ATTACHMENT 6

Peach Bottom Atomic Power Station
Units 2 and 3
Docket Nos. 50-277 and 50-278

License Amendment Request
Response to Request for Additional Information

Alternative Source Term (AST)

PBAPS Calculation 49-48/H, Revision 0, *"Heating and Ventilation - Seismic Analysis for Anchor Bolts"*

PHILADELPHIA ELECTRIC COMPANY
NUCLEAR GROUP
M-20599 Rev. 3/93
DOCTYPE 081

CALCULATION COVER SHEET

1. Calculation No. 49-48/H
Page 1

2. ☐ LGS ☒ PBAPS
UNIT(S) 2 & 3

3. MOD/NCR/ECR No.:
Other: CALC. TURNOVER TO DS

4. Responsible Branch: SECS

5. Total No. of Pages: 39

6. Last Page No: 28

7. ☒ Safety Related ☐ Non-Safety Related

8. Description:
HEATING AND VENTILATION - SEISMIC ANALYSIS FOR ANCHOR BOLTS.

9. System/Topic No.: 70,901
Structure: —
Component: —

RECORD OF REVISIONS

10. Rev. No.	11. Description of Revision	12. Vendor Calc. Number	12. Vendor Calc. Rev.	13. Assumptions Yes	13. Assumptions No	14. Signatures Preparer	14. Signatures Reviewer	14. Signatures Approver/Date
0	THIS CALCULATION HAS NOT BEEN VALIDATED							"APPROVED FOR RECORD"
	FOR TECHNICAL CONTENT. IT HAS BEEN							FM/MKS-UE 9/22/93
	ADMINISTRATIVELY PROCESSED AND ACCEPTED							
	FOR PIMS INDEXING. SINCE THE CALCULATION							
	MAY OR MAY NOT REFLECT THE CURRENT AS-BUILT							
	CONFIGURATION, THE USER MUST REVIEW THE							
	CALCULATION FOR TECHNICAL ADEQUACY AND THE							
	CURRENT CONFIGURATION NEEDED TO SUPPORT							
	OTHER CALCULATIONS OR DESIGN ACTIVITIES IN							
	PROGRESS.							

15. Related Calc. Numbers						
	Provides Info to:					
	Receives Info from:					
	Supersedes:					

16.
☒ Manual
☐ Computer
Computer program and version

CLASS I SYSTEMS & EQUIPMENT LOCATIONS FOR HEATING & VENTILATION

	SYSTEMS	DRAWINGS
1.	Standby Gas Treatment System	M-420
2.	Control Room Fresh Air Filter Fans & Duct	M-425, M-426, & M-447
3.	Emergency Switchgear Fans, Supply & Exhaust	M-401, M-422, M-423, M-425, M-426, M-428
4.	Battery Room Exhaust & Duct	M-401, M-422, M-423, M-425, M-426, M-428
5.	Standby Diesel Generators Building Fans & Duct	M-476
6.	Pump Structure Fans & Duct	M-473
7.	RCIC Coolers	M-410
8.	HPCI Coolers	M-410
9.	Core Spray Coolers	M-410
10.	RHR Coolers	M-410, M-411
11.	Drywell Coolers	M-455, M-457

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CLASS I SYSTEMS & EQUIPMENTS

PEACH BOTTOM APS UNITS 2&3

BECHTEL JOB NO. 6280

Signature W.W. Leong

Date 9/18/72

Sheet No. 1 of 5

49/H

TAG NO.	SPEC. NO.	SYSTEM/EQUIPMENT	BLDG.	BASE ELEV.	REMARK
		HEATING & VENTILATION			
0AV20	M-51	Standby Gas Treatment Fan	Radw.	91'	
0BV20	"	" " " "	"	91'	
0CV20	"	" " " "	"	91'	
0AV30	"	Control Rm. Vent. Supply Fan	"	165'	
0BV30	"	" " " "	"	165'	
0AV34	M-49-3	Emer. Switchgr. Fan	"	165'	
0BV34	M-49-11	" " "	"	171'	
0AV35	M-51	" " "	"	165'	
0BV35	"	" " "	"	165'	
0AV36	"	Battery Rm. Exh. Fan	"	165'	
0BV36	"	" " "	"	165'	
0AV52	"	Diesel Gen. Bldg. Pump Room Fan	D. Gen.	151'	
0BV52	"	" " " " "	"	151'	
0AV60	M-70	Pump Structure Fan	Intake	122'	
0BV60	"	" " "	"	122'	
0AV61	"	" " "	"	122'	
0BV61	"	" " "	"	122'	
0AV64	M-51	Diesel Gen. Bldg. Fan	D. Gen.	151'	
0BV64	"	" " "	"	151'	
0CV64	"	" " "	"	151'	
0DV64	"	" " "	"	151'	

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49H

CLASS I SYSTEMS & EQUIPMENTS

TAG NO.	SPEC. NO.	SYSTEM/EQUIPMENT	BLDG.	BASE ELEV.	REMARK
		HEATING & VENTILATION			
2AV22	M-77	RCIC Rm. Cooler	R'ctor	97'	
2BV22	"	" " "	"	97'	
2AV23	"	HPCI Rm. Cooler	"	96'	
2BV23	"	" " "	"	101'	
2AV24	"	Core Spray Rm. Cooler	"	104'	
2BV24	"	" " " "	"	99'	
2CV24	"	" " " "	"	104'	
2DV24	"	" " " "	"	99'	
2EV24	"	" " " "	"	102'	
2FV24	"	" " " "	"	102'	
2GV24	"	" " " "	"	105'	
2HV24	"	" " " "	"	100'	
2AV25	"	RHR Rm. Cooler	"	119'	
2BV25	"	" " "	"	99'	
2CV25	"	" " "	"	105'	
2DV25	"	" " "	"	98'	
2EV25	"	" " "	"	105'	
2FV25	"	" " "	"	98'	
2GV25	"	" " "	"	119'	
2HV25	"	" " "	"	99'	
2AV26	"	Drywell Cooler	"	143'	
2BV26	"	" " "	"	149'	
2CV26	"	" " "	"	141'	
2DV26	"	" " "	"	141'	
2EV26	"	" " "	"	142'	

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46/#

CLASS I SYSTEMS & EQUIPMENTS

TAG NO.	SPEC. NO.	SYSTEM/EQUIPMENT	BLDG.	BASE ELEV.	REMARK
		HEATING & VENTILATION			
2FV26	M-77	Drywell Cooler	R'ctor	128'	
2GV26	"	" " "	"	130'	
0AF34	M-54	Standby Gas Treatm't Filter	Radw.	91'	
0BF34	"	" " " " "	"	91'	
0AF35	"	" " " " "	"	91'	
0BF35	"	" " " " "	"	91'	
0AF36	"	" " " " "	"	91'	
0BF36	"	" " " " "	"	91'	
0AF37	"	" " " " "	"	91'	
0BF37	"	" " " " "	"	91'	
0AE65	"	" " " " "	"	91'	
0BE65	"	" " " " "	"	91'	
0AF40	"	Control Rm. Vent.	"	165'	
0BF40	"	" " " "	"	165'	
0AF41	"	Control Rm. Vent. Filter	"	165'	
0BF41	"	" " " " "	"	165'	
0AF50	"	" " " " "	"	165'	
0BF50	"	" " " " "	"	165'	
0AE42	"	" " " " "	"	165'	
0BE42	"	" " " " "	"	165'	

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48/H

CLASS I SYSTEMS & EQUIPMENTS

TAG NO.	SPEC. NO.	SYSTEM/EQUIPMENT	BLDG.	BASE ELEV.	REMARK
		HIGH PRESSURE SERV. WATER			
2AP42	M-11	H.P. Service Water Pump	Pmp.Struct.	112'-0	
2BP42	"	" " " "	"	"	
2CP42	"	" " " "	"	"	
2DP42	"	" " " "	"	"	
		STANDBY DIESEL GENERATORS			
0AG12	E-5	Diesel Generator	D. Gen.	114,300	
0BG12	"	" " "	"	"	
0CG12	"	" " "	"	"	
0DG12	"	" " "	"	"	
		EMER. SERVICE WATER			
2AE55	M-77	RCIC Compartm't Coolers	Reactor	91'-6	
2BE55	"	" " " "	"	"	
2AE56	"	HPCI Compartm't Coolers	"	"	
2BE56	"	" " " "	"	"	
2AE57	"	Core Spray Room Coolers	"	"	
2BE57	"	" " " "	"	"	
2CE57	"	" " " "	"	"	
2DE57	"	" " " "	"	"	
2EE57	"	" " " "	"	"	
2FE57	"	" " " "	"	"	
2GE57	"	" " " "	"	"	
2HE57	"	" " " "	"	"	

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48/H

CLASS I SYSTEMS & EQUIPMENTS

TAG NO.	SPEC. NO.	SYSTEM/EQUIPMENT		BLDG.	BASE ELEV.	REMARK
2AE58	M-77	RHR Compartm't Coolers		Reactor	91'-6	
2BE58	"	" " "		"	"	
2CE58	"	" " "		"	"	
2DE58	"	" " "		"	"	
2EE58	"	" " "	EMER. SERVICE WATER (Cont'd)	"	"	
2FE58	"	" " "		"	"	
2GE58	"	" " "		"	"	
2HE58	"	" " "		"	"	
0AP57	M-11	Service Water Pump		Pmp.Struct.	113'-0	
0BP57	"	" " "		"	"	
		ADDIT. ITEMS (NOT DIRECTLY ASSOC.)				
	E-7	Control Panel				
		Emer. Switchgear Panels				
		Battery Rack				

CC060

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BECHTEL

CALCULATION SHEET

DATE 9/19/72

DESIGN BY WILSON W. LEONG DATE CHECKED BY R.C. Hartray SHEET NO. 1 of 4

PROJECT P.B. APS UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/H

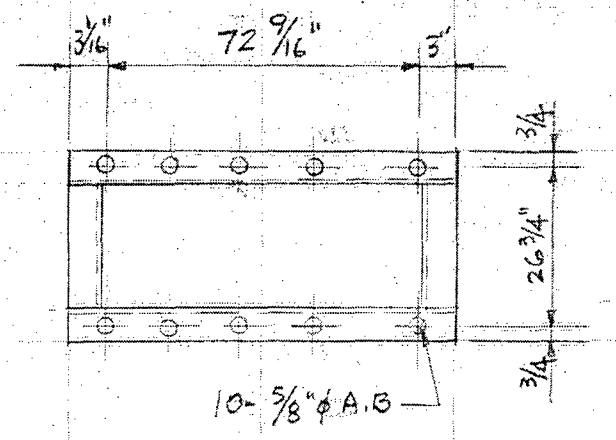
STANDBY GAS TREATMENT FAN (OAV20, OBV20 & OCV20)

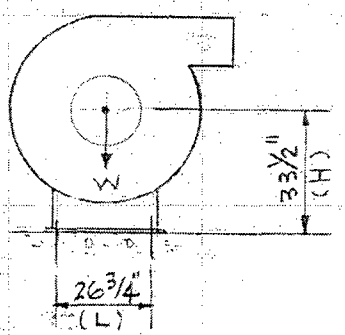
REFERENCES:

VENDOR PRINTS (SPEC. NO.) M-51-87 & M-51-152

EQUIPMENT SCHEDULE M-480 SHT. NO. 1 & 2 (LOADING TABLE)

RADWASTE BLDG. @ EL 91'-6





EQUIPMENT TOTAL WT. $W = 141^{\#} + 1500^{\#} = 1641^{\#}$

DAMPING = 5 %

HORIZONTAL ACCELERATION (D.B.E) = 0.20 g (MIN. REQ'D)

MAX. CREDIBLE EARTHQUAKE (M.C.E) = $2.4 \times 0.20g = 0.48g$ (HORIZ ACC'L)

∴ HORIZONTAL FORCE $F_H = ma = \frac{W}{g} \times 0.48g = \frac{1641}{g} \times 0.48g = 790^{\#}$

SHEAR $f_V = \frac{790^{\#}}{10 \text{ BOLTS}} = 79^{\#}/\text{BOLT}$ < ALLOWABLE SHEAR $F_V = 1000^{\#}/5/8"\phi$ A.B. (OK)

UPLIFT $F_U = F_H \times \frac{H}{L} - \frac{W}{2} = 790 \times \frac{33.5"}{26.75} - \frac{1641}{2} = 990^{\#} - 820^{\#}$

$= 170^{\#}$

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REQ'D TENSION STRESS $f_t = \frac{170}{5} = 34^{\#}/\text{BOLT}$ < $1480^{\#}/5/8"\phi$ A.B. (OK)

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BECHTEL

CALCULATION SHEET

DATE

DESIGN BY WILSON W. LEONG DATE CHECKED BY [illegible] SHEET NO. 2 1/1

PROJECT P.B. APS. UNITS NO 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/4

CONTROL ROOM VENT SUPPLY FAN (OAV 30 & OBV 30)

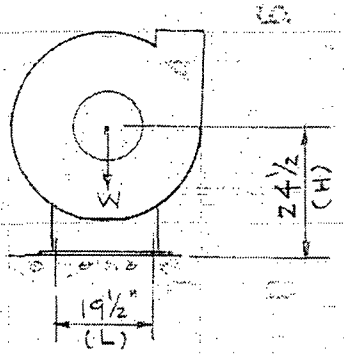
REFERENCES :

VENDOR PRINTS (SPEC. NO.) M-51-30 & M-51-65

EQUIPMENT SCHEDULE (FOR LOADING) M-480 SHT. NO. 1 & 2.

RADWASTE BLDG AT EL 165'-0

SEISMIC ANALYSIS REPORT (COMPUTER OUTPUT).



EQUIPMENT TOTAL WT. W = 780#

DAMPING = 5% (SEE P. B-24 ON SEISMIC REPORT FOR RAD. BLDG.)

HORIZ. ACC'L (D.B.E.) = 0.62 g (PEAK)

TOTAL ANCHOR BOLTS = 10 - ½" ϕ

MAX. CREDIBLE EARTHQUAKE (M.C.E.) = 0.62g x 2.4 = 1.48 g (HORIZ. ACC'L)

MAX. HORIZ. FORCE $F_H = 1.48\,g \times \frac{780^{\#}}{g} = 1160^{\#}$

SHEAR $f_V = \frac{1160^{\#}}{10\ \text{BOLTS}} = 116\ ^{\#}/\text{BOLT}$ < ALLOWABLE SHEAR $F_V = 750^{\#}/½"\phi$ A.B. (OK)

UPLIFT FORCE $F_u = 1160^{\#} \times \frac{24.5"}{19.5"} - \frac{780^{\#}}{2} = 1070^{\#}$

TENSION STRESS $f_t = \frac{1070^{\#}}{5\ \text{BOLTS}} = 214\ ^{\#}/\text{BOLT}$ (OK)

ALLOWABLE TENSION STRESS FOR ½"ϕ A.B : $F_t = \Sigma o u d_1 J = \Sigma o u (A-H) j$

$F_t = 1.6" \times 250^{\#}/_{0"} \times (10" - 6") \times 0.875 = 1400^{\#}/½"\phi$ A.B.

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0510 (5-71)

CALCULATION SHEET

DATE 9/19/72

DESIGN BY WILSON W. LEONG DATE CHECKED BY [illegible] SHEET NO 3 1/5

PROJECT P.B. APS UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLT FILE NO. 46/4

EMER. SWICHGR. FAN (OAV34 & OBV34)

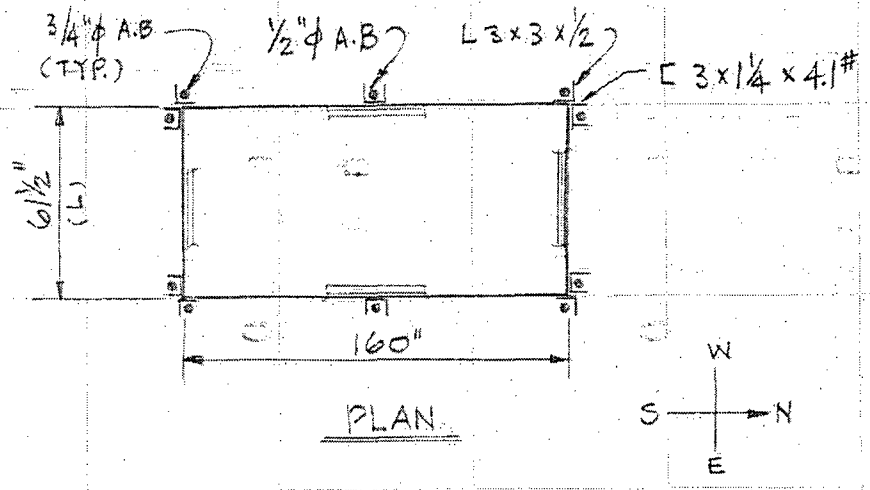
REFERENCES

EQUIPMENT SCHEDULE (LOADING) M-480 SHT. NO. 1 & 2

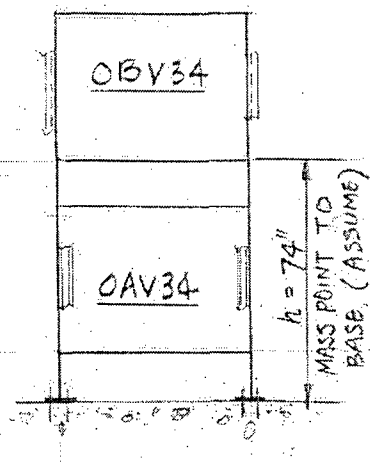
BLDG — RADWASTE AT EL 165'-0 FOR OAV34, EL 171'-0 FOR OBV34.

VENDOR PRINT (SPEC. NO.) M-49-1 ; M-49-3 FOR OAV34 ;
M-49-11 FOR OBV34 ;

MECH. DWG. M425 & M-426



PLAN



ELEV.

6 - C 3 x 1¼ (4.1#/FT) ; A = 1.19 □", I_x = 1.6 IN⁴, I_y = 0.2 IN⁴, S_x = 1.1 IN³, S_y = 0.21 IN³

4 - L 3 x 3 x ½ (9.4#/FT): A = 2.75 □", I_x = 2.2 IN⁴ = I_y, $S_x = S_y$ = 1.1 IN³

ANCHOR BOLTS : 4 - 3/4"ϕ AND 6 - ½"ϕ

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LOADING : WT. OF SUPPORTS (STEEL FRAMING) = 1140#

WT. OF EQUIPMENTS (OAV34 & OBV34) = 9860# = 4930 X 2

TOTAL W = 11000#

FORMULAS : HORIZ. FORCE $F_H = ma = \frac{W}{g} \times$ HORIZ. ACCELERATION (a)

214 ∴ HORIZ. SHEAR $f_v = \frac{F_H}{\text{NO. OF BOLTS}}$; TENSION $f_t = F_H \times \frac{h}{L} - \frac{W}{2}$ (TOTAL TENSION FORCE)

BECHTEL

CALCULATION SHEET

DATE

DESIGN BY WILSON W. LEONG DATE CHECKED BY [illegible] SHEET NO. 4 7/3

PROJECT P.B. APS. UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/4

(CONT'D) EMER. SWICHG'R FAN (OAV34 & OBV34)

DETERMINE HORIZ. ACC'L OF OAV34 & OBV34 AND STEEL FRAMING

(1) FIND THE EQUIPMENT (OAV34 & OBV34 AND FRAMING) FREQUENCY ON FLOOR ELEV 165'-0.

(2) REFER TO RADWASTE BLDG SEISMIC REPORTS PAGE B-20 W/ DAMPING = 2% TO GET HORIZ. ACC'L.

(1) $f_{cps} = \frac{3.127}{\sqrt{\Sigma\Delta}} = \frac{3.127}{\sqrt{\Delta_V + \Delta_M}}$ (FREQUENCY)

$\Delta_V = \frac{Wh}{A_V G}$; $\Delta_M = \frac{Wh^3}{3EI}$ (FOR CANTILEVER STRUCT.)

WHERE, W = 11000#, WEIGHT AT MASS POINT

h = 74", HEIGHT OF MASS POINT TO GROUND (BASE)

A_V = SHEAR AREA (IN EAST – WEST DIRECTION ↕)

$= [(3" \times 3/16") \times 4] + [(1\tfrac{1}{4}" \times 1/4") \times 4] + [2.75" \times 1/2 \times 4]$

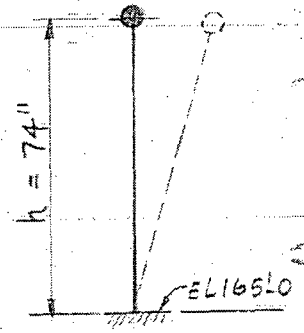
$\therefore A_V = 9.0$ □"

$I_{(E-W)\updownarrow} = (1.6\ in^4 \times 4 + 0.2\ in^4 \times 2) + (2.2\ in^4 \times 4) = 15.6\ in^4$

$E = 29 \times 10^6$ psi. YOUNG'S MODULUS FOR STEEL.

$G = 0.4E = 0.4 \times 29 \times 10^6 = 11.6 \times 10^6$ psi, SHEAR MODULUS.

Δ = DEFLECTION



$\Delta_V = \frac{Wh}{A_V G} = \frac{11000^{\#} \times 74"}{9.0\ □" \times 11.6 \times 10^6\ psi} = 0.008"$

$\Delta_M = \frac{Wh^3}{3EI} = \frac{11000^{\#} \times (74")^3}{3 \times 29 \times 10^6\ psi \times 15.6\ in^4} = 3.292"$ $\therefore \Sigma\Delta = 3.3"$

$\therefore$ FREQUENCY $f_{cps} = \frac{3.127}{\sqrt{\Sigma\Delta}} = \frac{3.127}{\sqrt{3.3}} = 1.72$ cps

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HORIZ. ACCELERATION "a" (EAST – WEST DIRECTION)

REFER TO RADWASTE BLDG SEISMIC REPORT GAGE B-20 W/ 2% DAMPING AND FREQUENCY "f_{cps}" = 1.72 cps. WE HAVE, HORIZ. ACC'L "a" = 0.27 g (FOR D.B.E.)

(CONSERVATIVE – 3 ACTUALLY LESS)

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BECHTEL

CALCULATION SHEET

DATE

DESIGN BY WILSON W. LEONG DATE CHECKED BY R.E. Hartley SHEET NO. 5 3/5

PROJECT P.B. APS UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/H

(CONT'D.) CHECK ANCHOR BOLTS FOR OAV34 & OBV34.

DESIGN BASIS EARTHQUAKE (D.B.E.) = 0.27g (HORIZ ACC'L)

MAX. CREDIBLE EARTHQUAKE (M.C.E), HORIZ ACC'L = 0.27g x 2.4 = 0.648g

∴ HORIZONTAL FORCE : $F_{H(D.B.E.)} = \frac{11000^{\#}}{g} \times 0.27g = 2970^{\#}$

$F_{H(M.C.E)} = \frac{11000^{\#}}{g} \times 0.648g = 7140^{\#}$

ALLOWABLE SHEAR FORCE : 4 - 3/4"ϕ A.B + 6 - 1/2"ϕ A.B.

∴ $F_V = 1500 \times 4 + 750^{\#} \times 6 = 10500^{\#} > F_H$ (OK)

VERTICAL TENSION FORCE : (EAST OR WEST SIDE)

$f_t = F_H \times \frac{h}{L} - \frac{W}{2} = \frac{7140^{\#} \times 74''}{61.5} - \frac{11000}{2} = 3091^{\#}$

ALLOWABLE TENSION : 2 - 3/4"ϕ A.B + 3 - 1/2"ϕ A.B.

∴ $F_t = 2220^{\#} \times 2 + 1400^{\#} \times 3 = 8600^{\#} > f_t$ (OK)

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EMER. SWITCHG'R FAN (OAV 35 & OBV 35)

REFERENCES :

VENDOR PRINTS (SPEC. NO.) M-51-31 & M-51-69

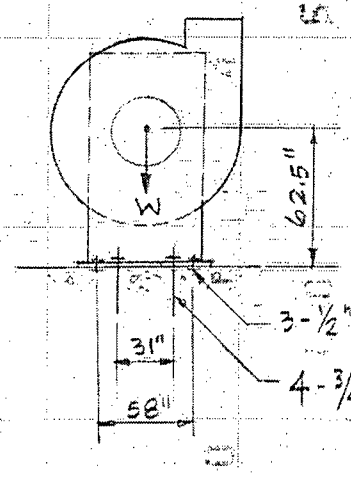
EQUIPMENT SCHEDULE M-480 SHT. NO. 1 & 2 (LOADING TABLE)

RADWASTE BLDG. BASE EL 165'-0

REFER TO SEISMIC REPORT FOR RADWASTE BLDG (PAGE NO. 24B) W/ 5% DAMPING TO GET HORIZONTAL ACC'L "a" = 0.62g (PEAK) FOR O.B.E.

OR $0.62g \times 2.4 = 1.48g$ FOR M.C.E.

TOTAL WT. W = 4600# (SEE M-480)



(SEE BACK PAGE FOR BASE)

∴ HORIZ. FORCE $F_H = 1.48g \times \frac{4600\#}{g} = 6800\#$

PLATFORM BOLTS (TOTAL 6-½"ϕ BOLTS)

SHEAR STRESS $f_V = \frac{6800}{6} = 1133\#/\text{BOLT} < 750\#/\text{½"ϕ} \times 1.89$ (OK)

TENSION FORCE $F_t = 6800\# \times \frac{62.5"}{58} = 7320\#$

UPLIFT (TENSION STRESS) PER BOLT $f_t = (7320 - \frac{4600}{2}) \times \frac{1}{3} = 1673 < 1400 \times 1.98$ (OK)

BASE ANCHOR BOLTS (TOTAL 8-¾"ϕ A.B.)

HORIZ. FORCE $F_H = 6800\#$, SHEAR STRESS $f_V = \frac{6800}{8} = 850\#/\text{BOLT} < 1500\#/\text{¾"ϕ} \times 1.33$ (OK)

TENSION FORCE $= F_H \times \frac{H}{L} = 6800 \times \frac{62.5"}{31"} = 13700\#$

UPLIFT $= 13700\# - 4600/2 = 11400\#$

∴ TENSION STRESS PER BOLT $f_t = \frac{11400\#}{4 \text{ BOLTS}} = 2850\#/\text{BOLT} < 2220 \times 1.98 = 4400\#/\text{¾"ϕ}$ (OK)

BECHTEL

CALCULATION SHEET

DATE

DESIGN BY WILSON W. LEONG DATE CHECKED BY RE Hachney SHEET NO. 7 2/3

PROJECT P.B. APS. UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/14

(CONT'D.) OAV 35 & OBV 35

IF WE ARE CONSIDERING ALL BOLTS (6-½"ϕ & 8-¾"ϕ) EMBEDDED TO THE FLOOR (CONCRETE), WE HAVE:

SHEAR FORCE $F_H = 6800^{\#}$ < ALLOWABLE SHEAR = $750 \times 6 + 1500 \times 8$

$= 4500 + 12000 = 16500^{\#}$ (OK)

TENSION FORCE (UPLIFT)

$F_u = F_H \times \frac{h}{L} - \frac{W}{2}$, ($h = 62.5"$ $L = \frac{58" - 31"}{2} + 31" = 44.5"$)

$F_u = 6800^{\#} \times \frac{62.5"}{44.5"} - \frac{4600^{\#}}{2} = 9550^{\#} - 2300^{\#} = 7250^{\#}$ < ALLOWABLE F_t (ok)

($F_t = 1400^{\#}/½"\phi \times 3 + 2220^{\#}/¾"\phi \times 4 = 13080^{\#}$)

00001458616

C0087

218

MASON INDUSTRIES, Inc.
Manufacturers of Vibration Control Products

92-10 182nd Place, Hollis, New York 11423 (Area Code 212) 523-3355
2335 East Pico Blvd., Los Angeles, California 90023 (Area Code 213) 233-5557

CUST.: AMERICAN STANDARD IND. DIV.
P.O. #: A-
M.I. #: 41345

P 7A

NO. REQ'D: TWO TAG:

DATE: 11-15-70 DRAWING NO.

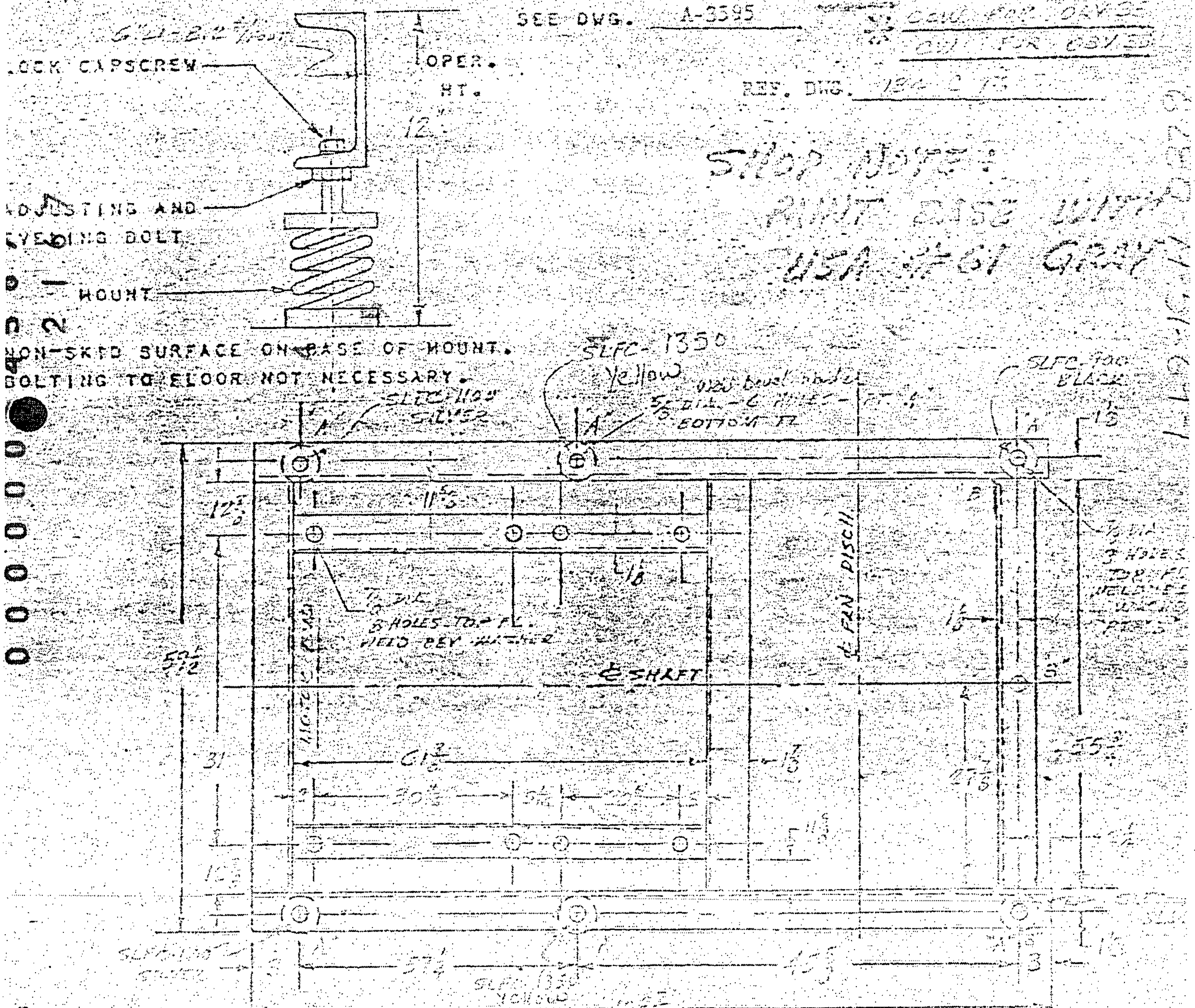
MAKE OF FAN AMERICAN STANDARD								SPEC	DRIVE				MOTOR		
SIZE	CL	W	ARR	ROT	DIS	BRG	RPM	FEAT	BELT	MOTOR	FAN	CENT	HP	FRAME	POS
542	[illegible]	SW	8	[illegible]	[illegible]	[illegible]	700		—	—	—	—	[illegible]	365T	—

SLIDE RAILS: MASON SIZE ___ BY OTHERS ___ WTS: STEEL BASE ___ BASE MEM.

TYPE "SLF" BASE 1" SPECIFIED DEFLECTION

SEE DWG. A-3395

REF. DWG.



EMER SWITCHG'R FAN OAV35 & OBV35

NO CONCRETE FILL IN THIS BASE

219

M-58-69
00088

BATTERY ROOM EXHAUST FAN (OAV36 & OBV36)

REFERENCES :

VENDOR PRINTS (Spec. No.) M-51-43, M-51-70 & M-51-71

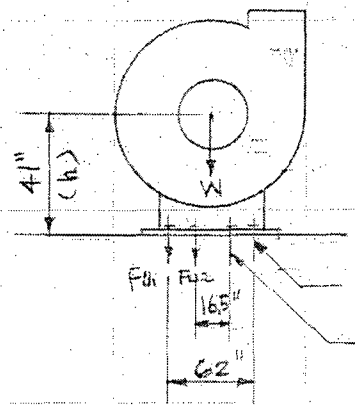
EQUIPMENT SCHEDULE (LOADING TABLE) M-480 SHT NO. 1 & 2

RADWASTE BLDG BASE EL 165'-0, DAMPING: 5%

HORIZ. ACC'L "a" = 0.62 g (PEAK POINT) (FOR O.B.E.)

" " a_{MAX} = 0.62g x 2.4 = 1.48g (FOR M.C.E.)

TOTAL WT. W = 2100#



HORIZONTAL FORCE $F_H = 1.48g \times \frac{2100^{\#}}{g} = 3110^{\#}$ (M.C.E.)

ALLOWABLE SHEAR $F_V = 750 \times 6 + 1500 \times 8$

$= 4500^{\#} + 12000^{\#} = 16500^{\#} > F_H$ (OK)

TENSION FORCE (UPLIFT), $F_u = F_{u1} + F_{u2}$, ASSUMED $F_{u1} = F_{u2}$

$F_{u1} \times 62" + F_{u2} \times 16.5" = F_H \times h$ ($F_{u1} = F_{u2} = \frac{1}{2} F_u$ CONSERVATIVE)

$\frac{1}{2} F_u (62" + 16.5") = 3110^{\#} \times 41"$

$\therefore F_{u(NET)} = \frac{2 \times 3110^{\#} \times 41"}{(62" + 16.5)} = 3260^{\#} <$ ALLOWABLE TENSION F_t (OK)

($F_t = 1400^{\#}/½"ϕ \times 3 + 2220^{\#}/¾"ϕ \times 4 = 13080^{\#}$)

00089

220

MASON INDUSTRIES, INC.
Manufacturers of Vibration Control Products

[illegible] Place
[illegible], New York 11[illegible]
Area Code [illegible]

3[illegible] East [illegible] Blvd.
Los Angeles, California [illegible]
Area Code [illegible]

CUST: [illegible]
P.O.# [illegible]
M.I.# [illegible] 70-[illegible]
NO. REQ'D: [illegible] TAG: OAV 36 48/H
DATE: [illegible]-70 DRAWING NO. [illegible]

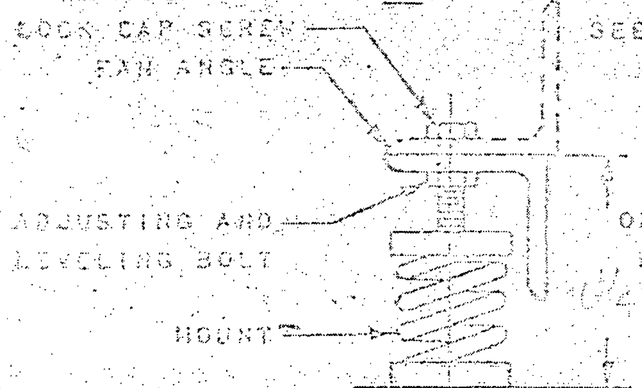
NAME OF FAN AMERICAN STANDARD								SPEC	DRIVE					MOTOR	
SIZE	CL	W	ARR	ROT	DIS	BRG	RPM	FEAT	BELT	MOTOR	FAN	CENT	HP	FRAME	FCS
[illegible]			8	CCW	UB	[illegible]	875		—	—	—	—		286T	—

SLIDE RAILS: MASON SIZE — BY OTHERS — WTS: STEEL BASE [illegible] BASE MEM. [illegible]

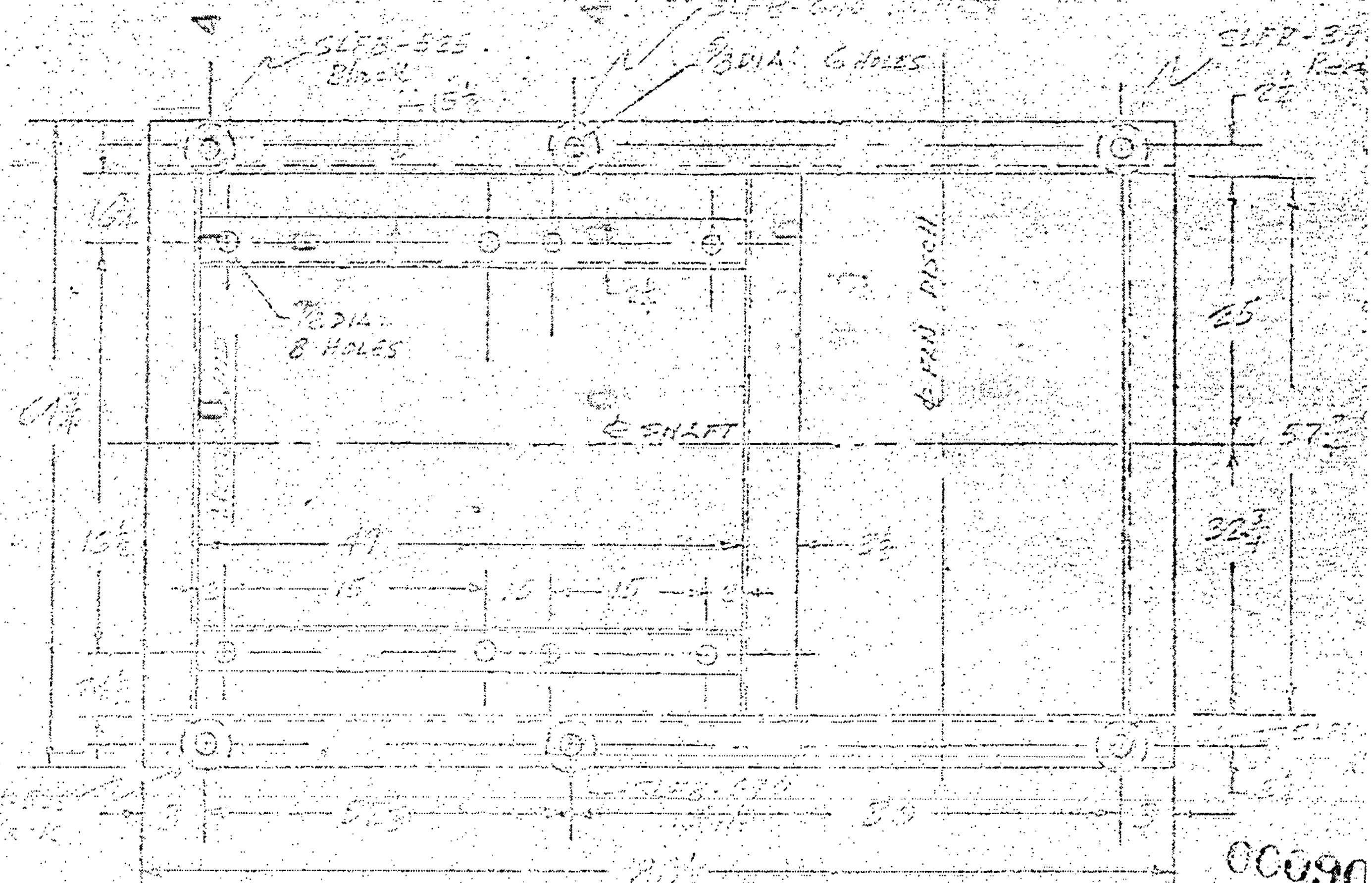
TYPE "SLF" BASE 1" SPECIFIED DEFLECTION P 8A 2/3

SEE DWG. A-3593

REF. DWG. 221C-3000



NON-SKID SURFACE ON BASE OF MOUNT.
BOLTING TO FLOOR NOT NECESSARY.



0C090

M-51-70

221

BATTERY ROOM EXHAUST FAN - OAV 36

MASON INDUSTRIES Inc.
Manufacturers of Vibration Co[illegible] Products

32-10 [illegible]2nd Place, [illegible], New York 11[illegible] (Area Code 212) [illegible]
3335 East Pico Blvd., Los Angeles, California 90023 (Area Code 213) [illegible]

CUST: AMERICAN STANDARD [illegible]
P.O.# A-127[illegible]
M.I.# 41346
NO. REQ'D: ONE TAG: [illegible] 48/H
DATE: 11-[illegible]-70 DRAWING NO. [illegible]

MAKE OF FAN: AMERICAN STANDARD								SPEC	DRIVE				MOTOR		
SIZE	CL	W	ARR	ROT	DIS	BRG	RPM	FEAT	BELT	MOTOR	FAN	CENT	HP	FRAME	POS
365			8	CW	UB	BB	875		—	—	—	—		256T	—
SLIDE RAILS: MASON SIZE —				BY OTHERS —					NTS: STEEL BASE —				BASE MEM. [illegible]		

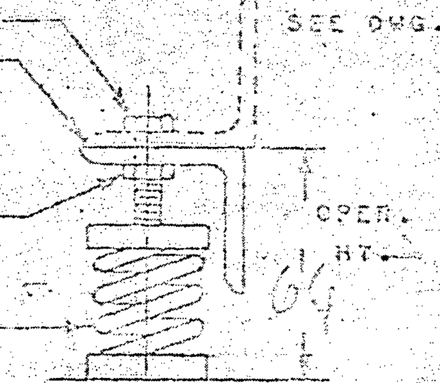
TYPE "SLF" BASE 1" SPECIFIED DEFLECTION

SEE DWG. A-3595

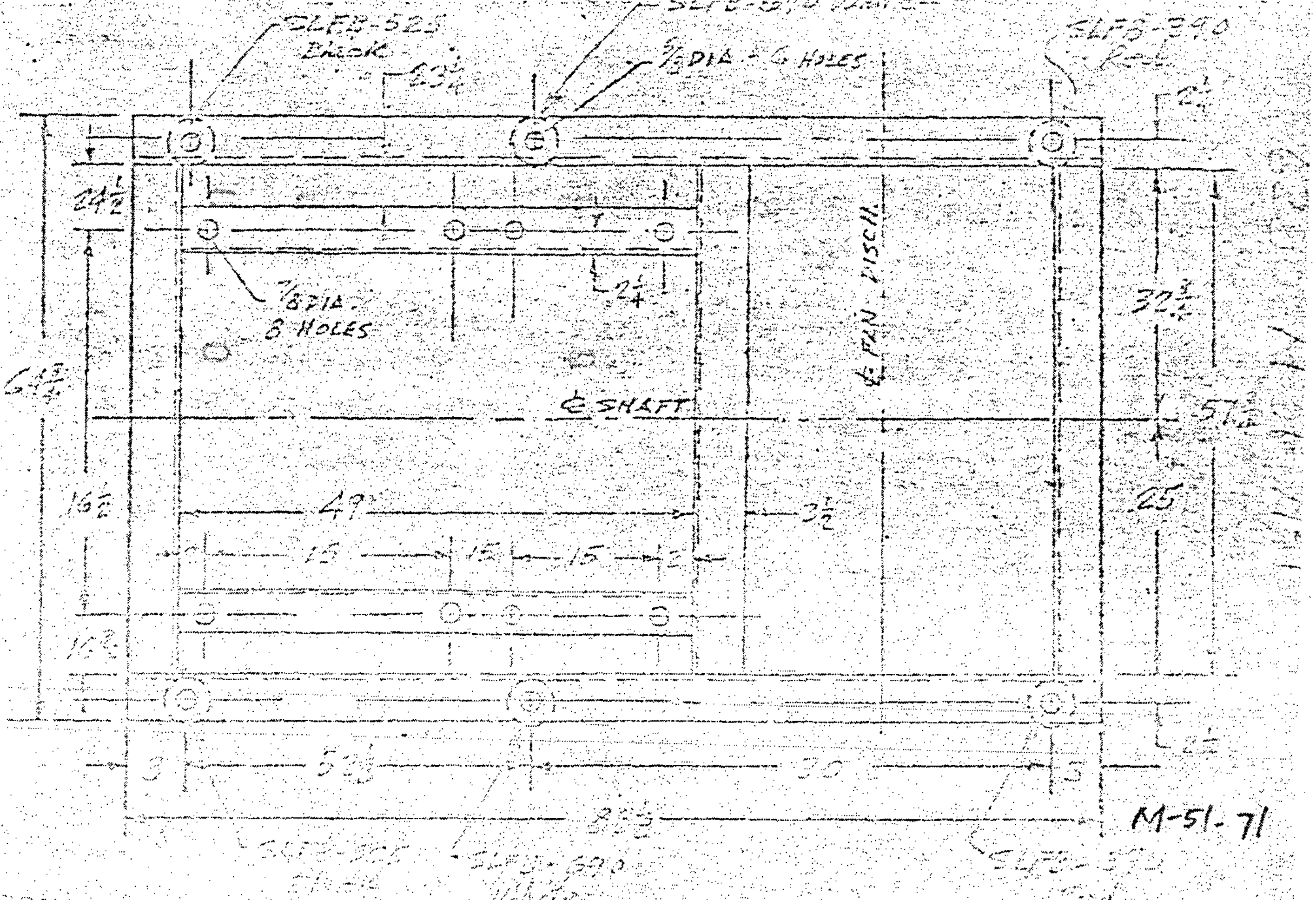
P.8B

3/5

REF. DWG. [illegible]



NON-SKID SURFACE ON BASE OF MOUNT.
BOLTING TO FLOOR NOT NECESSARY.



M-51-71

BATTERY ROOM EXHAUST FAN - OBV36

222

00091

0000014590 270

0510 (5-71)

BECHTEL

CALCULATION SHEET

DATE 9/21/72

DESIGN BY WILSON W. LEONG DATE CHECKED BY R.E. Hackney SHEET NO. 9 ½

PROJECT P.B. APS. UNITS NO. 2 & 3 JOB NO. 6286

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 46/H

DIESEL GEN. BLDG. PUMP ROOM FAN (OAV 52 & OBV 52)

VENDOR PRINT : M-51-58 & M-51-84

BASE EL 151'-0

TOTAL WT. W = 800#

DAMPING : 5%

ANCHOR BOLTS : 6-½"ϕ + 6-¾"ϕ.

TOTAL ALLOWABLE STRESS FOR A.B

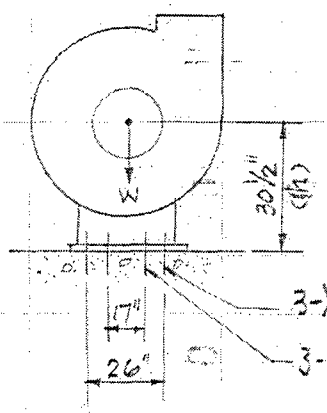
SHEAR = 750 x 6 + 1500 x 6
= 13500#

TENSION = 1400 x 3 + 2220 x 3
= 10860#

HORIZ. ACC'L "a" = 0.75 g (FOR O.B.E.)

OR a_{MAX} = 0.75 g x 2.4 = 1.80 g (FOR M.C.E.)

HORIZ. (SHEAR) FORCE $F_H = 1.80g \times \frac{800\#}{g} = 1440\#$ (M.C.E.)



BY INSPEC. ALL ANCHOR BOLTS ARE OK FOR SEISMIC.

00092

223

MASON INDUSTRIES, Inc.
Manufacturers of Vibration Control Products

CUST: [illegible]
P.O.#: 7109 — 48TH
M.I.#: 41348 — 8-1
NO. REQ'D: TWO TAG: OAV52, OBV52
DATE: 1-18-72 DRAWING NO. [illegible]

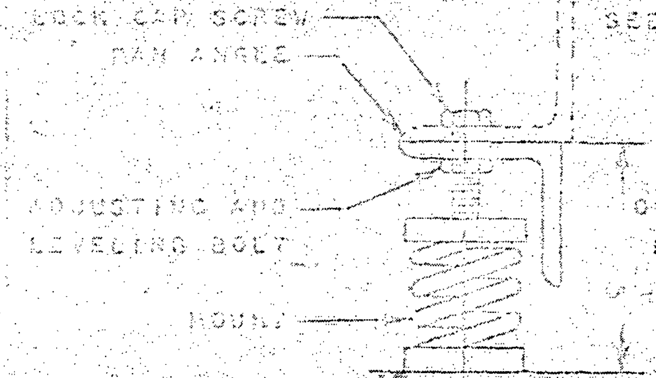
MAKE OF FAN [illegible]								SPEC.	DRIVE				MOTOR		
SIZE	CL	W	ARR	ROT	DIS	BRG	RPM	FEAT	BELT	MOTOR	FAN	CENT	HP	FRAME	POS
270	I	D	7	CC	TH	[illegible]	870		—	—	—	—	5	254T	
SLIDE RAILS: MASON SIZE —				BY OTHERS —				MTS: STEEL BASE 27				BASE HGH. [illegible]			

TYPE "SLF" BASE 1" SPECIFIED DEFLECTION
SEE DWG. [illegible]

P 9A 1/2

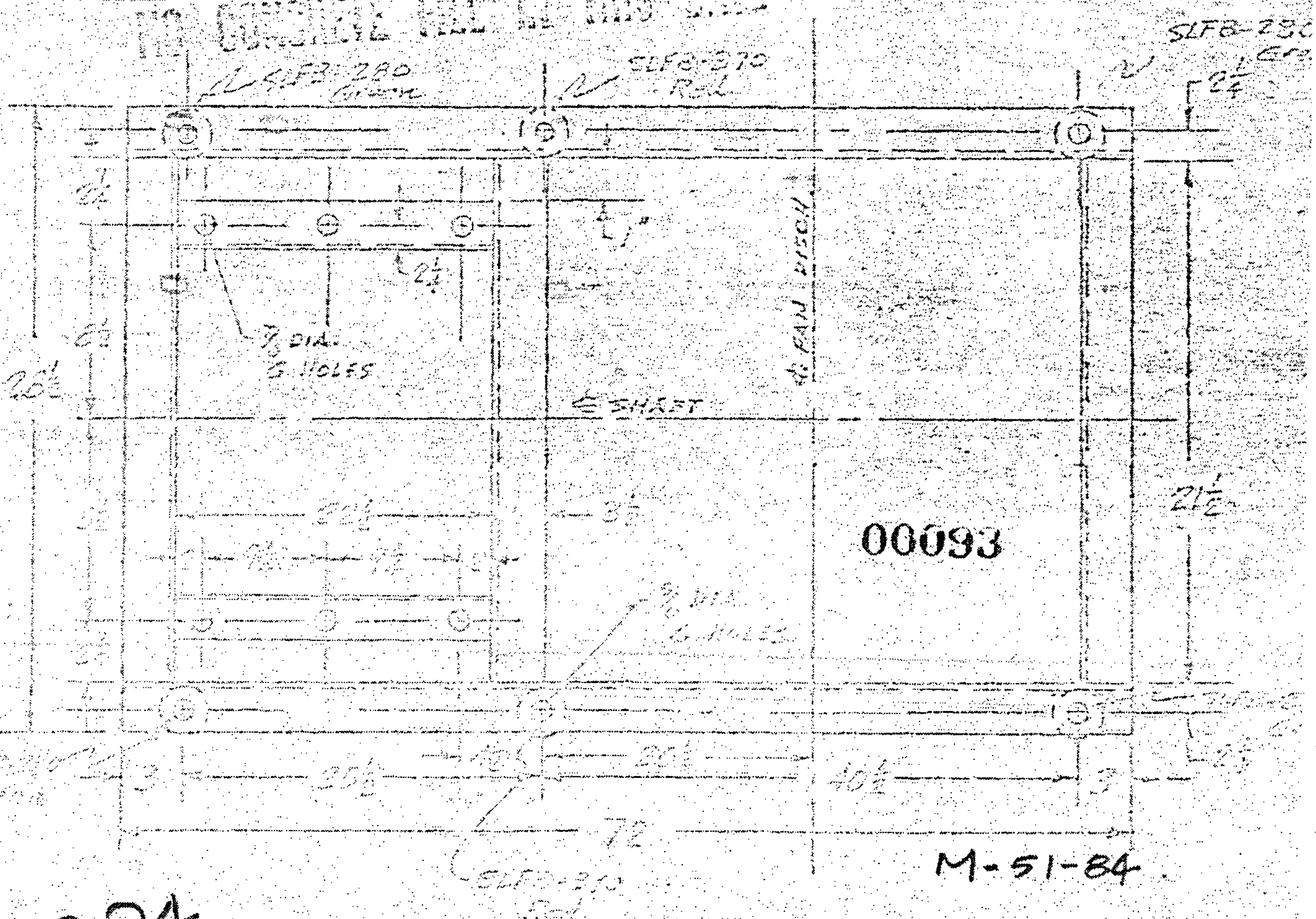
REF. DWG. 1344-C-99

SHOP NOTE: PAINT BASE WITH USA R.G. GRAY



NON-SKID SURFACE ON BASE OF MOUNT. BOLTING TO FLOOR NOT NECESSARY.

NO CONCRETE FILL IN THIS BASE



00093

M-51-84

224

DIESEL GEN. BLDG. PUMP ROOM FAN - OAV52 & OBV5

BECHTEL

CALCULATION SHEET

DATE

DESIGN BY WILSON W. LEONG DATE CHECKED BY [illegible] SHEET NO. 10 ½

PROJECT P.B. APS UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS 1 EQUIPMENT ANCHOR BOLTS FILE NO. 46/H

DIESEL GEN. BLDG. FAN (OAV64, OBV64, OCV64 & ODV64)

VENDOR PRINT : M-51-57 & M-51-85.

DIESEL GEN. BLDG. BASE EL 151'-0

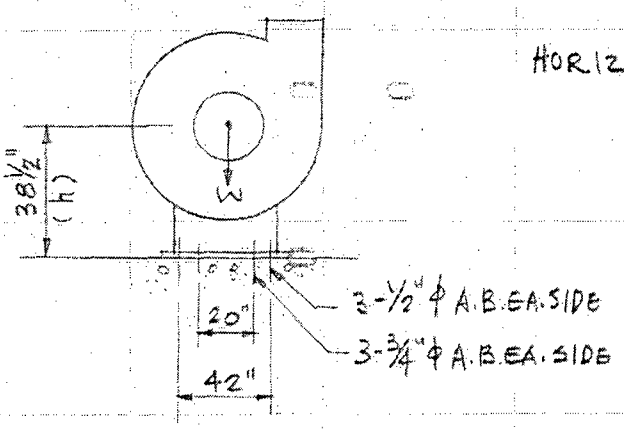
TOTAL WT. W = 2200 #

ANCHOR BOLTS : 6-½"ϕ & 6-¾"ϕ.

DAMPING : 5%

HORIZ. ACC'L "a" = 0.75g (FOR D.B.E.)

OR $a_{MAX.} = 0.75g \times 2.4 = 1.80g$ (FOR M.C.E.)



HORIZ. FORCE $F_H = 1.80g \times \frac{2200\#}{g} = 3960\#$ (FOR M.C.E.)

BY INSPEC. ALL ANCHOR BOLTS ARE OK FOR SEISMIC.

00094

225

MASON INDUSTRIES, Inc.
Manufacturers of Vibration Control Products

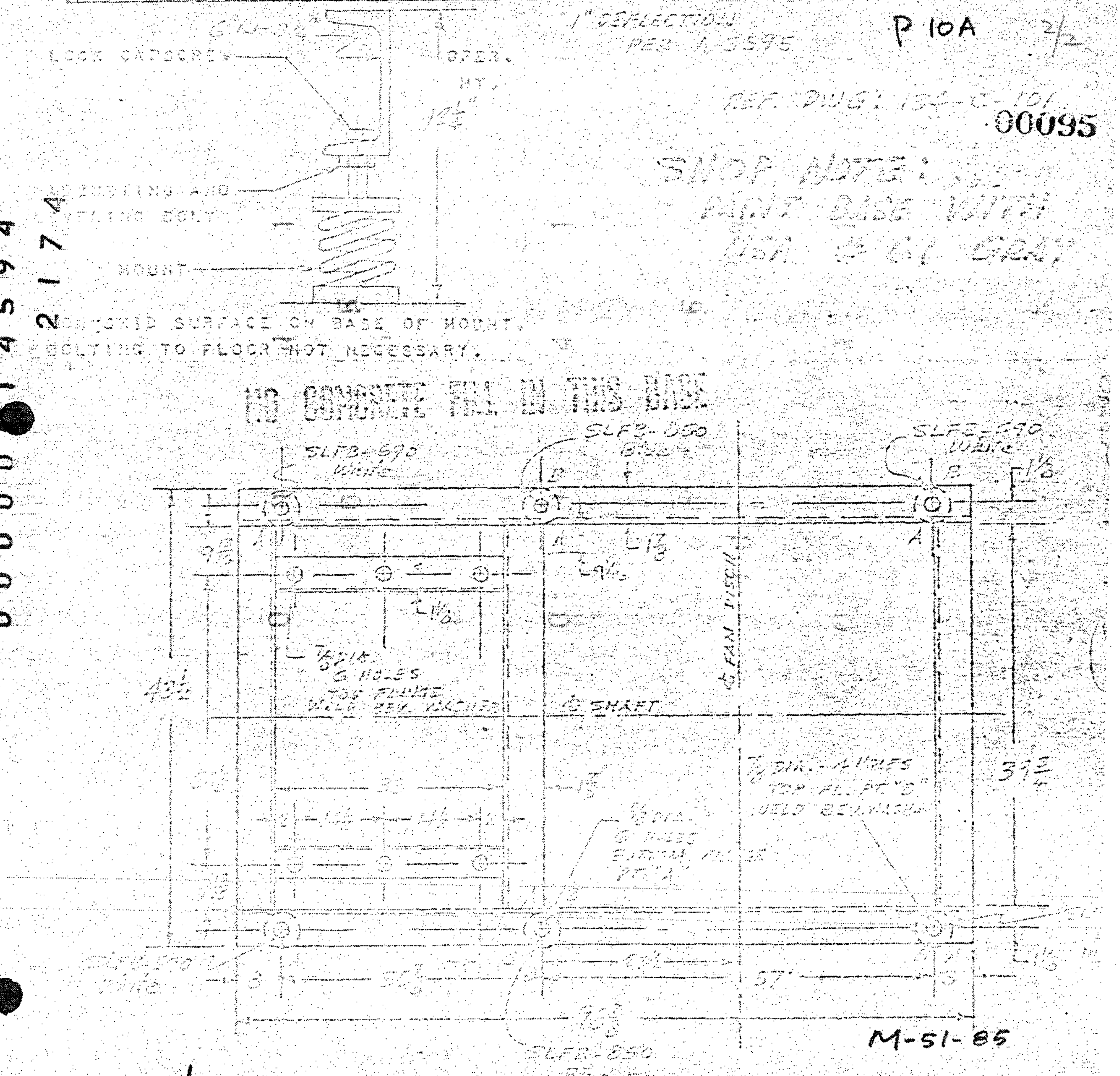
CUST: AMERICAN STANDARD [illegible]
P.O.#: [illegible]
M.I.#: 41543
NO. REQ'D: FOUR TAG: [illegible]
DATE: [illegible]-70 DRAWING NO. [illegible]

NAME OF FAN								SPEC	DRIVE				MOTOR		
SIZE	CL	W	ARR	ROT	DIS	BRG	RPM	FEAT	BELT	MOTOR	FAN	CENT	HP	FRAME	POS
[illegible]	1	2	7	CC	TH	BB	870		—	—	—	—	30	[illegible]	—

SLIDE RAILS: MASON SIZE ___ BY OTHERS ___ WTS: STEEL BASE ___ BASE MEN. [illegible]

P 10A

00095



M-51-85

DIESEL GEN. BLDG. FAN - 0AV64 THRU 0DV64

226

0 0 0 0 0 1 4 5 9 4
2 1 7 4

PUMP STRUCTURE FAN (OAV60, OBV60, OAV61 & OBV61)

VENDOR PRINT : M-70-7

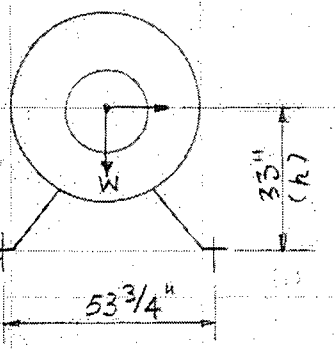
BLDG — PUMP STRUCTURE. (INTAKE)

BASE EL 122'-0

TOTAL WT. W = 1200# (SEE M-480)

ANCHOR BOLTS : 6 - 3/4" ϕ.

DAMPING = 5%.



HORIZ. ACC'L "a" = 0.50g (FOR D.B.E.)

OR a_{MAX} = 0.5g x 2.4 = 1.2g (FOR M.C.E.)

(SEE P. D-12 IN SEISMIC REPORT FOR PUMP STRUCTURE)

HORIZ. FORCE $F_H = 1.2g \times \frac{1200\#}{g} = 1440\#$

SHEAR STRESS $f_V = 1440\#/6\ \text{BOLTS} = 240\#/\text{BOLT} < 1500\#/3/4"\phi$ A.B. (OK)

TENSION FORCE = $1440\# \times \frac{33"}{53.75"} = 890\#$

UPLIFT (TENSION IN BOLT) $f_t = (890 - \frac{1200}{2}) \times 1/3\ \text{BOLTS} = 97\# < 2220\#/3/4"\phi$ (OK)

0510 (5-71)

BECHTEL

CALCULATION SHEET

DATE

DESIGN BY WILSON W. LEONG DATE CHECKED BY E Hackey SHEET NO. 12 1/1

PROJECT P.B. APS. UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/4

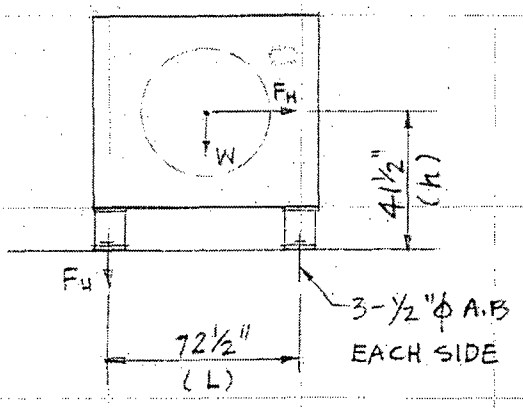
SYSTEM/EQUIPMENT	WT. OF EQUIP.	VENDOR PRINT
RCIC ROOM COOLER (2AV22 & 2BV22)	1500#	M-77-4
HPCI ROOM COOLER (2AV23 & 2BV23)	2600#	M-77-5
CORE SPRAY RM. COOLER (2AV24 TO 2HV24)	1470#	M-77-6
RHR ROOM COOLER (2AV25 TO 2HV25)	2500#	M-77-7

THESE EQUIPMENTS ARE IN REACTOR BLDG. BASE ELEVATION BELOW EL 135'-0 AND ABOVE EL 91'-0 (BETWEEN EL 96'-0 & EL 119'-0) AND USE 2% DAMPING, FROM SEISMIC REPOR FOR REACTOR BLDG.,

WE HAVE HORIZONTAL ACCELERATION "a" = 0.57 g (FOR D.B.E.)

= OR "a_{MAX}" = 0.57 g × 2.4 = 1.37 g (FOR M.C.E.)

CHECK ANCHOR BOLTS IN WORST CASE — HPCI RM. COOLER (2AV23 & 2BV23)



HORIZ. FORCE $F_H = 1.37\,g \times \frac{2600^{\#}}{g} = 3560^{\#}$

SHEAR STRESS $f_V = \frac{3560}{6\ \text{BOLTS}} = 594^{\#}/_{\text{BOLT}} < 750^{\#}/_{½"\phi} \times 1.89$

(OK)

UPLIFT $F_u = F_H \times \frac{h}{L} - \frac{W}{2}$

$= 3560^{\#} \times \frac{41.5"}{72.5"} - \frac{2600^{\#}}{2} = 2360 - 2300$

$= 60^{\#}$

TENSION STRESS $f_t = 60^{\#}/_{3\ \text{BOLTS}} = 20^{\#}/_{\text{BOLT}} < 1400^{\#}/_{½"\phi} \times 1.98$

(OK)

00097

228

BECHTEL

CALCULATION SHEET

DATE

DESIGN BY WILSON W. LEONG DATE CHECKED BY R.F. Hackney SHEET NO. 13

PROJECT P.B. APS. UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/H

DRYWELL COOLER (2AV26 @ EL 143'-0, 2BV26 @ EL 149'-0
2CV26 & 2DV26 @ EL 141'-0, 2EV26 @ EL 142'-0
2FV26 @ EL 128'-0 & 2GV26 @ EL 130'-0)

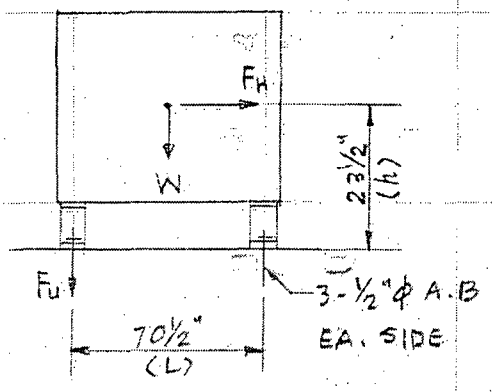
(REACTOR BLDG.)

VENDOR PRINT : M-77-8 OR M-77-28

WT. OF EQUIPMENT W = 2220# , 2% DAMPING.

WORST CONDITION (EL 149'-0) HORIZ. ACC'L "a" = 0.92g (FOR D.B.E.)

OR "a_{MAX} = 0.92 x 2.4 = 2.21g (FOR M.C.E.)



HORIZ. FORCE $F_H = 2.21g \times \frac{2220}{g} = 4900^{\#}$

SHEAR STRESS $f_V = \frac{4900}{6\ \text{BOLTS}} = 817^{\#}/\text{BOLT}$ (OK)

ALLOWABLE SHEAR = $750^{\#}/½"\phi_{A.B} \times 1.33 = 1000^{\#}$

UPLIFT $F_U = F_H \times \frac{h}{L} - \frac{W}{2}$

$= 4900^{\#} \times \frac{23.5"}{70.5"} - \frac{2220^{\#}}{2} = 1633 - 1110$

$= 523^{\#}$

TENSION STRESS $f_t = 523^{\#}/6\ \text{BOLTS} = 87^{\#}/\text{BOLT} < 1400^{\#}/½"\phi_{A.B} \times 1.98$

(OK)

0000021457

0098

229

BECHTEL

CALCULATION SHEET

DATE

DESIGN BY WILSON W. LEONG DATE CHECKED BY P.C.Hartung SHEET NO. 14 ½

PROJECT P.B APS UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/H

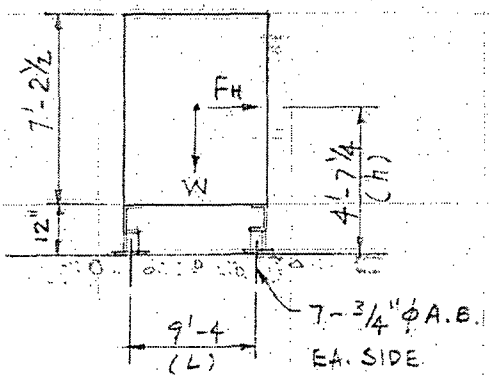
STANDBY GAS TREATMENT FILTER . (OAF34 - OAF35 - OAF36 - OAF37 - OAF65)

(OBF34 - OBF35 - OBF36 - OBF37 - OBF65 ARE SIMILAR)

VENDOR PRINTS M-54-4 & M-54-37.

P & I. D. NO. M-388 / 391 / 397.

RADWASTE BLDG. EL 91'-6 (FIN. GRAD ELEV. 116'-0)



TOTAL WT. OF EQUIPMENTS W = 8000#

DAMPING = 2%.

HORIZ. ACC'L = 0.15g (GROUND PEAK) (FOR D.B.E.)

(SEE RECOMMENDED RESPONSE SPECTRA)

MAX. HORIZ. ACC'L = 0.15g x 2.4 = 0.36g.

MAX. HORIZ. FORCE $F_H = 0.36g \times \frac{8000}{g} = 2880^{\#}$

SHEAR STRESS $f_V = \frac{2880}{14 \text{ BOLTS}} = 206^{\#}/\text{BOLT} < 1500 \times 1.33$

(OK)

UPLIFT FORCE $F_u = \frac{2880 \times 4.6}{9.33} - \frac{8000}{2} = 1420 - 4000$

(NEG.)

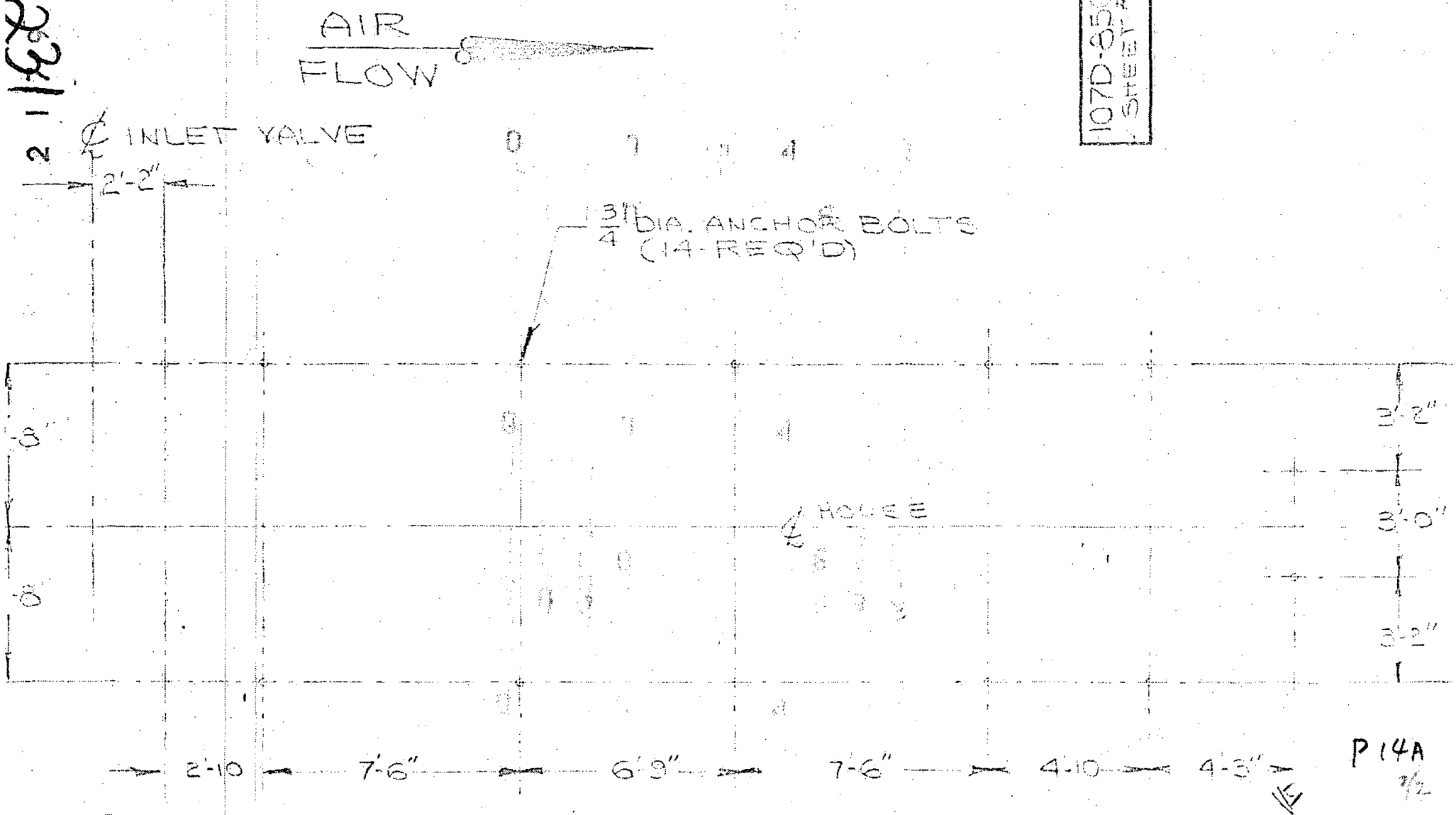
NO TENSION FORCES IN SUPPORTS (ANCHOR BOLTS)

00099

230

107D-8505 SHEET #2 OF 2

2 11/62



P 14A

FOUNDATION REQUIREMENTS

M-54-37

OAF 34 - OAF 35 - OAF 36 - OAF 37 - OAF 65, OR
OBF 34 - OBF 35 - OBF 36 - OBF 37 - OBF 65

0000

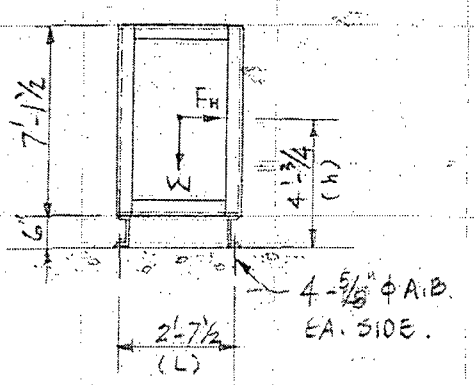
CONTROL ROOM VENT. FILTER (OAF40 - OAF41 - OAF42 - OAF50)

(OBF40 - OBF41 - OBF42 - OBF50 ARE SIMILAR)

VENDOR PRINTS M-54-5 & M-54-38

P & I. D. NO. M-388 / 391 / 397

RADWASTE BLDG. EL 165'-0"



TOTAL WT. OF EQUIPMENT W = 1700 #

DAMPING = 2%

HORIZ. ACC'L = 1.32g (FOR D.B.E.)

MAX. HORIZ. ACC'L = 1.32g x 2.4 = 3.17g (FOR M.C.E.)

MAX. HORIZ. FORCE $F_H = 3.17g \times \frac{1700}{g} = 5400^{\#}$

SHEAR STRESS $f_V = \frac{F_H}{\text{BOLTS}} = \frac{5400}{8 \text{ BOLTS}} = 675^{\#}/_{\text{BOLT}} < 1000 \times 1.89$

(OK)

UPLIFT FORCE $F_u = \frac{F_H \times h}{L} - \frac{W}{2} = \frac{5400 \times 4.06}{2.62} - \frac{1700}{2} = 7510^{\#}$

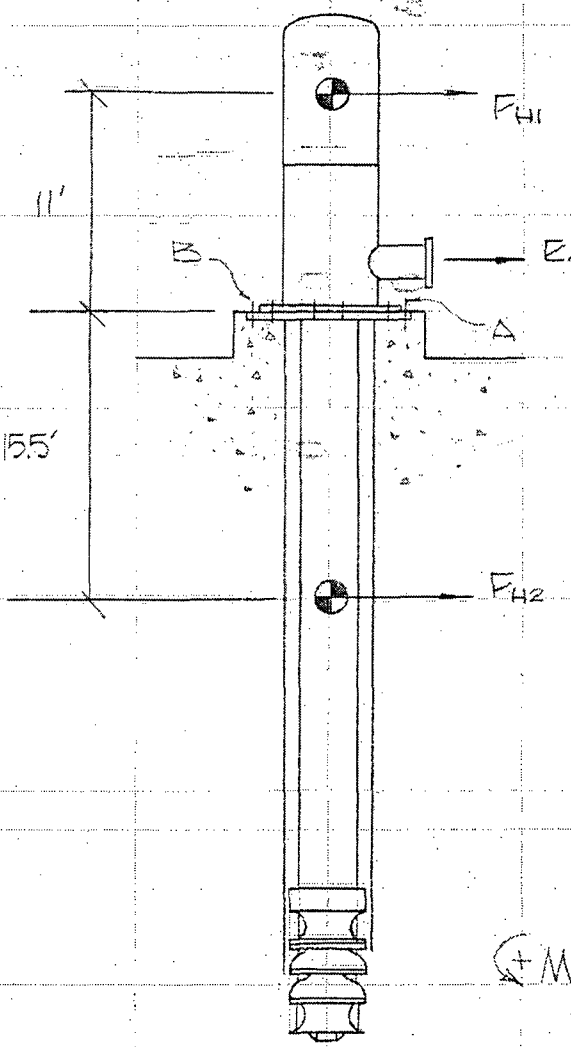
TENSION STRESS PER BOLT $f_t = \frac{7510^{\#}}{4 \text{ BOLTS}} = 1880^{\#}/_{\text{BOLT}} < 1480 \times 1.98$

(OK)

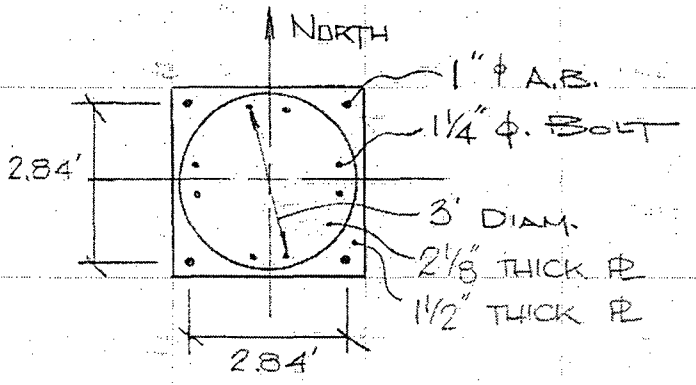
HIGH PRESSURE WATER PUMPS (2AP42 thru. 2DP42)

REFERENCES:

LOCATION & ORIENTATION M-272
VENDOR PRINT (SPEC. NO.) M-11-AC-12
C.W. PUMP STRUCTURE BLDG @ EL 113'-0"
BOLT TYPE C-89-REV 8&9
LOCATION C-86



ELEV



PLAN of BASE PL'S

MOTOR WGT. = 6,800 #
PUMP WGT. = 6,850 #
DAMPING = 0.5%
HORIZ. ACC'L (D.B.E.) = 1.52g (PEAK)
" " (M.C.E.) = 1.52g(2.4) = 3.65g

F_{H1} = 3.65(6800) = 24,800 #
F_{H2} = 3.65(6850) = 25,000 #

$\circlearrowleft M_B = 0 = -F_{H1}(11) + 15.5F_{H2} - 2.84A - WGT(1.42)$

$A = \frac{1}{2.84}(-11(24800) + 15.5(25000) - 1.42(13650))$

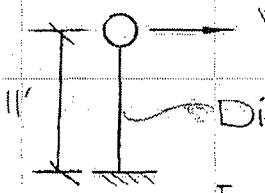
A = 33600 #/2 bolts = 16800 #/bolt

A = 16800 #/bolt > 7530 (1.98) = 14910 #/bolt allow tension
< type 2 anchor bolt w/6" hook

DETERMINE HORIZONTAL ACC'L

1) Find natural frequency of equipment assuming rigid base between pump and motor

Determine natural frequency of motor



Discharge Head 28" O.D., 3/8" thickness

$I = 0.0491(d_o^4 - d_i^4) = 0.0491(28^4 - 27.625^4) = 1584.6 \text{ in}^4$

$\Delta_M = \frac{WL^3}{3EI} = \frac{6800(11\times12)^3}{3(30\times10^6)1584.6} = 0.11 \text{ in} = 0.0091 \text{ ft}$

$\Delta_V = \frac{WL}{A_w G} = \frac{6800(11\times12)}{3.14(28)(.375)(11.6\times10^6)} = 0.00235 \text{ in} = 0.0002 \text{ ft}$ small >

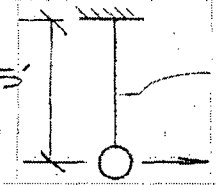
$\omega^2 = g/\varepsilon\Delta = 32.2/0.0093 = 3462.36$

$\omega = 58.84$; $f = 58.84/6.28 = 9.369$ cps

$\therefore a = 0.43g$; $a_{max} = 0.43g(2.4) = 1.032g$

Nat. freq. of pump is not equal to that of the motor. The worst condition is minimum accelaration of the pump.

Determine nat. freq. of pump



Pipe Col. 14" O.D., 3/8" thickness

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$I = 0.0491 (d_o^4 - d_i^4) = 0.0491 (14^4 - 13.625^4) = 194.1 \text{ in}^4$

$\Delta_M = \frac{WL^3}{3EI} = \frac{685D (15.5 \times 12)^3}{3(30 \times 10^6) 194} = 2.525 \text{ in} = 0.21 \text{ ft}$

$\omega^2 = 32.2 / 0.21 = 153.33$; $\omega = 12.38$

$f = 12.38 / 6.28 = 1.97 \text{ cps}$ $\therefore a = 0.23g$ (D.B.E.)

$a_{max} = 0.23g (2.4) = 0.55g$ (M.C.E.)

Use minimum accaleration for motor

ANCHOR BOLT TENSION (CRITICAL CASE SHOWN ONLY)

$F_{H1} = 1.032 [6800] = 7000 \#$; $F_{H2} = 0.117 (2.4) [685D] = 193D \#$

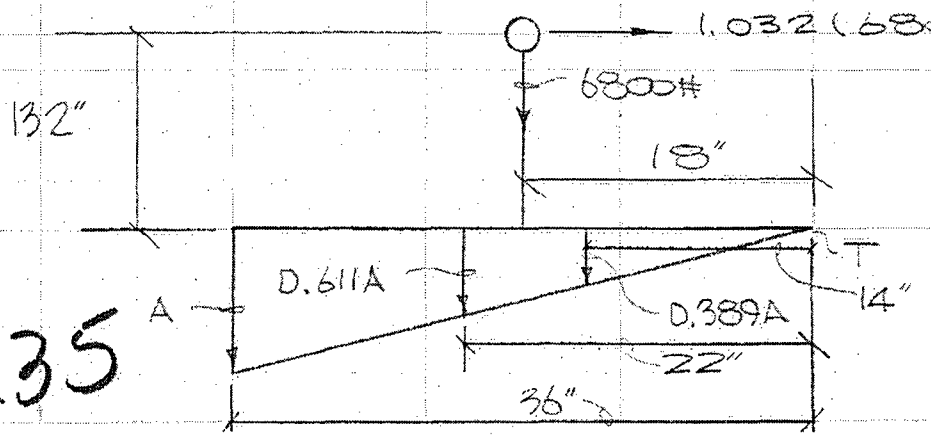
$A = 1/2.84 [+11 (7000) - 15.5 (193D) - 1.42 (1365D)] = 972 \#/2 \text{ bolts}$

$A = 486 \#/\text{bolt} < 1.89 (884D)$ allow.

Combined stress is O.K. by inspection since shear is low

$V = [7000 + 1930]/4 = 2220 \#/\text{bolt} < 1.89 (2500)$

MACHINE BOLTS CONNECTING MOTOR BASE PL TO SOLE PL



$M_T = D = 36A + 22(.0611A) + 14(0.389A) + 18(0.8) - 132(7.D)$

$D = 55.80A - 1048.6$

$A = 18.8\,K/2\text{ bolts} = 9.4\,K/\text{bolt}$

Allowable $= 1.33\,(13.92k) = 18.5\,K/\text{bolt}$

O.K.

SHEAR (Max. condition possible)

$V = [1.032(6800) + 0.55(6850)]/4 = 2692\#/\text{bolt}$

Allowable $= 1.89(2500) = 4730\#/\text{bolt}$

O.K.

BECHTEL

CALCULATION SHEET

DATE 9/27/72

DESIGN BY R. Hachay DATE CHECKED BY W.W.L. SHEET NO. 20

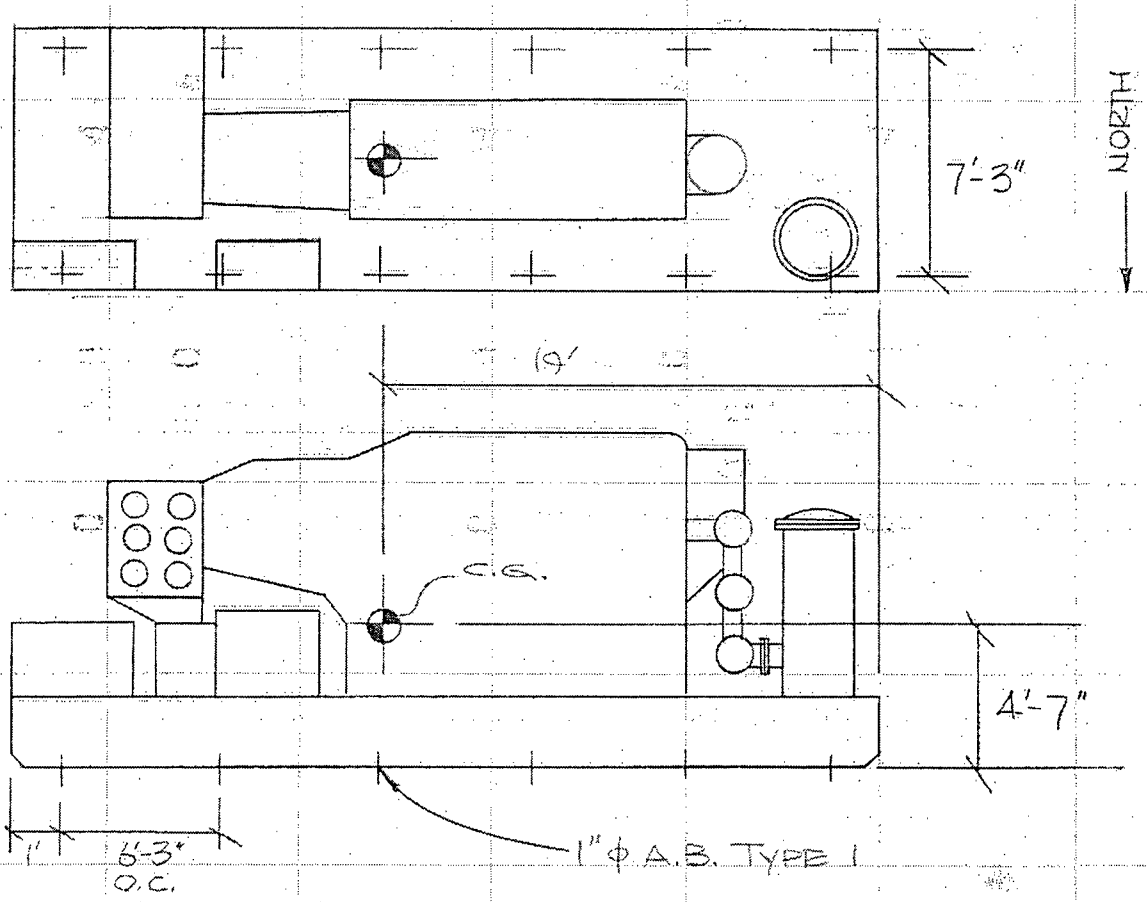
PROJECT P.B. APS UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIP ANCHOR BOLTS FILE NO. 48/H

EMERGENCY DIESEL GENERATOR BLDG (DAG12, DBG12, DCG12, & DDG12)

REFERENCES:

VENDOR PRINTS (SPEC. NO.) E5-8
EQUIPMENT SCHEDULE M-283
EMERGENCY DIESEL GENERATOR BLDG AT EL 127'
P. & I. STRUCTURAL DWGS S-551, S-552



EQUIPMENT TOTAL WET. = 115,700#
DAMPING = 0.5%

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BECHTEL

CALCULATION SHEET

DATE

DESIGN BY R. Hachey DATE CHECKED BY W.W.L. SHEET NO. 21 ½

PROJECT P.B. APS UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIP. ANCHOR BOLTS FILE NO. 48/H

FLOOR ACCELERATION - SAME AS EQUIPMENT*

N-S	E-W	DIRECTION
0.158g	0.13g	D.B.E. FROM SEISMIC REPORT
0.2g	0.2g	D.B.E. FROM U.B.C.
0.48g	0.48g	M.C.E BASED ON U.B.C.

MAX. HORIZ. FORCE = 0.48 (115,700) = 55,400 #

SHEAR

$$f_v = \frac{55400}{12 \text{ bolts}} = 4620 \#/\text{bolt} < 1.89(2500) = 4730 \#/\text{bolt} \quad \text{(OK)}$$

UPLIFT FORCE NON EXISTENT IN EITHER DIRECTION (N-S DIRECT. SHOWN)

$$F_u = \frac{55400(4.5834)}{7.25} - \frac{115700}{2} = \text{ALL BOLTS COMPRESSION}$$

(OK)

* SINCE THE FLOOR NAT. FREQ. IS GREATER THAN 20 CPS AND THE DIESEL GENERATOR IS CONNECTED TO THE FLOOR AS A RIGID BODY, USE THE HIGH FREQ. END OF THE ACCELERATION SPECTRA FOR CHECKING EQUIPMENT ANCHOR BOLTS.

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COUNT

BECHTEL

CALCULATION SHEET

DATE 9/28/72

DESIGN BY WILSON W. LEONG DATE CHECKED BY SHEET NO. 22

PROJECT P.B. APS UNITS NO. 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 48/14

2AE55	(RCIC COMPARTMENT COOLERS)	SIMILAR TO	2AV22
2BE55	(" " ")	SIMILAR TO	2BV22
2AE56	(HPIC COMPARTMENT COOLERS)	" "	2AV23
2BE56	(" " ")	" "	2BV23
2AE57	(CORE SPRAY ROOM COOLERS)	" "	2AV24
TO			TO
2HE57	(CORE SPRAY ROOM COOLERS)	" "	2HV24
2AE58	(RHR COMPARTMENT COOLERS)	" "	2AV25
TO			TO
2HE58	(RHR COMPARTMENT COOLERS)	" "	2HV25

REFER CALC. PAGE NO. 12

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BECHTEL

CALCULATION SHEET

DATE 9/28/72

DESIGN BY R. Hachey DATE CHECKED BY W.W.L. SHEET NO. 23 ¼

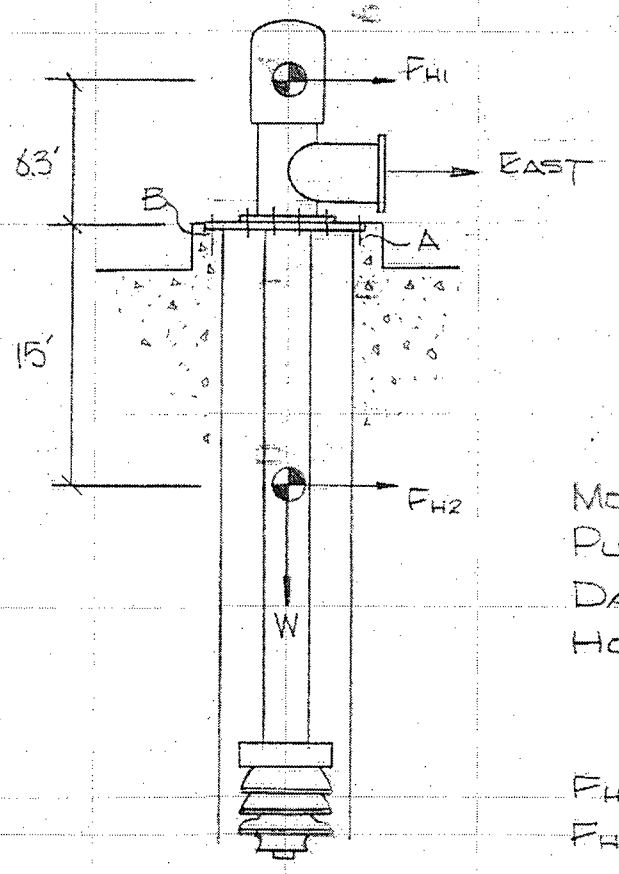
PROJECT P.B. APS UNITS 2 & 3 JOB NO. 6280

SUBJECT SEISMIC ANALYSIS FOR CLASS I EQUIPMENT ANCHOR BOLTS FILE NO. 4.8.1

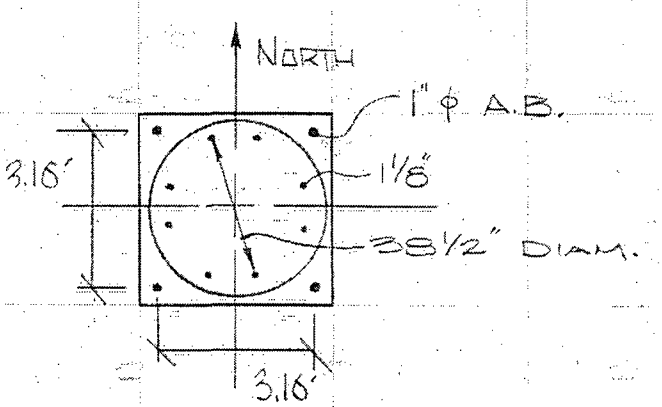
EMERGENCY SERVICE WATER PUMP (DAP57 & DBP57)

REFERENCES:

LOCATION & ORIENTATION M-272
VENDOR PRINT (SPEC. No.) M-11-AC-13
C.W. PUMP STRUCTURE BLDG @ EL 113'-1"
BOLT TYPE - C-89-REV 8 & 9
LOCATION C-86



ELEV.



PLAN of BASE PL'S

MOTOR WGT. = 3,000 #
PUMP WGT. = 5,500#
DAMPING = 0.5%
HORIZ. ACC'L (D.B.E.) = 1.52g (PEAK)
" " (M.C.E.) = 1.52(2.4) = 3.65g

$F_{H1} = 3.65(3000) = 10{,}950\#$
$F_{H2} = 3.65(5500) = 20{,}000\#$

$(+M_B = 0 = -F_{H1}(6.3) + 15F_{H2} - 3.16A - WGT(3.16/2)$

$A = -1.99F_{H1} + 4.75F_{H2} - 0.5\,WGT$

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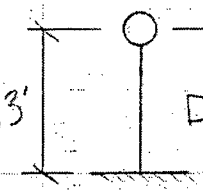
$A = -1.99(10950) + 4.75(20000) - 0.5(3000 + 5500)$

$A = 68{,}935\ \#/2\ \text{bolts} = 34{,}467\ \#/\text{bolt} > 8.84\ \text{K/bolt}$ type 2 - tension allow.

DETERMINE HORIZONTAL ACC'L

1) Find natural frequency of equipment
   a) Assume frequency of motor differs from pump due to rigid base

Determine natural frequency of motor (critical



Discharge Head 20" O.D., 3/8" wall thickness

$I = 0.0491(d_o^4 - d_i^4) = 0.0491[20^4 - 19.625^4] = 573\ in^4$

$\Delta_M = \frac{WL^3}{3EI} = \frac{3000(6.3 \times 12)^3}{3(30 \times 10^6)\,573} = 0.0251\ in = 0.0021\ ft$

$f = \frac{1}{2\pi}\sqrt{\frac{K}{M}} = \frac{1}{2\pi}\sqrt{\frac{Wg}{\Delta W}} = \frac{1}{2\pi}\sqrt{\frac{g}{\Delta}} = \frac{\omega}{2\pi}$

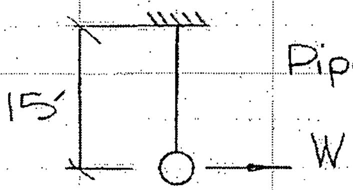
$\omega^2 = 32.2 / 0.0021 = 15300$; $\omega = 124$ rad/sec

$f = 124/6.28 = 19.7$ cps $\therefore a = 0.234\ g$

$a_{max} = 0.234g(2.4) = 0.56g$

Natural frequency of the motor is not equal to that of the pump. The worst condition is minimum acceleration of the pump. The minimum acceleration is $a = 0.117(2.4) = 0.281\ g$

Determine nat. freq. of pump



Pipe Col. 18" O.D., 3/8" wall thickness

$I = 0.0491(d_o^4 - d_i^4) = 0.0491[18^4 - 17.625^4]$
$I = 416 \text{ in}^4$

$\Delta = \frac{WL^3}{3EI} = \frac{5500(12 \times 15)^3}{3(30 \times 10^6)416} = 0.857 \text{ in} = 0.0714 \text{ ft}$

$\omega^2 = g/\Delta = 32.2/0.0714 = 451$

$\omega = 21.2$ rad/sec ; $f = 21.2/6.28 = 3.38$ cps

$a = 0.312g$; $a_{MAX} = 0.312(2.4) = 0.75g$

Assume motor acceleration is minimum for worst condition

Bolt Tension

$F_{H1} = 0.117(2.4)[3000] = 842\#$
$F_{H2} = 0.75[5500] = 4120\#$

$A = -1.99[842] + 4.75[4120] - 4250 = 13675\#/2$ bolts

$A = 6825\#$/bolt tension < 8840#/bolt allow

Check Top Bolts

$M = 6.3[0.56 \times 3000] - \sin 75°(38.5/12)A = 0$

$A = 3413\#/2$ bolts $= 1707\#$/bolt

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1707 #/bolt < 1.33(13.92 k) allow - AISC O.K.

SHEAR (max condition possible)

V = 0.50(3000) + 0.75(5500) = 5810 #/4 bolts

V = 1452 #/bolt < 1.89(2500) #/bolt allow