



Submittal Documents

Water Heater Anchorage

TVC Lloyd's Station

Caliber Plumbing & Mechanical

Portland, OR

DEFERRED SUBMITTAL REVIEW (THIRD PARTY)

No Exception Taken ☒ Make Corrections Noted ☐

Rejected ☐ Revise and Re-Submit ☐

Submit Specified Item ☐

The documents contained herein have been reviewed by this office for general conformance with the design loading and for interaction of components with the primary structure.

Kramer Gehlen and Associates, Inc.
Consulting Structural Engineers

Date 07/27/2023 By NP



7/26/2023

EXPIRES: 6/30/24

ISAT
14325 N.E. Airport Way #101
Portland, OR 97230
503-252-4423

Delegated-Design Submittal Review LSW Architects, P.C.	
Project Name: LLOYD	Received On: 7/27/23
LSW Project Number: 2022-0002	Reviewed On: 07/27/2023
Submittal ID:	Reviewed By: Carrie McIntyre
Action:	
<input checked="" type="checkbox"/> No Exception Taken	<input type="checkbox"/> Revise and Resubmit
<input type="checkbox"/> Make Corrections Noted	<input type="checkbox"/> Submit Specified Item
<input type="checkbox"/> No Action Taken	<input type="checkbox"/> Rejected
<p>The delegated design work referenced in this submittal is the responsibility of the delegated-design contractor. The design-build contractor is fully responsible for the detailed design and construction and its coordination with the Work in accordance with the Contract Documents and all applicable rules, regulations, and other requirements. Review is for conformance with specified performance and design criteria, if any, and otherwise for conformance with the design concept, only. Review is not for the purpose of determining the adequacy, accuracy and completeness of the design or design services. Corrections or comments made during this review do not relieve the Contractor of its obligation to comply with the requirements of the Contract Documents.</p>	
Comments:	



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Basis for Design

BUILDING CODE:

2018 EDITION OF THE INTERNATIONAL BUILDING CODE INCLUDING PROVISIONS OF THE 2019 EDITION OF THE OREGON STRUCTURAL SPECIALTY CODE SUPPLEMENTED BY THE ASCE 7-16

EQUIPMENT:

TAG #	EXPOSED TO WIND?	HIGHEST LEVEL	ISOLATION	WEIGHT (LBS)
WATER HEATER	N	GRADE	N/A	700

MATERIAL SPECIFICATIONS:

STRUT: ASTM A653 (Fy = 42,000 PSI)

STRUT FITTINGS: ASTM A653 (Fy = 33,000 PSI)

BOLTS: ASTM A307

COLD FORMED STEEL SHALL BE GRADE 50 FOR 16 GA OR HEAVIER AND GRADE 33 FOR 18 GA AND LIGHTER.

SHEET METAL SCREWS SHALL CONFORM TO ICC REPORT ESR-1408

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Basis for Design (cont.)

BOLT/STRUT NUT TORQUE (IF NOT SUPPLIED BY THE MANUFACTURER):

1/2" DIA: 50 FT-LBS

SCOPE OF WORK:

THE SUPPORTING STRUCTURE IS BEYOND THE SCOPE OF THIS SUBMITTAL. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO SUBMIT THESE CALCULATIONS AND ASSOCIATED DOCUMENTS TO THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION TO ANALYZE THE ABILITY OF THE SUPPORTING STRUCTURE TO ACCOMMODATE THE REACTIONS FROM THE CONNECTIONS SPECIFIED IN THIS SUBMITTAL. EQUIPMENT DIMENSIONS USED IN CALCULATIONS ARE BASED ON EQUIPMENT DATA SHEETS ATTACHED. CONTRACTOR SHALL FIELD VERIFY DIMENSIONS. EFFECTS FROM THERMAL LOADING IS NOT PART OF THIS ANALYSIS. IF THERMAL LOADING NEEDS TO BE ACCOUNTED FOR ISAT SHALL BE NOTIFIED TO REDESIGN. THIS SET OF CALCULATIONS IS BASED ON THE LOADS AND ASSUMPTIONS STATED WITHIN THIS SUBMITTAL. CONTRACTOR PROCEEDS AT THEIR OWN FABRICATION AND INSTALLATION RISK PRIOR TO FINAL APPROVED SUBMITTAL. IF THE LOADS AND ASSUMPTIONS ARE NOT CORRECT THIS SUBMITTAL SHALL BE REVISED. FOR ANY SPECIAL INSPECTIONS REQUIRED REFER TO ISAT DRAWINGS/DETAILS AND BASIS FOR DESIGN FOR APPLICABLE ESR REPORT(S).

ALL STRUCTURAL STEEL AND ANCHORS EXPOSED TO WEATHER, MOIST CONDITIONS OR CHEMICAL ATTACK SHALL BE HOT DIPPED GALVANIZED OR STAINLESS STEEL OR TREATED FOR CORROSION RESISTANCE PER PROJECT SPECIFICATIONS. IN LIEU OF PROPRIETARY EPOXY ANCHOR RODS THREADED ROD MAY BE USED PROVIDED MATERIAL SPECIFICATIONS ARE MATCHED. FASTENER HOLES SHALL BE MAXIMUM 1/16" DIA. LARGER THAN BOLT DIAMETER. DOES NOT APPLY TO VERTICAL ONLY SUPPORTS, USE WASHERS AS NECESSARY FOR OVERSIZED HOLES. IF HOLES ARE OVERSIZED, THE FASTENERS OR ANCHORS CAN BE MODIFIED BY WELDING A 1/4" THICK 1 5/8" SQUARE WASHER TO THE MOUNTING HOLE WITH A 3/16" FILLET WELD APPLIED TO A MINIMUM OF (2) SIDES OF THE WASHER, BY FILLING VOID WITH EPOXY OR JB WELD PART NUMBER 8265S PRIOR TO PLACEMENT OF WASHER OR BY USE OF NEOPRENE GROMMETS. WHERE EQUIPMENT IS ANCHORED TO A HOUSE KEEPING PAD, ATTACHMENT OF PAD TO SLAB TO BE ADDRESSED BY OTHERS. WHERE ANCHORS ARE INSTALLED IN HKP TOTAL CONCRETE THICKNESS INCLUDES EXISTING SLAB THICKNESS.

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Details

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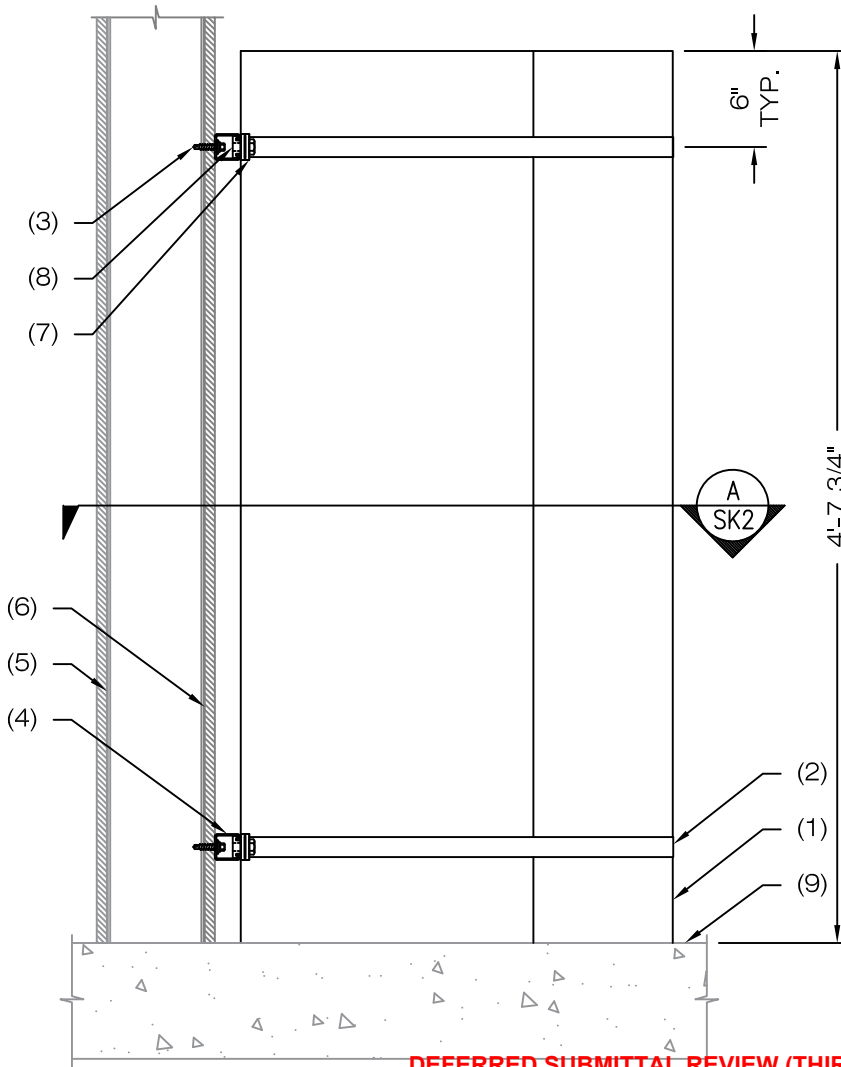
Date 07/27/2023 By NP



EXPIRES: 6/30/24

NOTES:

1. WATER HEATER - MAX. WT. = 700 LBS.
2. 1 1/2" WIDE 24 GA. METAL STRAP - TYP.
3. #14 SMS - TYP.
4. PHD 1001 OR EQUAL - TYP. - ATTACH STRUT TO MIN. (3) STUDS
5. MIN. 20 GA. STUD
6. MAX. (2) LAYERS OF 5/8" THICK GYP.
7. PHD 5002 OR EQUAL - TYP. (2) PER STRAP ATTACHMENT
8. 1/2" DIA. STRUT NUT AND BOLT - TYP.
9. (E) CONCRETE



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1

WATER HEATER ANCHORAGE ELEVATION

SCALE: 1" = 1'-0"



14325 NE AIRPORT WAY, STE. 101
503-252-4423 (Toll Free) 503-252-4427 (fax)
www.isatsb.com

PROJECT
TVC LLOYD STATION

CONTRACTOR
CALIBER PLUMBING & MECHANICAL

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REV #
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DATE
7/26/23

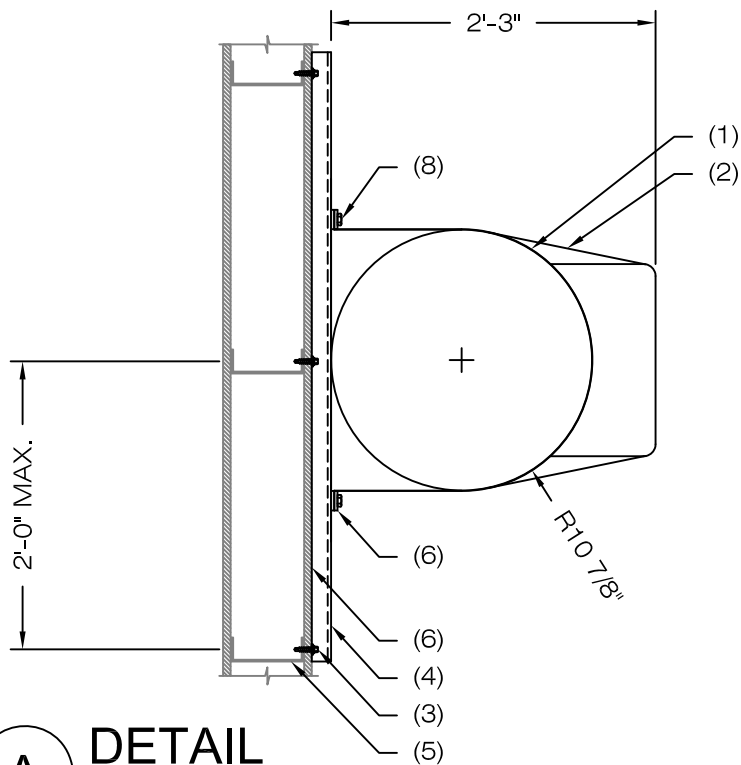
DRAWN BY
GW

DETAIL NUMBER

SK1

TASK NUMBER
233625

SUBMITTED 7/28/23



NOTES:

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2. 1 1/2" WIDE 24 GA. METAL STRAP - TYP.
3. #14 SMS - TYP.
4. PHD 1001 OR EQUAL - TYP. - ATTACH STRUT TO MIN. (3) STUDS
5. MIN. 20 GA. STUD - TYP.
6. MAX. (2) LAYERS OF 5/8" THICK GYP.
7. PHD 5002 OR EQUAL - TYP. (2) PER STRAP ATTACHMENT
8. 1/2" DIA. STRUT NUT AND BOLT - TYP.

A DETAIL

SCALE: 3/4" = 1'-0"

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PROJECT
 TVC LLOYD STATION

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Page 7 of 21

REV #
 0

DATE
 7/26/23

DRAWN BY
 GW

DETAIL NUMBER

SK2

TASK NUMBER
 233625

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Calculations

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ATC Hazards by Location

Search Information

Address: 1200 NE Broadway, Portland, OR 97232, USA
Coordinates: 45.5346390000001, -122.6529164
Elevation: 148 ft
Timestamp: 2023-07-26T21:07:30.654Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: II
Site Class: D-default



Basic Parameters

Name	Value	Description
S _S	0.876	MCE _R ground motion (period=0.2s)
S ₁	0.39	MCE _R ground motion (period=1.0s)
S _{MS}	1.052	Site-modified spectral acceleration value
S _{M1}	* null	Site-modified spectral acceleration value
S _{DS}	0.701	Numeric seismic design value at 0.2s SA
S _{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F _a	1.2	Site amplification factor at 0.2s
F _v	* null	Site amplification factor at 1.0s
CR _S	0.884	Coefficient of risk (0.2s)
CR ₁	0.868	Coefficient of risk (1.0s)
PGA	0.397	MCE _G peak ground acceleration
F _{PGA}	1.203	Site amplification factor at PGA
PGA _M	0.478	Site modified peak ground acceleration
T _L	16	Long-period transition period (s)
SsRT	0.876	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.991	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.39	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.449	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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SUBMITTED 7/28/23



SEISMIC DESIGN FORCE (SDF) CALCULATION WORKSHEET
APPLICABLE CODES: 2006 / 2009 / 2012 / 2015 / 2018 IBC (Based on ASCE 7-05/10/16)
INTERNATIONAL SEISMIC APPLICATION TECHNOLOGY
14325 NE Airport Way #101, Portland, OR 97230
PHONE 503-252-4423 | FAX 503-252-4427

Rev. 0

Project Name: TVC Lloyd Station
Location: Portland, OR
Project Zip Code: 97232
Contractor: Caliber Plumbing

Date: 7/26/2023

TABLE 1 - PROJECT SEISMIC ENGINEERING PARAMETERS

Note: The following Seismic Criteria was obtained from the structural portion of the project documents. Information not provided in the project documents has been derived from the code sections or tables noted below.

Design spectral response acceleration (5% Damped) at short periods (ASCE 7-05/10, Section 11.4.4 & ASCE 7-16, Section 11.4.5) $S_{DS} = 0.701$
Component Importance Factor (ASCE 7-05/10, Section 13.1.3) $I_p = 1.00$
Average Roof Height of Structure Relative to the Base Elevation $h = 1.00$
Factors that vary per trade. (See Table 3 below for values)
Component Amplification Factor (ASCE 7-05/10/16, Table 13.6-1) $a_p =$ (see table 3)
Component Response Modification Factor (ASCE 7-05/10/16, Table 13.6-1) $R_p =$ (see table 3)

Seismic Design Category (ASCE 7-05/10/16, Table 11.6-1) **Seismic Design Category = D**

TABLE 2 - SEISMIC DESIGN FORCE EQUATIONS (FROM ASCE 7-05/10/16, CHAPTER 13)

F_p CALCULATION (Eq. 13.3-1)	$F_{p,max}$ - MAXIMUM LIMIT (Eq. 13.3-2)	$F_{p,min}$ - MINIMUM LIMIT (Eq. 13.3-3)
$F_p = \frac{0.4a_p \times S_{DS} \times W_p \times 0.7}{(R_p/I_p)} \times (1 + 2(z/h))$	F_p need not be greater than $1.6 \times S_{DS} \times I_p \times W_p \times 0.7 = 0.79$	F_p shall not be less than $0.3 \times S_{DS} \times I_p \times W_p \times 0.7 = 0.15$

NOTE: Values in Table 2 are multiplied by a factor of 0.7 for conversion to "Allowable Stress Design" (ASCE 7-05/10/16, Section 2.4.1)

TABLE 3 - SEISMIC DESIGN FORCE (F_p) PER TRADE & FLOOR

Floor # / Story	z (Ft)	Air-Side Equipment	Wet-Side Equipment & Engines, Turbines, Pumps, Compressors & Pressure Vessels	Generators, Batteries, Inverters, Transformers, Comm. Equip., Instrumentation, and Controls	MCC's, Panel Boards, Switchgear & Misc. Components Constructed of Sheet Metal Framing	Lighting Fixtures & Other Mechanical or Electrical Components	Neoprene Isolated Eq., Suspended V.I. & Skirt Supported/Hi-Def. Curb Eq.	Spring V.I. Equipment
		$a_p = 2.5$ $R_p = 6.0$	$a_p = 1.0$ $R_p = 2.5$	$a_p = 1.0$ $R_p = 2.5$	$a_p = 2.5$ $R_p = 6.0$	$a_p = 1.0$ $R_p = 1.5$	$a_p = 2.5$ $R_p = 2.5$	$a_p = 2.5$ $R_p = 2.0$
LL	0	0.15	0.15	0.15	0.15	0.15	0.20	0.25
Roof	1	0.25	0.24	0.24	0.25	0.39	0.59	0.74

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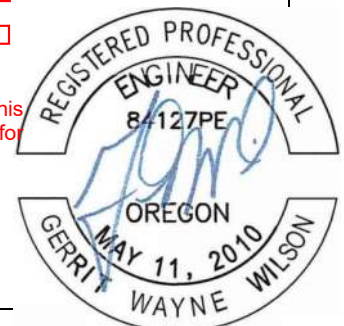
NOTE: Values in Table 3 are the resultant after comparing F_p with $F_{p,max}$ & $F_{p,min}$.

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z = Overhead Deck Elevation From Grade (ft.)
NONVIB = Non-Vibration Isolated components & systems
VIB = Vibration Isolated components & systems



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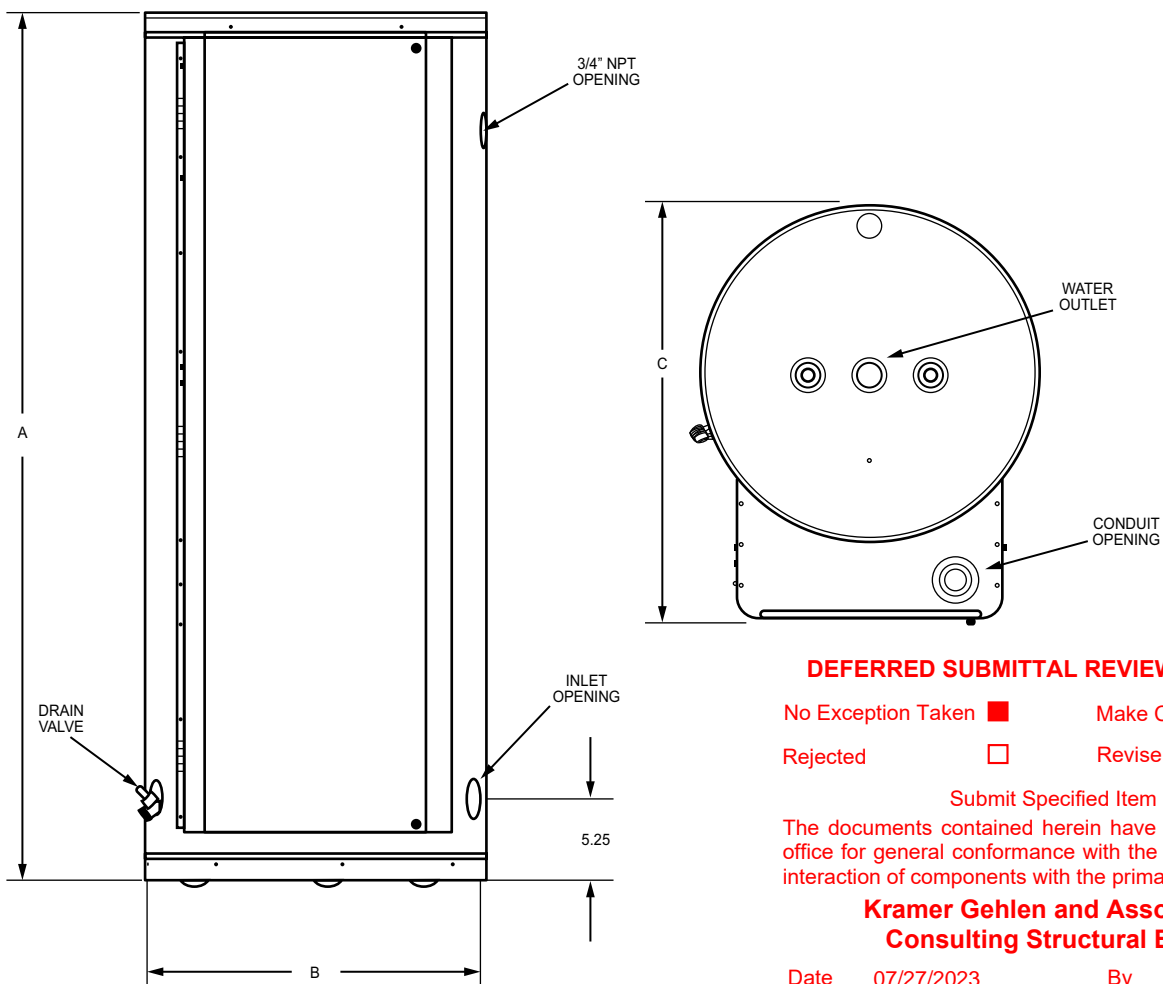


Commercial Electric

Water Heaters

OPTIONS

- UL listed conversion kits to adjust voltage and kW requirements in the field before and after installation
- ASME 160 psi (1103 kPa) tank construction
- International voltages – 220, 380, 400, 415, 575, and 600 volts, three phase available with Y connected elements
- MANIFOLD KITS – for multiple tank installations. Two heaters -part # 100109231, three heaters- part # 100109232 and four heaters- part # 100109233



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Model Number	Tank Capacity		Dimensions						Inlet/Outlet (NPT)	
			A		B		C			
	gal.	litre	Inches	cm	Inches	cm	Inches	cm	Inches	cm
CSB 52	50	189	55-3/4	142	21-3/4	55.2	27	68.6	1-1/4	3.2
CSB 82	80	302	60-1/4	153	25-1/2	64.8	31	78.7	1-1/4	3.2
CSB 120	119	450	62-1/4	158.1	29-1/2	75	35	88.9	1-1/4	3.2

For ASME Construction add "A" to the end of the model number (example: CSB 52 24 SFEA).



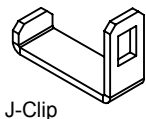
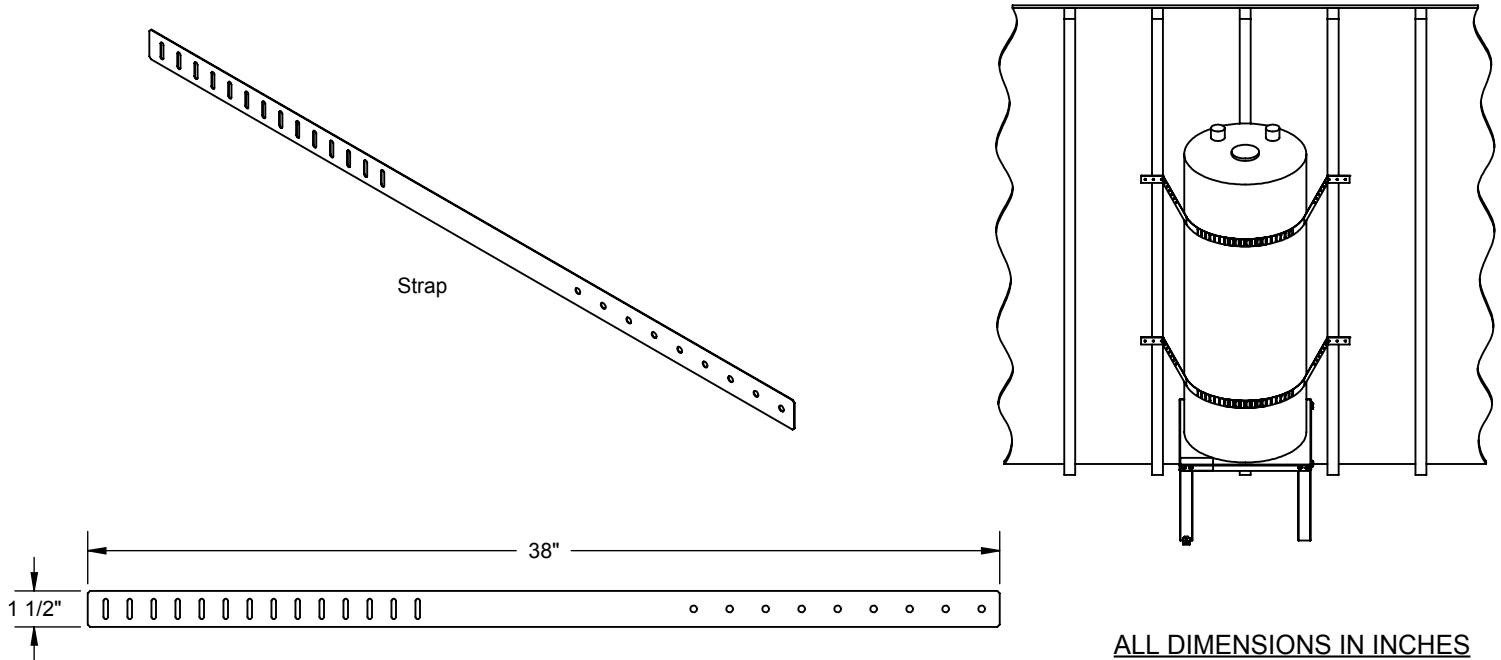
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PRODUCT SPECIFICATION DRAWING

QUICK STRAP® #QS-50

Seismic support for water heaters



J-Clip



Carriage Bolt, #3/8-16 x 3.0" long



3/8" Hex Nut



Lag Bolt, #1/4-10 x 2-1/2" Long

The QUICK STRAP® #QS-50 is a seismic/earthquake support system for water heaters up to 80 U.S. gallons in size. The system includes: (4) Straps, (4) Lag Bolts, (4) J-Clips, (2) 3/8" Carriage Bolts and (2) 3/8" Hex Nuts. The Quick Link® system allows for full adjustment from the front side of the water heater.

Product Information:

- Material: Strap, 24 gage CRS, galvanized
- California Division State Architect (DSA) approval #97-010
- UPC / IPC / IAPMO listed



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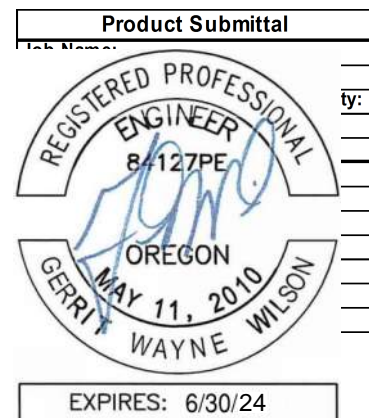
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spec_QS-50_RevK



SUBMITTED 7/28/23

Date 07/27/2023 By NP

WATER HEATER WALL ATTACHMENT

USE WORST CASE LOADING FOR ALL DESIGN CASES

WATER HEATER

$W_p = 700 \text{ LBS}$

$F_p = 0.15 * W_p = 105 \text{ LBS}$

$n = 2 \text{ STRAPS}$

$F_p / n = 53 \text{ LBS PER STRAP}$

- CHECK STRAP

MIN. THICKNESS, $t = 24 \text{ GA} = 0.0239"$

MIN. WIDTH, $w = 1.50"$

MAX. HOLE SIZE, $d = 1.0"$

$F_y = 33 \text{ KSI}$

$\Omega t = 2.0$

$T_a = t * (w - d) * F_y / \Omega t = 197 \text{ LBS} > F_p / n$, THEREFORE OK

- CHECK STRAP CONNECTION TO STRUT

3/8" STRUT NUT / BOLT

$T_a = 1000 \text{ LBS}$

$V_a = 800 \text{ LBS}$

$T_a, V_a \gg F_p / n$, OK BY INSPECTION

- CHECK STRUT TO WALL CONNECTION

USE MIN. (3) STUD CONNECTIONS PER STRUT - (1) SMS PER CONNECTION TO STUD

#14 SMS THRU 5/8" GYP & 20 GA. STUD

$T_a = 99 \text{ LBS}$ (REF. H3.9.1)

$V_a = 110 \text{ LBS}$ (REF. H3.10)

F_p PERPENDICULAR TO WALL

(TAKE HALF OF STRAP LOAD TO ONE STUD CONNECTION)

$T = (F_p / n) / 2 = 27 \text{ LBS}$

INT: $27 / 99 = 0.27 < 1.0$, OK

F_p PARALLEL TO WALL

$e = 1.625 + 27 / 2 = 15.125"$

$g = 48"$

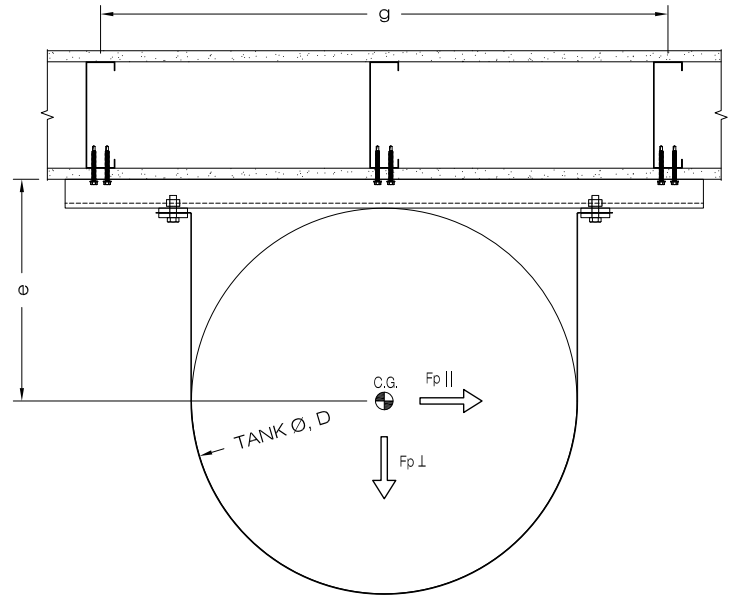
$D = 27"$

$T = (F_p / n) * e / D = 30 \text{ LBS}$

$V = (F_p / n) = 53 \text{ LBS}$

INT: $T / T_a + V / (3 * V_a) = 0.54 < 1.0$, OK

STRUT OK BY INSPECTION



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Appendix



ALLOWABLE SCREW PULL-OUT TENSION STRENGTH FOR $F_u = 45$ KSI (33 KSI YIELD STRENGTH) ¹								
MATERIAL NOT IN CONTACT WITH SCREW HEAD $\Omega = 3$								
SCREW SIZE	SCREW DIAMETER	ALLOWABLE FASTENER STRENGTH	ALLOWABLE PULL-OUT STRENGTH, P_{not} / Ω^2					
			THICKNESS OF MEMBER NOT IN CONTACT WITH SCREW HEAD					
			MIL	MIL	MIL	MIL	MIL	MIL
		P_{st} / Ω	33 (DW)	33 (ST)	43	54	68	97
	INCH	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.
#8	0.164	726	65	72	94	118	149	213
#10	0.190	386	76	84	109	137	173	247
#12	0.216	868	86	95	124	156	196	281
1/4	0.250	1067	99	110	144	180	227	325

ALLOWABLE PULL-OVER TENSION STRENGTH - $F_u = 45$ KSI (33 KSI YIELD STRENGTH) ¹								
MATERIAL IN CONTACT WITH SCREW HEAD - HEX WASHER HEAD SCREWS $\Omega^3 = 6$								
SCREW SIZE	HEX HEAD DIAMETER	ALLOWABLE FASTENER STRENGTH	ALLOWABLE PULL-OVER STRENGTH, P_{nov} / Ω^2					
			THICKNESS OF MEMBER IN CONTACT WITH SCREW HEAD					
			MIL	MIL	MIL	MIL	MIL	MIL
		P_{st} / Ω	33 (DW)	33 (ST)	43	54	68	97
	INCH	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.	LBS.
#8	0.335	363	118	130	170	213	269	384
#10	0.399	193	140	155	202	254	320	458
#12	0.415	434	146	162	211	264	333	476
1/4	0.500	533	175	195	254	318	401	574

1. MINIMUM SPACING IS TO BE THREE TIMES THE FASTENER DIAMETER. MINIMUM EDGE DISTANCE SHALL BE 1.5 TIMES THE FASTENER DIAMETER.
2. CONNECTION CAPACITY MAY BE GOVERNED BY THE ALLOWABLE TENSILE STRENGTH OF THE FASTENER. TABULATED VALUES ARE BASED ON DARTS SELF-DRILLING SCREWS GIVEN IN ESR-1408.
3. FOR ECCENTRICALLY LOADED CONNECTIONS THAT PRODUCE A NON-UNIFORM PULL-OVER FORCE ON THE FASTENER, THE NOMINAL PULL-OVER STRENGTH HAS BEEN TAKEN AS 50 PERCENT OF P_{nov} .
4. PENETRATION OF SCREWS THROUGH JOINED MATERIALS SHALL NOT BE LESS THAN 3 EXPOSED THREADS.
5. 33 MIL (DW) = 20 GA. DRYWALL, 33 MIL (ST) = 20 GA. STRUCTURAL, 43 MIL = 18 GA., 54 MIL = 16 GA., 68 MIL = 14 GA., 97 MIL = 12 GA.

SCREW TENSION DESIGN VALUES FOR METAL STUDS JOISTS AND ACCESSORIES

AI SI SPECIFICATION, S100

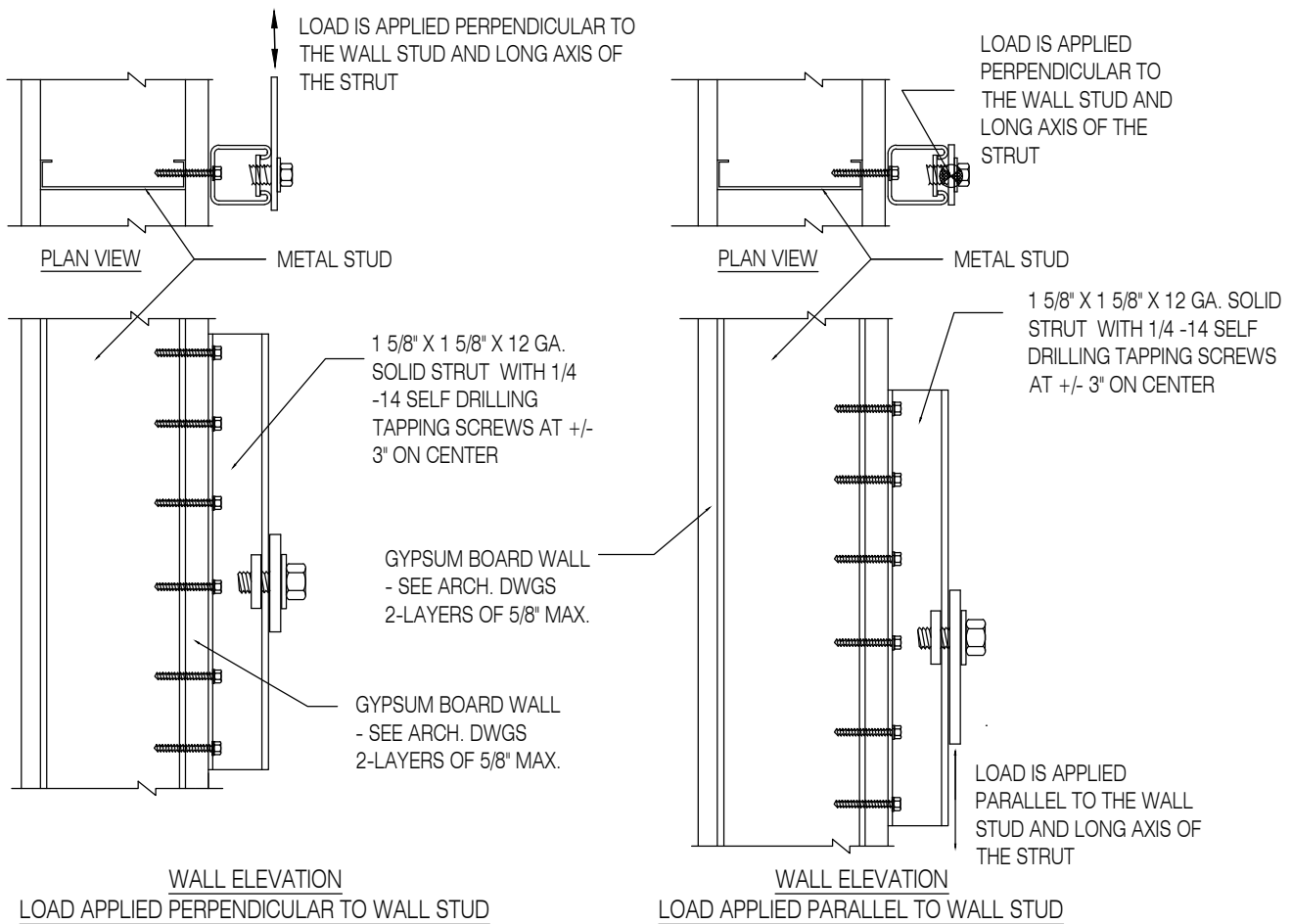


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ALLOWABLE SHEAR PER SCREW						
SCREW SIZE	WALL STUD THICKNESS (GAGE)	GYPSUM BOARD THICKNESS INCH	LOAD APPLIED PARALLEL LBS.	GYPSUM BOARD THICKNESS INCH	LOAD APPLIED PARALLEL LBS.	LOAD APPLIED PERPENDICULAR LBS.
#14	33 MIL (20 GA.)	5/8	150	(2) AT 5/8	110	30
	≥ 43 MIL (18 GA.)	5/8	225	(2) AT 5/8	165	45
#12	33 MIL (20 GA.)	5/8	140	(2) AT 5/8	100	25
	≥ 43 MIL (18 GA.)	5/8	210	(2) AT 5/8	150	40
#10	33 MIL (20 GA.)	5/8	130	(2) AT 5/8	90	25
	≥ 43 MIL (18 GA.)	5/8	190	(2) AT 5/8	140	40

NOTES:

1. THE PRINCIPLE OF SUPERPOSITION CAN BE USED TO COMBINE LOADS NOT PARALLEL OR PERPENDICULAR TO THE WALL SUCH AS A BRACE SPLAYED AT A 45 DEGREE ANGLE.
2. INSPECTION SHALL INCLUDE VERIFICATION OF SCREWS BEARING AGAINST THE STRUT AND THE STRUT BEARING AGAINST THE WALL BOARD MATERIAL.

SCREW SHEAR DESIGN VALUES FOR GYPSUM WALL (Based Static and Cyclic Load Tests)



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ICC-ES Evaluation Report

Reissued December 2022

ESR-1408

This report is subject to renewal December 2024.

DIVISION: 05 00 00—METALS
Section: 05 05 23—Metal Fastenings

DIVISION: 09 00 00—FINISHES
Section: 09 22 16.23—Fasteners

REPORT HOLDER:

PRIMESOURCE BUILDING PRODUCTS, INC.

EVALUATION SUBJECT

PRO-TWIST™ MARKER® & DARTS® SELF-DRILLING SCREWS

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018, 2015, 2012 and 2009 *International Building Code*® (IBC)
- 2021, 2018, 2015, 2012 and 2009 *International Residential Code*® (IRC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)[†]

[†]The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see [ESR-1408 LABC and LARC Supplement](#).

Property evaluated:

Structural

2.0 USES

The Pro-Twist™ Marker® & Darts® self-drilling tapping screws described in this report are used to connect cold-formed steel members together. The screws are used in engineered connections of cold-formed steel and connections prescribed by the code for cold-formed steel framing.

3.0 DESCRIPTION

3.1 General:

Pro-Twist™ Marker® & Darts® self-drilling tapping screws are manufactured from carbon steel wire complying with

ASTM A510, minimum grade 1018. See Table 1 for part numbers of evaluated screws, screw descriptions (size, tpi, length), nominal diameter, head style, head diameter, drill point, coating information, drilling capacities and minimum required protrusion length.

3.2 Pan Framer Screws:

The #7 pan framer screws comply with the material and performance requirements of ASTM C1513. The dimensions of the screws comply with the manufacturer's quality documentation. See Figure 1.

3.3 Pancake Framer Screws:

The #10 and #12 pancake framer screws comply with ASTM C1513. See Figure 2.

3.4 Hex Washer Head Screws:

The #8, #10, #12 and #14 hex washer head screws comply with ASTM C1513. See Figure 3 for coarse thread screws (HWD) and Figure 4 for fine thread screws (X5).

3.5 Modified Truss Head Screws:

The #8 and #10 modified truss head screws comply with ASTM C1513. See Figure 5.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Screw thread length must be selected on the basis of thickness of the fastened steel members plus the minimum required protrusion past the back of the supporting steel. Point selection must be based on the drilling capacity of the screw. See Table 1 for minimum required protrusion lengths and drilling capacities.

When tested for corrosion resistance in accordance with ASTM B117, the zinc coated and phosphate coated screws meet the minimum requirement listed in ASTM F1941, as required by ASTM C1513, with no white corrosion after three hours and no red rust after 24 hours of testing in accordance with

4.1.2 Prescriptive Design: The washer head and modified truss head Sections 3.3, 3.4, 3.5, respectively



ASTM C1513 screws of the same size and head style/dimension are prescribed in the IRC and in the AISI Standards referenced in IBC Section 2211 (2009 IBC Section 2210) for steel-to-steel connections.

4.1.3 Engineered Design: The pan framer, pancake framer, hex washer head and modified truss head screws described in Sections 3.2, 3.3, 3.4 and 3.5, respectively, may be used in engineered connections of cold-formed steel light-framed construction. Design of the connections must comply with Section J4 of AISI S100 (Section E4 of AISI S100 for the 2015, 2012 and 2009 IBC), using the nominal and allowable fastener tension and shear strengths for the screws provided in Table 2. Design provisions for tapping screw connections subjected to combined shear and tension loading are outside the scope of this report.

Under the 2021 IBC, for screws used in framing connections, in order for the screws to be considered fully effective, the minimum spacing between the fasteners must be 3 times the nominal screw diameter and the minimum edge distance must be 1.5 times the nominal screw diameter. Under the 2018, 2015, 2012 and 2009 IBC, for screws used in framing connections, in order for the screws to be considered fully effective, the minimum spacing between the fasteners and the minimum edge distance must be 3 times the nominal diameter of the screw, except when the edge is parallel to the direction of the applied force, in which case the minimum edge distance must be 1.5 times the nominal screw diameter. When the spacing between screws is less than 3 times the nominal screw diameter, but at least 2 times the fastener diameter, the connection shear strength determined in accordance with Section J4 of AISI S100 (Section E4 of AISI S100 for the 2015, 2012 and 2009 IBC) must be reduced by 20 percent. [Refer to Section B1.5.1.3 of AISI S240 (Section D1.5 of AISI S200 for the 2015, 2012 and 2009 IBC)].

For screws used in applications other than framing connections, the minimum spacing between the fasteners must be three times the nominal screw diameter and the minimum edge and end distances must be 1.5 times the nominal screw diameter. Additionally, under the 2009 IBC, when the distance to the end of the connected part is parallel to the line of the applied force, the allowable connection shear strength determined in accordance with Section E4.3.2 of Appendix A of AISI S100 must be considered.

The connection shear strengths are for connections where the connected steel elements are in direct contact with one another. Connected members must be checked for rupture in accordance with Section J6 of AISI S100-16 (Section E6 of AISI S100 for the 2015 IBC, Section E5 of AISI S100 for the 2012 and 2009 IBC).

4.2 Installation:

Installation of the Pro-Twist™ Marker® & Darts® self-drilling tapping screws must be in accordance with the manufacturer's published installation instructions and this report. The manufacturer's published installation instructions must be available at the jobsite at all times during installation.

Pro-Twist™ Marker® & Darts® self-drilling tapping screws must be installed perpendicular to the work surface using a

screw gun with a depth-sensitive nosepiece having a maximum speed of 2,500 rpm for Nos. 7, 8 and 10, and a maximum speed of 1,800 rpm for Nos. 12 and 14. The fastener must penetrate a minimum of three thread pitches beyond the steel substrate.

5.0 CONDITIONS OF USE

The Pro-Twist™ Marker® & Darts® self-drilling tapping screws described in this report comply with, or are suitable alternatives to what is specified in, the code indicated in Section 1.0 of this report, subject to the following conditions:

- 5.1 Fasteners must be installed in accordance with the manufacturer's published installation instructions and this report. In the event of a conflict between this report and the manufacturer's published installation instructions, this report governs.
- 5.2 The allowable loads specified in Section 4.1.3 are not allowed to be increased when the fasteners are used to resist wind or seismic forces.
- 5.3 Evaluation of screws subjected to cyclic or fatigue loading is outside the scope of this report. Applicable Seismic Design Categories shall be determined in accordance with the code for the entire assembly constructed with the screws.
- 5.4 Drawings and calculations verifying compliance with this report and the applicable code must be submitted to the code official for approval. The drawings and calculations are to be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.5 The use of screws in engineered steel deck diaphragms has not been evaluated and is outside the scope of this evaluation report.
- 5.6 The screws are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Tapping Screw Fasteners Used in Steel-to-steel Connections (AC118), dated January 2018 (editorially revised December 2020).

7.0 IDENTIFICATION

7.1 The Pro-Twist™ Marker® & Darts® screws are identified by a "PT" marking on the fastener heads. Each box of fasteners has a label showing the PrimeSource Building Products, Inc. name and address, the Pro-Twist™ Marker® & Darts® logo (see Figure 6), fastener type and size, lot number, and the evaluation report number (ESR-1408).

7.2 The report holder's contact information is the following:

PRIMESOURCE BUILDING PRODUCTS, INC.
1321 GREENWAY DRIVE
IRVING, TEXAS 75038
(972) 999-8500
www.protwist.com



EXPIRES: 6/30/24

SUBMITTED 7/28/23

TABLE 1—PRO-TWIST™ MARKER® & DARTS® SELF-DRILLING SCREWS

PART NUMBER	DESCRIPTION¹ (Nominal size- tpi × length)	BASIC (NOMINAL) SCREW DIAMETER (inch)	HEAD DIAMETER (inch)	HEAD STYLE	DRILL POINT	COATING²	DRILLING CAPACITY (inch)	MINIMUM REQUIRED PROTRUSION (inch)
PFD716	7-18 X 7/16	0.151	0.305	Pan Framer	TEK PT/2	Black Phosphate	0.033-0.112	0.167
PFZD716	7-18 X 7/16	0.151	0.305	Pan Framer	TEK PT/2	Zinc	0.033-0.112	0.167
PPH1058	10-16 X 5/8	0.190	0.431	Pancake Framer	TEK PT/3	Zinc	0.110-0.175	0.188
PPH12034	12-14 X 3/4	0.216	0.457	Pancake Framer	TEK PT/3	Zinc	0.110-0.210	0.214
HWD812	8-18 X 1/2	0.164	0.335	Hex Washer	TEK PT/2	Zinc	0.033-0.112	0.167
HWD858	8-18 X 5/8	0.164	0.335	Hex Washer	TEK PT/2	Zinc	0.033-0.112	0.167
HWD834	8-18 X 3/4	0.164	0.335	Hex Washer	TEK PT/2	Zinc	0.033-0.112	0.167
HWD8100	8-18 X 1	0.164	0.335	Hex Washer	TEK PT/2	Zinc	0.033-0.112	0.167
HWD8114	8-18 X 1 1/4	0.164	0.335	Hex Washer	TEK PT/2	Zinc	0.033-0.112	0.167
HWD8112	8-18 X 1 1/2	0.164	0.335	Hex Washer	TEK PT/2	Zinc	0.033-0.112	0.167
HWD8200	8-18 X 2	0.164	0.335	Hex Washer	TEK PT/2	Zinc	0.033-0.112	0.167
HWD1012	10-16 X 1/2	0.190	0.399	Hex Washer	TEK PT/3	Zinc	0.110-0.175	0.188
HWD1058	10-16 X 5/8	0.190	0.399	Hex Washer	TEK PT/3	Zinc	0.110-0.175	0.188
HWD1034	10-16 X 3/4	0.190	0.399	Hex Washer	TEK PT/3	Zinc	0.110-0.175	0.188
HWD10100	10-16 X 1	0.190	0.399	Hex Washer	TEK PT/3	Zinc	0.110-0.175	0.188
HWD10114	10-16 X 1 1/4	0.190	0.399	Hex Washer	TEK PT/3	Zinc	0.110-0.175	0.188
HWD10112	10-16 X 1 1/2	0.190	0.399	Hex Washer	TEK PT/3	Zinc	0.110-0.175	0.188
HWD10200	10-16 X 2	0.190	0.399	Hex Washer	TEK PT/3	Zinc	0.110-0.175	0.188
HWD12034	12-14 X 3/4	0.216	0.415	Hex Washer	TEK PT/3	Zinc	0.110-0.210	0.214
HWD12078	12-14 X 7/8	0.216	0.415	Hex Washer	TEK PT/4	Zinc	0.110-0.210	0.214
HWD12100	12-14 X 1	0.216	0.415	Hex Washer	TEK PT/3	Zinc	0.110-0.210	0.214
HWD12114	12-14 X 1 1/4	0.216	0.415	Hex Washer	TEK PT/3	Zinc	0.110-0.210	0.214
HWD12112	12-14 X 1 1/2	0.216	0.415	Hex Washer	TEK PT/3	Zinc	0.110-0.210	0.214
HWD12200	12-14 X 2	0.216	0.415	Hex Washer	TEK PT/3	Zinc	0.110-0.210	0.214
HWD12212	12-14 X 2 1/2	0.216	0.415	Hex Washer	TEK PT/3	Zinc	0.110-0.210	0.214
HWD12300	12-14 X 3	0.216	0.415	Hex Washer	TEK PT/3	Zinc	0.110-0.210	0.214
HWD14034	14-14 X 3/4	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14100	14-14 X 1	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14114	14-14 X 1 1/4	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14112	14-14 X 1 1/2	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14200	14-14 X 2	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14212	14-14 X 2 1/2	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14300	14-14 X 3	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14400	14-14 X 4	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14500	14-14 X 5	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
HWD14600	14-14 X 6	0.250	0.500	Hex Washer	TEK PT/3	Zinc	0.110-0.250	0.214
X512114	12-24 X 1 1/4	0.216	0.415	Hex Washer	TEK PT/5	PGP	0.210-0.250	0.214
X512112	12-24 X 1 1/2	0.216	0.415	Hex Washer	TEK PT/5	PGP	0.210-0.250	0.214
X512200	12-24 X 2	0.216	0.415	Hex Washer	TEK PT/5	PGP	0.210-0.250	0.214
MTD812	8-18 X 1/2	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167
MTD834	8-18 X 3/4	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167
MTD8100	8-18 X 1	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167
MTD8114	8-18 X 1 1/4	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167
MTD8158	8-18 X 1 5/8	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167



TABLE 1—PRO-TWIST™ MARKER® & DARTS® SELF-DRILLING SCREWS (Continued)

PART NUMBER	DESCRIPTION ¹ (Nominal size- tpi × length)	BASIC (NOMINAL) SCREW DIAMETER (inch)	HEAD DIAMETER (inch)	HEAD STYLE	DRILL POINT	COATING ²	DRILLING CAPACITY (inch)	MINIMUM REQUIRED PROTRUSION (inch)
MTD8178	8-18 X 1 ⁷ / ₈	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167
MTD8200	8-18 X 2	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167
MTD8212	8-18 X 2 ¹ / ₂	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167
MTD8300	8-18 X 3	0.164	0.437	Modified Truss	TEK PT/2	Zinc	0.033-0.112	0.167
MTD1034	10-16 X 3 ³ / ₄	0.190	0.437	Modified Truss	TEK PT/3	Zinc	0.110-0.175	0.188

For SI: 1 inch = 25.4 mm.

¹tpi = threads per inch²PGP = PrimeGuard Plus

TABLE 2—SHEAR AND TENSILE STRENGTHS OF PRO-TWIST™ MARKER® & DARTS® SELF-DRILLING TAPPING SCREWS

FASTENER DESCRIPTION			NOMINAL SCREW STRENGTH (lbf)		ALLOWABLE SHEAR LOAD PER FASTENER (lbf)	ALLOWABLE TENSION LOAD PER FASTENER (lbf)
Head Style	Nominal Size—tpi	Basic (Nominal) Screw Diameter (in.)	Shear, P _{ss}	Tension, P _{ts}		
Pan Framer	7-18	0.151	1,040	1,497	347	499
Pancake Framer	10-16	0.190	1,755	2,313	585	771
	12-14	0.216	2,089	2,927	696	976
Hex Washer	8-18	0.164	1,274	1,974	425	658
	10-16	0.190	1,484	1,158	495	386
	12-14	0.216	2,077	2,603	692	868
	12-24	0.216	2,447	4,200	816	1,400
	14-14	0.250	2,772	3,201	924	1,067
Modified Truss	8-18	0.164	1,363	1,993	454	664
	10-16	0.190	1,855	2,605	618	868

For SI: 1 inch = 25.4 mm, 1 lbf = 4.45 N.



EXPIRES: 6/30/24

SUBMITTED 7/28/23



FIGURE 1—PFD AND PFZD PAN FRAMER HEAD SCREW

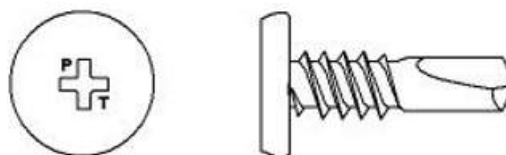


FIGURE 2—PPH PANCAKE FRAMER HEAD SCREW

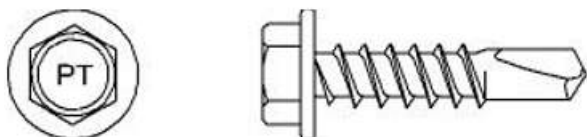


FIGURE 3—HWD HEX WASHER HEAD SCREW

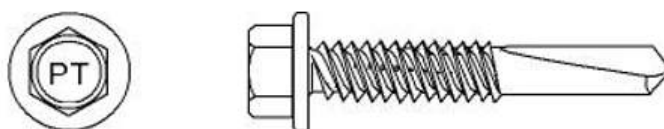


FIGURE 4—X5 HEX WASHER HEAD SCREW

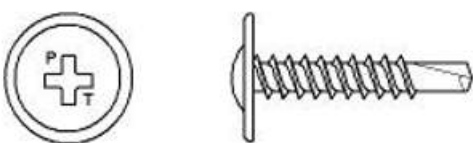


FIGURE 5—MTD MODIFIED TRUSS HEAD SCREW



FIGURE 6—PRO-TWIST™ MARKER® & DARTS® LOGO

