1



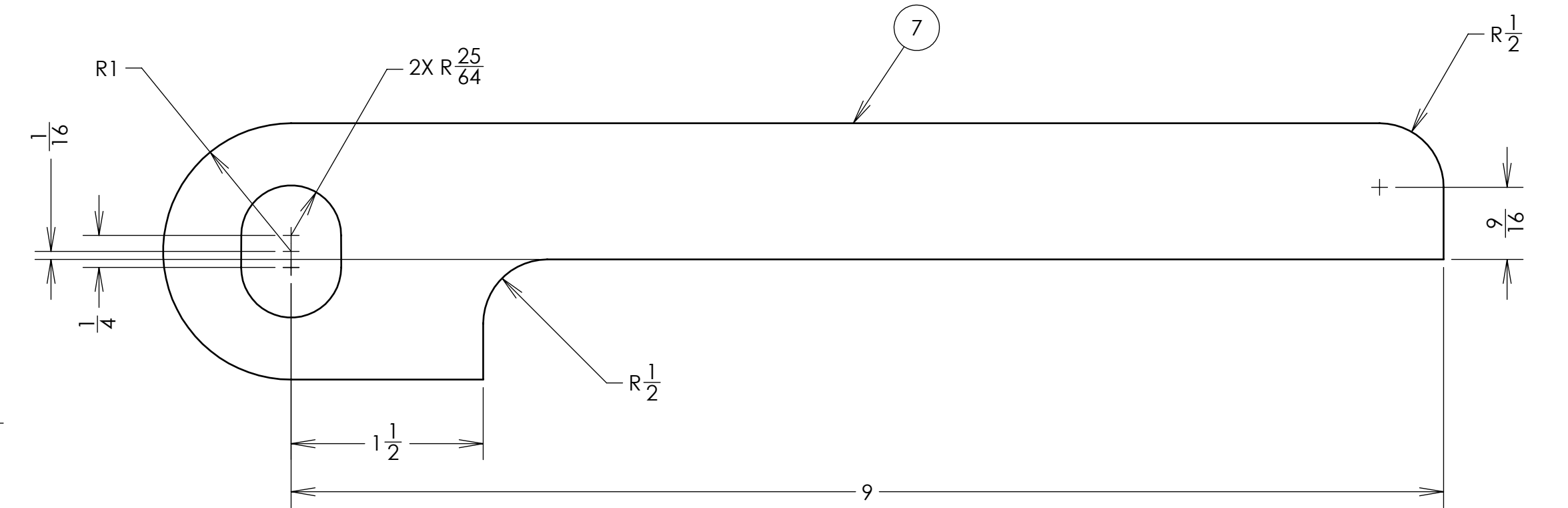
TYPICAL PANEL EDGE DETAIL
 SCALE: 1:1



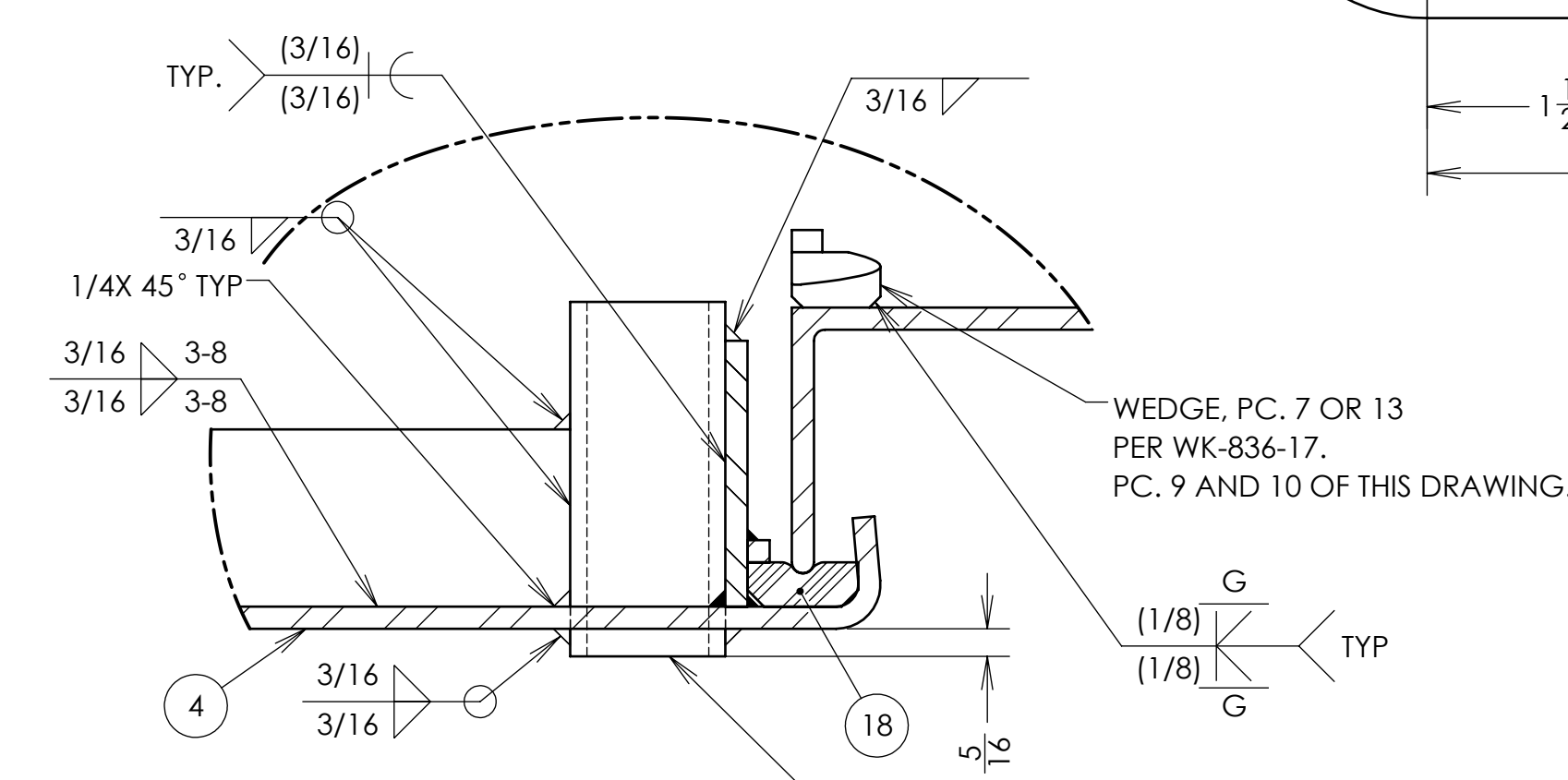
HINGE PAD
 SCALE: 1:1



DETAIL 17-C
 SCALE: 2:1



HINGE BLADE
 SCALE: 1:1



SECTION 20-A
 DOG ASSY REMOVED FOR CLARITY

SIZE D	FSCM. NO. 87045	DWG. NO. WK-929-45	REV. A
SCALE: 1:2	SHEET NO. 3 OF 3		

The background of the page features a large, light gray circular shape on the right side, partially overlapping a solid blue triangular shape on the left. The text 'WATER TREATMENT' is centered within the gray area.

WATER TREATMENT

Watts UV Disinfection Systems

**Value Priced.
Order Today!**



Applications

- Well water
- Homes
- Water systems
- Aquaculture
- Food service
- Water coolers
- RO systems

Features & Benefits

- Disinfection without chemicals.
- Effective disinfection for chlorine resistant bacteria, virus cysts.
- Lamps rated for 12 month continuous service life.
- Highly polished 304 stainless steel reactor chamber.
- Audible and visual alarm indicating lamp failure.
- Easy lamp replacement service.
- Available in 110 v and 230v.
- 30mj/cm² dose at specified flow rate at the end of lamp life.
- Quartz sleeve and lamps.

Independent Lab Validated

Watts UV systems have been third party tested to verify that they meet or exceed the 40 mJ/cm² requirement for disinfection at the specified flow rates.

Specifications

Chamber materials	304SS
Max. water temperature	104°F (40°C)
Min. water temperature	36°F (2°C)
Max pressure	125 psi
UV dose (end of life)	30 mj/cm ²
Lamp life	9,000 hrs
Lamps per chamber	Single

Water Quality Guidelines

Total Iron	less than 0.3 mg/l
Hydrogen sulfide	less than 0.05 mg/l
Turbidity	less than 10 mg/l
Manganese	less than 0.05 mg/l
Hardness	less than 7 grains
UV transmittance	greater than 90%

Note: Minimum water quality guidelines are recommended to ensure proper operation and continuous disinfection.

Models

Product Code	Flow Rate (GPM)	Pipe Size	Dimensions (L X W X H)	Electrical	Shipping (Lbs.)
WUV2-110	2	1/2" MNPT	18" x 6" x 5-3/8"	110-130 v / 50-60 Hz	6
WUV2-230	2	1/2" MNPT	18" x 6" x 5-3/8"	200-250 v / 50-60 Hz	6
WUV6-110	6	3/4" MNPT	25-1/2" x 6" x 5-3/8"	110-130 v / 50-60 Hz	7
WUV6-230	6	3/4" MNPT	25-1/2" x 6" x 5-3/8"	200-250 v / 50-60 Hz	7
WUV8-110	8	3/4" MNPT	32" x 8-1/4" x 3-3/4"	110-130 v / 50-60 Hz	9
WUV8-230	8	3/4" MNPT	32" x 8-1/4" x 3-3/4"	200-250 v / 50-60 Hz	9
WUV12-110	12	1" MNPT	41-1/2" x 8-1/4" x 3-3/4"	110-130 v / 50-60 Hz	17
WUV12-230	12	1" MNPT	41-1/2" x 8-1/4" x 3-3/4"	200-250 v / 50-60 Hz	17

The background features a large, light grey curved shape on the right side, and a blue curved shape on the left side, separated by a white curved line.

PADDLES AND PAINT



Protective & Marine Coatings

MACROPOXY® 646-100 FAST CURE EPOXY

PART A
PART B

B58-620
B58V620

SERIES
HARDENER

Revised: October 19, 2016

PRODUCT INFORMATION

4.52

PRODUCT DESCRIPTION

MACROPOXY 646-100 FAST CURE EPOXY is a high solids, less than 100 g/L VOC, high build, fast drying, polyamide epoxy designed to protect steel and concrete in industrial exposures. Ideal for maintenance painting and fabrication shop applications. The high solids content ensures adequate protection of sharp edges, corners, and welds. This product can be applied directly to marginally prepared steel surfaces.

- Low VOC, <100 g/L
- Low odor
- Outstanding application properties
- Chemical resistant
- Abrasion resistant

PRODUCT CHARACTERISTICS

Finish:	Semi-Gloss
Color:	Mill White and a wide range of colors available through tinting
Volume Solids:	73% ± 2%, mixed
Weight Solids:	83% ± 2%, mixed
VOC (EPA Method 24):	Unreduced: <100 g/L; .83 lb/gal mixed Reduced 10%: <100 g/L; .83 lb/gal
Mix Ratio:	1:1 by volume

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	7.0 (175)	13.5 (338)
Dry mils (microns)	5.0* (125)*	10.0* (250)*
~Coverage sq ft/gal (m²/L)	116 (2.8)	232 (5.7)
Theoretical coverage sq ft/gal (m²/L) @ 1 mil / 25 microns dft	1168 (28.6)	

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

*May be applied at 3.0-10.0 mils (75-250 microns) dft in a multi-coat system. Refer to Recommended Systems and Performance Tips Sections.

Drying Schedule @ 7.0 mils wet (175 microns):

	@ 40°F/4.5°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	4-5 hours	2 hours	1.5 hours
To handle:	48 hours	8 hours	4.5 hours
To recoat:			
minimum:	48 hours	8 hours	4.5 hours
maximum:	1 year	1 year	1 year
Cure for			
service:	10 days	7 days	4 days
immersion:	14 days	7 days	4 days

If maximum recoat time is exceeded, abrade surface before recoating.

Drying time is temperature, humidity, and film thickness dependent.

Pot Life:	10 hours	4 hours	2 hours
Sweat-in-time:	30 minutes	30 minutes	15 minutes

Shelf Life:	36 months, unopened Store indoors at 40°F (4.5°C) to 100°F (38°C).
Flash Point:	61°F (16°C), PMCC, mixed
Reducer/Clean Up:	Reducer R7K111 or Oxsol 100

RECOMMENDED USES

- Marine applications
- Fabrication shops
- Pulp and paper mills
- Power plants
- Offshore platforms
- Mill White is acceptable for immersion use for salt water and fresh water
- Not acceptable for potable water
- Suitable for use in USDA inspected facilities
- Acceptable for use in Canadian Food Processing facilities, categories: D3 (Confirm acceptance of specific part numbers/rexes with your SW Sales Representative)
- Conforms to AWWA D102 OCS #5
- Approved with FIRETEX hydrocarbon coatings
- Refineries
- Chemical plants
- Tank exteriors
- Water treatment plants

PERFORMANCE CHARACTERISTICS

Substrate*: Steel

Surface Preparation*: SSPC-SP10/NACE 2

System Tested*:

1 ct. Macropoxy 646-100 Fast Cure @ 6.0 mils (150 microns) dft
*unless otherwise noted below

Test Name	Test Method	Results
Abrasion Resistance	ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load	84 mg loss
Accelerated Weathering - QUV¹	ASTM D4587, QUV-A, 12,000 hours	Passes
Adhesion	ASTM D4541	1,037 psi
Corrosion Weathering¹	ASTM D5894, 36 cycles, 12,000 hours	Rating 10 per ASTM D714 for blistering; Rating 9 per ASTM D610 for rusting
Direct Impact Resistance	ASTM D2794	30 in. lb.
Dry Heat Resistance	ASTM D2485	250°F (121°C)
Exterior Durability	1 year at 45° South	Excellent, chalks
Flexibility	ASTM D522, 180° blend, 3/4" mandrel	Passes
Immersion	1 year fresh and salt water	Passes, no rusting, blistering, or loss of adhesion
Pencil Hardness	ASTM D3363	3H
Salt Fog Resistance¹	ASTM B117, 6,500 hours	Rating 10 per ASTM D610 for rusting; Rating 9 per ASTM D1654 for corrosion
Water Vapor Permeance	ASTM D1653, Method B	1.16 grains/day

Epoxy coatings may darken or discolor following application and curing.

Footnotes:

¹ Zinc Clad II Plus Primer



Protective & Marine Coatings

MACROPOXY® 646-100 FAST CURE EPOXY

PART A
PART B

B58-620
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SERIES
HARDENER

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PRODUCT INFORMATION

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RECOMMENDED SYSTEMS

	Dry Film Thickness / ct.	
	Mils	(Microns)
Immersion and atmospheric:		
Steel:		
2 cts. Macropoxy 646-100	5.0-10.0	(125-250)
Concrete/Masonry, smooth:		
2 cts. Macropoxy 646-100	5.0-10.0	(125-250)
Concrete Block:		
1 ct. Kem Cati-Coat HS Epoxy Filler/Sealer as needed to fill voids and provide a continuous substrate.	10.0-20.0	(250-500)
2 cts. Macropoxy 646-100	5.0-10.0	(125-250)
Atmospheric:		
*Steel:		
(Shop applied system, new construction, AWWA D102, can also be used at 3 mils (75 microns) dft when used as part of a multi-coat system)		
1 ct. Macropoxy 646-100 Fast Cure Epoxy	3.0-6.0	(75-150)
1-2 cts. of recommended topcoat		
Steel:		
1 ct. Recoatable Epoxy Primer	4.0-6.0	(100-150)
2 cts. Macropoxy 646-100	5.0-10.0	(125-250)
Steel:		
1 ct. Macropoxy 646-100	3.0-10.0	(75-250)
1-2 cts. Acrolon 218 Polyurethane	3.0-6.0	(75-150)
or Hi-Solids Polyurethane	3.0-5.0	(75-125)
or SherThane 2K Urethane	2.0-4.0	(50-100)
Steel:		
2 cts. Macropoxy 646-100	5.0-10.0	(125-250)
1-2 cts. Tile-Clad HS Epoxy	2.5-4.0	(63-100)
Steel:		
1 ct. Zinc Clad II Plus	3.0-6.0	(75-150)
1 ct. Macropoxy 646-100	3.0-10.0	(75-250)
1-2 cts. Acrolon 218 Polyurethane	3.0-6.0	(75-150)
Steel:		
1 ct. Zinc Clad III HS	3.0-5.0	(75-125)
or Zinc Clad IV	3.0-5.0	(75-125)
1 ct. Macropoxy 646-100	3.0-10.0	(75-250)
1-2 cts. Hi-Solids Polyurethane-100	3.0-6.0	(75-150)
Aluminum:		
2 cts. Macropoxy 646-100	5.0-10.0	(125-250)
Galvanizing:		
2 cts. Macropoxy 646-100	5.0-10.0	(125-250)

The systems listed above are representative of the product's use, other systems may be appropriate.

DISCLAIMER

The information and recommendations set forth in this Product Data Sheet are based upon tests conducted by or on behalf of The Sherwin-Williams Company. Such information and recommendations set forth herein are subject to change and pertain to the product offered at the time of publication. Consult your Sherwin-Williams representative to obtain the most recent Product Data Information and Application Bulletin.

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:

Iron & Steel

Atmospheric: SSPC-SP2/3

Immersion: SSPC-SP10/NACE 2, 2-3 mil (50-75 micron) profile

Aluminum: SSPC-SP1

Galvanizing: SSPC-SP1

Concrete & Masonry

Atmospheric: SSPC-SP13/NACE 6, or ICRI No. 310.2R,

CSP 1-3

Immersion: SSPC-SP13/NACE 6-4.3.1 or 4.3.2, or

ICRI No. 310.2R, CSP 1-3

Surface Preparation Standards

Condition of Surface	ISO 8501-1 BS7079:A1	SSPC	NACE
White Metal	Sa 3	SP 5	1
Near White Metal	Sa 2.5	SP 10	2
Commercial Blast	Sa 2	SP 6	3
Brush-Off Blast	Sa 1	SP 7	4
Hand Tool Cleaning	C St 2	SP 2	-
Pitted & Rusted	D St 2	SP 2	-
Rusted	C St 3	SP 3	-
Power Tool Cleaning	Pitted & Rusted	D St 3	SP 3

TINTING

Tint Part A with Maxitones at 150% strength. Five minutes minimum mixing on a mechanical shaker is required for complete mixing of color.

Tinting is not recommended for immersion service.

APPLICATION CONDITIONS

Temperature: 40°F (4.5°C) minimum, 140°F (60°C) maximum (air, surface, and material)

Relative humidity: At least 5°F (2.8°C) above dew point
85% maximum

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:

Part A: 1 gallon (3.78L) and 5 gallon (18.9L) containers

Part B: 1 gallon (3.78L) and 5 gallon (18.9L) containers

Weight:

13.24 ± 0.2 lb/gal ; 1.6 Kg/L
mixed, may vary by color

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

WARRANTY

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accord with applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.



Protective & Marine Coatings

MACROPOXY® 646-100 FAST CURE EPOXY

PART A
PART B

B58-620
B58V620

SERIES
HARDENER

Revised: October 19, 2016

APPLICATION BULLETIN

4.52

SURFACE PREPARATIONS

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Iron & Steel, Atmospheric Service:

Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6/NACE 3, blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils / 50 microns). Prime any bare steel within 8 hours or before flash rusting occurs.

Iron & Steel, Immersion Service:

Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Near White Metal Blast Cleaning per SSPC-SP10/NACE 2. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2-3 mils / 50-75 microns). Remove all weld spatter and round all sharp edges by grinding. Prime any bare steel the same day as it is cleaned.

Aluminum

Remove all oil, grease, dirt, oxide and other foreign material by Solvent Cleaning per SSPC-SP1.

Galvanized Steel

Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1 (recommended solvent is VM&P Naphtha). When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP7 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned.

Concrete and Masonry

For surface preparation, refer to SSPC-SP13/NACE 6, or ICRI No. 310.2R, CSP 1-3. Surfaces should be thoroughly clean and dry. Concrete and mortar must be cured at least 28 days @ 75°F (24°C). Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement and hardeners. Fill bug holes, air pockets and other voids with Steel-Seam FT910.

Concrete, Immersion Service:

For surface preparation, refer to SSPC-SP13/NACE 6, Section 4.3.1 or 1.3.2 or ICRI No. 310.2R, CSP 1-3.

Follow the standard methods listed below when applicable:

ASTM D4258 Standard Practice for Cleaning Concrete.
ASTM D4259 Standard Practice for Abrading Concrete.
ASTM D4260 Standard Practice for Etching Concrete.
ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete.
SSPC-SP 13/Nace 6 Surface Preparation of Concrete.
ICRI No. 310.2R Concrete Surface Preparation.

Previously Painted Surfaces

If in sound condition, clean the surface of all foreign material. Smooth, hard or glossy coatings and surfaces should be dulled by abrading the surface. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if this product attacks the previous finish, removal of the previous coating may be necessary. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface as above.

Surface Preparation Standards

Condition of Surface	ISO 8501-1 BS7079:A1	SSPC	NACE
White Metal	Sa 3	SP 5	1
Near White Metal	Sa 2.5	SP 10	2
Commercial Blast	Sa 2	SP 6	3
Brush-Off Blast	Sa 1	SP 7	4
Hand Tool Cleaning	Rusted C St 2	SP 2	-
	Pitted & Rusted D St 2	SP 2	-
Power Tool Cleaning	Rusted C St 3	SP 3	-
	Pitted & Rusted D St 3	SP 3	-

APPLICATION CONDITIONS

Temperature: 40°F (4.5°C) minimum, 140°F (60°C) maximum (air, surface, and material)
At least 5°F (2.8°C) above dew point

Relative humidity: 85% maximum

APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compliant with existing VOC regulations and compatible with the existing environmental and application conditions.

Reducer/Clean UpReducer R7K111 or Oxsol 100

Airless Spray

Pump.....30:1
Pressure.....2800 - 3000 psi
Hose.....1/4" ID
Tip0.017" - .023"
Filter60 mesh
Reduction.....As needed up to 10% by volume

Conventional Spray

GunDeVilbiss MBC-510
Fluid TipE
Air Nozzle.....704
Atomization Pressure.....60-65 psi
Fluid Pressure.....10-20 psi
Reduction.....As needed up to 10% by volume
Requires oil and moisture separators

Brush

Brush.....Nylon/Polyester or Natural Bristle
Reduction.....Not recommended

Roller

Cover3/8" woven with solvent resistant core
Reduction.....Not recommended

If specific application equipment is not listed above, equivalent equipment may be substituted.



Protective & Marine Coatings

MACROPOXY® 646-100 FAST CURE EPOXY

PART A
PART B

B58-620
B58V620

SERIES
HARDENER

Revised: October 19, 2016

APPLICATION BULLETIN

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APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with low speed power agitation. Make certain no pigment remains on the bottom of the can. Then combine one part by volume of Part A with one part by volume of Part B. Thoroughly agitate the mixture with power agitation. Allow the material to sweat-in as indicated prior to application. Re-stir before using.

If reducer solvent is used, add only after both components have been thoroughly mixed, after sweat-in.

Apply paint at the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	7.0 (175)	13.5 (338)
Dry mils (microns)	5.0* (125)	10.0* (250)*
~Coverage sq ft/gal (m ² /L)	116 (2.8)	232 (5.7)
Theoretical coverage sq ft/gal (m ² /L) @ 1 mil / 25 microns dft	1168 (28.6)	

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

*May be applied at 3.0-10.0 mils (75-250 microns) dft in a multi-coat system. Refer to Recommended Systems and Performance Tips Sections.

Drying Schedule @ 7.0 mils wet (175 microns):

	@ 40°F/4.5°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	4-5 hours	2 hours	1.5 hours
To handle:	48 hours	8 hours	4.5 hours
To recoat:			
minimum:	48 hours	8 hours	4.5 hours
maximum:	1 year	1 year	1 year
Cure for			
service:	10 days	7 days	4 days
immersion:	14 days	7 days	4 days
<i>If maximum recoat time is exceeded, abrade surface before recoating. Drying time is temperature, humidity, and film thickness dependent.</i>			
Pot Life:	10 hours	4 hours	2 hours
Sweat-in-time:	30 minutes	30 minutes	15 minutes

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

CLEAN UP INSTRUCTIONS

Clean spills and spatters immediately with Reducer R7K111 or Oxsol 100. Clean tools immediately after use with Reducer R7K111 or Oxsol 100. Follow manufacturer's safety recommendations when using any solvent.

DISCLAIMER

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PERFORMANCE TIPS

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and adhesion.

Do not mix previously catalyzed material with new.

Do not apply the material beyond recommended pot life.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer R7K111 or Oxsol 100.

Insufficient ventilation, incomplete mixing, miscatalyzation, and external heaters may cause premature yellowing.

Excessive film build, poor ventilation, and cool temperatures may cause solvent entrapment and premature coating failure.

Tinting is not recommended for immersion service.

Use only Mil White for immersion service.

Quik-Kick Epoxy Accelerator is acceptable for use. See data page 4.99 for details.

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

For Immersion Service: (if required) Holiday test in accordance with ASTM D5162 for steel, or ASTM D4787 for concrete. When coating over steel in a zinc/epoxy/epoxy, or epoxy/epoxy/epoxy system, Macropoxy 646-100 must be applied at a minimum dft of 3.0 mils per coat.

Acceptable for Concrete Floors.

Refer to Product Information sheet for additional performance characteristics and properties.

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

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WARRANTY

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accord with applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.



Protective & Marine Coatings

ZINC CLAD® II LV INORGANIC ZINC-RICH COATING

PART A
PART F

B69VZ19
B69D11

BASE
ZINC DUST

Revised October 28, 2014

PRODUCT INFORMATION

6.14

PRODUCT DESCRIPTION

ZINC CLAD II LV is a solvent-based, two-component, inorganic ethyl silicate, zinc rich coating. This is a fast drying, high solids, low VOC coating with 82% by weight of zinc dust in the dry film.

- Coating self-heals to resume protection if damaged
- Provides cathodic/sacrificial protection by the same mechanism as galvanizing
- Forms an inorganic barrier to moisture and solvents
- Meets Class B requirements for slip coefficient and creep resistance, 0.56
- Meets AASHTO M-300-specification

PRODUCT CHARACTERISTICS

Finish:	Flat
Color:	Gray-Green
Volume Solids:	69% ± 2%, mixed (void content method)
Weight Solids:	86% ± 2%, mixed
VOC (EPA Method 24):	Unreduced: <400 g/L 3.33 lb/gal (mixed)
Zinc Content in Dry Film:	82% by weight
Mix Ratio:	2 components, premeasured 4.50 gallons (17.0L) mixed

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	3.0 75	6.0 150
Dry mils (microns)	2.0 50	4.0 100
~Coverage sq ft/gal (m²/L)	280 6.8	550 13.4
Theoretical coverage sq ft/gal (m²/L) @ 1 mil / 25 microns dft	1104 27.0	

Dry film thickness in excess of 6.0 mils (150 microns) per coat is not recommended.

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 6.0 mils wet (150 microns):

	@ 40°F/4.5°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	25 minutes	20 minutes	5 minutes
To handle:	25 minutes	20 minutes	10 minutes
To topcoat:	4 days	24 hours	8 hours
To cure:	5 days	36 hours	24 hours
To stack:	6 hours	2 hours	1 hour

Drying time is temperature, humidity, and film thickness dependent.

Pot Life: 8 hours @ 77°F (25°C)

High humidity will shorten pot life.

Sweat-in-Time: None required, but material should be mixed for at least 5 minutes before use.

Shelf Life: Part A: 9 months, unopened
Part F: 24 months, unopened
Store indoors at 40°F (4.5°C) to 100°F (38°C)

Flash Point: 65°F (18.3°C)

Reducer/Clean Up:
Above 70°F (21°C): R2KT4, 150 Flash Naphtha
Below 70°F (21°C): R2K4, Xylene

RECOMMENDED USES

For use over prepared blasted steel in areas such as:

- Bridges
- Refineries
- Shop or field application
- Drilling rigs
- Nuclear Power Plants
- DOE Nuclear Fuel Facilities
- Nuclear fabrication shops
- DOE Nuclear Weapons Facilities
- As a one-coat maintenance coating or as a permanent primer for severe corrosive environments (pH range 5-9)
- Ideal for application at low temperatures or service at high temperatures and/or humidity conditions
- Fresh and demineralized water immersion service (non-potable)
- This product meets specific design requirements for non-safety related nuclear plant applications in Level II, III and Balance of Plant, and DOE nuclear facilities*.

* Nuclear qualifications are NRC license specific to the facility.

PERFORMANCE CHARACTERISTICS

Substrate*: Steel

Surface Preparation*: SSPC-SP10/NACE 2

System Tested*:

1 ct. Zinc Clad II LV @ 4.0 mils (100 microns) dft

*unless otherwise noted below

Test Name	Test Method	Results
Adhesion	ASTM D4541	10.025 MPa = 1454lb psi
Direct Impact Resistance	ASTM D2794	50 in lbs.
Dry Heat Resistance	ASTM D2485	750°F (399°C)*
Flexibility	ASTM D522, 180° bend, 1" mandrel	Passes
Moisure Condensation Resistance	ASTM D4585, 100°F, 1000 hours	Rating 10 per ASTM D714 for Blistering; Rating 10 per ASTM D610 for Rusting
Pencil Hardness	ASTM D3363	2H
Radiation Tolerance	ASTM D4082 / ANSI 5.12	Pass at 5 mils (125 microns)
Salt Fog Resistance	ASTM B117, 1000 hours	Rating 10 per ASTM D714 for Blistering; Rating 10 per ASTM D610 for Rusting
Slip Coefficient*	AISC Specifications for Structural Joints	Class B, 0.53

Provides performance comparable to products formulated to specifications Mil-P-38336 and Mil-P-46105 and SSPC Paint 20.

*Refer to Slip Certification document



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PRODUCT INFORMATION

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RECOMMENDED SYSTEMS

Dry Film Thickness / ct.
Mils (Microns)

Steel, Untopcoated, Immersion or Atmospheric:

1 ct. Zinc Clad II LV 2.0-4.0 (50-100)

Steel, Epoxy Topcoat, Atmospheric:

1 ct. Zinc Clad II LV 2.0-4.0 (50-100)

1 ct. Macropoxy 646 5.0-10.0 (125-250)

Steel, Polyurethane Topcoat, Atmospheric:

1 ct. Zinc Clad II LV 2.0-4.0 (50-100)

1 ct. Macropoxy 646 5.0-10.0 (125-250)

1 ct. Acrolon 218 HS 3.0-6.0 (75-150)

Steel, Polyurethane Topcoat, Atmospheric:

1 ct. Zinc Clad II LV 2.0-4.0 (50-100)

1 ct. Macropoxy 646 5.0-10.0 (125-250)

1 ct. Hi-Solids Polyurethane 3.0-4.0 (75-100)

NOTE: 1 ct. of DTM Wash Primer can be used as an intermediate coat under recommended topcoats to prevent pinholing.

Steel, Class B Compliant System

1 ct. Zinc Clad II LV 2.0-4.0 (50-100)

1 ct. Steel Spec Epoxy Primer Red 4.0-6.0 (100-150)

The systems listed above are representative of the product's use, other systems may be appropriate.

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SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:

Iron & Steel:

Atmospheric: SSPC-SP6/NACE3, 2 mil
(50 micron) profile

Immersion: SSPC-SP10/NACE 2, 2 mil
(50 micron) profile

Surface Preparation Standards

Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE
White Metal	Sa 3	Sa 3	SP 5	1
Near White Metal	Sa 2.5	Sa 2.5	SP 10	2
Commercial Blast	Sa 2	Sa 2	SP 6	3
Brush-Off Blast	Sa 1	Sa 1	SP 7	4
Hand Tool Cleaning	C St 2	C St 2	SP 2	-
Pitted & Rusted	D St 2	D St 2	SP 2	-
Rusted	C St 3	C St 3	SP 3	-
Pitted & Rusted	D St 3	D St 3	SP 3	-

TINTING

Do not tint.

APPLICATION CONDITIONS

Temperature: 20°F (7°C) minimum, 100°F (38°C) maximum
(air, surface, and material)
At least 5°F (2.8°C) above dew point

Relative humidity: 40% - 90% maximum
Water misting may be required at humidities below 50%

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging: 4.50 gallons (17.0L) total, mixed
Part A: 3.25 gallon (12.3L) kit
Part F: 73 lbs (33.1 Kg) zinc dust

Weight: 22.99 ± 0.2 lb/gal ; 2.76 Kg/L, mixed

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

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WARRANTY

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SURFACE PREPARATIONS

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Zinc rich coatings require direct contact between the zinc pigment in the coating and the metal substrate for optimum performance.

Iron & Steel (atmospheric service):

Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Commercial Blast Cleaning per SSPC-SP6/NACE 3. For better performance, use Near White Metal Blast Cleaning per SSPC-SP10/NACE 2. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils / 50 microns). Prime any bare steel the same day as it is cleaned or before flash rusting occurs.

Iron & Steel (immersion service):

Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Near White Metal Blast Cleaning per SSPC-SP10/NACE 2. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils / 50 microns). Remove all weld spatter and round all sharp edges by grinding. Prime any bare steel the same day as it is cleaned or before flash rusting occurs.

Note: If blast cleaning with steel media is used, an appropriate amount of steel grit blast media may be incorporated into the work mix to render a dense, angular 1.5-2.0 mil (38-50 micron) surface profile. This method may result in improved adhesion and performance.

Surface Preparation Standards

Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE
White Metal	SSa 3	SSa 3	SP 5	1
Near White Metal	SSa 2.5	SSa 2.5	SP 10	2
Commercial Blast	SSa 1	SSa 1	SP 6	3
Brush-Off Blast	SSa 1	SSa 1	SP 7	4
Hand Tool Cleaning	CS 2	CS 2	SP 2	-
Pitted & Rusty	DS 2	DS 2	SP 2	-
Rusted	CS 3	CS 3	SP 3	-
Power Tool Cleaning	DS 3	DS 3	SP 3	-

APPLICATION CONDITIONS

Temperature: 20°F (7°C) minimum, 100°F (38°C) maximum (air, surface, and material)
At least 5°F (2.8°C) above dew point

Relative humidity: 40% - 90% maximum
Water misting may be required at humidities below 50%

APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compliant with existing VOC regulations and compatible with the existing environmental and application conditions.

Reducer/Clean up

Above 70°F (21°C).....R2KT4, 150 Flash Naphtha
Below 70°F (21°C).....R2K4, Xylene

Airless Spray

(use Teflon packings and continuous agitation)

Unit.....Graco 30:1
Pressure.....2700 psi
Hose.....3/8" ID
Tip......019" - .021"
Filter.....30 mesh
Reduction.....As needed up to 5% by volume

For continuous operation in larger areas, use Speeflo Airless Commander Zinc Pump. Set ball checks to maximum travel for viscous material.

Conventional Spray

(continuous agitation required)

Gun.....Binks 95
Fluid Nozzle.....66
Fluid Hose.....1/2" ID, 50 ft maximum
Air Nozzle.....63PB
Air Hose.....1/2" ID, 50 ft maximum
Atomization Pressure.....25 psi
Fluid Pressure.....10-20 psi
Reduction.....As needed up to 5% by volume

Keep pressure pot at level of applicator to avoid blocking of fluid line due to weight of material. Blow back coating in fluid line at intermittent shutdowns, but continue agitation at pressure pot.

Brush For touch up in small areas only

If specific application equipment is not listed above, equivalent equipment may be substituted.



Protective & Marine Coatings

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APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Zinc Clad II LV comes in premeasured containers, which when mixed provides ready-to-apply material.

Mixing Instructions:

Thoroughly agitate Binder, Part A using low speed continuous air driven agitation. Slowly mix all of Zinc Dust, Part F, into all of Binder Part A until mixture is completely uniform. After mixing, pour mixture through 30-mesh screen. Mixed material must be used within 8 hours. Do not mix previously mixed material with new. No "sweat-in" period is required.

If reducer solvent is used, add only after components have been thoroughly mixed.

Continuous agitation of mixture during application is required, otherwise zinc dust will quickly settle out.

Apply paint at the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	3.0 75	6.0 150
Dry mils (microns)	2.0 50	4.0 100
~Coverage sq ft/gal (m ² /L)	280 6.8	550 13.4
Theoretical coverage sq ft/gal (m ² /L) @ 1 mil / 25 microns dft	1104 27.0	

Dry film thickness in excess of 6.0 mils (150 microns) per coat is not recommended.

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 6.0 mils wet (150 microns):

	@ 40°F/4.5°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	25 minutes	20 minutes	5 minutes
To handle:	25 minutes	20 minutes	10 minutes
To topcoat:	4 days	24 hours	8 hours
To cure:	5 days	36 hours	24 hours
To stack:	6 hours	2 hours	1 hour

Drying time is temperature, humidity, and film thickness dependent.

Pot Life: 8 hours @ 77°F (25°C)

High humidity will shorten pot life.

Sweat-in-Time: None required, but material should be mixed for at least 5 minutes before use.

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

CLEAN UP INSTRUCTIONS

Clean spills and spatters immediately with Reducer R2KT4, 150 Flash Naphtha or R2K4, Xylene. Clean hands and tools immediately after use with Reducer R2KT4, 150 Flash Naphtha or R2K4, Xylene. Follow manufacturer's safety recommendations when using any solvent.

DISCLAIMER

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PERFORMANCE TIPS

Topcoating: Note minimum cure times at normal conditions before topcoating. Longer drying periods are required if primer cannot be water mist sprayed when humidity is low. Water misting may be required at humidities below 50% to enhance cure rate.

Occasionally topcoats will pinhole or delaminate from zinc-rich coatings. This is usually due to poor ambient conditions or faulty application of topcoats. This can be minimized by:

- Provide adequate ventilation and suitable application and substrate temperature.
- If pinholing develops during topcoating, apply a mist coat of the topcoat, reduced up to 50%. Allow 10 minutes flash off and follow with a full coat.

Any salting on the zinc surface due to weathering exposure must be removed prior to topcoating

Excessive film build, poor ventilation, and cool temperatures may cause solvent entrapment and premature coating failure.

An intermediate coat is recommended to provide uniform appearance of the topcoat.

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and performance.

Do not mix previously catalyzed material with new.

Do not apply the material beyond recommended pot life.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer R2KT4, 150 Flash Naphtha.

Keep pressure pot at level of applicator to avoid blocking of fluid line due to weight of material. Blow back coating in fluid line at intermittent shutdowns, but continue agitation at pressure pot.

Application above recommended film thickness may result in mud cracking and poor topcoat appearance.

Topcoats may be applied once 50 MEK double rubs are achieved. No zinc or only slight traces should be visible. Coin hardness test can also be used.

Cured films of inorganic zinc coatings contain no appreciable amounts of combustible materials. Both Fire and Smoke Indices would be expected to approach 0.

Refer to Product Information sheet for additional performance characteristics and properties.

SAFETY PRECAUTIONS

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AMERCOAT® 370

DESCRIPTION

Two-component, fast dry multi-purpose epoxy coating

PRINCIPAL CHARACTERISTICS

- Multi-purpose high build epoxy
- Application over a wide range of surface temperatures
- Suitable for immersion in fresh and salt water
- Class A slip resistance for high strength bolted connections

COLOR AND GLOSS LEVEL

- White, Black, Oxide Red, Light Buff, Pearl Gray
- Flat

Note: Epoxy coatings will characteristically chalk and fade upon exposure to sunlight. Light colors are prone to ambering to some extent

BASIC DATA AT 68°F (20°C)

Data for mixed product	
Number of components	Two
Volume solids	66 ± 2%
VOC (Supplied)	max. 2.5 lb/US gal (approx. 300 g/l)
Temperature resistance (Continuous)	To 200°F (93°C)
Temperature resistance (Intermittent)	To 250°F (121°C)
Recommended dry film thickness	4.0 - 6.0 mils (100 - 150 µm) depending on system
Theoretical spreading rate	212 ft ² /US gal for 5.0 mils (5.3 m ² /l for 125 µm)
Shelf life	Base: at least 36 months when stored cool and dry Hardener: at least 24 months when stored cool and dry

Notes:

- See ADDITIONAL DATA – Overcoating intervals
- See ADDITIONAL DATA – Curing time
- Intermittent temperature resistance should be less than 5% of the time, and maximum 24 hours
- Color will drift at elevated temperatures



AMERCOAT® 370

RECOMMENDED SUBSTRATE CONDITIONS AND TEMPERATURES

- Coating performance is, in general, proportional to the degree of surface preparation
- Abrasive blasting is usually the most effective and economical method. When this is impossible or impractical, coating can be applied over mechanically cleaned surfaces
- All surfaces must be clean, dry and free of all contaminants, including salt deposits. Contact PPG for maximum allowable salt containment levels

Mild steel

- Remove all loose rust, dirt, grease or other contaminants by one of the following depending on the degree of cleanliness required: SSPC SP-2, 3, 6, 7 or 10 (ISO 8501-1 St-2, St-3, Sa 1, Sa 2.5). These minimum surface preparation standards apply to steel that has been previously abrasive blasted. The choice of surface preparation will depend on the system selected and end-use service conditions
- For more severe service and immersion, clean to SSPC SP-10 (ISO8501-1 Sa 2.5). Blast to achieve an anchor profile of 2.0 – 4.0 mils (50 – 100 µm) as indicated by a Keane-Tator Surface profile Comparator or Testex Tape. Previously blasted steel may be ultra-high pressure water jetted to SSPC SP WJ-2(L) / NACE WJ-2(L). The wet surface can be dried by blowing with dry compressed air giving special attention to horizontal surfaces and recesses

Concrete

- Prepare in accordance with SSPC SP-13 guidelines
- Abrade surface per ASTM D-4259 to remove all efflorescence and laitance, to expose subsurface voids, and to provide a surface roughness equivalent of 60 grit sandpaper or coarser
- Test for moisture by conducting a plastic sheet test in accordance with ASTM D4263
- Fill voids as necessary with AMERCOAT 114 A epoxy filler

Galvanized steel

- Remove oil or soap film with detergent or emulsion cleaner
- Lightly abrasive blast with a fine abrasive in accordance with SSPC SP-16 guidelines to achieve a profile of 1.5 – 3.0 mils (38 – 75 µm). When light abrasive blasting is not possible, galvanizing can be treated with a suitable zinc phosphate conversion coating.
- Galvanizing that has at least 12 months of exterior weathering and has a rough surface with white rust present may be over-coated after power washing and cleaning to remove white rust and other contaminants
- The surface must have a measurable profile
- A test patch is recommended to determine compatibility and adhesion
- Not recommended over chromate sealed galvanizing without blasting to thoroughly remove chromates. Adhesion problems may occur

Non-ferrous metals and stainless steel

- Abrasive blast in accordance with SSPC SP-16 guidelines to achieve a uniform and dense 1.5-4.0 mil anchor profile. Size and hardness of abrasive should be adjusted as necessary based on the hardness of the substrate
- Aluminum may be treated with a surface treatment compliant with Mil-DTL-5541 or equivalent (non-immersion applications only).

AMERCOAT® 370

Aged coatings

- All surfaces must be clean, dry, tightly bonded and free of all loose paint, corrosion products or chalky residue
- Abrade surface, or clean with PPREP 88. This product is compatible over most types of properly applied and tightly adhering coatings, however, a test patch is recommended to confirm compatibility

Repair

- Prepare damaged areas to original surface preparation specifications, feathering edges of intact coating. Thoroughly remove dust or abrasive residue before touch-up.

Substrate temperature and application conditions

- Surface temperature during application should be between 20°F (-7°C) and 120°F (49°C)
- Surface temperature during application should be at least 5°F (3°C) above dew point
- Ambient temperature during application and curing should be between 20°F (-7°C) and 120°F (49°C)
- Relative humidity during application should not exceed 85%

SYSTEM SPECIFICATION

- Primers: Direct to substrate; DIMETCOTE- Series Primers, AMERCOAT 68HS, AMERCOAT 69MCZ
- Topcoats: AMERCOAT 450-Series Polyurethanes, AMERSHIELD, PSX 700, AMERCOAT 229T, PITTHANE Polyurethanes

INSTRUCTIONS FOR USE

Mixing ratio by volume: base to hardener 80:20 (4:1)

- Pre-mix base component with a pneumatic air mixer at moderate speeds to homogenize the container. Add hardener to base and agitate with a power mixer for 1–2 minutes until completely dispersed

Induction time

None

Pot life

4 hours at 70°F (21°C)

Note: See ADDITIONAL DATA – Pot life

AMERCOAT® 370

Application

- Area should be sheltered from airborne particulates and pollutants
- Avoid combustion gases or other sources of carbon dioxide that may promote amine blush and ambering of light colors
- Ensure good ventilation during application and curing
- Provide shelter to prevent wind from affecting spray patterns

Material temperature

Material temperature during application should be between 40°F (4°C) and 90°F (32°C)

Air spray

- Use standard conventional equipment

Recommended thinner

THINNER 21-06 (AMERCOAT 65) (xylene), THINNER 21-25 (AMERCOAT 101) (recommended for > 90°F (32°C))

Volume of thinner

0 - 20%

Nozzle orifice

Approx. 0.070 in (1.8 mm)

Airless spray

- 45:1 pump or larger
- Can be applied with plural component equipment

Recommended thinner

THINNER 21-06 (AMERCOAT 65) (xylene), THINNER 21-25 (AMERCOAT 101) (recommended for > 90°F (32°C))

Nozzle orifice

0.017 – 0.019 in (approx. 0.43 – 0.48 mm)

Brush/roller

- Use a high quality natural bristle brush and/or solvent resistant, 3/8" nap roller. Ensure brush/roller is well loaded to avoid air entrainment. Multiple coats may be necessary to achieve adequate film-build

Recommended thinner

AMERCOAT 65 (xylene), AMERCOAT 101 (recommended for > 90°F (32°C))

Cleaning solvent

Amercoat 12 Cleaner (Thinner 90-58) or Amercoat 65 Thinner (Thinner 21-06)



AMERCOAT® 370

ADDITIONAL DATA

Overcoating interval for DFT up to 4.0 mils (100 µm)						
Overcoating with...	Interval	20°F (-7°C)	32°F (0°C)	50°F (10°C)	70°F (21°C)	90°F (32°C)
urethane and PSX	Minimum	3 hours	2 hours	1.5 hours	45 minutes	30 minutes
	Maximum	2 months	1.5 months	1.5 months	30 days	14 days

Notes:

- Surface must be clean and dry. Any contamination must be identified and removed. A detergent wash with PREP 88 or equivalent is required prior to application of topcoats after 30 days of exposure. However, particular attention must be paid to surfaces exposed to sunlight where chalking may be present. In those situations, a further degree of cleaning may be required. PPG Technical Service can advise on suitable cleaning methods. If maximum recoat/topcoat time is exceeded, then roughen surface.
- Dry times are dependent on air and surface temperatures as well as film thickness, ventilation, and relative humidity. Maximum recoating time is highly dependent upon actual surface temperatures – not simply air temperatures. Surface temperatures should be monitored, especially with sun-exposed or otherwise heated surfaces. Higher surface temperatures shorten the maximum recoat window

Overcoating interval for DFT up to 4.0 mils (100 µm)						
Overcoating with...	Interval	20°F (-7°C)	32°F (0°C)	50°F (10°C)	70°F (21°C)	90°F (32°C)
itself	Minimum	3 hours	2 hours	1.5 hours	45 minutes	30 minutes
	Maximum - immersion	3 months	2 months	30 days	30 days	30 days
	Maximum - non-immersion	6 months	6 months	6 months	6 months	6 months

Notes:

- Surface must be clean and dry. Any contamination must be identified and removed. A detergent wash with PREP 88 or equivalent is required prior to application of topcoats after 30 days of exposure. However, particular attention must be paid to surfaces exposed to sunlight where chalking may be present. In those situations, a further degree of cleaning may be required. PPG Technical Service can advise on suitable cleaning methods. If maximum recoat/topcoat time is exceeded, then roughen surface.
- If the surface is uniformly and freely chalking after 6 months of exterior weathering, the surface is recoatable with itself after thorough cleaning.
- Dry times are dependent on air and surface temperatures as well as film thickness, ventilation, and relative humidity. Maximum recoating time is highly dependent upon actual surface temperatures – not simply air temperatures. Surface temperatures should be monitored, especially with sun-exposed or otherwise heated surfaces. Higher surface temperatures shorten the maximum recoat window

Curing time for DFT up to 4.0 mils (100 µm)			
Substrate temperature	Dry to touch	Dry to handle	Service- water immersion
20°F (-7°C)	2 hours	20 hours	N/A
32°F (0°C)	1.5 hours	9 hours	7 days
50°F (10°C)	45 minutes	4.5 hours	48 hours
70°F (21°C)	30 minutes	1.5 hours	24 hours
90°F (32°C)	20 minutes	75 minutes	12 hours

Note: Adequate ventilation must be maintained during application and curing

AMERCOAT® 370

Pot life (at application viscosity)	
Mixed product temperature	Pot life
50°F (10°C)	6 hours
70°F (21°C)	4 hours
90°F (32°C)	2 hours

Product Qualifications

- ANSI / NSF Standard 61 for drinking water (valves only). For NSF application instructions, please visit our website at: www.ppgamercoatus.ppgmc.com/NSF/
- AWWA C550-06
- Compliant with USDA Incidental Food Contact Requirements
- Qualified for Class A Slip Resistance per the Research Council on Structural Connections, Appendix A

SAFETY PRECAUTIONS

- For paint and recommended thinners see INFORMATION SHEETS 1430, 1431 and relevant Material Safety Data Sheets
- This is a solvent-borne paint and care should be taken to avoid inhalation of spray mist or vapor, as well as contact between the wet paint and exposed skin or eyes

WORLDWIDE AVAILABILITY

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REFERENCES

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• SAFETY IN CONFINED SPACES AND HEALTH SAFETY, EXPLOSION HAZARD – TOXIC HAZARD	INFORMATION SHEET	1431

WARRANTY

PPG warrants (i) its title to the product, (ii) that the quality of the product conforms to PPG's specifications for such product in effect at the time of manufacture and (iii) that the product shall be delivered free of the rightful claim of any third person for infringement of any U.S. patent covering the product. THESE ARE THE ONLY WARRANTIES THAT PPG MAKES AND ALL OTHER EXPRESS OR IMPLIED WARRANTIES, UNDER STATUTE OR ARISING OTHERWISE BY LAW, FROM A COURSE OF DEALING OR USAGE OF TRADE, INCLUDING WITHOUT LIMITATION ANY OTHER WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR USE, ARE DISCLAIMED BY PPG. Any claim under this warranty must be made by Buyer to PPG in writing within five (5) days of Buyer's discovery of the claimed defect, but in no event later than the expiration of the applicable shelf life of the product, or one year from the date of the delivery of the product to the Buyer, whichever is earlier. Buyer's failure to notify PPG of such non-conformance as required herein shall bar Buyer from recovery under this warranty.



AMERCOAT® 370

LIMITATIONS OF LIABILITY

IN NO EVENT WILL PPG BE LIABLE UNDER ANY THEORY OF RECOVERY (WHETHER BASED ON NEGLIGENCE OF ANY KIND, STRICT LIABILITY OR TORT) FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IN ANY WAY RELATED TO, ARISING FROM, OR RESULTING FROM ANY USE MADE OF THE PRODUCT. The information in this sheet is intended for guidance only and is based upon laboratory tests that PPG believes to be reliable. PPG may modify the information contained herein at any time as a result of practical experience and continuous product development. All recommendations or suggestions relating to the use of the PPG product, whether in technical documentation, or in response to a specific inquiry, or otherwise, are based on data, which to the best of PPG's knowledge, is reliable. The product and related information is designed for users having the requisite knowledge and industrial skills in the industry and it is the end-user's responsibility to determine the suitability of the product for its own particular use and it shall be deemed that Buyer has done so, at its sole discretion and risk. PPG has no control over either the quality or condition of the substrate, or the many factors affecting the use and application of the product. Therefore, PPG does not accept any liability arising from any loss, injury or damage resulting from such use or the contents of this information (unless there are written agreements stating otherwise). Variations in the application environment, changes in procedures of use, or extrapolation of data may cause undesirable results. This sheet supersedes all previous versions and it is the Buyer's responsibility to ensure that this information is current prior to using the product. Current sheets for all PPG Protective & Marine Coatings Products are maintained at www.ppgme.com. The English text of this sheet shall prevail over any translation thereof.

Packaging: Available in 1-gallon and 5-gallon kits; (1-gallon kits have 0.8 gallons of base and 0.2 gallons of hardener; 5 gallon kits have 4-gallons of base and 1-gallon of hardener)

Product code	Description
AT370-112	Light Buff Base
AT370-3	White Base
AT370-9	Black Base
AT370-23	Pearl Gray Base
AT370-72	Oxide Red Base
AT370-B	Hardener

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**PPG Protective &
Marine Coatings**

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PITPGUARD® | 97-946 SERIES

DESCRIPTION

Surface tolerant epoxy

PRINCIPAL CHARACTERISTICS

- Fast drying properties
- VOC compliant for <250 g/L specifications
- High performance coating for new or old steel
- Self Priming in many applications
- Compatible with prepared damp surfaces
- Compatible with adherent rust remaining on prepared surfaces
- Can be applied and cured at low temperatures

COLOR AND GLOSS LEVEL

- White, gray
- Semi-gloss

Note: Epoxy coatings will characteristically chalk and fade upon exposure to sunlight. Light colors are prone to ambering to some extent in interior or exterior exposures

BASIC DATA AT 68°F (20°C)

Data for mixed product	
Number of components	Two
Volume solids	72 ± 3%
VOC (Supplied)	max. 2.0 lb/US gal (approx. 240 g/l)
Temperature resistance (Continuous)	To 300°F (149°C)
Temperature resistance (Intermittent)	To 400°F (204°C)
Recommended dry film thickness	4.0 - 7.0 mils (100 - 175 µm) depending on system
Theoretical spreading rate	289 ft ² /US gal for 4.0 mils (7.2 m ² /l for 100 µm)
Shelf life	Base: at least 36 months when stored cool and dry Hardener: at least 18 months when stored cool and dry

Notes:

- See ADDITIONAL DATA – Overcoating intervals
- See ADDITIONAL DATA – Curing time
- Discoloration will occur at high temperatures



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RECOMMENDED SUBSTRATE CONDITIONS AND TEMPERATURES

- Coating performance is, in general, proportional to the degree of surface preparation
-

Steel

- Remove weld spatter, protrusions, and laminations in steel. Grind welds smooth in accordance with NACE RP-0178
 - Remove all surface contaminants, oil and grease in accordance with SSPC SP-1
 - Abrasive blast with an angular abrasive to an SSPC SP-10 cleanliness or higher for tank lining service. Achieve a surface profile of 2.0 – 4.0 mils (50 – 100 µm)
 - For atmospheric service, abrasive blast to SSPC SP-6 standards
 - The product may be applied over an SSPC SP-12 WJ-2(L) for non-tank lining applications where a previous blast profile can be exposed.
 - For maintenance and repair in atmospheric service, the product can be applied over surfaces prepared in accordance with SSPC SP-2 or SSPC SP-3 (hand and power tool cleaning).
 - AMERCOAT 114 A may be used as a pit filler for severely pitted steel and surface discontinuities
 - Check with PPG technical service for the maximum allowable soluble salt level for water immersion service. This will vary based on the water chemistry and service temperatures
-

Concrete

- Remove all surface contaminants such as oil, grease, and embedded chemicals
 - Abrade surface per ASTM D-4259 to remove all efflorescence and laitance, to expose subsurface voids, and to provide a surface roughness equivalent of 60 grit sandpaper or coarser
 - Surface should be free from moisture in accordance with ASTM D4263. Refer to Information Sheet # 1496ACUS for further details regarding moisture measurements
 - Slabs on grade should have a maximum moisture content of 3 lbs / 1,000 ft²/24 hours when measured by calcium chloride test
-

Non-ferrous metals

- Lightly abrasive blast or mechanically abrade in accordance with SSPC SP-16 to achieve a uniform and dense 1.5 – 4.0 mil anchor profile
-

Galvanizing

- Remove oil or soap film with detergent or emulsion cleaner, then use a phosphatizing conversion coating
 - Alternately, power tool clean to uniformly abrade the surface or lightly abrasive blast with a fine abrasive to produce a uniform and dense anchor profile of 1.0 – 3.0 mils (25 – 75 µm)
 - Galvanizing that has had at least 12 months of exterior weathering may be coated after power washing to remove all contaminants and white rust
 - Galvanized surfaces that have been passivated with a chromate treatment must be abrasive blasted. Coatings may not adhere to chromate sealed galvanizing if the chromates are not completely removed.
-

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Stainless steel

- Abrasive blast cleaning to SSPC SP-10 standards (SP-16 for stainless steel) using a fine abrasive to obtain an angular 1.0-1.5 mil anchor profile. Blast stainless steel with a non-metallic abrasive

Aged coatings and repairs

- Ensure the coating system is sound and well adhered
- Do not apply over acrylic coatings or coatings that exhibit poor solvent resistance
- A test patch is recommended to determine compatibility and adhesion
- Sweep blast or otherwise thoroughly abrade the existing coating in accordance with SSPC SP-7
- Alternately, PREP 88 may be used to prepare some existing coatings. Please refer to PREP 88 data sheet for details
- Feather the edges of tightly adhered, in-tact coatings at the perimeter of repair areas
- Power tool clean the existing steel in accordance with SSPC SP-3 (atmospheric service) or SSPC SP-11 (immersion service)

Substrate temperature and application conditions

- Surface temperature during application should be between 35°F (2°C) and 130°F (54°C)
- Surface temperature during application should be at least 5°F (3°C) above dew point
- Ambient temperature during application and curing should be between 35°F (2°C) and 100°F (38°C)
- Relative humidity during application and curing should not exceed 85%

Warning

Removal of old paint by sanding, scraping or other means may generate dust or fumes which contain lead. EXPOSURE TO LEAD DUST OR FUMES MAY CAUSE ADVERSE HEALTH EFFECTS, ESPECIALLY IN CHILDREN OR PREGNANT WOMEN. Controlling exposure to lead or other hazardous substances requires the use of proper protective equipment, such as a properly fitted and approved (e.g., NIOSH-approved) respirator and proper containment and cleanup. For additional information, contact the USEPA/Lead Information Hotline at 1-800-424-LEAD or the regional Health Canada office

SYSTEM SPECIFICATION

- Primers: Direct to substrate; AQUAPON 97-670, METALHIDE 2000, DURETHANE MCZ, DIMETCOTE- Series Primers, AMERCOAT 68HS, AMERCOAT 68MCZ
- Topcoats: PITTHANE polyurethanes, AMERCOAT polyurethanes, PSX 700, PSX One

INSTRUCTIONS FOR USE

Mixing ratio by volume: base to hardener 50:50 (1:1)

- Pre-mix pigmented components with a pneumatic air mixer at moderate speeds to homogenize the container. Add hardener to base and agitate with a power mixer for 1-2 minutes until completely dispersed

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Induction time

Mixed product induction time	
Mixed product temperature	Induction time
35°F (2°C)	40 minutes
50°F (10°C)	20 minutes
70°F (21°C)	10 minutes
90°F (32°C)	None

Pot life

4 hours at 70°F (21°C)

Note: See ADDITIONAL DATA – Pot life

Application

- Area should be sheltered from airborne particulates and pollutants
- Avoid combustion gases or other sources of carbon dioxide that may promote amine blush and ambering of light colors
- Ensure good ventilation during application and curing
- Provide shelter to prevent wind from affecting spray patterns

Material temperature

Material temperature during application should be between 35°F (2°C) and 90°F (32°C)

Air spray

- Use standard conventional equipment

Recommended thinner

THINNER 21-06 (97-727), THINNER 91-82 (AMERCOAT T-10), THINNER 91-31 (97-734) or THINNER 21-25 (AMERCOAT 101) is recommended for > 90F (32C)

Volume of thinner

0 - 15%

Nozzle orifice

Approx. 0.070 in (1.8 mm)

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Airless spray

- 45:1 pump or larger

Recommended thinner

THINNER 21-06 (97-727), THINNER 91-82 (AMERCOAT T-10), THINNER 91-31 (97-734) or THINNER 21-25 (AMERCOAT 101) is recommended for > 90F (32C)

Volume of thinner

0 - 10%

Nozzle orifice

0.017 – 0.021 in (approx. 0.43 – 0.53 mm)

Brush/roller

- Use a high quality natural bristle brush and/or solvent resistant, 3/8" nap roller. Ensure brush/roller is well loaded to avoid air entrainment. Multiple coats may be necessary to achieve adequate film-build

Recommended thinner

THINNER 21-06 (97-727), THINNER 91-82 (AMERCOAT T-10), THINNER 91-31 (97-734) or THINNER 21-25 (AMERCOAT 101) is recommended for > 90F (32C)

Volume of thinner

0 – 5%

Cleaning solvent

THINNER 90-58 (AMERCOAT 12) or THINNER 21-06 (97-727)



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ADDITIONAL DATA

Overcoating interval for DFT up to 5.0 mils (125 µm)					
Overcoating with...	Interval	32°F (0°C)	50°F (10°C)	70°F (21°C)	90°F (32°C)
itself	Minimum	24 hours	6 hours	3 hours	1.5 hours
	Maximum	3 months	2 months	30 days	14 days
urethane and PSX	Minimum	24 hours	6 hours	3 hours	1.5 hours
	Maximum	30 days	14 days	7 days	4 days

Notes:

- Dry times are dependent on air and surface temperatures as well as film thickness, ventilation, and relative humidity. Maximum recoating time is highly dependent upon actual surface temperatures – not simply air temperatures. Surface temperatures should be monitored, especially with sun-exposed or otherwise heated surfaces. Higher surface temperatures shorten the maximum recoat window
- Surface must be clean and dry. Any contamination must be identified and removed. A detergent wash with PREP 88 or equivalent is required prior to application of topcoats after 30 days of exposure. However, particular attention must be paid to surfaces exposed to sunlight where chalking may be present. In those situations, a further degree of cleaning may be required. PPG Technical Service can advise on suitable cleaning methods. If maximum recoat/topcoat time is exceeded, then roughen surface.

Curing time for DFT up to 5.0 mils (125 µm)			
Substrate temperature	Dry to touch	Dry to handle	Service- water immersion
35°F (2°C)	24 hours	38 hours	21 days
50°F (10°C)	8 hours	16 hours	7 days
70°F (21°C)	4 hours	8 hours	5 days
90°F (32°C)	1 hour	4 hours	3 days

Pot life (at application viscosity)	
Mixed product temperature	Pot life
50°F (10°C)	8 hours
70°F (21°C)	4 hours
90°F (32°C)	1.5 hours

DISCLAIMER

- For industrial or professional use only

SAFETY PRECAUTIONS

- For paint and recommended thinners see INFORMATION SHEETS 1430, 1431 and relevant Material Safety Data Sheets
- This is a solvent-borne paint and care should be taken to avoid inhalation of spray mist or vapor, as well as contact between the wet paint and exposed skin or eyes

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Danger

Rags, steel wool or waste soaked with this product may spontaneously catch fire if improperly discarded. Immediately after use, place rags, steel wool or waste in a sealed water-filled metal container. Refer to www.pittsburghpaints.com, Spontaneous Combustion Advisory for additional information.

WORLDWIDE AVAILABILITY

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WARRANTY

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AVAILABILITY

Packaging

2-gallon and 10-gallon kits

Product codes	Description
97-946	White
97-948	Gray
97-949	Hardener

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