PANEL SCHEDULES

<N>PANEL 'FS' VOLTAGE 120/ 208 V
LOCATION FUEL STATION TYPE NQOD
AIC RATING 22 KAIC PHASE 3 WIRE 4

CKT	DESCRIPTION	BRKR P	BRKR T	LCL	KVA LOAD A	KVA LOAD B	KVA LOAD C	KVA LOAD A	KVA LOAD B	KVA LOAD C	LCL	BRKR P	BRKR T	DESCRIPTION	CKT
1	EPO RELAY	1	20	0.0	0.1			1.7			0.0	2	20	UNLEADED DISPENSER	2
3	CONTROL CIRCUIT	1	20	0.0		0.1			1.7		0.0	-	-	-----	4
5	WP RECEPT	1	20	0.0			0.2			1.7	0.0	2	20	DIESEL DISPENSER	6
7	SPARE	1	20	0.0				1.7			0.0	-	-	-----	8
9	SPARE	1	20	0.0							0.0	1	20	SPARE	10
11	SPARE	1	20	0.0							0.0	1	20	SPARE	12
13	SPARE	1	20	0.0							0.0	1	20	SPARE	14
15	SPACE			0.0							0.0			SPACE	16
17	SPACE			0.0							0.0			SPACE	18
19	SPACE			0.0							0.0			SPACE	20
21	SPACE			0.0							0.0			SPACE	22
23	SPACE			0.0							0.0			SPACE	24
25	SPACE			0.0							0.0			SPACE	26
27	SPACE			0.0							0.0			SPACE	28
29	SPACE			0.0							0.0			SPACE	30
	SUBTOTAL			0.0	0	0	0	3	2	2	0.0			SUBTOTAL	

MCB OR MLO: MCB
MAIN CIRCUIT BREAKER RATING: 100 AMPS
BUS RATING: 125 AMPS
MOUNTING: H-FRAME MOUNTED

TOTAL LOAD PHASE A: 3 KVA
TOTAL LOAD PHASE B: 2 KVA
TOTAL LOAD PHASE C: 2 KVA
TOTAL LCL (NEC/CEC 215.2.A.1): 0 KVA
TOTAL PANEL LOAD (KVA): 7 KVA
TOTAL PANEL LOAD (AMPS): 19 AMPS

OPTIONS
1 FED FROM 'MSA'
2 COPPER BUSSING
3 DOOR-IN-DOOR ENCLOSURE

V.17

<E> PANEL 'LA' VOLTAGE 120/ 208 V
LOCATION SERVICE AREA TYPE --
AIC RATING -- PHASE 3 WIRE 4

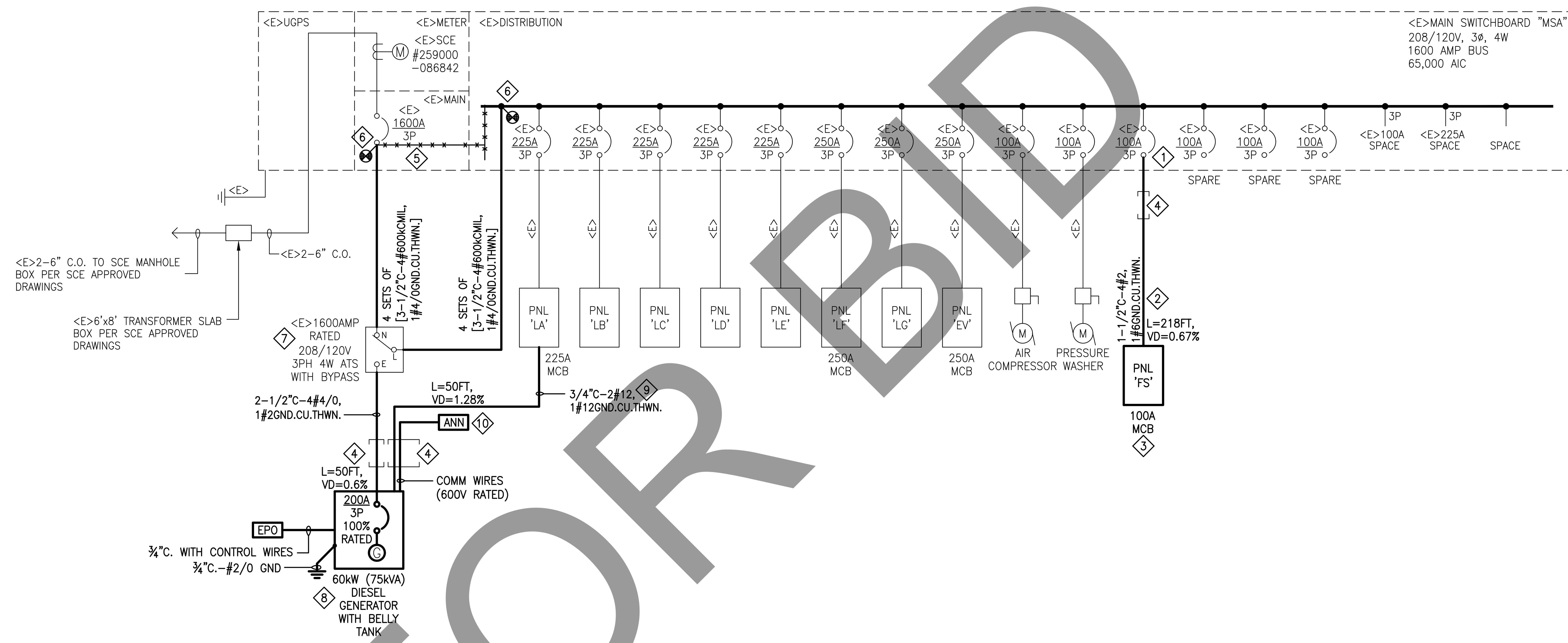
CKT	DESCRIPTION	BRKR P	BRKR T	LCL	KVA LOAD A	KVA LOAD B	KVA LOAD C	KVA LOAD A	KVA LOAD B	KVA LOAD C	LCL	BRKR P	BRKR T	DESCRIPTION	CKT
1	SERVICE 110 WEST - RECEPT	-	-	0.0	0.4			0.4			0.0	1	20	SERVICE 110 S - RECEPT	2
3	SERVICE 110 WEST - RECEPT	3	20	0.0		0.4			0.4		0.0	1	20	SERVICE 110 S - RECEPT	4
5	SERVICE 110 WEST - RECEPT	-	-	0.0			0.4			0.4	0.0	1	20	SERVICE 110 S - RECEPT	6
7	SERVICE 110 SW - CORD REELS	1	20	0.0	0.5			0.5			0.0	2	20	SERVICE 110 SE - CORD REELS	8
9	SERVICE 110 SW - CORD REELS	1	20	0.0		0.5			0.5		0.0	-	-	SERVICE 110 SE - CORD REELS	10
11	SERVICE 110 SW - CORD REELS	1	20	0.0			0.5			0.4	0.0	-	-	SERVICE 110 NE - RECEPT	12
13	SERVICE 110 N - RECEPT	1	20	0.0	0.4			0.4			0.0	3	20	SERVICE 110 NE - RECEPT	14
15	SERVICE 110 NE - CORD REELS	2	20	0.0		0.5			0.4		0.0	-	-	SERVICE 110 NE - RECEPT	16
17	SERVICE 110 NE - CORD REELS	-	-	0.0			0.5			0.5	0.0	-	-	SERVICE 110 NW - CORD REELS	18
19	SERVICE 110 LTG/EXIT SIGNS	1	20	0.0	1.1			0.5			0.0	3	20	SERVICE 110 NW - CORD REELS	20
21	FIRE ALARM CIRCUIT	1	20	0.0		0.5			0.5		0.0	-	-	SERVICE 110 NW - CORD REELS	22
23	**GENERATOR - BATTERY**	**1**	**20**	0.0			0.5			2.0	0.0	1	20	SERVICE 110 W - ROLL UP DOOR	24
25	**GENERATOR - BLOCK HEATER**	**1**	**20**	0.0	0.5			2.0			0.0	1	20	SERVICE 110 E - ROLL UP DOOR	26
27	**SPARE**	**1**	**20**	0.0					0.6		0.2 X	1	20	MOTORIZED LOUVERS	28
29	-----	-	-	0.0							0.0	-	-	-----	30
31	SPARE	3	30	0.0							0.0	3	30	SPARE	32
33	-----	-	-	0.0							0.0	-	-	-----	34
35	-----	-	-	0.0						0.5	0.0	1	30	GATE MOTOR ENTRANCE	36
37	SPARE	3	50	0.0				1.5			0.0	1	20	SITE SIGN	38
39	-----	-	-	0.0					1.5		0.0	1	20	BUILDING SIGN	40
41	SPARE	1	30	0.0						0.2	0.0	**1**	**20**	**RECEPT - WP**	42
	SUBTOTAL			0.0	3	2	2	5	4	4	0.2			SUBTOTAL	

MCB OR MLO: MCB
MAIN CIRCUIT BREAKER RATING: 225 AMPS
BUS RATING: 225 AMPS
MOUNTING: SURFACE

TOTAL LOAD PHASE A: 8 KVA
TOTAL LOAD PHASE B: 6 KVA
TOTAL LOAD PHASE C: 6 KVA
TOTAL LCL (NEC/CEC 215.2.A.1): 0 KVA
TOTAL PANEL LOAD (KVA): 20 KVA
TOTAL PANEL LOAD (AMPS): 54 AMPS

OPTIONS
1 CONTRACTOR SHALL PROVIDE NEW CIRCUIT BREAKER AT **BOLD** CIRCUIT. MATCH EXISTING FOR RATING.
2 RETURN <E>SPARE BACK TO COUNTY.

V.17



1 SINGLE LINE DIAGRAM
SCALE: N.T.S.

GENERATOR SIZING CALCULATION:

PER COUNTY PROVIDED INFO, PEAK LOAD OF VICTORVILLE FLEET MAINTENANCE BUILDING IN 2019 WAS: <208/120V 3PH 4W SYSTEM>

PEAK LOAD (2019): 38kW (~47.5kVA)
ADDITIONAL LOAD OF FUELING STATION: 7kVA
SPARE CAPACITY (25%): 14kVA
GENERATOR SHALL BE SIZED FOR: 68.5kVA (55kW)
THEREFORE, 60kW DIESEL GENERATOR WAS SELECTED.

REFERENCE SHEET NOTES

1. REUSE <E>CIRCUIT BREAKER FOR NEW FUEL PUMP STATION PANEL 'FS'. PROVIDE NEW PERMANENT NAMEPLATE. MATCH EXISTING FOR DESCRIPTION.
2. SEE SITE PLAN FOR FEEDER ROUTING. COORDINATE WITH CIVIL PLAN FOR EXACT LOCATION.
3. SEE PANEL SCHEDULE FOR CIRCUIT BREAKERS LAYOUT.
4. UTILIZE <E>UNDERGROUND 4" CONDUITS STUB UP FROM BUILDING INDOOR TO EXTERIOR AND PULL BOX. FIELD VERIFY FOR EXACT LOCATION.
5. REMOVE EXISTING CABLE/BUSS OF LOAD SIDE OF 1600AMP MAIN CIRCUIT BREAKER. FIELD VERIFY AND COORDINATE WITH MANUFACTURER FOR EXACT REQUIREMENT.
6. INTERCEPT AND EXTEND CONNECTION TO <E>1600A ATS. FIELD VERIFY AND COORDINATE WITH MANUFACTURER FOR EXACT REQUIREMENT. MODIFY EXISTING BUSS AS REQUIRED. VERIFY WITH MANUFACTURER FOR EXACT REQUIREMENT AND RE-CERTIFY SWITCHBOARD PER UL REQUIREMENT.
7. <E>ATS TO BE RELOCATED AT NEW LOCATION PER PLAN. COORDINATE WITH COUNTY FOR <E>ATS LOCATION. INSTALL LUG REDUCER AT EMERGENCY SIDE FOR 60kW GENERATOR POWER CONNECTION. COORDINATE WITH MANUFACTURER FOR REQUIREMENT.
8. DIESEL GENERATOR WITH BELLY TANK. BASIS OF DESIGN IS BASED ON GENERAC SD-060. COORDINATE WITH MANUFACTURER FOR EXACT REQUIREMENT.
9. (2) 120V POWER CONNECTION FOR BATTERY CHARGER, BLOCK HEATER AND OTHER GENERATOR ACCESSORIES. VERIFY WITH MANUFACTURER FOR EXACT REQUIREMENT.
10. PROVIDE 3/4"C WITH COMMUNICATION WIRING (600V RATED) TO GENERATOR ANNUNCIATOR. VERIFY WITH COUNTY FOR ANNUNCIATOR LOCATION.

NOT FOR BID

County of San Bernardino
BUILDING AND SAFETY
THE PLANS AND DETAILS HAVE BEEN
REVIEWED
FOR CODE COMPLIANCE
THE REVIEW OF THESE PLANS SHALL NOT BE CONSTRUED TO BE A PERMIT FOR ANY VIOLATION OF ANY CODE OR ORDINANCE OF THIS COUNTY
By
Date 03/15/2021
THESE PLANS SHALL BE ON THE JOB FOR ALL REQUIRED INSPECTIONS

REVIEWED
FOR
CODE COMPLIANCE
Mar 12, 2021
INTERWEST CONSULTING GROUP

SALASO'BRIEN
expect a difference
305 South 11th Street
San Jose, California 95112-2218
877.725.2755 | 877.925.1477 (f)
WWW.SALASOBRIEN.COM
National Strength. Local Action.

REGISTERED PROFESSIONAL ENGINEER
KIT CHAN
No. E18090
ELECTRICAL
STATE OF CALIFORNIA

COUNTY OF SAN BERNARDINO

VICTORVILLE FLEET MAINTENANCE BUILDING
15000 TOKAY STREET
VICTORVILLE, CA 92395

SBC VICTORVILLE GENERATOR & FUEL STATION

ISSUE MARK	DATE	DESCRIPTION
	04/29/20	100% CD SET
	10/23/20	100% CD REVISED SET
	02/18/21	100% CD SET

SOBE PROJECT NO: 1901457
DATE: 04/29/20
DRAWN BY: CAD
CHECKED BY: BN
APPROVED BY: AC

SHEET TITLE
ELECTRICAL SINGLE LINE DIAGRAM & PANEL SCHEDULES
SCALE: AS NOTED
THIS DRAWING IS 24" x 36" AT FULL SIZE

E-6
SHEET 13 OF 13

Modern Custom Fabrication

COMPRESS Pressure Vessel Calculations

Description: SADDLE CALCS

Project: 10K -D5 SUPERVAULT

Saddle #1

ASME Section VIII Division 1, 2001 Edition, A03 Addenda		
Saddle Material	SA 36	
Saddle Construction	Web at edge of rib	
Welded to Vessel	Yes	
Saddle Allowable Stress, S_s	23,760 psi	
Saddle Yield Stress, S_y	36,000 psi	
Foundation Allowable Stress	750 psi	
Design Pressure	**Left Saddle**	**Right Saddle**
Operating	2.67 psi	
Test	4.33 psi	
Dimensions		
Right saddle distance to datum	32"	
Tangent To Tangent Length, L	242"	
Saddle separation, L_s	178"	
Vessel Radius, R	64.3125"	
Tangent Distance Left, A_l	31"	
Tangent Distance Right, A_r	33"	
Saddle Height, H_s	68.3125"	
Saddle Contact Angle, θ	126°	
Web Plate Thickness, t_s	0.25"	
Base Plate Length, E	116.5625"	
Base Plate Width, F	11"	
Base Plate Thickness, t_b	0.75"	
Number of Stiffening Ribs, n	6	
Largest Stiffening Rib Spacing, d_i	23.0625"	
Stiffening Rib Thickness, t_w	0.25"	
Saddle Width, b	10"	
Reinforcing Plate		
Thickness, t_p	0.25"	
Width, W_p	16.5"	
Contact Angle, θ_w	138°	
Bolting		
Material	A307	
Bolt Allowable Shear	10,000 psi	
Description	1" coarse threaded	
Corrosion on root	0"	
Anchor Bolts per Saddle	4	
Base coefficient of friction, μ	0.45	
Hole Diameter	1.125"	

Slotted Hole in Which Saddle	Left Saddle	
Slotted Hole Length	1"	
Weight		
	Operating, Corroded	**Hydrotest**
Weight on Left Saddle	39,550 lb	45,256 lb
Weight on Right Saddle	40,449 lb	46,285 lb
Weight of Saddle Pair	1,294 lb	

Notes
(1) Saddle calculations are based on the method presented in "Stresses in Large Cylindrical Pressure Vessels on Two Saddle Supports" by L.P. Zick.

Stress Summary

Load	Condition	Saddle	Bending + pressure between saddles (psi)				Bending + pressure at the saddle (psi)			
			S_1 (+)	allow (+)	S_1 (-)	allow (-)	S_2 (+)	allow (+)	S_2 (-)	allow (-)
Seismic	Operating	Right Saddle	950	27,840	608	7,027	-52	27,840	-394	7,027
		Left Saddle					288	27,840	-54	7,027
Wind	Operating	Right Saddle	798	27,840	456	7,027	14	27,840	-329	7,027
		Left Saddle					297	27,840	-45	7,027
	Test	Right Saddle	1,067	32,400	512	7,027	179	32,400	-376	7,027
		Left Saddle					503	32,400	-52	7,027
Weight	Operating	Right Saddle	786	23,200	444	5,856	14	23,200	-329	5,856
		Left Saddle					297	23,200	-45	5,856

Stress Summary

Load	Condition	Saddle	Tangential shear (psi)		Circumferential stress (psi)			Stress over saddle (psi)		Splitting (psi)	
			S_3	allow	S_4 (horns)	S_4 (Wear plate)	allow (+/-)	S_5	allow	S_6	allow
Seismic	Operating	Right Saddle	2,788	18,560	-19,916	-33,339	34,800	9,006	18,000	2,439	15,840
		Left Saddle	2,776	18,560	-18,231	-30,389	34,800	8,806	18,000	2,385	15,840
Wind	Operating	Right Saddle	2,010	18,560	-14,923	-24,980	34,800	6,748	18,000	1,828	15,840
		Left Saddle	2,081	18,560	-13,662	-22,773	34,800	6,599	18,000	1,787	15,840
	Test	Right Saddle	2,240	25,920	-16,756	-28,049	32,400	7,577	32,400	2,052	32,400
		Left Saddle	2,336	25,920	-15,339	-25,569	32,400	7,409	32,400	2,007	32,400
Weight	Operating	Right Saddle	1,936	18,560	-14,530	-24,323	34,800	6,571	18,000	1,780	15,840
		Left Saddle	2,026	18,560	-13,301	-22,171	34,800	6,425	18,000	1,740	15,840

Seismic base shear on vessel	
Vessel is assumed to be a rigid structure.	
Method of seismic analysis	IBC 2018 ground supported
Vertical seismic accelerations considered	Yes
Force Multiplier	0.3333
Minimum Weight Multiplier	0.2
Importance factor, I_e	1.25
Site Class	D
Short period spectral response acceleration as percent of g, S_s	63.2
1 second spectral response acceleration as percent of g, S_1	24.2
From ASCE Table 11.4-1, F_a	1.2944
From ASCE Table 11.4-2, F_v	1.4
Risk Category (IBC Table 1604.5)	III
Hazardous, toxic, or explosive contents	No
Equations	
$S_{MS} = F_a \cdot S_s$	
$S_{M1} = F_v \cdot S_1$	
$S_{DS} = \left(\frac{2}{3}\right) \cdot S_{MS}$	
$S_{D1} = \left(\frac{2}{3}\right) \cdot S_{M1}$	
$F_p = 0.3 \cdot S_{DS} \cdot W \cdot I_e \cdot 0.7$	
Results	
$S_{MS} = 1.2944 \cdot 0.632$	0.8181
$S_{M1} = 1.4 \cdot 0.242$	0.3388
$S_{DS} = \left(\frac{2}{3}\right) \cdot 0.8181$	0.5454
$S_{D1} = \left(\frac{2}{3}\right) \cdot 0.3388$	0.2259
Seismic Design Category (Section 11.6)	D
$F_p = 0.3 \cdot 0.5454 \cdot 79{,}999 \cdot 1.25 \cdot 0.7$	11,452.71 lb_f

Saddle reactions due to weight + seismic
V_v = vertical seismic force acting on the saddle
V = horizontal seismic shear acting on the saddle (worst case if not slotted)
Seismic longitudinal reaction, Q_l
Seismic transverse reaction, Q_t

Equations

$$Q_l = \frac{V \cdot H_s}{L_s} + V_v$$

$$Q_t = \frac{V \cdot H_s}{R_o \cdot \text{Sin}(\theta \ / \ 2)} + V_v$$

$$Q = W + \max\left[Q_t, Q_l\right]$$

Results

Operating	Right Saddle	$Q_l = \frac{11{,}452.71 \cdot 68.3125}{178} + 8{,}089.8$	12,485.1 lb_f
		$Q_t = \frac{5{,}790.7 \cdot 68.3125}{64.3125 \cdot \text{Sin}(126 \ / \ 2)} + 8{,}089.8$	14,993.08 lb_f
		$Q = 40{,}449 + \max\left[14{,}993.08, 12{,}485.1\right]$	55,442.08 lb_f
	Left Saddle	$Q_l = \frac{11{,}452.71 \cdot 68.3125}{178} + 7{,}910$	12,305.3 lb_f
		$Q_t = \frac{5{,}662 \cdot 68.3125}{64.3125 \cdot \text{Sin}(126 \ / \ 2)} + 7{,}910$	14,659.85 lb_f
		$Q = 39{,}550 + \max\left[14{,}659.85, 12{,}305.3\right]$	54,209.85 lb_f

Saddle reactions due to weight + wind	
Wind longitudinal reaction, Q_l	
Wind transverse reaction, Q_t	
Wind pressure, P_w	16.7223 psf

Equations

$$V_{wt} = P_w \cdot G \cdot \left(C_{f(\text{shell})} \cdot (\text{Projected shell area}) + C_{f(\text{saddle})} \cdot (\text{Projected saddle area})\right)$$

$$V_{we} = P_w \cdot G \cdot \left(\frac{C_{f(\text{shell})} \cdot \pi \cdot R_o^2}{144} + C_{f(\text{saddle})} \cdot (\text{Projected saddle area})\right)$$

$$Q_t = \frac{V_{wt} \cdot H_s}{R_o \cdot \text{Sin}(\theta \ / \ 2)}$$

$$Q_l = \frac{V_{we} \cdot H_s}{L_s}$$

$$Q = W + \max\left[Q_t, Q_l\right]$$

Results

		$V_{wt} = 16.72 \cdot 0.85 \cdot (0.57 \cdot 112.0229 + 2 \cdot 0.2778)$	915.5 lb_f

Operating	Right Saddle	$V_{we} = 16.72 \cdot 0.85 \cdot \left(\frac{0.5 \cdot \pi \cdot 64.3125^{\ 2}}{144} + 2 \cdot 12.0398 \right)$	983.57 lb_f
		$Q_t = \frac{915.5 \cdot 68.3125}{64.3125 \cdot \text{Sin}(126\ /\ 2)}$	1,091.4 lb_f
		$Q_l = \frac{983.57 \cdot 68.3125}{178}$	377.47 lb_f
		$Q = 40{,}449 + \max\left[1{,}091.4, 377.47\right]$	41,540.4 lb_f
	Left Saddle	$V_{wt} = 16.72 \cdot 0.85 \cdot (0.57 \cdot 110.2364 + 2 \cdot 0.2778)$	901.03 lb_f
		$V_{we} = 16.72 \cdot 0.85 \cdot \left(\frac{0.5 \cdot \pi \cdot 64.3125^{\ 2}}{144} + 2 \cdot 12.0398 \right)$	983.57 lb_f
		$Q_t = \frac{901.03 \cdot 68.3125}{64.3125 \cdot \text{Sin}(126\ /\ 2)}$	1,074.14 lb_f
		$Q_l = \frac{983.57 \cdot 68.3125}{178}$	377.47 lb_f
		$Q = 39{,}550 + \max\left[1{,}074.14, 377.47\right]$	40,624.14 lb_f
Test	Right Saddle	$V_{wt} = 5.52 \cdot 0.85 \cdot (0.57 \cdot 112.0229 + 2 \cdot 0.2778)$	302.12 lb_f
		$V_{we} = 5.52 \cdot 0.85 \cdot \left(\frac{0.5 \cdot \pi \cdot 64.3125^{\ 2}}{144} + 2 \cdot 12.0398 \right)$	324.58 lb_f
		$Q_t = \frac{302.12 \cdot 68.3125}{64.3125 \cdot \text{Sin}(126\ /\ 2)}$	360.16 lb_f
		$Q_l = \frac{324.58 \cdot 68.3125}{178}$	124.57 lb_f
		$Q = 46{,}285 + \max\left[360.16, 124.57\right]$	46,645.16 lb_f
	Left Saddle	$V_{wt} = 5.52 \cdot 0.85 \cdot (0.57 \cdot 110.2364 + 2 \cdot 0.2778)$	297.34 lb_f
		$V_{we} = 5.52 \cdot 0.85 \cdot \left(\frac{0.5 \cdot \pi \cdot 64.3125^{\ 2}}{144} + 2 \cdot 12.0398 \right)$	324.58 lb_f
		$Q_t = \frac{297.34 \cdot 68.3125}{64.3125 \cdot \text{Sin}(126\ /\ 2)}$	354.47 lb_f
		$Q_l = \frac{324.58 \cdot 68.3125}{178}$	124.57 lb_f
		$Q = 45{,}256 + \max\left[354.47, 124.57\right]$	45,610.47 lb_f

Longitudinal stress between saddles (Seismic, Operating, left saddle loading and geometry govern)

$$S_1 = \pm \frac{3 \cdot K_1 \cdot Q \cdot (L\ /\ 12)}{\pi \cdot R^2 \cdot t} = \frac{3 \cdot 0.6001 \cdot 54{,}209.85 \cdot (242\ /\ 12)}{\pi \cdot 64.1875^{\ 2} \cdot 0.25} = 608 \ \ \text{psi}$$

$$S_p = \frac{P \cdot R}{2 \cdot t} = \frac{2.67 \cdot 64.0625}{2 \cdot 0.25} = 342 \ \ \text{psi}$$

Maximum tensile stress $S_{1t} = S_1 + S_p$ = 950 psi
Maximum compressive stress (shut down) $S_{1c} = S_1$ = 608 psi

Tensile stress is acceptable ($\leq 1.2 \cdot S \cdot E = 27{,}840 \text{ psi}$)

Compressive stress is acceptable ($\leq 1.2 \cdot S_c = 7{,}027 \text{ psi}$)

Longitudinal stress at the right saddle (Seismic, Operating)

$$L_e = \frac{2 \cdot H_l}{3} + L + \frac{2 \cdot H_r}{3} = \frac{2 \cdot 4.5678}{3} + 242 + \frac{2 \cdot 4.5678}{3} = 248.0903 \text{ in}$$

Seismic vertical acceleration coefficient $m = 1.397 \cdot 0.1432 = 0.2$

$$w = \frac{W_t \cdot (1 + m)}{L_e} = \frac{79{,}999 \cdot (1 + 0.2)}{248.0903} = 386.95 \text{ lb}_f\text{/in}$$

Bending moment at the right saddle:

$$M_q = w \cdot \left(\frac{2 \cdot H_r \cdot A_r}{3} + \frac{A_r^2}{2} - \frac{R^2 - H_r^2}{4} \right)$$
$$= 386.95 \cdot \left(\frac{2 \cdot 4.5678 \cdot 33}{3} + \frac{33^2}{2} - \frac{64.3125^2 - 4.5678^2}{4} \right)$$
$$= -148{,}518.6 \text{ lb}_f\text{-in}$$

$$S_2 = \pm \frac{M_q \cdot K_1'}{\pi \cdot R^2 \cdot t} = \frac{-148{,}518.6 \cdot 8.5944}{\pi \cdot 64.1875^2 \cdot 0.25} = -394 \text{ psi}$$

$$S_p = \frac{P \cdot R}{2 \cdot t} = \frac{2.67 \cdot 64.0625}{2 \cdot 0.25} = 342 \text{ psi}$$

Maximum tensile stress $S_{2t} = S_2 + S_p$ = -52 psi
Maximum compressive stress (shut down) $S_{2c} = S_2$ = -394 psi

Tensile stress is acceptable ($\leq 1.2 \cdot S = 27{,}840 \text{ psi}$)

Compressive stress is acceptable ($\leq 1.2 \cdot S_c = 7{,}027 \text{ psi}$)

Longitudinal stress at the right saddle (Weight, Operating)

$$L_e = \frac{2 \cdot H_l}{3} + L + \frac{2 \cdot H_r}{3} = \frac{2 \cdot 4.5678}{3} + 242 + \frac{2 \cdot 4.5678}{3} = 248.0903 \text{ in}$$

$$w = \frac{W_t}{L_e} = \frac{79{,}999}{248.0903} = 322.46 \text{ lb}_f\text{/in}$$

Bending moment at the right saddle:

$$M_q = w \cdot \left(\frac{2 \cdot H_r \cdot A_r}{3} + \frac{A_r^2}{2} - \frac{R^2 - H_r^2}{4} \right)$$
$$= 322.46 \cdot \left(\frac{2 \cdot 4.5678 \cdot 33}{3} + \frac{33^2}{2} - \frac{64.3125^2 - 4.5678^2}{4} \right)$$
$$= -123{,}765.5 \text{ lb}_f\text{-in}$$

$$S_2 = \pm \frac{M_q \cdot K_1'}{\pi \cdot R^2 \cdot t} = \frac{-123{,}765.5 \cdot 8.5944}{\pi \cdot 64.1875^2 \cdot 0.25} = -329 \text{ psi}$$

$$S_p = \frac{P \cdot R}{2 \cdot t} = \frac{2.67 \cdot 64.0625}{2 \cdot 0.25} = 342 \text{ psi}$$

Maximum tensile stress $S_{2t} = S_2 + S_p$ = 14 psi
Maximum compressive stress (shut down) $S_{2c} = S_2$ = -329 psi

Tensile stress is acceptable ($\leq S = 23{,}200$ psi)

Compressive stress is acceptable ($\leq S_c = 5{,}856$ psi)

Tangential shear stress in the shell (right saddle, Seismic, Operating)

$$Q_{shear} = Q - w \cdot \left(A_r + \frac{2 \cdot H_r}{3}\right) = 55{,}442.08 - 386.95 \cdot \left(33 + \frac{2 \cdot 4.5678}{3}\right) = 41{,}494.36 \ \ \text{lb}_f$$

$$S_3 = \frac{K_{2.2} \cdot Q_{shear}}{R \cdot t} = \frac{1.078 \cdot 41{,}494.36}{64.1875 \cdot 0.25} = 2{,}788 \ \ \text{psi}$$

Tangential shear stress is acceptable ($\leq 0.8 \cdot S = 18{,}560$ psi)

Circumferential stress at the right saddle horns (Seismic, Operating)

$$S_4 = \frac{-Q}{4 \cdot (t + t_p) \cdot \left(b + 1.56 \cdot \sqrt{R_o \cdot t}\right)} - \frac{12 \cdot K_3 \cdot Q \cdot R}{L \cdot \left(t^2 + t_p^2\right)}$$
$$= \frac{-55{,}442.08}{4 \cdot (0.25 + 0.25) \cdot \left(10 + 1.56 \cdot \sqrt{64.3125 \cdot 0.25}\right)} - \frac{12 \cdot 0.0129 \cdot 55{,}442.08 \cdot 64.1875}{242 \cdot \left(0.25^2 + 0.25^2\right)}$$
$$= -19{,}916 \ \ \text{psi}$$

Circumferential stress at saddle horns is acceptable ($\leq 1.5 \cdot S_a = 34{,}800$ psi)

Circumferential stress at the right saddle wear plate horns (Seismic, Operating)

$$S_4 = \frac{-Q}{4 \cdot t \cdot \left(b + 1.56 \cdot \sqrt{R_o \cdot t}\right)} - \frac{12 \cdot K_3 \cdot Q \cdot R}{L \cdot t^2}$$
$$= \frac{-55{,}442.08}{4 \cdot 0.25 \cdot \left(10 + 1.56 \cdot \sqrt{64.3125 \cdot 0.25}\right)} - \frac{12 \cdot 0.0106 \cdot 55{,}442.08 \cdot 64.1875}{242 \cdot 0.25^2}$$
$$= -33{,}339 \ \ \text{psi}$$

Circumferential stress at wear plate horns is acceptable ($\leq 1.5 \cdot S_a = 34{,}800$ psi)

Ring compression in shell over right saddle (Seismic, Operating)

$$S_5 = \frac{K_5 \cdot Q}{(t + t_p) \cdot \left(t_s + 1.56 \cdot \sqrt{R_o \cdot t_c}\right)}$$
$$= \frac{0.7388 \cdot 55{,}442.08}{(0.25 + 0.25) \cdot \left(0.25 + 1.56 \cdot \sqrt{64.3125 \cdot 0.5}\right)}$$
$$= 9{,}006 \ \ \text{psi}$$

Ring compression in shell is acceptable ($\leq 0.5 \cdot S_y = 18{,}000$ psi)

Saddle splitting load (right, Seismic, Operating)

Area resisting splitting force = Web area + wear plate area

$A_e = H_{eff} \cdot t_s + t_p \cdot W_p = 3 \cdot 0.25 + 0.25 \cdot 16.5$ = 4.875 in^2

$$S_6 = \frac{K_8 \cdot Q}{A_e} = \frac{0.2145 \cdot 55{,}442.08}{4.875} = 2{,}439 \ \ \text{psi}$$

Stress in saddle is acceptable $\left(\leq \frac{2}{3} \cdot S_s = 15{,}840 \ \ \text{psi}\right)$

Shear stress in anchor bolting, one end slotted

Maximum seismic or wind base shear $= 11{,}452.71 \ \ \mathrm{lb}_f$

Thermal expansion base shear $= W \cdot \mu$ = 40,197*0.45 $= 18{,}088.65 \ \ \mathrm{lb}_f$

Corroded root area for a 1" coarse threaded bolt $= 0.551 \ \ \mathrm{in}^2$ (4 per saddle)

Bolt shear stress = $\dfrac{18{,}088.65}{0.551 \cdot 1 \cdot 4} = 8{,}207 \ \ \mathrm{psi}$

Anchor bolt stress is acceptable (≤ 10,000 psi)

Shear stress in anchor bolting, transverse

Maximum seismic or wind base shear $= 11{,}452.71 \ \ \mathrm{lb}_f$

Corroded root area for a 1" coarse threaded bolt $= 0.551 \ \ \mathrm{in}^2$ (4 per saddle)

Bolt shear stress = $\dfrac{11{,}452.71}{0.551 \cdot 2 \cdot 4} = 2{,}598 \ \ \mathrm{psi}$

Anchor bolt stress is acceptable (≤ 10,000 psi)

Web plate buckling check (Escoe pg 251)

Allowable compressive stress S_c = min(23,760 , 3,942) = 3,942 psi

$$S_c = \frac{K_i \cdot \pi^2 \cdot E}{12 \cdot \left(1 - 0.3^{\,2}\right) \cdot \left(\frac{d_i}{t_s}\right)^2} = \frac{1.28 \cdot \pi^2 \cdot 29\mathrm{E}{+}06}{12 \cdot \left(1 - 0.3^{\,2}\right) \cdot \left(\frac{23.0625}{0.25}\right)^2} = 3{,}942 \ \ \mathrm{psi}$$

Allowable compressive load on the saddle

$$b_e = \frac{d_i \cdot t_s}{(d_i \cdot t_s) + 2 \cdot t_w \cdot (b - 1)} = \frac{23.0625 \cdot 0.25}{(23.0625 \cdot 0.25) + 2 \cdot 0.25 \cdot (10 - 1)} = 0.5616$$

$$F_b = n \cdot (A_s + 2 \cdot b_e \cdot t_s) \cdot S_c = 6 \cdot (2.4375 + 2 \cdot 0.5616 \cdot 0.25) \cdot 3{,}942 = 64{,}299.04 \ \ \mathrm{lb}_f$$

Saddle loading of 56,089.08 lb_f is ≤ F_b; satisfactory.

Primary bending + axial stress in the saddle due to end loads (assumes one saddle slotted)

$$\sigma_b = \frac{V \cdot (H_s - x_o) \cdot y}{I} + \frac{Q}{A} = \frac{11{,}452.71 \cdot (68.3125 - 52.1145) \cdot 5.975}{196.32} + \frac{55{,}442.08}{43.2764} = 6{,}927 \ \ \mathrm{psi}$$

The primary bending + axial stress in the saddle ≤ S_s = 23,760 psi; satisfactory.

Secondary bending + axial stress in the saddle due to end loads (includes thermal expansion, assumes one saddle slotted)

$$\sigma_b = \frac{V \cdot (H_s - x_o) \cdot y}{I} + \frac{Q}{A} = \frac{29{,}541.36 \cdot (68.3125 - 52.1145) \cdot 5.975}{196.32} + \frac{54{,}209.85}{43.2764} = 15{,}816 \ \ \mathrm{psi}$$

The secondary bending + axial stress in the saddle ≤ 2*S_y = 72,000 psi; satisfactory.

Saddle base plate thickness check (Roark sixth edition, Table 26, case 7a)

where $a = 23.0625, b = 10.75 \ \ \mathrm{in}$

$$t_b = \sqrt{\frac{\beta_1 \cdot q \cdot b^2}{1.5 \cdot S_a}} = \sqrt{\frac{1.8979 \cdot 44 \cdot 10.75^{\,2}}{1.5 \cdot 23{,}760}} = 0.5189 \ \ \mathrm{in}$$

The base plate thickness of 0.75 in is adequate.

Foundation bearing check

$$S_f = \frac{Q_{\max}}{F \cdot E} = \frac{56{,}089.08}{11 \cdot 116.5625} = 44 \ \ \mathrm{psi}$$

Concrete bearing stress ≤ 750 psi ; satisfactory.

PSOMAS

Structural Design Calculations for

Generator and Tank Concrete Pad and Anchors

Prepared For

Victorville Fuel Station

Psomas Project Number

2OBR010100

Calculations by

Doug Fredericks

10/7/2020

PSOMAS

Client: Victorville Fuel Station
Project: Generator Concrete Pad
Project #: 2OBR010100
Date: 10/7/2020
Prepared by: Doug Fredericks

General Site Information

Type	Value	Description
S_S	1.288	MCE_R ground motion. (for 0.2 second period)
S_1	0.498	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.545	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.03	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
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	12	Long-period transition period in seconds
SsRT	1.288	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.38	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.498	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.544	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.933	Mapped value of the risk coefficient at short periods
C_{R1}	0.915	Mapped value of the risk coefficient at a period of 1 s

PSOMAS

Client:	Victorville Fuel Station
Project:	Generator Concrete Pad
Project #:	2OBR010100
Date:	10/7/2020
Prepared by:	Doug Fredericks

Generator CIP Concrete Pad and Anchors

ASCE 7-16 Section 15 for Rigid Non-Building Structure

Dead Loads

	Component W		z to Component CG	
Generator Open Set	2.425	k	5.375	ft
Enclosure	0.625	k	5.375	ft
Tank	1.365	k	1.792	ft
W_{top}	3.05	kip		
W_{bot}	1.365	kip	*(total weight of components)*	

Wind Load

ASCE 7-16 Section 29.4

V		110	mph
Exposure Cat =	C		
Kz =		0.85	
Kzt =		1	
Ke =		1	
Kd		0.85	
qz =		22.38	
GCpi =		0.85	
Cf		1.45	
F		27.58	x Af
Width of Unit		10.667	ft
Height of Unit		7.167	ft
Af		76.44	ft^2
F		2108.61	p
Wind OM		7.56	k-ft

Seismic Calculations

ASCE 7-16 Section 15 for Rigid Non-Building Structure; 0.3 x Ie x Sds

Risk Category	III			
Ie		1.25		*(importance factor)*
S_{DS}		1.036	g	*(design short period spectral acceleration)*
V		0.388	x W	*(ASCE 15.4-5) (S1 is not > 0.6g)*

Vertical: 0.2 x Sds

Vert	0.207	x W

Seismic Overturning Moment about Anchors

Item	W (k)	V (k)	z (ft)	Mmt (k-ft)
Generator Open Set	2.425	0.942	5.375	13.034
Enclosure	0.625	0.243	5.375	3.359
Tank	1.365	0.530	1.792	2.446
Total	4.415	1.714		18.839

Seismic Vertical Overturning Moment about One Row of Anchors

Item	W (k)	Vert (k)	b/2 (ft)	Mmt (k-ft)
Total	4.415	0.914	1.667	1.372

Resisting Overturning Moment about One Row of Anchors

Item	W (k)	b/2 (ft)	0.9*Mmt (k-ft)
Total	4.415	1.667	6.623

Anchor Tie Down Force

Resisting Mmt	6.623	k-ft
Total Seismic Mmt	20.211	k-ft
Remainder	13.588	k-ft
Tu	4.077	kips per row

Concrete Pad

W	5.50	ft	*(width)*
L	12.00	ft	*(length)*
t	1.25	ft	*(thickness)*
A	66.00	ft^2	*(area of pad)*
I	166.38	ft4	*(Mmt of Inertia of pad)*
γ	0.15	kcf	*(unit weight of concrete)*
P	82.50	kip	*(weight of pad)*

Slab Overturning Moment Check

Slab OT Mmt	20.02	k-ft	*(Slab weight x Seismic factor x thickness/2)*
Equipment OT Mmt	9.46	k-ft	*(Equip weight x seismic factor x (z+thickness)*
OM	29.48	k-ft	*(overturning moment)*
Wind OM	7.56	k-ft	*(overturning moment)*
RM	239.02	k-ft	*(resisting moment)*
OT Factor of Safety	8.11		

OK

Soil Pressures at Seismic Overturning

P/A	1.3	ksf	*Sum of Weight / Area of pad*
Mc/I	0.49	ft	*(eccentricity)*
q_{max}	1.804	ksf	*(maximum soil pressure)*
q_{max}	0.830	ksf	*(minimum soil pressure)*
Max Allow Soil Pressure	2.000	ksf	*Use 1500 psf for non-seismic allowable*
	OK		*and apply 1.333*

Concrete Pad Capacity

f'_c	4	ksi	*(compressive strength of concrete)*
f_y	60	ksi	*(yield strength of steel)*
b	12	in	*(effective width for 1' strip)*
bar	#6		*(bar size)*
dbar	0.75	in	*(diameter of bar)*
clr	3	in	*(clear to rebar)*
s	12	in	*(rebar spacing)*
A_s	0.44	in^2	*(area of steel)*
d	11.25	in	*(effective depth)*
$\rho_{prov'd}$	0.0033		*(reinforcement ratio)*
ρ_{min}	0.0032		*(min reinforcement ratio)*
ϕV_c	**6.40**	kip/ft	*(shear capacity of concrete)*
ϕM_n	267.3	k-in	*(moment capacity)*
	22.28	k-ft/ft	*(moment capacity)*

Concrete Slab Loading Demand

L	2.5	ft	*(Length of slab overhanging equipment base)*
V_u	4.51	k	*(qmax applied to overhang)*
	OK, No Shear Reinforcement Needed		
M_u	5.64	k-ft	*(qmax applied to overhang)*
	OK, Flexural Reinforcement Adequate		

Anchor Bolts Load Demand

Tu	4.08	k-ft	
# of anchors / row	5		*(number of anchors per side)*
Tu per anchor	**0.815**	kip	*(max tension for bolts to resist)*
V of Equipment	1.714	kip	*(Seismic shear of equipment)*
Sliding Resistance	0.915	kip	*(Use 0.3 friction factor)*
V Remainder	0.799	kip	
Vu per anchor	**0.080**	kip	

Anchor Bolts Resistance

Type	Stainless Steel KB-TZ Hilti anchors		
Design Strength per Manufacturer			
f'c	4000	psi	
Anchor diameter	0.50	in	
Nominal Embedment	3.25	in	
Tension	2.735	k	< OK >
Shear	6.880	k	< OK >
Unity check	0.134		< OK >

TABLE 4—DESIGN INFORMATION, STAINLESS STEEL KB-TZ

DESIGN INFORMATION	Symbol	Units	Nominal anchor diameter									
			$^3/_8$		$^1/_2$				$^5/_8$			
Anchor O.D.	d_a	in. (mm)	0.375 (9.5)		0.5 (12.7)				0.625 (15.9)			
Effective min. embedment[1]	h_{ef}	in. (mm)	2 (51)		2 (51)		$3^1/_4$ (83)		$3^1/_8$ (79)	4 (102)		
Min. member thickness	h_{min}	in. (mm)	4 (102)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)	
Critical edge distance	c_{ac}	in. (mm)	$4^3/_8$ (111)	$3^7/_8$ (98)	$5^1/_2$ (140)	$4^1/_2$ (114)	$7^1/_2$ (191)	6 (152)	7 (178)	$8^7/_8$ (225)	6 (152)	
Min. edge distance	c_{min}	in. (mm)	$2^1/_2$ (64)		$2^7/_8$ (73)		$2^1/_8$ (54)		$3^1/_4$ (83)	$2^3/_8$ (60)		
	for $s \geq$	in. (mm)	5 (127)		$5^3/_4$ (146)		$5^1/_4$ (133)		$5^1/_2$ (140)	$5^1/_2$ (140)		
Min. anchor spacing	s_{min}	in. (mm)	$2^1/_4$ (57)		$2^7/_8$ (73)		2 (51)		$2^3/_4$ (70)	$2^3/_8$ (60)		
	for $c \geq$	in. (mm)	$3^1/_2$ (89)		$4^1/_2$ (114)		$3^1/_4$ (83)		$4^1/_8$ (105)	$4^1/_4$ (108)		
Min. hole depth in concrete	h_o	in. (mm)	$2^5/_8$ (67)		$2^5/_8$ (67)		4 (102)		$3^3/_4$ (98)	$4^3/_4$ (121)		
Min. specified yield strength	f_y	lb/in² (N/mm²)	92,000 (634)		92,000 (634)				92,000 (634)			
Min. specified ult. Strength	f_{uta}	lb/in² (N/mm²)	115,000 (793)		115,000 (793)				115,000 (793)			
Effective tensile stress area	$A_{se,N}$	in² (mm²)	0.052 (33.6)		0.101 (65.0)				0.162 (104.6)			
Steel strength in tension	N_{sa}	lb (kN)	5,968 (26.6)		11,554 (51.7)				17,880 (82.9)			
Steel strength in shear	V_{sa}	lb (kN)	4,720 (21.0)		6,880 (30.6)				9,870 (43.9)			
Pullout strength in tension, seismic[2]	$N_{p,eq}$	lb (kN)	2,340 (10.4)		2,735 (12.2)		NA		NA	5,840 (26.0)		
Steel strength in shear, seismic[2]	$V_{sa,eq}$	lb (kN)	2,825 (12.6)		6,880 (30.6)				9,350 (41.6)			
Pullout strength uncracked concrete[3]	$N_{p,uncr}$	lb (kN)	2,630 (11.7)		NA		5,760 (25.6)		NA			
Pullout strength cracked concrete[3]	$N_{p,cr}$	lb (kN)	2,340 (10.4)		3,180 (14.1)		NA		NA	5,840 (26.0)		

Client:	Victorville Fuel Station
Project:	Generator Concrete Pad
Project #:	2OBR010100
Date:	10/7/2020
Prepared by:	Doug Fredericks

Above Ground Tank CIP Concrete Pad and Anchors

ASCE 7-16 Section 15 for Rigid Non-Building Structure

Dead Loads

	Component W		z to Component CG	
Each Tank Shell	45	k	6.6666667	ft
Diesel	66.5	k	6.6666667	ft
Other	0	k	0.000	ft
W_{top}	111.5	kip		
W_{bot}	0	kip	*(total weight of components)*	

Wind Load

ASCE 7-16 Section 29.4

V	110	mph
Exposure Cat =	C	
Kz =	0.85	
Kzt =	1	
Ke =	1	
Kd	0.85	
qz =	22.38	
GCpi =	0.85	
Cf	1.45	
F	27.58	x Af
Width of Unit	20.250	ft
Height of Unit	12.000	ft
Af	243.00	ft^2
F	6702.80	p
Wind OM	40.22	k-ft

Seismic Calculations

ASCE 7-16 Section 15 for Rigid Non-Building Structure; 0.3 x Ie x Sds

Risk Category	III		
Ie	1.25		*(importance factor)*
S_{DS}	1.294	g	*(design short period spectral acceleration)*
V	0.485	x W	*(ASCE 15.4-5) (S1 is not > 0.6g)*

Vertical: 0.2 x Sds

Vert	0.259	x W

Seismic Overturning Moment about Anchors

Item	W (k)	V (k)	z (ft)	Mmt (k-ft)
Each Tank Shell	45.000	21.844	6.667	145.625
Diesel	66.500	32.280	6.667	215.201
Other	0.000	0.000	0.000	0.000
Total	111.500	54.124		360.825

Seismic Vertical Overturning Moment about One Row of Anchors

Item	W (k)	Vert (k)	b/2 (ft)	Mmt (k-ft)
Total	111.500	28.866	5.333	138.557

Resisting Overturning Moment about One Row of Anchors

Item	W (k)	b/2 (ft)	0.9*Mmt (k-ft)
Total	111.500	5.333	535.200

Anchor Tie Down Force

Resisting Mmt	535.200	k-ft	
Total Seismic Mmt	998.764	k-ft	*Omega = 2*
Remainder	463.564	k-ft	
Tu	43.459	kips per row	

Concrete Pad

W	16.00	ft	*(width)*
L	20.00	ft	*(length)*
t	1.00	ft	*(thickness)*
A	320.00	ft^2	*(area of pad)*
I	6826.67	ft4	*(Mmt of Inertia of pad)*
γ	0.15	kcf	*(unit weight of concrete)*
P	320.00	kip	*(weight of pad)*

Slab Overturning Moment Check

Slab OT Mmt	77.67	k-ft	*(Slab weight x Seismic factor x thickness/2)*
Equipment OT Mmt	414.95	k-ft	*(Equipment weight x seismic factor x (z+thickness)*
OM	492.62	k-ft	*(overturning moment)*
Wind OM	40.22	k-ft	*(overturning moment)*
RM	3452.00	k-ft	*(resisting moment)*
OT Factor of Safety	7.01		
	OK		

Soil Pressures at Seismic Overturning

P/A	1.3	ksf	*Sum of Weight / Area of pad*
Mc/I	0.58	ft	*(eccentricity)*
q_{max}	1.926	ksf	*(maximum soil pressure)*
q_{max}	0.771	ksf	*(minimum soil pressure)*
Max Allow Soil Pressure	2.000	ksf	*Use 1500 psf for non-seismic allowable*
	OK		*and apply 1.333*

Concrete Pad Capacity

f'_c	4	ksi	*(compressive strength of concrete)*
f_y	60	ksi	*(yield strength of steel)*
b	12	in	*(effective width for 1' strip)*
bar	#6		*(bar size)*
dbar	0.75	in	*(diameter of bar)*
clr	3	in	*(clear to rebar)*
s	12	in	*(rebar spacing)*
A_s	0.44	in^2	*(area of steel)*
d	8.25	in	*(effective depth)*
$\rho_{prov'd}$	0.0044		*(reinforcement ratio)*
ρ_{min}	0.0032		*(min reinforcement ratio)*
ϕV_c	**4.70**	kip/ft	*(shear capacity of concrete)*
ϕM_n	196.02	k-in	*(moment capacity)*
	16.34	k-ft/ft	*(moment capacity)*

Concrete Slab Loading Demand

L	2	ft	*(Length of slab overhanging equipment base)*
V_u	3.85	k	*(qmax applied to overhang)*

OK, No Shear Reinforcement Needed

M_u	3.85	k-ft	*(qmax applied to overhang)*

OK, Flexural Reinforcement Adequate

Anchor Bolts Load Demand

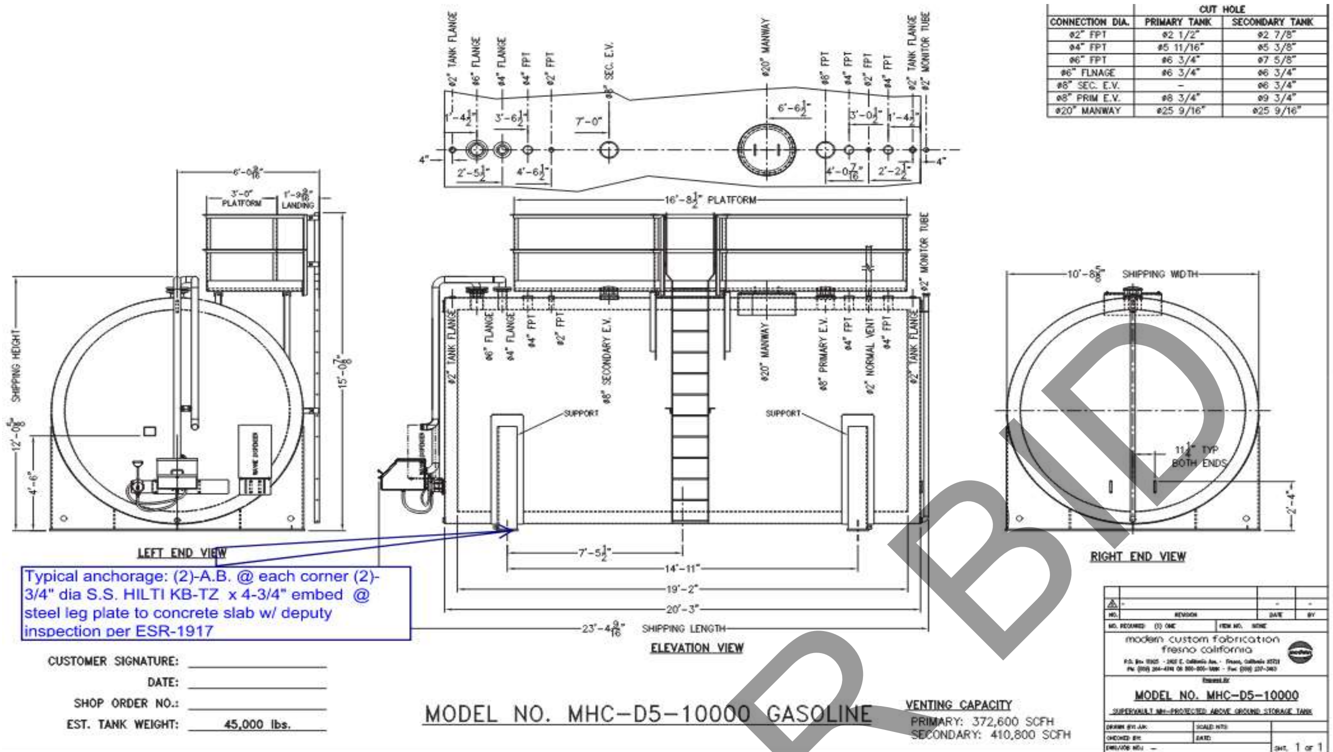
Tu	43.46	k-ft	
# of anchors / row	8		*(number of anchors per side)*
Tu per anchor	**5.432**	kip	*(max tension for bolts to resist)*
V of Equipment	54.124	kip	*(Seismic shear of equipment)*
Sliding Resistance	33.450	kip	*(Use 0.3 friction factor)*
V Remainder	20.674	kip	
Vu per anchor	**1.292**	kip	

Anchor Bolts Resistance

Type	Stainless Steel KB-TZ Hilti anchors	
Design Strength per Manufacturer		
f'c	4000 psi	
Anchor diameter	0.75 in	
Nominal Embedment	4.75 in	
Tension	8.11 k	< OK >
Shear	12.890 k	< OK >
Unity check	0.534	< OK >

TABLE 4—DESIGN INFORMATION, STAINLESS STEEL KB-TZ

DESIGN INFORMATION	Symbol	Units	Nominal anchor diameter								
			3/8		1/2				5/8		
Anchor O.D.	d_a	in. (mm)	0.375 (9.5)		0.5 (12.7)				0.625 (15.9)		
Effective min. embedment[1]	h_{ef}	in. (mm)	2 (51)		2 (51)		3 1/4 (83)		3 1/8 (79)	4 (102)	
Min. member thickness	h_{min}	in. (mm)	4 (102)	5 (127)	4 (102)	6 (152)	6 (152)	8 (203)	5 (127)	6 (152)	8 (203)
Critical edge distance	c_{ac}	in. (mm)	4 3/8 (111)	3 7/8 (98)	5 1/2 (140)	4 1/2 (114)	7 1/2 (191)	6 (152)	7 (178)	8 7/8 (225)	6 (152)
Min. edge distance	c_{min}	in. (mm)	2 1/2 (64)		2 7/8 (73)		2 1/8 (54)		3 1/4 (83)	2 3/8 (60)	
	for $s \geq$	in. (mm)	5 (127)		5 3/4 (146)		5 1/4 (133)		5 1/2 (140)	5 1/2 (140)	
Min. anchor spacing	s_{min}	in. (mm)	2 1/4 (57)		2 7/8 (73)		2 (51)		2 3/4 (70)	2 3/8 (60)	
	for $c \geq$	in. (mm)	3 1/2 (89)		4 1/2 (114)		3 1/4 (83)		4 1/8 (105)	4 1/4 (108)	
Min. hole depth in concrete	h_o	in. (mm)	2 5/8 (67)		2 5/8 (67)		4 (102)		3 3/4 (98)	4 3/4 (121)	
Min. specified yield strength	f_y	lb/in² (N/mm²)	92,000 (634)		92,000 (634)				92,000 (634)		
Min. specified ult. Strength	f_{uta}	lb/in² (N/mm²)	115,000 (793)		115,000 (793)				115,000 (793)		
Effective tensile stress area	$A_{se,N}$	in² (mm²)	0.052 (33.6)		0.101 (65.0)				0.162 (104.6)		
Steel strength in tension	N_{sa}	lb (kN)	5,968 (26.6)		11,554 (51.7)				17,880 (82.9)		
Steel strength in shear	V_{sa}	lb (kN)	4,720 (21.0)		6,880 (30.6)				9,870 (43.9)		
Pullout strength in tension, seismic[2]	$N_{p,eq}$	lb (kN)	2,340 (10.4)		2,735 (12.2)		NA		NA	5,840 (26.0)	
Steel strength in shear, seismic[2]	$V_{sa,eq}$	lb (kN)	2,825 (12.6)		6,880 (30.6)				9,350 (41.6)		
Pullout strength uncracked concrete[3]	$N_{p,uncr}$	lb (kN)	2,630 (11.7)		NA		5,760 (25.6)		NA		
Pullout strength cracked concrete[3]	$N_{p,cr}$	lb (kN)	2,340 (10.4)		3,180 (14.1)		NA		NA	5,840 (26.0)	



	CUT HOLE	
CONNECTION DIA.	PRIMARY TANK	SECONDARY TANK
ø2" FPT	ø2 1/2"	ø2 7/8"
ø4" FPT	ø5 11/16"	ø5 3/8"
ø6" FPT	ø6 3/4"	ø7 5/8"
ø6" FLNAGE	ø6 3/4"	ø6 3/4"
ø8" SEC. E.V.	–	ø6 3/4"
ø8" PRIM E.V.	ø8 3/4"	ø9 3/4"
ø20" MANWAY	ø25 9/16"	ø25 9/16"

CUSTOMER SIGNATURE: ____________

DATE: ____________

SHOP ORDER NO.: ____________

EST. TANK WEIGHT: 45,000 lbs.

MODEL NO. MHC-D5-10000 GASOLINE

VENTING CAPACITY

PRIMARY: 372,600 SCFH

SECONDARY: 410,800 SCFH