

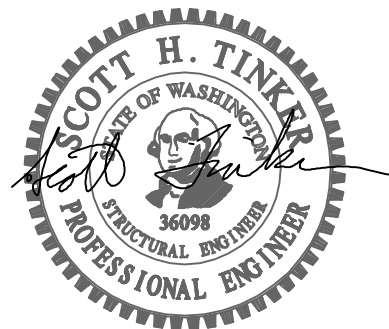
January 26, 2024

STRUCTURAL CALCULATIONS
(Permit Submittal)

CENTERIS DATA CENTER MECHANICAL ANCHOR
1023 39th Avenue SE
Puyallup, WA 98374

Quantum Job Number: 23444.01

Prepared for:
CENTERIS
18300 Cascade Ave. S
Suite 220
Seattle, WA 98188



Prepared by:
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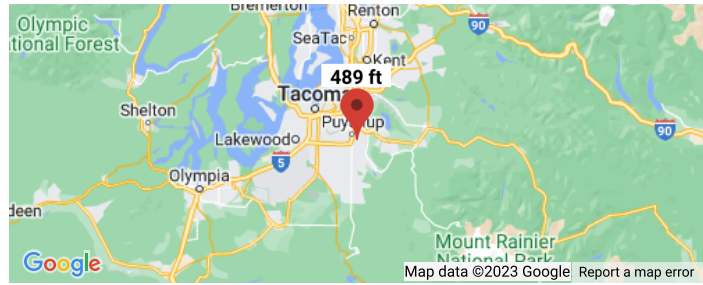
⚠ This is a beta release of the new ATC Hazards by Location website. Please [contact us](#) with feedback.

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

ATC Hazards by Location

Search Information

Address: 1015 39th Ave SE Puyallup, WA 98374
Coordinates: 47.1590004, -122.2794422
Elevation: 489 ft
Timestamp: 2023-12-01T15:14:56.409Z
Hazard Type: Seismic
Reference Document: ASCE7-16
Risk Category: III
Site Class: D-default



Basic Parameters

Name	Value	Description
S _S	1.257	MCE _R ground motion (period=0.2s)
S ₁	0.433	MCE _R ground motion (period=1.0s)
S _{MS}	1.508	Site-modified spectral acceleration value
S _{M1}	* null	Site-modified spectral acceleration value
S _{DS}	1.005	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	0.914	Coefficient of risk (0.2s)
CR ₁	0.898	Coefficient of risk (1.0s)
PGA	0.5	MCE _G peak ground acceleration
F _{PGA}	1.2	Site amplification factor at PGA
PGA _M	0.6	Site modified peak ground acceleration
T _L	6	Long-period transition period (s)
SsRT	1.257	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.375	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.433	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.483	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGA _d	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.

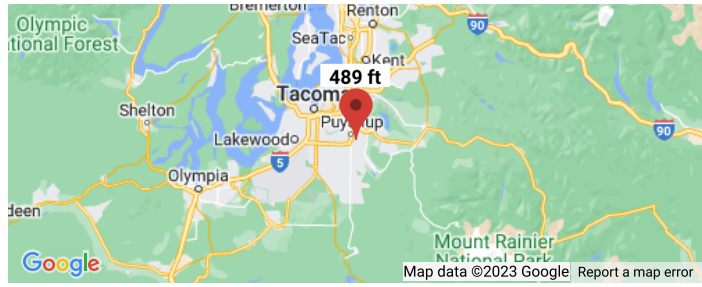
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Search Information

Address: 1015 39th Ave SE Puyallup, WA 98374
Coordinates: 47.1590004, -122.2794422
Elevation: 489 ft
Timestamp: 2023-12-01T15:13:57.333Z
Hazard Type: Wind



ASCE 7-16

MRI 10-Year 67 mph
 MRI 25-Year 73 mph
 MRI 50-Year 78 mph
 MRI 100-Year 82 mph
 Risk Category I 92 mph
 Risk Category II 97 mph
 Risk Category III 104 mph
 Risk Category IV 108 mph

ASCE 7-10

MRI 10-Year 72 mph
 MRI 25-Year 79 mph
 MRI 50-Year 85 mph
 MRI 100-Year 91 mph
 Risk Category I 100 mph
 Risk Category II 110 mph
 Risk Category III-IV 115 mph

ASCE 7-05

ASCE 7-05 Wind Speed 85 mph

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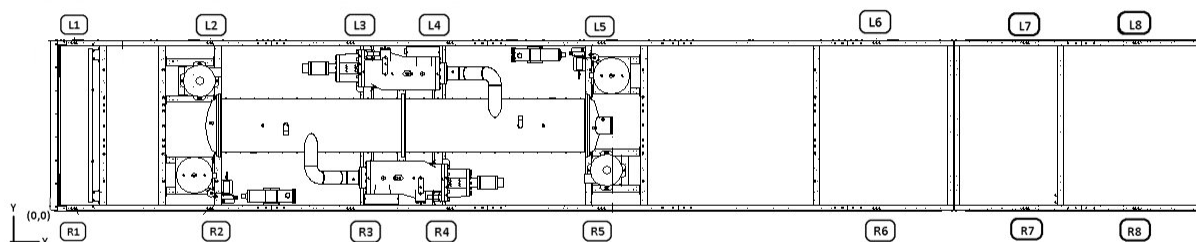
Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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Project Name	Unit Tag	Date	Chiller Type
CCI Data Center Seattle	YVAA0523	2023-08-15	Air Cooled VSD Screw Chillers
PIN			Version
YVAA0523JPK46BHVTXXXSAKLAXX4556XDFXXV151W1SXGA2BMXKXRNXGXXXB1SXX			E.21.9.29933.0-D.98.0005



LOCATION	X Distance (in)	Y Distance (in)	JCI PART NUMBER	SAP NUMBER	COLOUR	Operating Weights (lb)
R1	10.4	1.3	029-25335-002	434004	Brick Red	1156
R2	81.0	1.3	029-25335-004	434005	Charcoal	2854
R3	153.8	1.3	029-25335-004	434005	Charcoal	2992
R4	205.5	1.3	029-25335-004	434005	Charcoal	2992
R5	284.2	1.3	029-25335-004	434005	Charcoal	3247
R6	426.9	1.3	029-25335-002	434004	Brick Red	1323
R7	504.7	1.3	029-25335-001	434002	Charcoal	444
R8	561.6	1.3	029-25335-002	434004	Brick Red	827
L1	10.4	87.1	029-25335-002	434004	Brick Red	1141
L2	81.0	87.1	029-25335-004	434005	Charcoal	2835
L3	153.8	87.1	029-25335-004	434005	Charcoal	2981
L4	205.5	87.1	029-25335-004	434005	Charcoal	2981
L5	284.2	87.1	029-25335-004	434005	Charcoal	3298
L6	426.9	87.1	029-25335-002	434004	Brick Red	1323
L7	504.7	87.1	029-25335-001	434002	Charcoal	444
L8	561.6	87.1	029-25335-002	434004	Brick Red	827

Total Weight (lb)		Centre of Gravity (in)	
Operating	31665	Xg	230.8
Shipping	30309	Yg	46.1

All values are de-rated by 15% apart from those which have part number. (029-25334-013 and 029-25336-014: 0% de-rated), (029-25335-004: 10% de-rated), (029-25335-001 and 029-25335-003: 25% de-rated)

York Air Cooled Screw Chiller Foundation Design

IBC 2018, ASCE 7-16, ACI 318-14

1.) Chiller

Weight: 31.7 kips
 Total Height H: 94.68 in
 Total Width B: 85.8 in
 Total Width L: 599.27 in
 Center of Gravity: 46.1 in
 Snow Load: 25 psf

2) Seismic Design per ASCE 7-16 Chapter 13 Non-Structural Components

Weight of Chiller is less than 25% total weight of chiller and slab-on-grade.

Wet-Side HVACR

ap = 1
 Rp = 2.5
 Sds = 1.01
 Ie = 1.25

Lateral Loads

Lateral resistance is provided by the chiller anchored to the concrete slab.

Fp = 6.40 kips ASCE 7-16 EQ 13.3-1
 X Fpmin = 12.00 kips ASCE 7-16 EQ 13.3-2 Controls
 Fpmax = 63.97 kips ASCE 7-16 EQ 13.3-3

EQ = 12.00 kips

Shear Connection

Number of Anchors = 16.0 1/2" Titan HD Anchors
 with 4 1/2" Embed
 Anchor Shear = $V \cdot \Omega / \#$ = 0.75 kips/anchor < Capacity = 4.5 kips OK

Overturning Resistance About Width

	C.O.G.	EQ	OT Moment
Chiller	46.1 in	12.0 kips	46.1 k-ft
	Moment Arm	DL	Res. Moment
Resisting Dead Load	42.9 in	31.7 kips	113 k-ft
F.O.S. = M_R / M_{OT} =	2.5 OK		



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 Seattle, WA 98101

Project: Centeris Data Centers

Date: 1/25/24 Job No: 23444.01

Designer: TVM Sheet: 1

Client: Benaroya

Checked:

York Air Cooled Screw Chiller Foundation Design

IBC 2018, ASCE 7-16, ACI 318-14

3) Wind Design per ASCE 7-16 Chapter 29 Non-Building Structure Procedure

Wind Speed V:	104.0	mph	ASCE 7-16 Risk Category III
Exposure Cat.	B		
Exposure Coe Kz:	0.62		Table 26.10-1 (H = 20')
Direction Coe. Kd:	0.85		Table 26.6-1
Topo Coe. Kzt:	1.00		Sec. 26.8
V_Pressure qz =	14.6	psf	EQ 26.10-1
Gust Factor G:	0.85		Sec 26.11
Af =	394	sqft	
h/d =	1.10		
Cf =	1.30		Figure 29.4-1
F =	6.35	kips	EQ 29.4-1

Shear Connection

WL < EQ Shear Connection OK By Inspection

Overturing Resistance About Width

$M_{OT} = F \cdot H/2$	25	k-ft
$M_R = DL \cdot W/2$	113	k-ft
F.O.S. = $M_R / M_{OT} =$	4.5	OK

York Air Cooled Screw Chiller Foundation Design

IBC 2018, ASCE 7-16, ACI 318-14

4) Foundation Design

Bearing Analysis

Allowable Bearing	2000	psf
Footing Width:	47.8	ft
Footing Length:	8.2	ft
Thickened Edge Width:	1.0	ft

Dead Load:	32	kips
Snow Load:	9.7	kips
1.0DL+1.0SL Pressure:	370	psf < 2000 psf OK

Earthquake OT	46	k-ft
Applied Pressure:	118	psf
1.15DL+0.7EQ Pressure:	409	psf < 2000 psf * (4/3) OK

Sliding Analysis

Slab-on-Grade Thickness	8	in
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Allow. Coefficient of Friction:	0.3	
(0.7) Earthquake :	8.4	kips
Dead Load:	71	kips Includes Slab-on-Grade Weight
Sliding Resistance:	21.18	kips
Unity Check $U_c =$	2.52	> 1.0 OK



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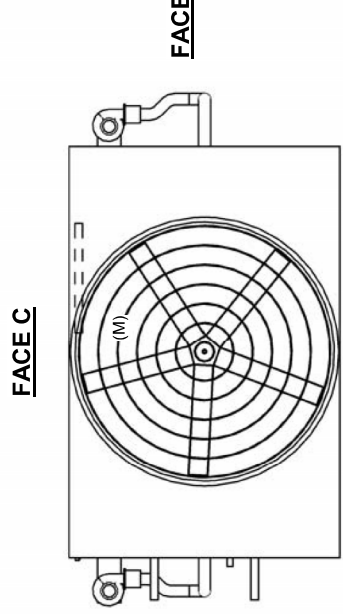
Designer: TVM Sheet: 3

Client: Benaroya

Checked:

NOTES:

1. (M)- FAN MOTOR LOCATION
2. HEAVIEST SECTION IS COIL SECTION
3. MPT DENOTES MALE PIPE THREAD
FPT DENOTES FEMALE PIPE THREAD
BFW DENOTES BEVELED FOR WELDING
GVD DENOTES GROOVED
FLG DENOTES FLANGE
4. +UNIT WEIGHT DOES NOT INCLUDE ACCESSORIES (SEE ACCESSORY DRAWINGS)
5. 3/4" [19MM] DIA. MOUNTING HOLES. REFER TO RECOMMENDED STEEL SUPPORT DRAWING
6. MAKE-UP WATER PRESSURE 20 PSI MIN [137 kPa], 50 PSI MAX [344 kPa]
7. DIMENSIONS LISTED AS FOLLOWS:
ENGLISH FT-IN
[METRIC] [mm]
8. * - APPROXIMATE DIMENSIONS DO NOT USE FOR PRE-FABRICATION OF CONNECTING PIPING



SHIPPING WEIGHT	30160 lbs+ [13685] kg+	OPERATING WEIGHT	44310 lbs+ [20100] kg+	HEAVIEST SECTION WEIGHT	21530 lbs+ [9770] kg+	NO. OF SHIPPING SECTIONS	2	DRAWN BY:	AWT
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UNIT ESW4 12-44O18-SF

DWG. #

SLWX41218-DA

TITLE STEEL SUPPORT CONFIGURATION

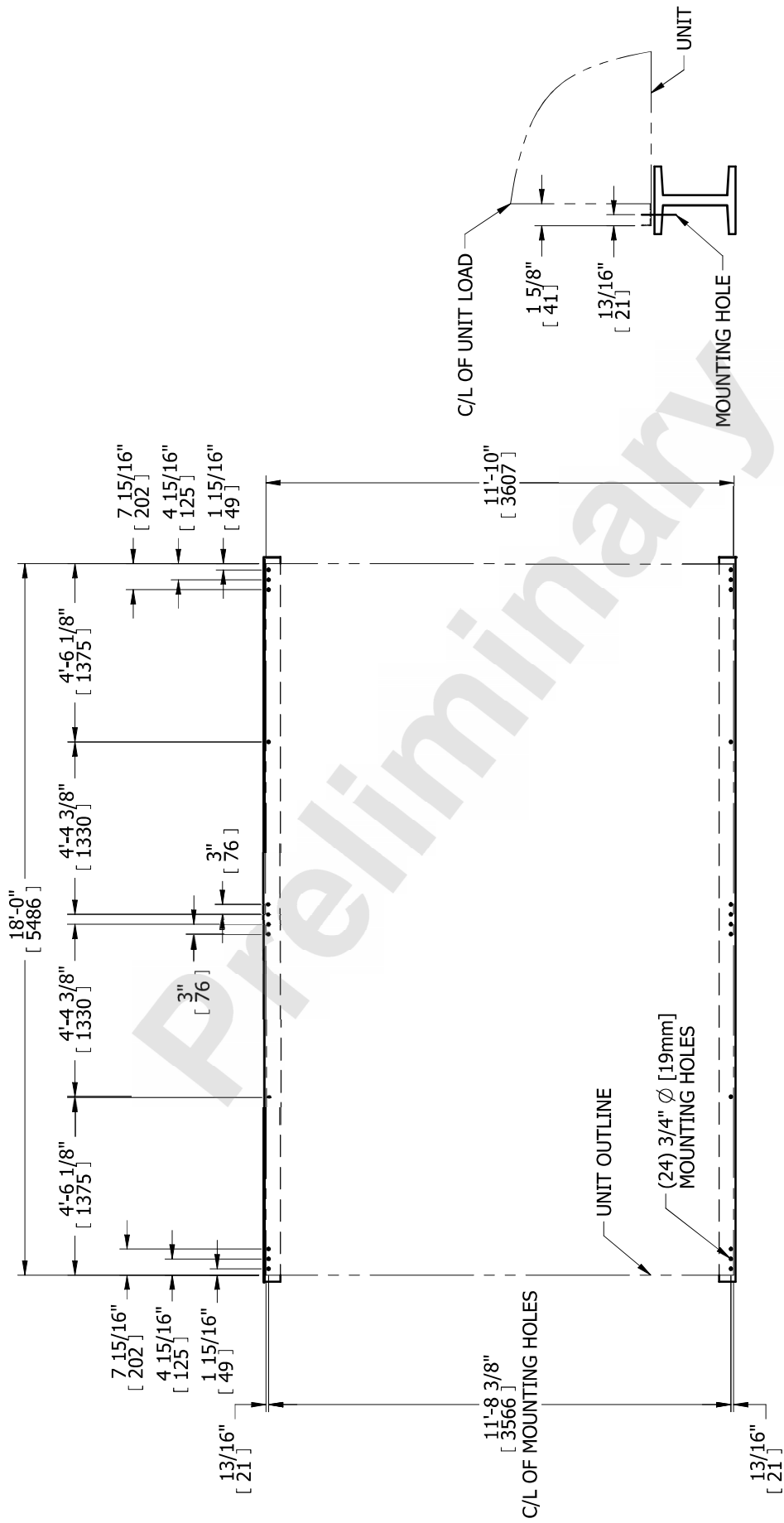
SCALE

N.T.S.

DRAWN BY MER



EVAPCO, INC.



PLAN VIEW

TYPICAL END VIEW

NOTES:

1. BEAMS SHOULD BE SIZED IN ACCORDANCE WITH ACCEPTED STRUCTURAL PRACTICES. MAXIMUM DEFLECTION OF BEAM UNDER UNIT TO BE 1/360 OF UNIT LENGTH NOT TO EXCEED 1/2" [13mm].
2. DEFLECTION MAY BE CALCULATED BY USING 55% OF THE OPERATING WEIGHT AS A UNIFORM LOAD ON EACH BEAM. SEE CERTIFIED PRINT FOR OPERATING WEIGHT.
3. SUPPORT BEAMS AND ANCHOR HARDWARE ARE TO BE FURNISHED BY OTHERS. ANCHOR HARDWARE TO BE ASTM A325 5/8" [16mm] BOLT OR EQUIVALENT.
4. BEAMS MUST BE LOCATED UNDER THE FULL LENGTH OF THE PAN SECTION.
5. SUPPORTING BEAM SURFACE MUST BE LEVEL. DO NOT LEVEL THE UNIT BY PLACING SHIMS BETWEEN THE UNIT MOUNTING FLANGE AND THE SUPPORTING BEAM.

6. THE FACTORY RECOMMENDED STEEL SUPPORT CONFIGURATION IS SHOWN. CONSULT THE FACTORY FOR ALTERNATE SUPPORT CONFIGURATIONS.
7. UNIT SHOULD BE POSITIONED ON STEEL SUCH THAT THE ANCHORING HARDWARE FULLY PENETRATES THE BEAM'S FLANGE AND CLEARS THE BEAM'S WEB.
8. WHEN VIBRATION ISOLATION IS REQUIRED, THE VIBRATION ISOLATORS (BY OTHERS) MUST BE LOCATED UNDER THE SUPPORTING BEAMS AND NOT BETWEEN THE SUPPORTING STEEL BEAMS AND THE UNIT.
9. DIMENSIONS LISTED AS FOLLOWS: ENGLISH FT-IN [METRIC] [mm]

Evapco Cooling Tower Foundation Design

IBC 2018, ASCE 7-16, ACI 318-14

1.) Chiller

Weight: 44.3 kips
 Total Height H: 242 in
 Total Width B: 142 in
 Total Width L: 216 in
 Center of Gravity: 121 in
 Snow Load: 25 psf

2) Seismic Design per ASCE 7-16 Chapter 15 Non-Building Structures

Lateral System

Cooling Towers Concrete or Steel

R: 3.5 ASCE Table 15.4-2
 Ω_0 : 1.75 ASCE Table 15.4-2
 C_d : 3.0 ASCE Table 15.4-2
 I_E : 1.25

Lateral resistance is provided by the cooling tower anchored to the concrete slab.

Cs = 0.35914 From Quantum Seismic Spreadsheet
 EQ = 15.91 kips

Shear Connection

Number of Anchors = 24.0 5/8" Titan HD Anchors with 4 1/2" Embed
 Anchor Shear = $V \cdot \Omega / \#$ = 1.16 kips/anchor < Capacity = 6.4 kips OK

Overturing Resistance About Width

	C.O.G.	EQ	OT Moment
Chiller	121 in	15.9 kips	160 k-ft

	Moment Arm	DL	Res. Moment
Resisting Dead Load	71 in	44.3 kips	262 k-ft

F.O.S. = M_R / M_{OT} = 1.6 OK

Evapco Cooling Tower Foundation Design

IBC 2018, ASCE 7-16, ACI 318-14

3) Wind Design per ASCE 7-16 Chapter 29 Non-Building Structure Procedure


Wind Speed V:	104.0	mph	ASCE 7-16 Risk Category III
Exposure Cat.	B		
Exposure Coe Kz:	0.62		Table 26.10-1 (H = 20')
Direction Coe. Kd:	0.85		Table 26.6-1
Topo Coe. Kzt:	1.00		Sec. 26.8
V_Pressure qz =	14.6	psf	EQ 26.10-1
Gust Factor G:	0.85		Sec 26.11
Af =	363	sqft	
h/d =	1.70		
Cf =	1.30		Figure 29.4-1
F =	5.85	kips	EQ 29.4-1

Shear Connection

WL < EQ Shear Connection OK By Inspection

Overturing Resistance About Width

$M_{OT} = F \cdot H / 2$	59	k-ft
$M_R = DL \cdot W / 2$	262	k-ft
F.O.S. = $M_R / M_{OT} =$	4.4	OK

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Evapco Cooling Tower Foundation Design

IBC 2018, ASCE 7-16, ACI 318-14

4) Foundation Design

Bearing Analysis

Allowable Bearing 2000 psf
 Footing Width: 47.8 ft
 Footing Length: 8.2 ft
 Thickened Edge Width: 1.0 ft


Dead Load: 44 kips
 Snow Load: 9.7 kips
 1.0DL+1.0SL Pressure: 483 psf < 2000 psf OK

Earthquake OT 160 k-ft
 Applied Pressure: 412 psf
 1.15DL+0.7EQ Pressure: 744 psf < 2000 psf * (4/3) OK

Sliding Analysis

Slab-on-Grade Thickness 8 in

Allow. Coefficient of Friction: 0.3
 (0.7) Earthquake : 11.1 kips
 Dead Load: 83 kips Includes Slab-on-Grade Weight
 Sliding Resistance: 24.97 kips
 Unity Check $U_c =$ 2.24 > 1.0 OK

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			Checked:	

Seismic Base Shear for the Equivalent Lateral Force Procedure

Per IBC 2018 & ASCE 7-16 Chapter 15.4

Structure: **Evapco Cooling Tower**
 Address: **1015 39th Ave SE Puyallup, WA 98374**
 Latitude: **47.1590** Longitude: **-122.2794**

Structure Classification

Risk Category: **III** per ASCE Table 1.5-1

Seismic Force-Resisting System: **Cooling Towers Concrete or Steel** per ASCE 15.7.14

R: **3 1/2** per ASCE Table 15.4-2
 W_o : **1 3/4** per ASCE Table 15.4-2
 C_d : **3** per ASCE Table 15.4-2
 h_n (ft): **20.00** height above the base to the highest level of the structure

Site Ground Motion

S_1 (g-sec): **0.43** S_s (g-sec): **1.26**
 Site Class: **D** **Assumed Value** per ASCE 11.4.3

ASCE 11.4.8 Exception 2 Used

F_v **1.87**

F_a **1.20**

1.2 Min Value where SC D Assumed

S_{M1} (g-sec): **0.81**

S_{MS} (g-sec): **1.51**

per ASCE 11.4.4

S_{D1} (g-sec): **0.54**

S_{DS} (g-sec): **1.01**

per ASCE 11.4.5

SDC: **D** per ASCE 11.6
 I_E : **1.25** per ASCE Table 1.5-2


Fundamental Period per ASCE 12.8.2

Period Method: **Approximate Fundamental Period**
 Structure Type: **All Other Structural Systems**
 T_L (sec): **6.00** ASCE Figures 22-14 through 22-17
 T_S : 0.54
 T_a (sec): 0.19 $C_t * h_{nx}$ per ASCE Eq. 12.8-7
 T_{use} (sec): **0.19** $\tau \leq T_L$

Equivalent Lateral Force Procedure Design Base Shear per ASCE 12.8

C_s : 0.359 = $S_{DS} / (R/I_E)$ per ASCE Eq. 12.8-2
 C_{s-max} : 1.018 = $S_{D1} / (T_a * R/I_E)$ for $T \leq T_L$ per ASCE Eq. 12.8-3
 C_{s-max} : -- = $S_{D1} * T_L / (T_a^2 * R/I_E)$ for $T > T_L$ per ASCE Eq. 12.8-4
 C_{s-min} : 0.055 per ASCE Eq. 15.4-1
 C_{s-min} : -- = $0.8S_1 / (R/I_E)$ for $S_1 \Rightarrow 0.6g$ per ASCE Eq. 15.4-2
 C_{s-use} : 0.359

V : 0.359 W = $C_{s-use} * W$ per ASCE Eq. 12.8-1

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