ATTACHMENT 3

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 PS-049, Revision 2, *"Seismic Evaluation of Consoles 2(3)0C05A, 2(3)0C04A and 2(3)0C03 for Mod 955"*

NUCLEAR ENGINEERING DEPARTMENT
M-20599 Rev. 2/89
DOCTYPE 061

CALCULATION COVER SHEET

1. Calculation No. PS-049
Page 1 of ~~70~~ ~~78~~ B 60 | 2

2. ☐ LGS ☒ PBAPS | UNIT(S) 2 & 3

Attachment 1, Pg 1, 2 | B

3. Initiating Document: Mod# 955	4. Responsible Branch: Computers Branch	5. Total No. of Sheets: 81 2 ~~70~~ ~~78~~ B	6. Last Sheet No: Appendix 1, Pg 10	7. ☒ Safety Related ☐ Non-Safety Related

8. Description: Seismic Evaluation of Consoles 2(3)OC05A, 2(3)OC04A and 2(3)OC03 for MOD. 955

9. System No.: ~~N/A~~ 70 | B
Structure: CONTROL RM/RADWASTE BLDG.
Component: 2(3)OC05A, 2(3)OC04A, 2(3)OC03

RECORD OF REVISIONS

10. No.	11. Description of Revision	12. Vendor Calc. Number	12. Vendor Calc. Rev.	13. Other Calcs Requiring Revision	14. Signatures: Preparer	Reviewer	Approver/Date
0	issue for use	19597-NM(C) PS-049	A	N/A	C.H. Chen N. Golestaneh	S. Kowal S. Wang (IR)	NBN 1/8-8-90
*1	Added recorder and various misc. changes	19597-NM(C) PS-049	B	N/A	C.H. Chen N. Golestaneh	S. Kowal	NBN 1/10-15-90
*2	Added computer trend recorder	N/A	N/A	N/A	C.H. Chen	J.W. Witte	12/5/90
	*Note: This copy includes the Rev 1 + Rev. 2 versions of this calculation as noted herein.						

15. Related Calc. Numbers							16.
	Provides Info to:	N/A	C.H. Chen 4/2/91				☒ Manual ☐ Computer
	Receives Info from:	N/A					Computer program and version
	Supersedes:	N/A					

	MAN. CALC.	COMP. CALC.	ATTRIBUTES *	REV. 0	REV. 1	REV. 2	REV. 3	REV. 4	REV. 5	REV. 6	REV. 7
1.	X	X	SOURCES OF DATA & FORMULAE WERE REVIEWED AND VERIFIED TO BE CORRECT AND COMPLETE.	JK 1.1	TIC MC	JDW					
2.	X	X	INPUT DATA FROM SOURCES IN ITEM 1, ABOVE, IS CORRECT AND PROPERLY EMPLOYED IN THE CALC.	JK 1.1	TIC MC	JDW					
3.	X	X	CALCULATION ASSUMPTIONS WERE REVIEWED AND FOUND TO BE COMPLETE AND VALID.	JK (.1	TIC MC	JDW					
4.	X		THE ANALYTICAL METHOD EMPLOYED IN THE CALC. HAS BEEN CONSIDERED AND IS PROPER FOR THE INTENDED USE OF THE CALCULATION.	JK (.1	TIC MC	JDW					
5.	X		MATHEMATICAL ACCURACY HAS BEEN CHECKED AND IS CORRECT (INDICATE METHOD USED): a) COMPLETE CHECK OF EACH COMPUTATION	JK 1.1	TIC MC	N/A JDW					
			b) SPOT-CHECK OF SELECTED COMPUTATIONS WHICH ARE INITIALED IN THE CALCULATION		N/A TIC MC	N/A JDW					
			c) PERFORMANCE OF ALTERNATE OR APPROXIMATION CALCULATION PER ERDP 3.9 CALC. IS ATTACHED.		N/A TIC MC	N/A JDW					
6.	X	X	CALCULATION RESULTS WERE CHECKED AGAINST APPLICABLE, DOCUMENTED DESIGN CRITERIA AND FOUND TO BE IN CONFORMANCE.	JK 1.1	N/A TIC MC	N/A JDW					
7.	X	X	EXISTING CALCULATION WHICH REQUIRE REVISION BECAUSE OF THIS CALCULATION HAVE BEEN IDENTIFIED.	N/A	TIC MC	JDW					
8.		X	THE ANALYTICAL METHOD DESCRIBED IN THE COMPUTER CALCULATION SUMMARY IS PROPER FOR THE INTENDED USE OF THE CALCULATION.	N/A	N/A TIC MC	N/A JDW					
9.		X	COMPUTATIONAL ACCURACY HAS BEEN CHECKED AND FOUND CORRECT (INDICATE METHOD USED): a) CHECK SAMPLE CALC. USING DATA OTHER THAN USED IN SAMPLE.		N/A TIC MC	N/A JDW					
			b) PERFORMANCE OF ALTERNATE OR APPROXIMATE CALCULATION PER ERDP 3.9 CALC. IS ATTACHED.								
			c) DESCRIBE OTHER METHOD IF 9.A OR 9.B IS NOT USED. SWEC QA ACCEPTED COMPUTER PROGRAM	N/A							
10.		X	OUTPUT IS REASONABLE CONSIDERING THE INPUT.	JK 1.1	TIC MC	N/A JDW					

* THESE ARE THE MINIMUM ATTRIBUTES AND ARE NOT INTENDED TO LIMIT THE INITIATIVE OF THE CHECKER TO REVIEW OTHER ATTRIBUTES. ATTRIBUTES APPLICABLE TO MANUAL AND COMPUTER CALCULATIONS ARE NOTED BY AN (X) IN THE APPROPRIATE COLUMN. FOR CHECKING OF REVISIONS TO MANUAL CALCULATIONS, THE ATTRIBUTES MAY BE LIMITED TO ONLY REVISED PORTIONS OF THE CALCULATION. CHECKER SHALL INITIAL EACH ATTRIBUTE COMPLETED.

I 95 07-NM(C)-PS-049

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION TITLE PAGE

CLIENT PHILADELPHIA ELECTRIC CO. PROJECT PEACH BOTTOM ATOMIC POWER STATION - UNIT		PAGE 3 OF ~~70~~ 60 ~~78~~ A 12

CALCULATION TITLE (Indicative of the Objective) :

Seismic Evaluation of Consoles 2(3)OC05A 2(3)OC04A and 2(3)OC03 for MOD 955

QA CATEGORY (✓)
✓ I -NUCLEAR SAFETY RELATED
__ II __ III __ OTHER

CALCULATION IDENTIFICATION NUMBER				OPTIONAL
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	WORK PACKAGE NO.
19597	NM(C)	PS-049	N/A	N/A

* APPROVALS-SIGNATURE & DATE Mukund Motiwala 8/8/90

PREPARER(S) / DATE(S)	REVIEWER(S) / DATE(S)	INDEPENDENT REVIEWER(S) / DATE(S)	REV. NO. OR NEW CALC. NO.	SUPERSEDE *CALC. NO OR REV. NO	CONFIRM'N *REQD (✓) YES	CONFIRM'N *REQD (✓) NO
C H Chen C H Chen 8/2/90 Pages 1 ~ 54 N A Goldstein N A Goldstein 8/2/90 pages 55 - 60 Appendix 1 - pgs 1-10	J Kowal L. KOWAL 8-8-90	W. WANG B/8/90	A	N/A		✓
C H Chen C H Chen 10/15/90 Pages 1 ~ 54 Attachment 1 N A Goldstein N A Goldstein 10/15/90 Pages 55 ~ 60 Appendix 1: pgs 1-10	J Kowal L. KOWAL 10-15-90	J Kowal L. KOWAL 10-15-90	B			✓
APPROVED BY : Mukund Motiwala 10/15/90						
F. X. McCrea (PECO) 12/4/90	N/A	J. W. Wang 12/4/90	2	N/A		✓

DISTRIBUTION *

GROUP	NAME & LOCATION	COPY	GROUP	NAME & LOCATION	COPY
RECORD MGMT. FILES / FIRE FILE IF NONE	BOSTON 245/02				
PROJECT FILE	CHOC				

CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	4

Table of Contents

CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	4a

Table of Contents

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

5010.65 ct

CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	5

Revision Status Table

Rev No	Page No.	Description/reason
A		Original issue - Cover sheet Rev. 0 from 8/1/90
B Rev. 1 from 10/23/90	52a 52b 52c	This revision is made to include the following changes: 1. Deviation of support design for RWM CRT for unit 2 console 20C05A. This change is required due to space availability of unit 2 console.
	52d 52e	2. Addition of a modification--replacement of a Gemax 6"x6" computer trend recorder with a 6"x6" tracor westronics multipens recorder. This modification was not originally planed for installation during the upcoming outage.
	16 25	3. Material changes for bolts, nuts, washers and screws to accomodate vendor deviation request. Replace page 16 with a new page.
	58	4. Revise seismic capability limits of existing Q devices for clarification, and replace with revised page.
	1,2 3	Editorial changes related to the above revision are identified below: Update page number.
	4	Update table of contents to include changes for items 1 & 2 above.
	4a	Update table of contents to include Attachment 1.
	6	Change note to read from "items 4 & 5" to "item 4".
	11	Add weight of tracor westronics multipens recorder.
	Atta.1 1,2	Attach voided pages 16 and 58 as Attachment 1 for record.
2		Revision 2 includes the following changes:
	6,11 52d 52f 52g 54	1. Removal of the existing RWM operator interface and replacement with a new 6" x 6" computer trend recorder.
		Editorial changes related to revision 2 are identified below.
	1,2,3	Update page numbers.
	4&4a	Update table of contents.
	5	Update revision sheet.

1.0 INTRODUCTION

PECo Nuclear Engineering Department intends to install additional devices on control room consoles 2(3)0C05A, 2(3)0C04A and 2(3)0C03 (hereafter referred to as 05A, 04A and 03) during the upcoming outage in October, 1990 (ref. 1). This installation is identified as modification (MOD) 955, which involves mounting of the following devices:

05A

1. Remove the existing computer trend Gemax recorder and install a new 13 in. Rod Worth Minimizer(RWM) CRT

2. Install a panel switch

3. Install two digital displays with associated electronics and power supplies.

4. Remove old RWM operator interface and install a 6"x6" computer trend recorder.

5. Remove Gemax 6"x6" computer trend recorder and replace with 6"x6" Tracor Westronics multipen recorder

Note: Items 4 and 5 will not be installed during the upcoming outage. Therefore, qualification of supports for these items will not be performed in this calculation. 2

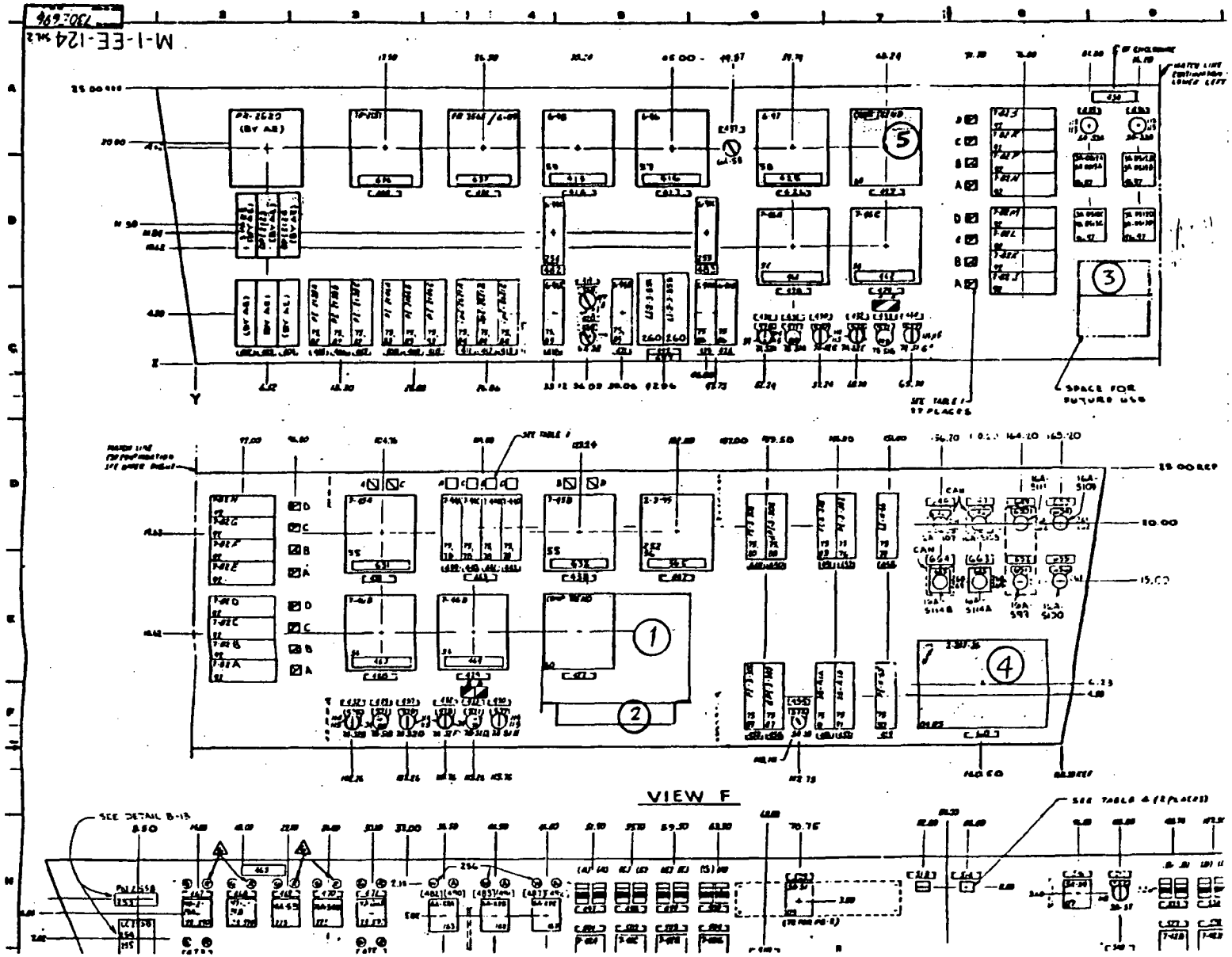
04A

1. Install a digital display with its associated electronics and power supply.

03

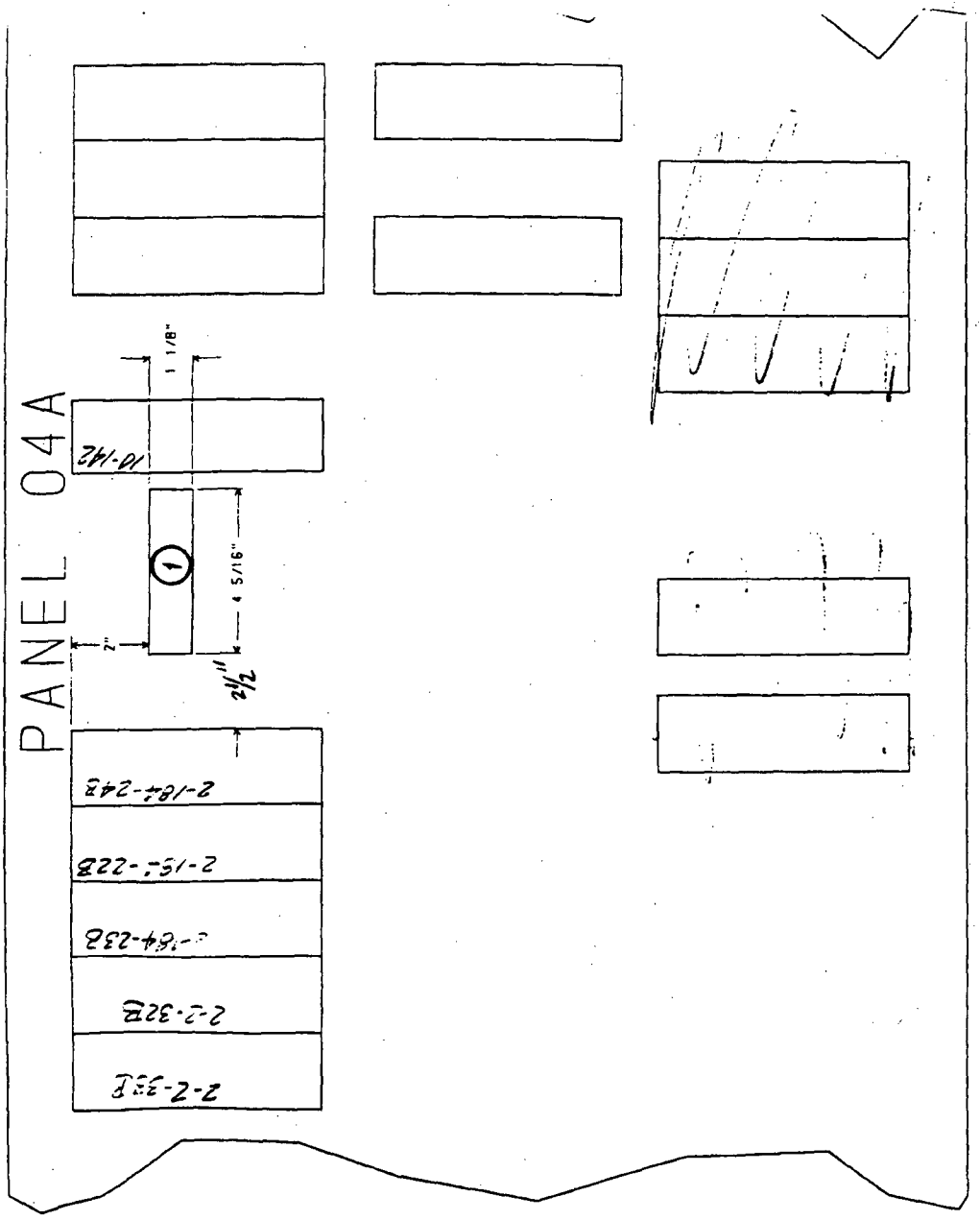
1. Same as 04A

The locations of the above modifications are identified on the attached sketches (pages 7, 8 AND 9).

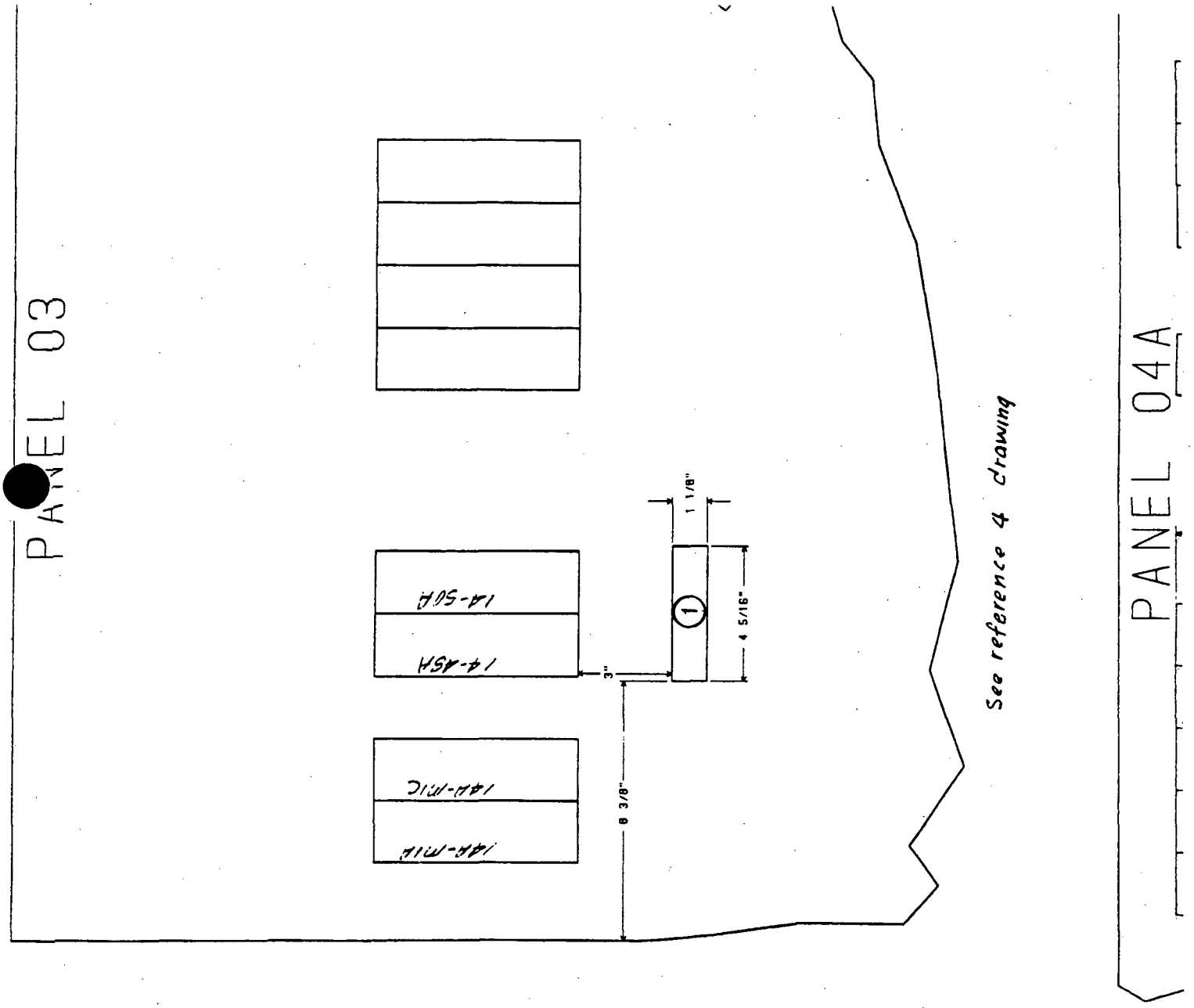


Console 05A

19597-NM(C)-PS-049



19597-NM(C)-PS-049



The above modifications involve cutouts of the console panel to provide openings for mounting the devices, and attachment of the devices to console structural members, etc. Therefore, the impacts that may arise from the modifications need to be addressed, which are stated in the "Objective" section.

2.0 OBJECTIVE

The objectives of this calculation are:

1. To demonstrate the adequacy of MOD 955 supports/braces.

2. To address the impact of the modifications on the existing consoles and devices.

3. To assess the impact of non Q devices on the Q devices and consoles and provide resolution as necessary (for console 05A only).

4. To provide seismic capability limits of existing Q devices from SWEC/Vendor data bases (for console 05A only).

CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	11

3.0 Design Input

Weight of Devices (provided by PECo)

Rod Worth Minimizer(RWM) CRT	35 lb	
Panel switch	5	
RWM cable connector	2	
Digital display	1	
Electronic box	2	
6"x6" Computer Trend Recorder	20	/2
Power supply	4	
Tracor westronics multipens recorder	20	/B

Material	Sy ksi	Su ksi	Ref.
A-569 sheet metal	25		*
Bolt, A-307	--	60	5
Stud, A-108 Gr. 1010 or 1018		40-60	**
Screw, A-193, Gr B7	105	125	5
Unistrut A-570, Gr 33	33	52	7

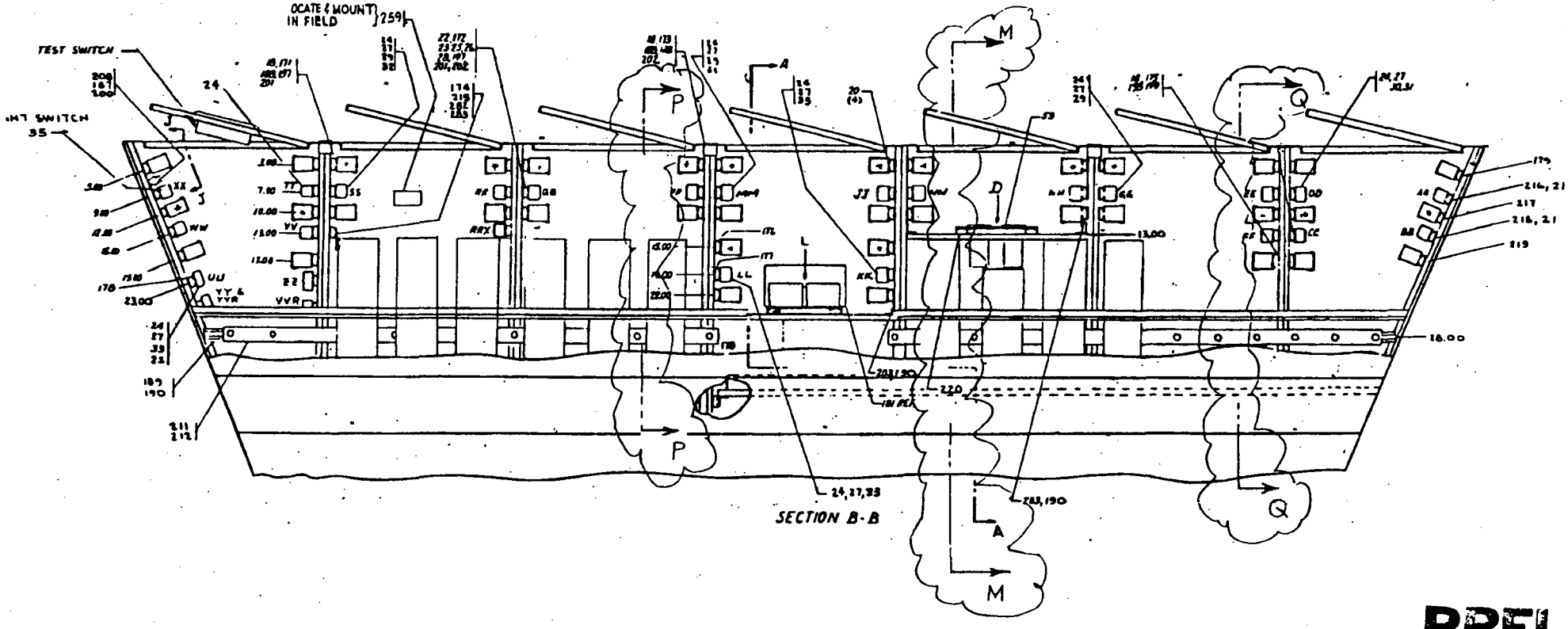
* Metal Handbook, 8th ed. American Society for Metals

** KSM Structural Eng. Aspects of Headed Concrete Anchor and Deformed Bar Anchors in the Concrete Construction Industry.

Allowable Stresses, ksi	Tensile	Shear	Ref.
A-569 sheet metal	0.6 Sy(15)	0.4 Sy(10)	6
Bolt, A-307	26 - 1.8 fv	20	6
Stud, A-108 Gr. 1010 or 1018	0.33 Su(13.2)	0.17 Su(6.8)	6
Screw, A-193, Gr B7	0.33 Su(41)	0.17 Su(21)	6
Unistrut A-570, Gr 33	0.6 Sy(19.8)	0.4 Sy(13.2)	6

Support Sketches

see attached sheets (pages 12 to 26--console 05A, pages 27 to 29--console 04A, pages 30 to 33--panel 03)



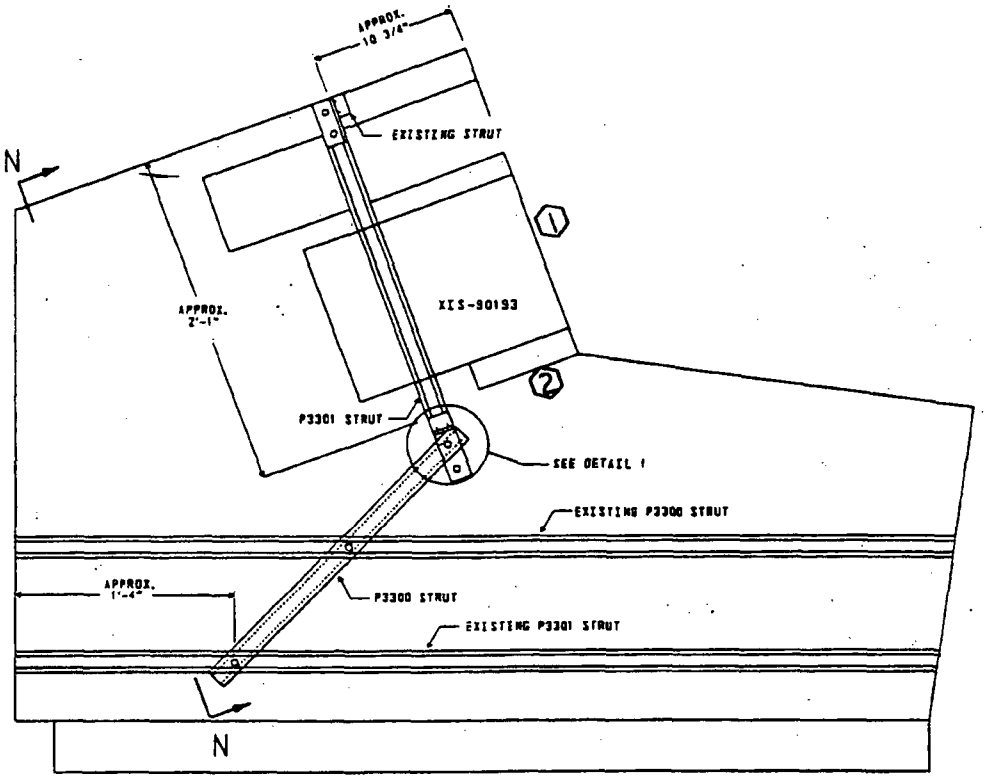
CONSOLE 05A (Pages 12 to 26)

PREL

INTERIM DRAWI

STATION

PBAPS LGS



SECTION M-M

1 13" RWM CRT
2 Panel switch

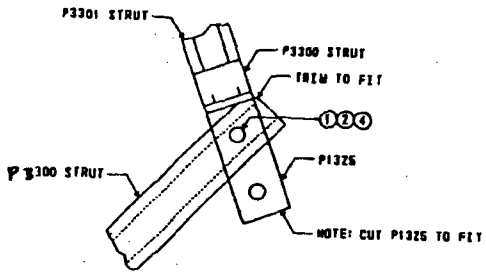
NOTES:

ALL CONNECTIONS USING UNISTRUT BOLTS SHALL BE TORQUED TO THE FOLLOWING VALUES UNLESS OTHERWISE NOTED:

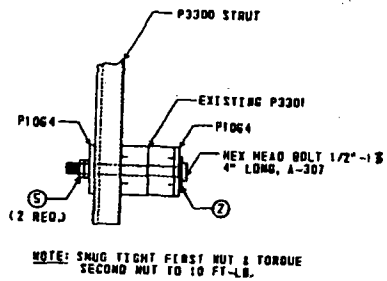
1/4" BOLT 6 FT-LB.

1/2" BOLT 50 FT-LB.

ITEM NUMBER	PART DISCRIPTION	CAT. NUMBER
①	HEX HEAD BOLT 1/2"X 1 3/16"	HHCS050119EG
②	1/2" WASHER	HFLW050EG
③	FLAT PLATE	P1064
④	1/2" SPRING NUT	P4010
⑤	1/2" NUT	HHXN050EG

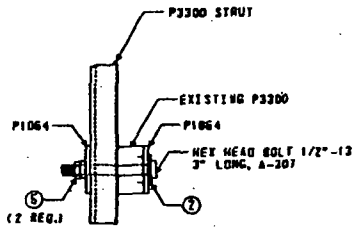


DETAIL 1



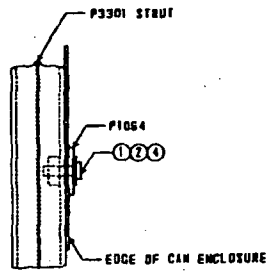
NOTE: SNUG TIGHT FIRST NUT & TORQUE SECOND NUT TO 10 FT-LB.

DETAIL 2

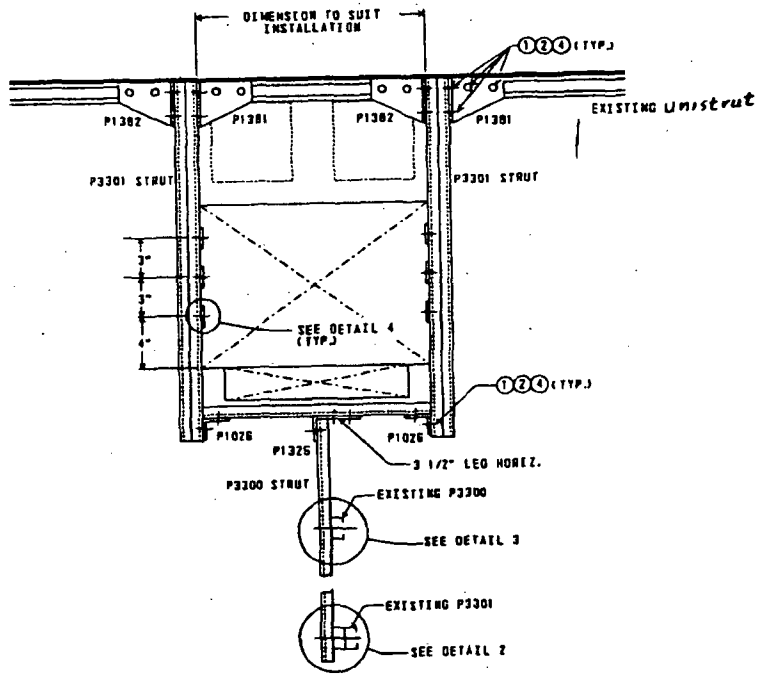


NOTE: SNUG TIGHT FIRST NUT & TORQUE SECOND NUT TO 10 FT-LB.

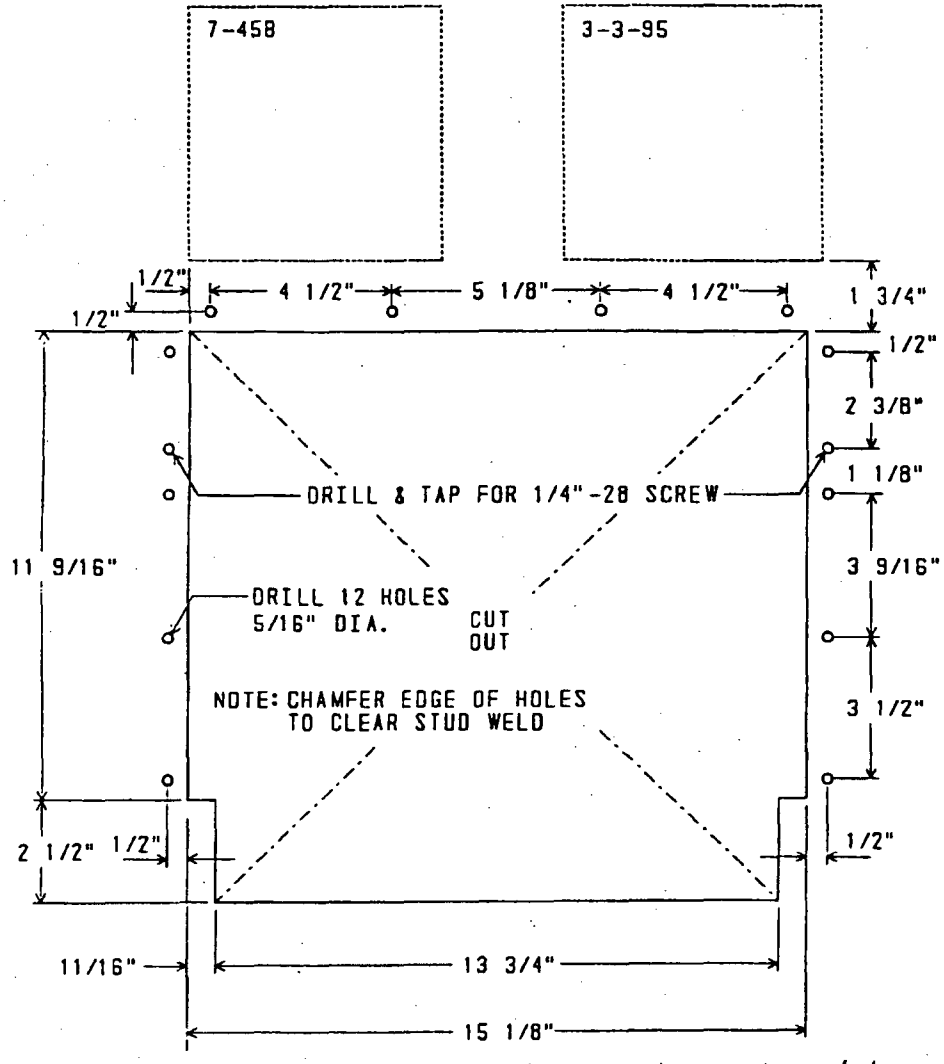
DETAIL 3



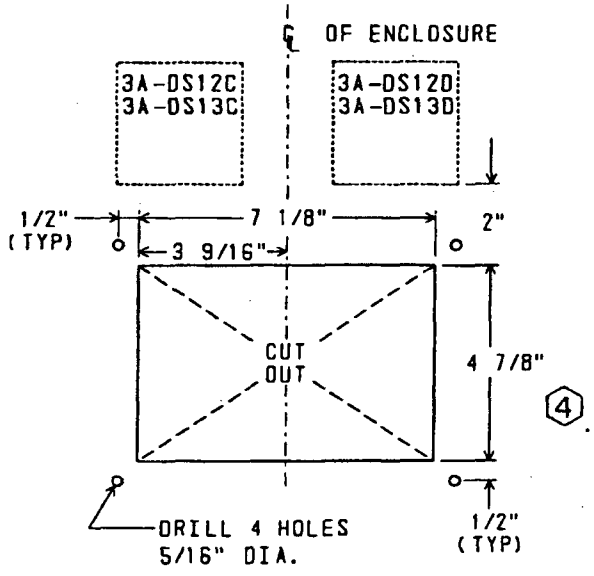
DETAIL 4



SECTION N-N

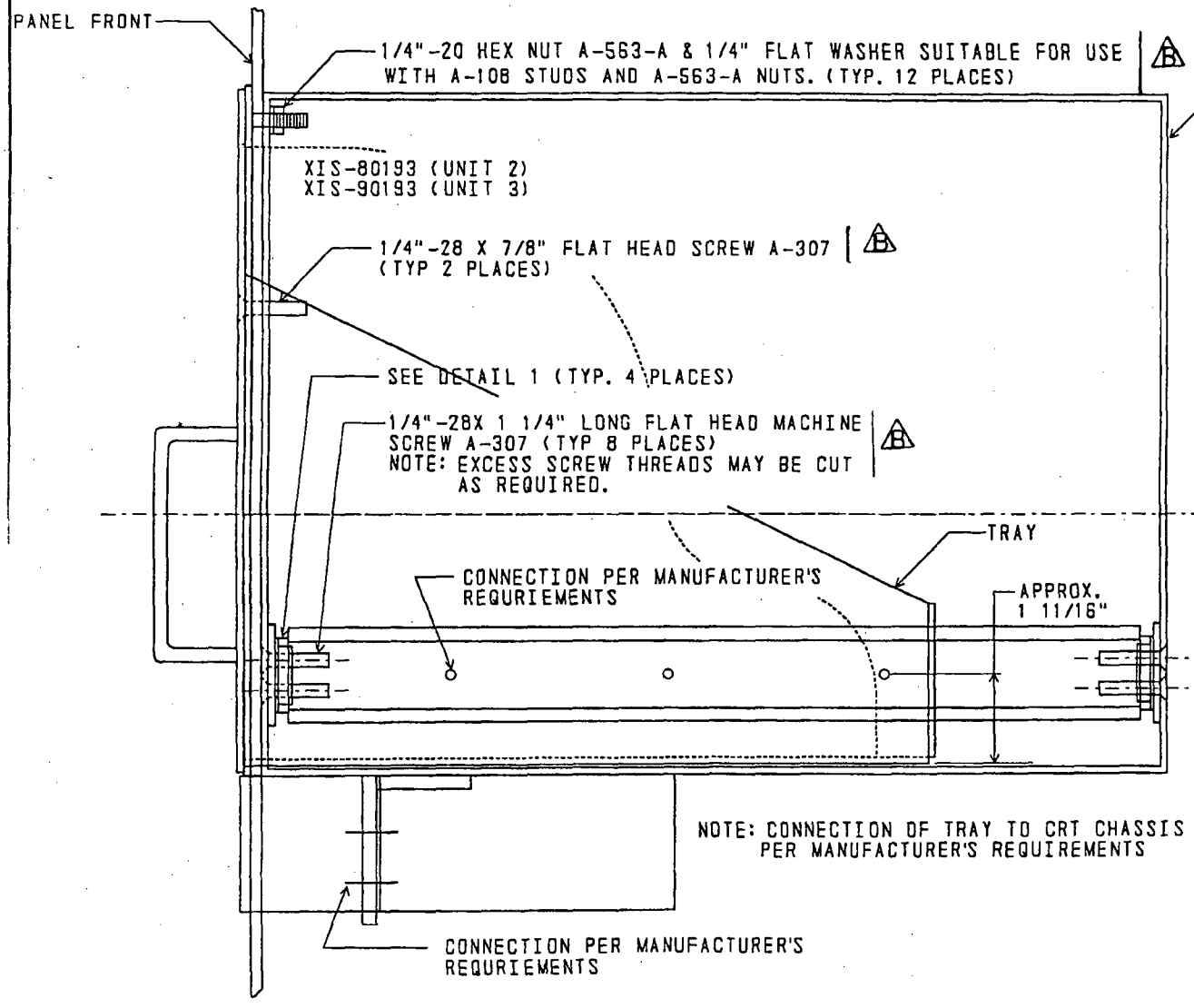


Cutout for 13" CRT and panel switch



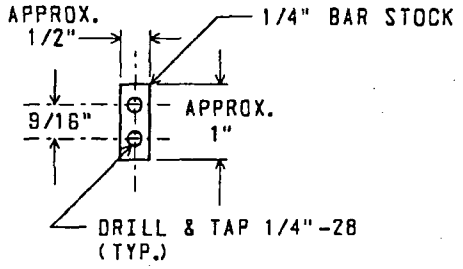
NOTE: CHAMFER EDGE OF HOLES
TO CLEAR STUD WELD

Cutout for Digital Displays



XIS-80193 & XIS-90193 ASSEMBLY DETAIL

ROUTE 25011



DETAIL 1

THIS IDCN SUPERSEDES M-1-EE-124 SHEET 8 IDCN "M"

INTERIM DRAWING CHANGE NOTICE

STATION		UNIT			
PBAPS	LGS	C	1	2	3
☒	☐	☐	☐	☒	☒

PHILADELPHIA ELECTRIC COMPANY

MOD	DRAWING	SHEET	REV.	IDCN
955G	M-1-EE-124	8	59	W

PRELIMINARY ISSUE ☐ DRAFT ISSUE ☐ MOD ISSUE ☒

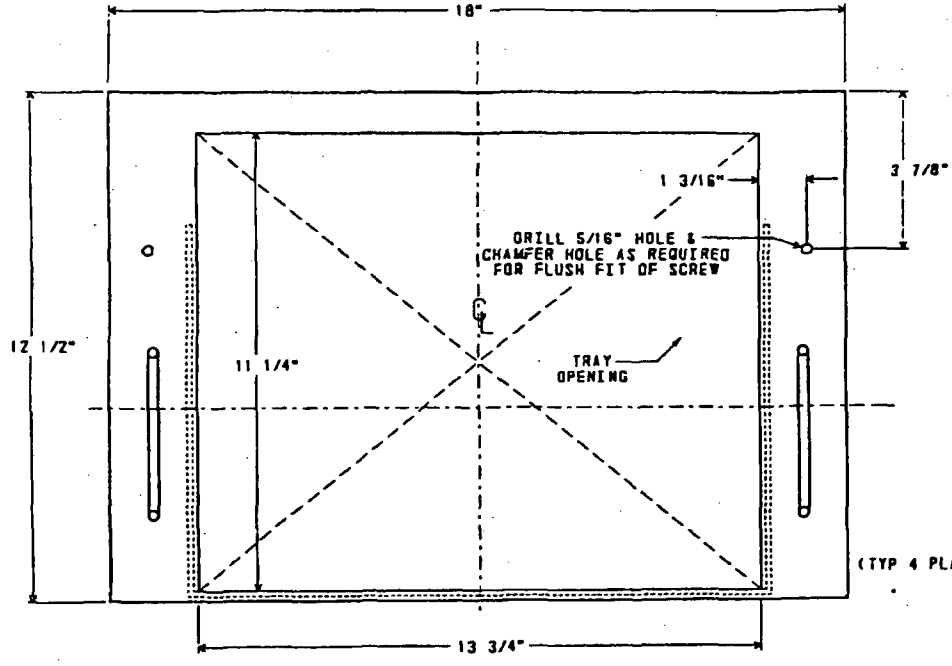
DATE	DESIGN	CHKD.	APPR.	STRL.

DESCRIPTION: PAGE 1 OF 1

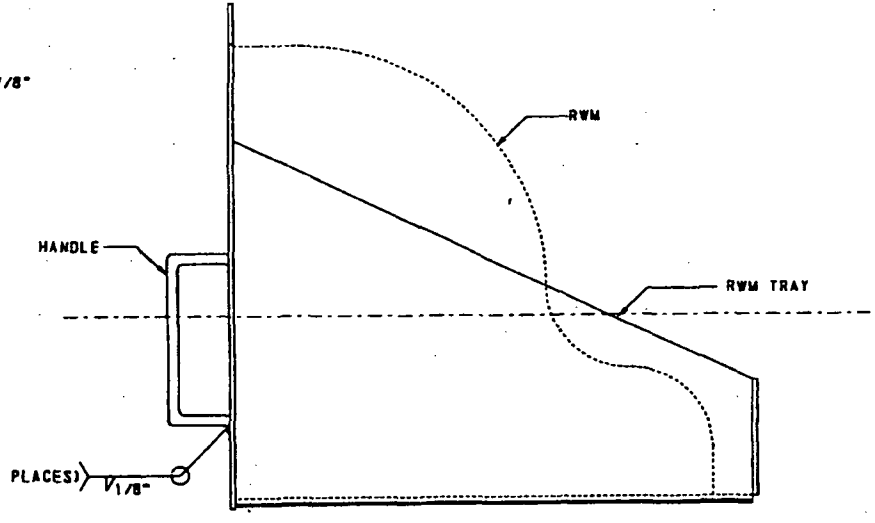
86150041 0239955

MOD 955G

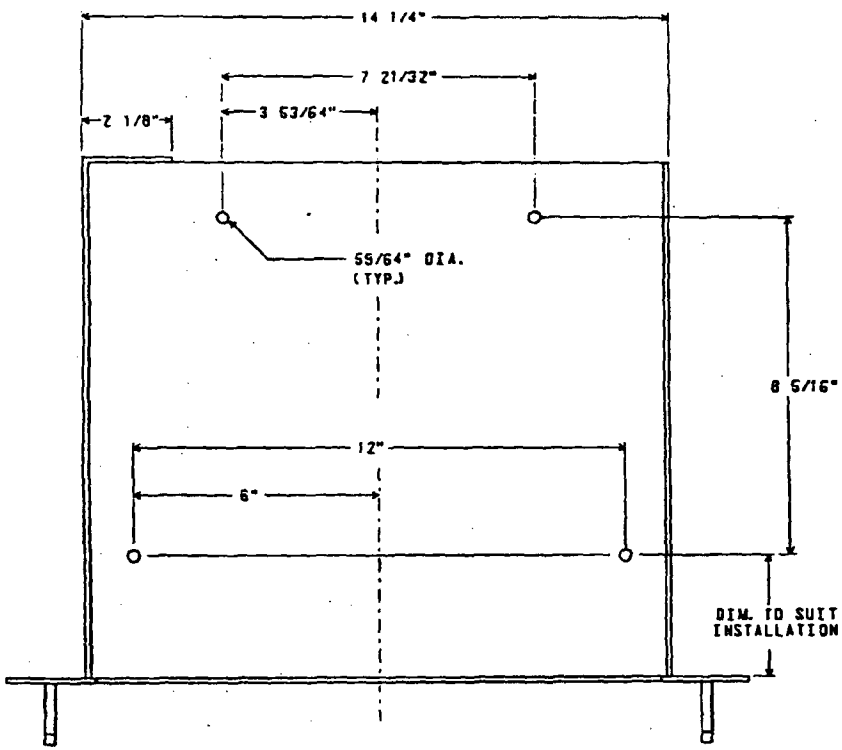
ADDED: ASSEMBLY DETAIL FOR DEVICE XIS-80193 & XIS-90193



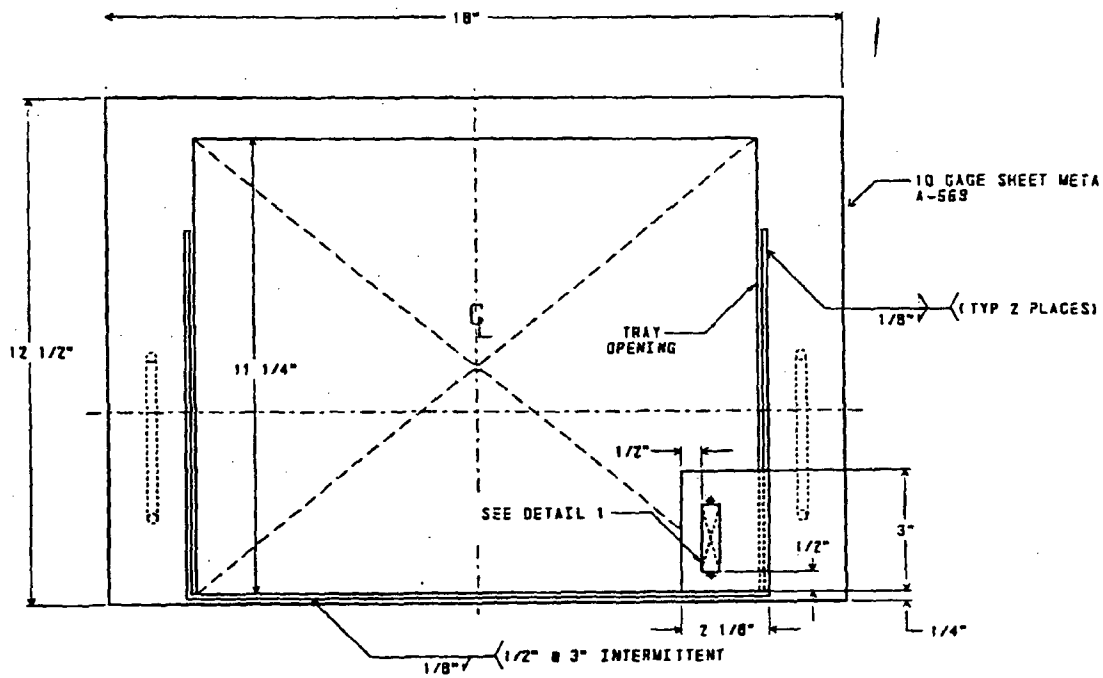
TRAY FRONT VIEW



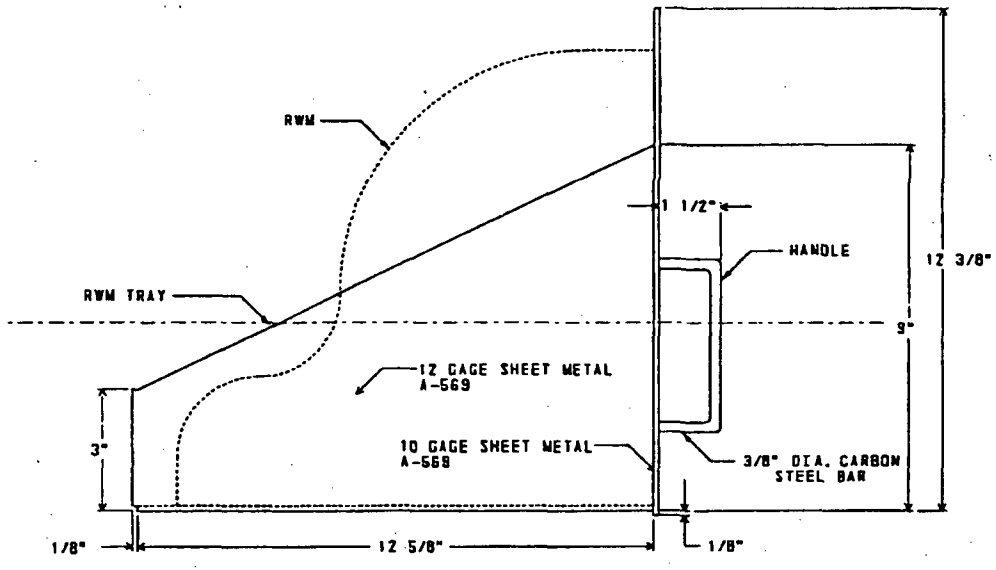
TRAY RIGHT SIDE VIEW



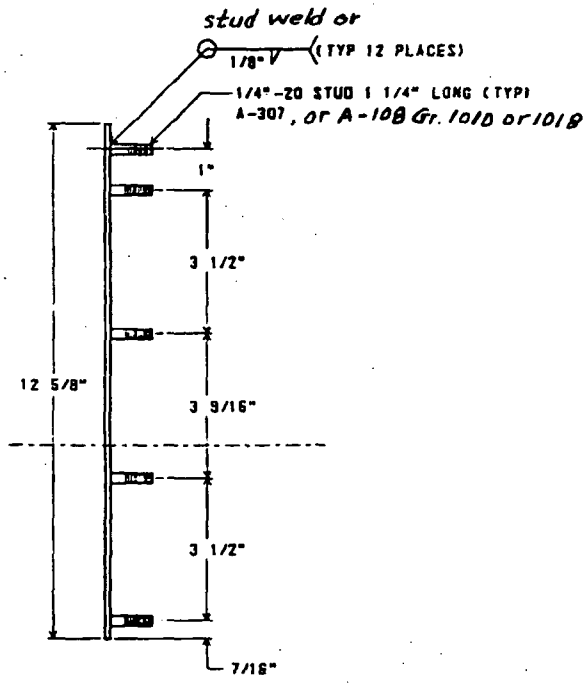
TRAY TOP VIEW



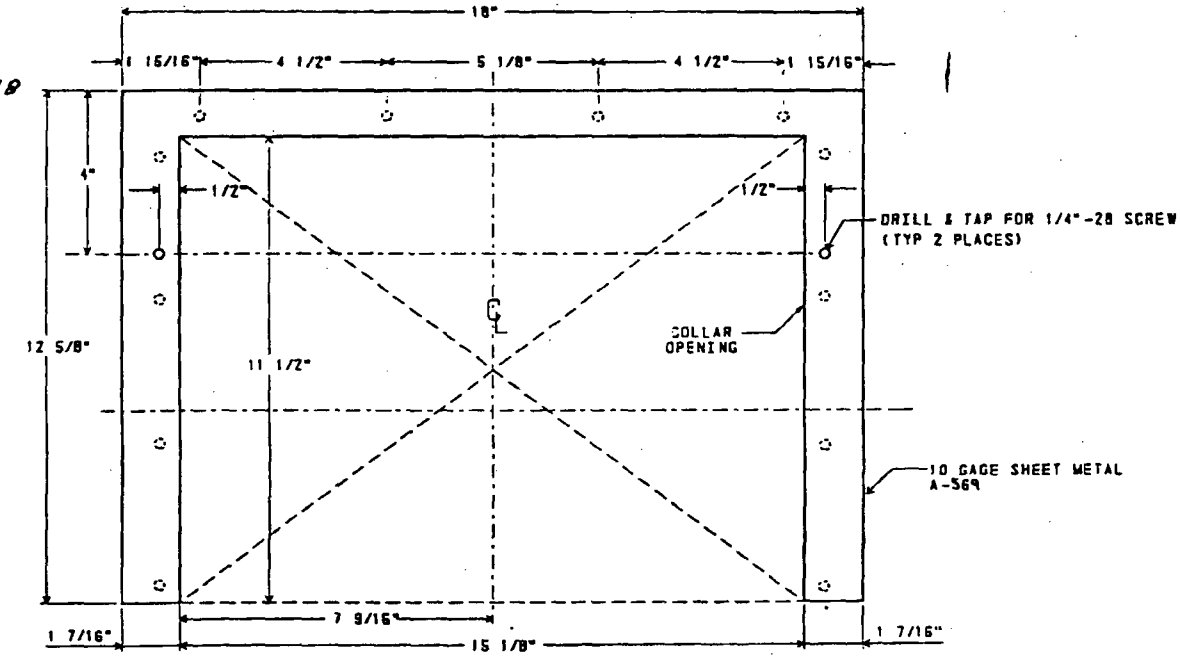
TRAY REAR VIEW



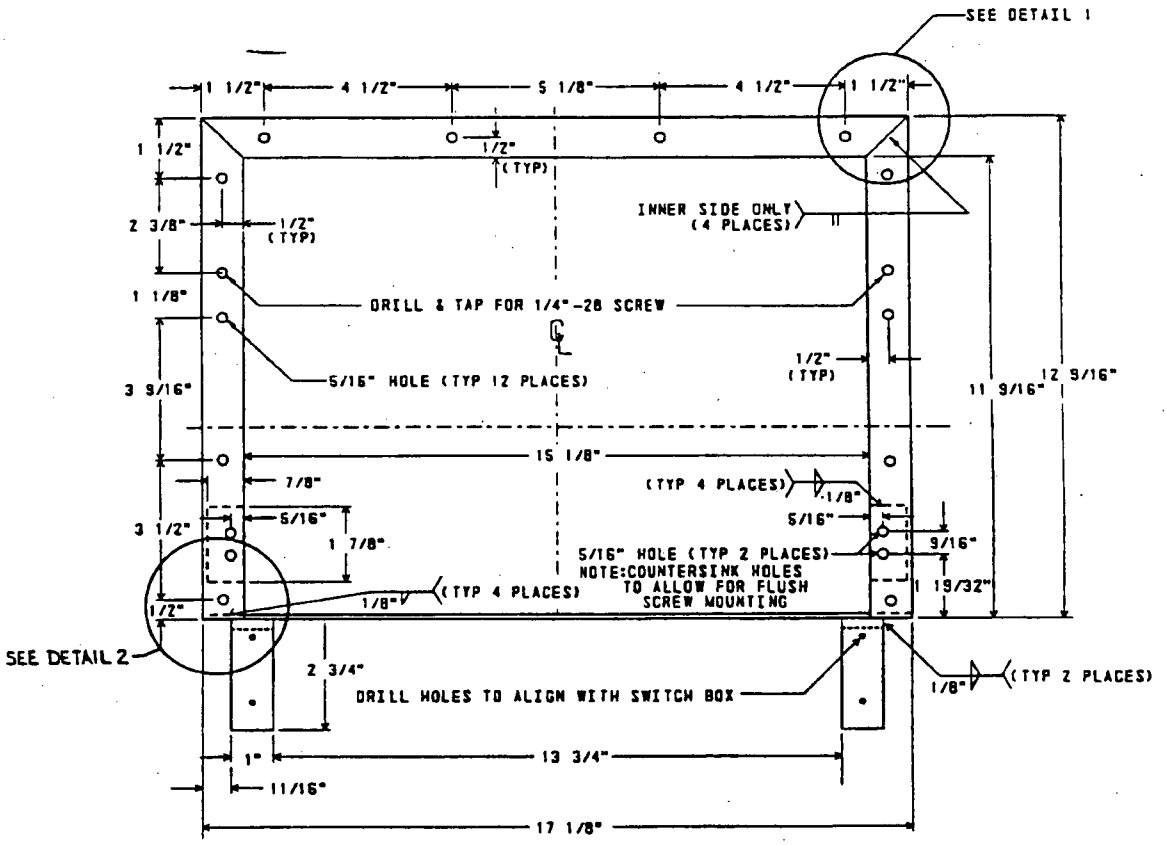
TRAY LEFT SIDE VIEW



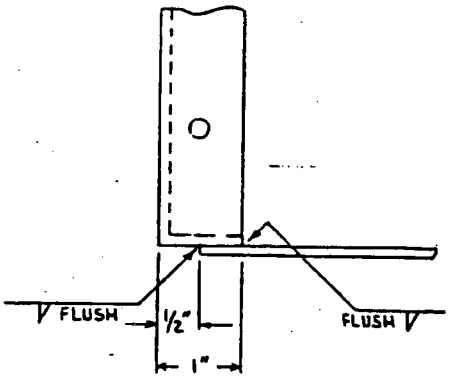
COLLAR SIDE VIEW



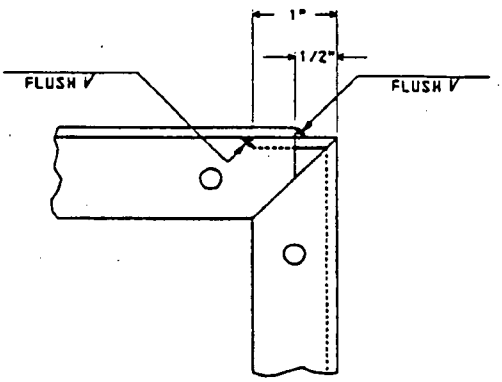
COLLAR FRONT VIEW



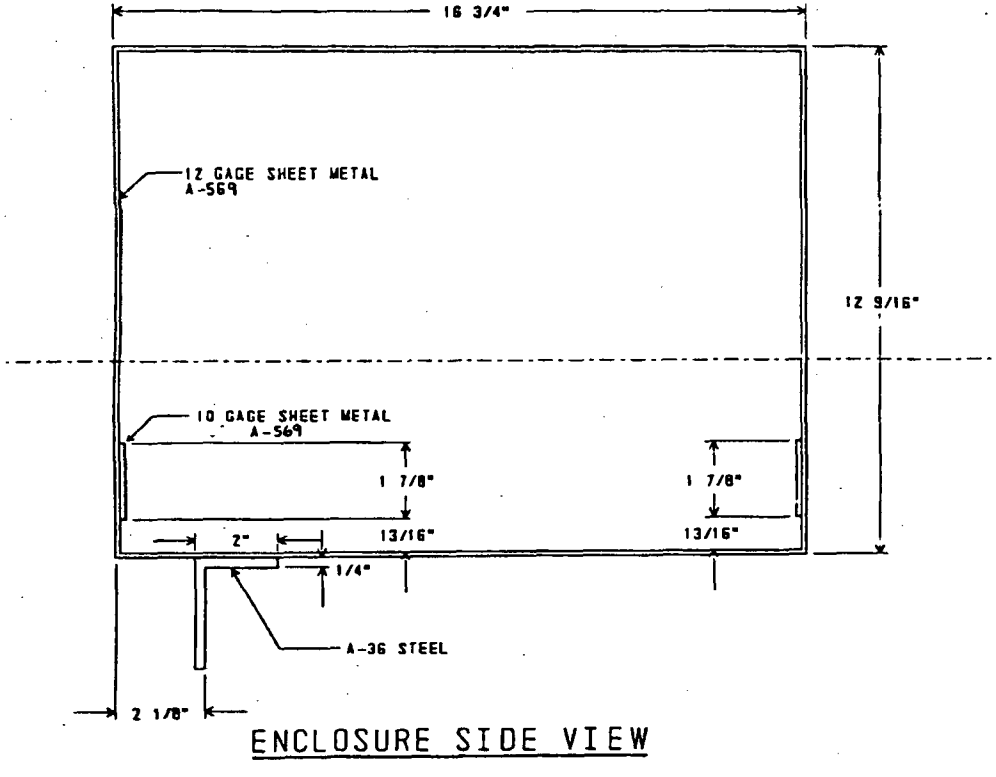
ENCLOSURE FRONT VIEW



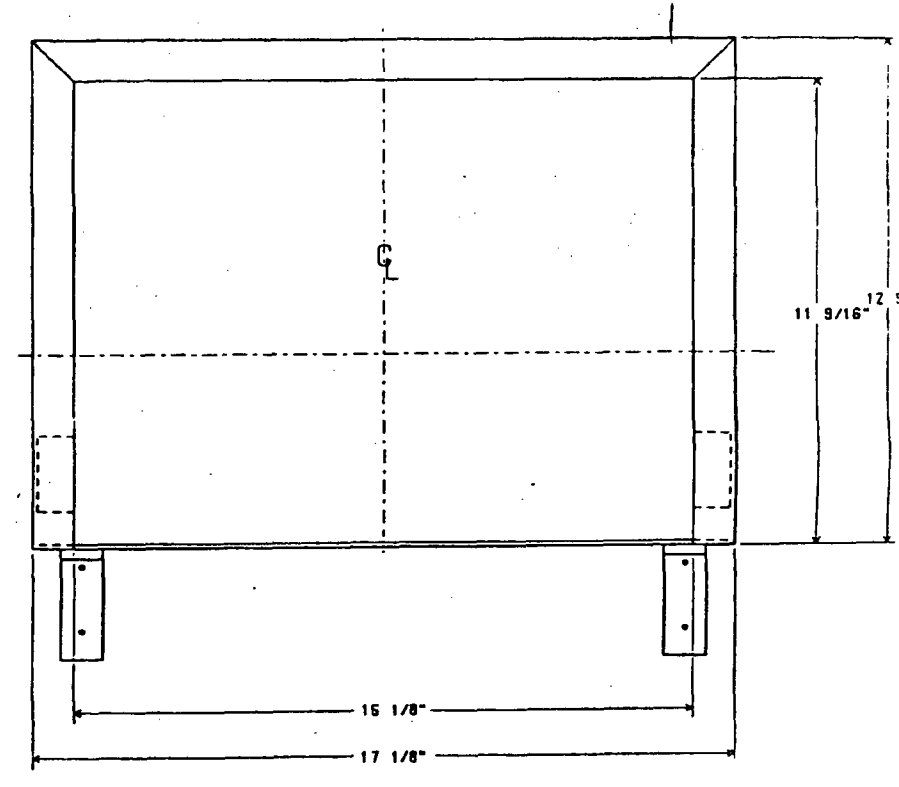
DETAIL 2



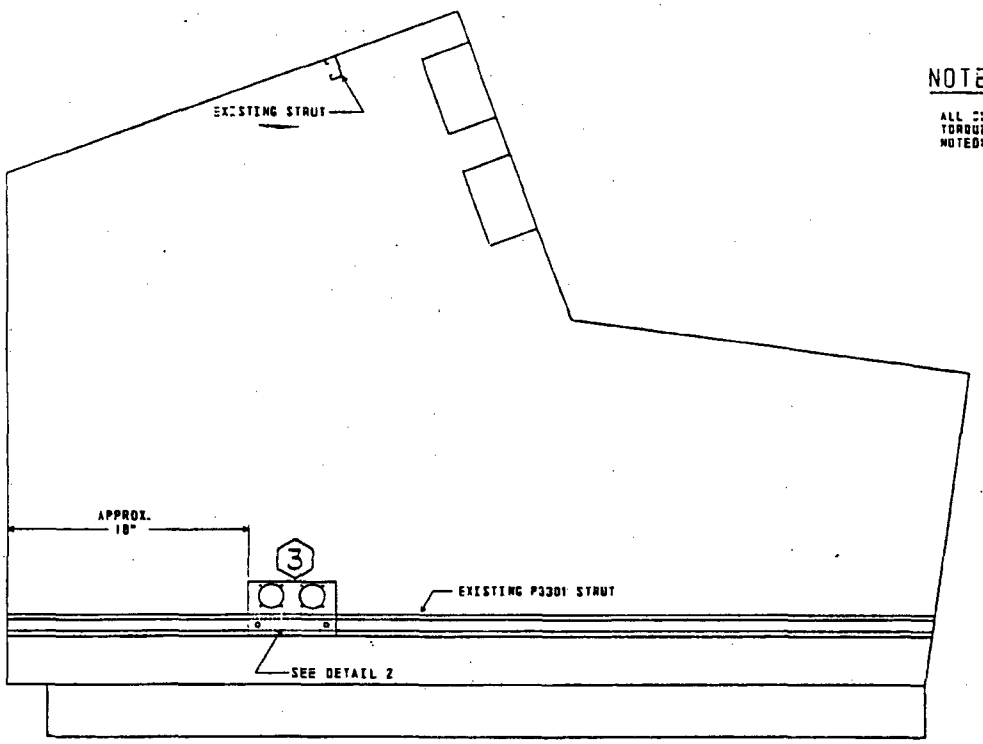
DETAIL 1



ENCLOSURE SIDE VIEW



ENCLOSURE REAR VIEW



NOTES:

ALL CONNECTIONS USING UNISTRUT BOLTS SHA TORQUED TO THE FOLLOWING VALUES UNLESS C NOTED:

1/4" BOLT 6 FT-LB.

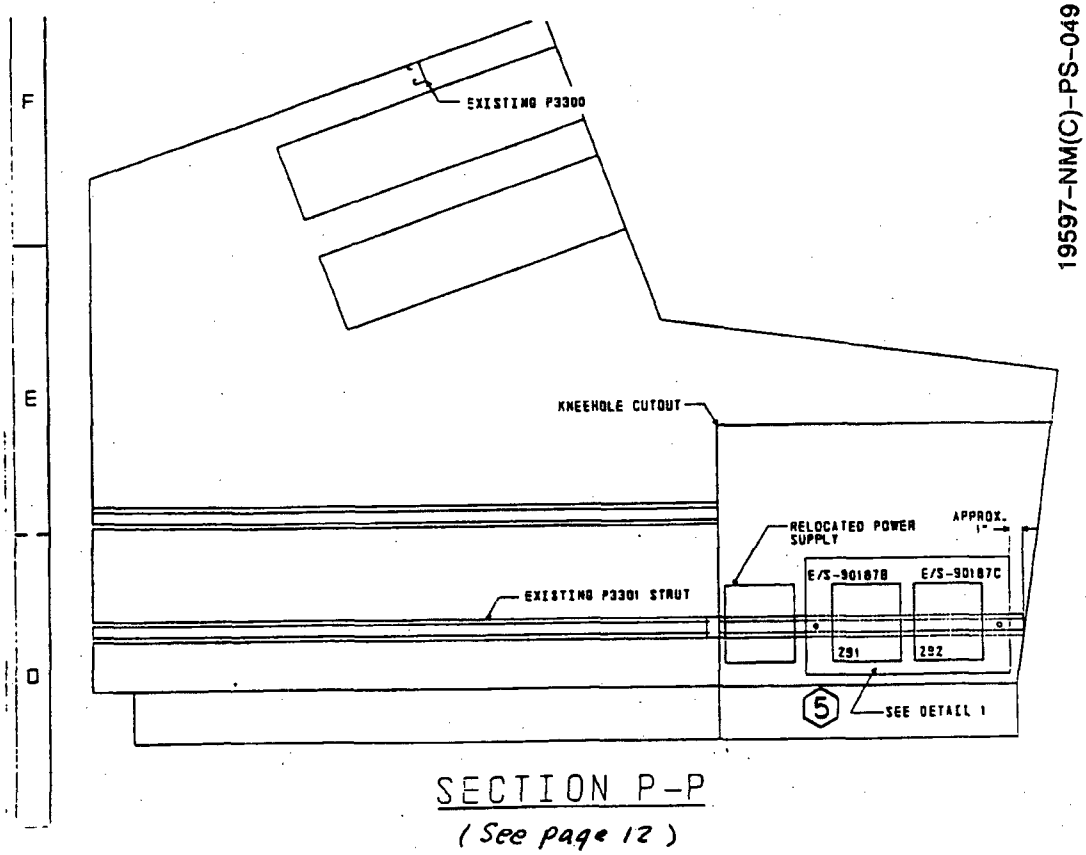
1/2" BOLT 50 FT-LB.

SECTION Q-Q

(See page 12)

3 Cable Connectors

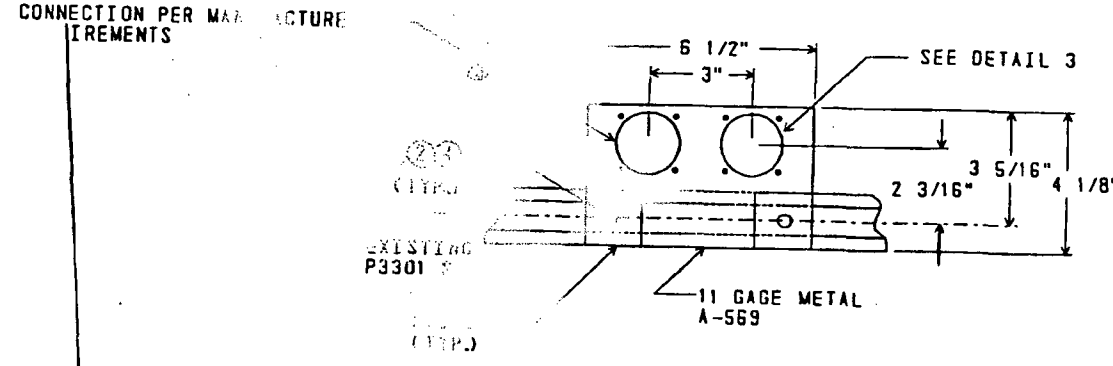
5 Power supplies



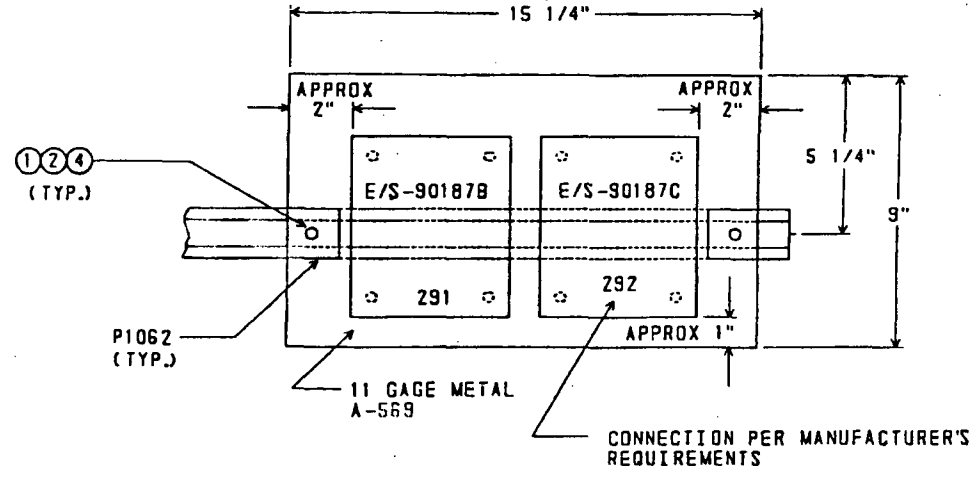
SECTION P-P

(See page 12)

ITEM NUMBER	PART DISCRIPTION	CAT. NUMBER
①	HEX HEAD BOLT 1/4"X 1 1/2" (TRIM TO 1" LENGTH)	HHCS025150EG
②	1/4" WASHER	HFLW025EG
③	FLAT PLATE	P1062
④	1/4" SPRING NUT	P4006-1420



DETAIL 2



DETAIL 1

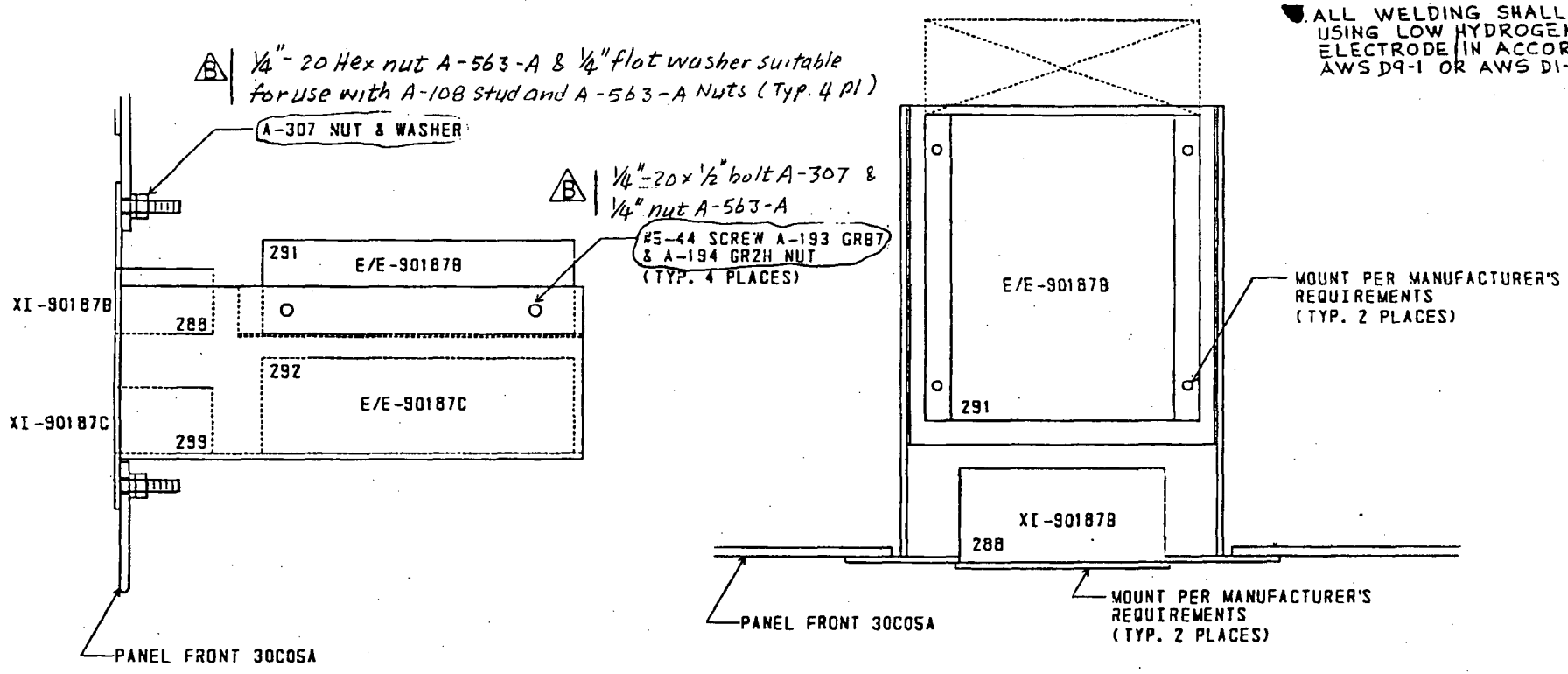
B

A

NOTES :

ASSEMBLY DETAILS

1. ALL WELDING SHALL BE PE
USING LOW HYDROGEN E-70X
ELECTRODE IN ACCORDANCE
AWS D9-1 OR AWS D1-1 CODE



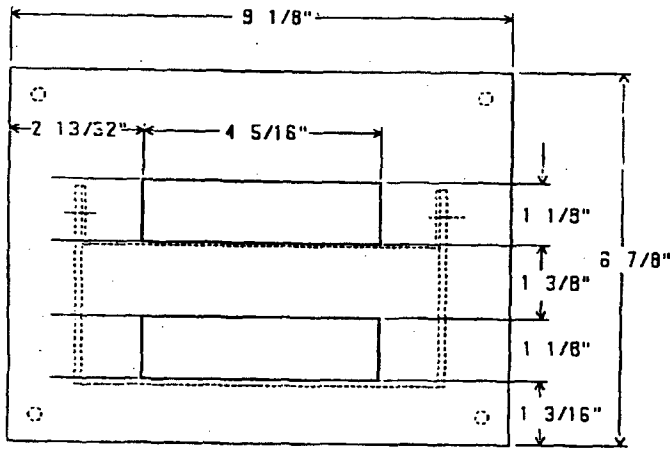
TRAY SIDE VIEW

TRAY TOP VIEW

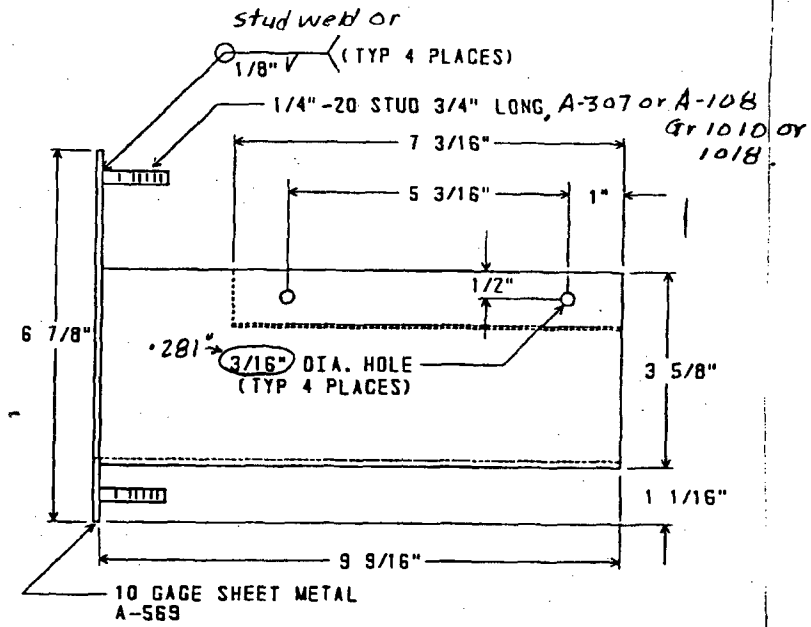
(4) Digital Displays & Electronics Boxes

Console 05A

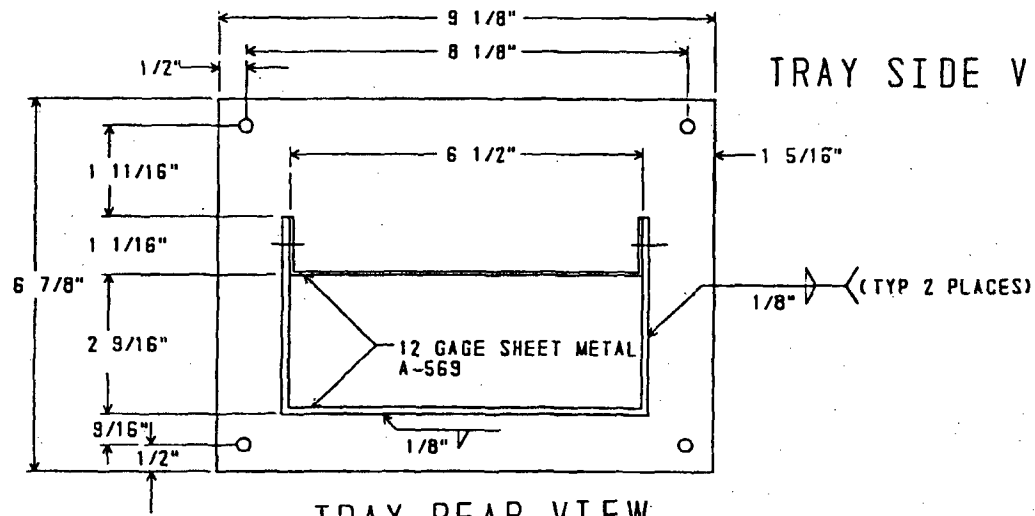
FABRICATION DETAILS



TRAY FRONT VIEW



TRAY SIDE VIEW



TRAY REAR VIEW

ROUTE 2501

INTERIM DRAWING CHANGE NOTICE

STATION: PBAPS ☒ LGS ☐

UNIT: C ☐ 1 ☐ 2 ☐ 3 ☒

PHILADELPHIA ELECTRIC COMPANY

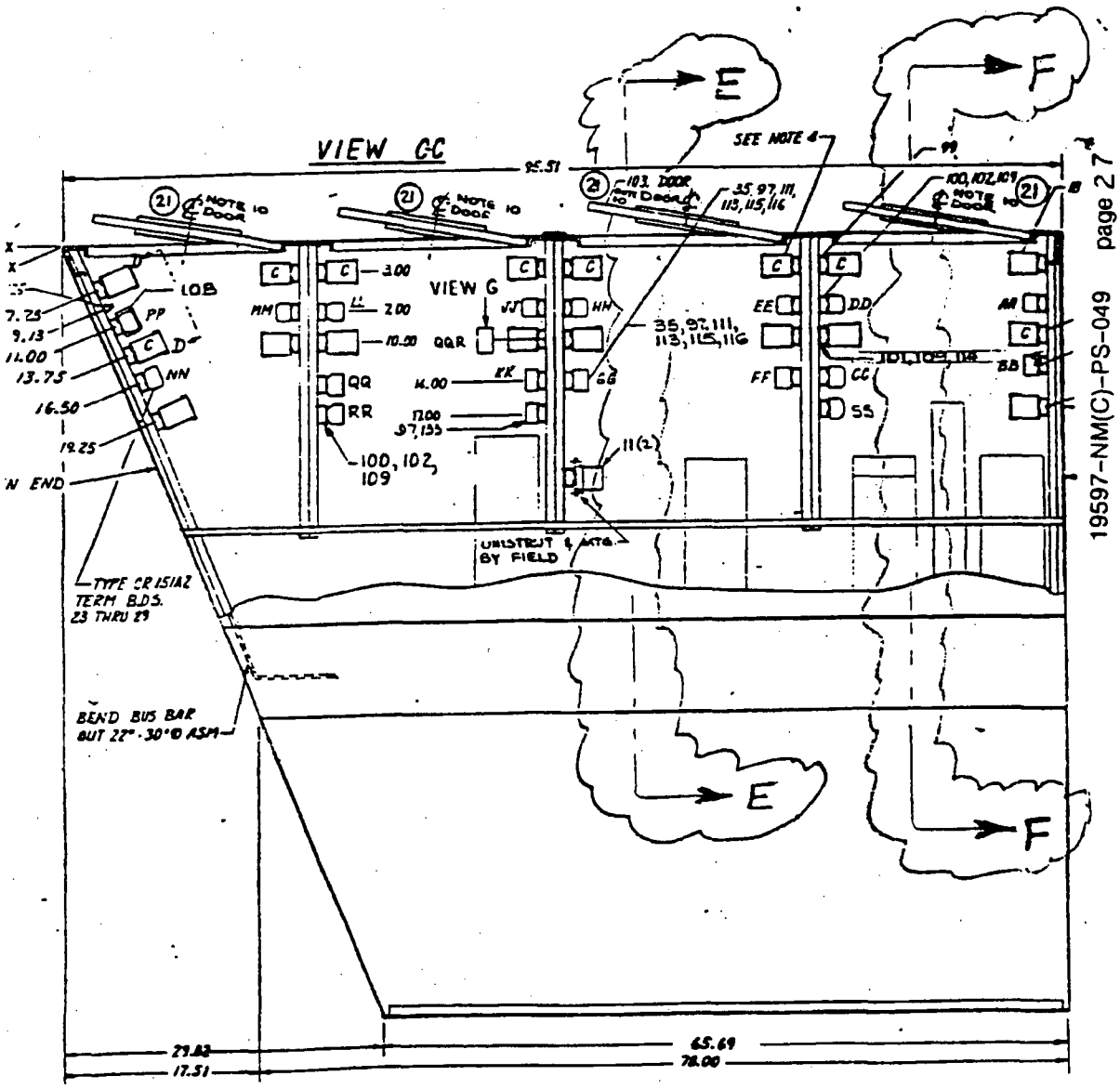
MOD	DRAWING	SHEET	REV.	IDCN
955G	M-1-EE-67	1	29	D

PRELIMINARY ISSUE ☐ DRAFT MOD ISSUE ☐ MOD ISSUE ☒

DATE	DESIGN	CHKD.	APPR.	STRL.

OF 1

E.A. 8615.0041
REF. 0239955 MOD 955G
ADDED: SECTIONS E-E & F-F



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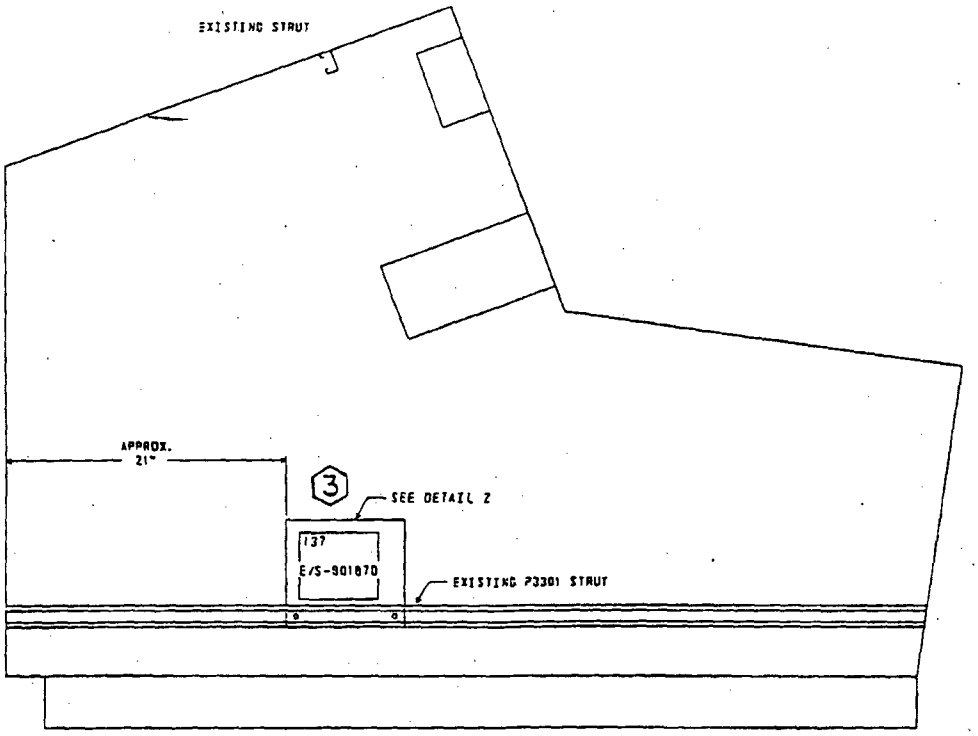
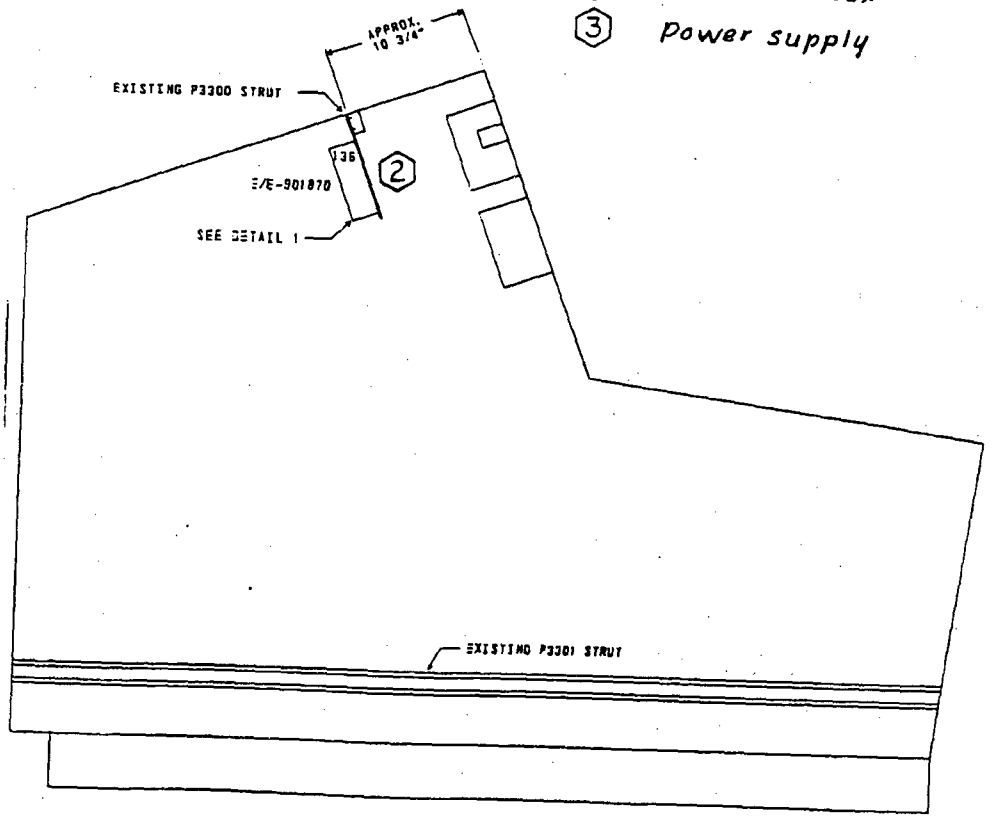
CONSOLE 04A (page 27 - 29)

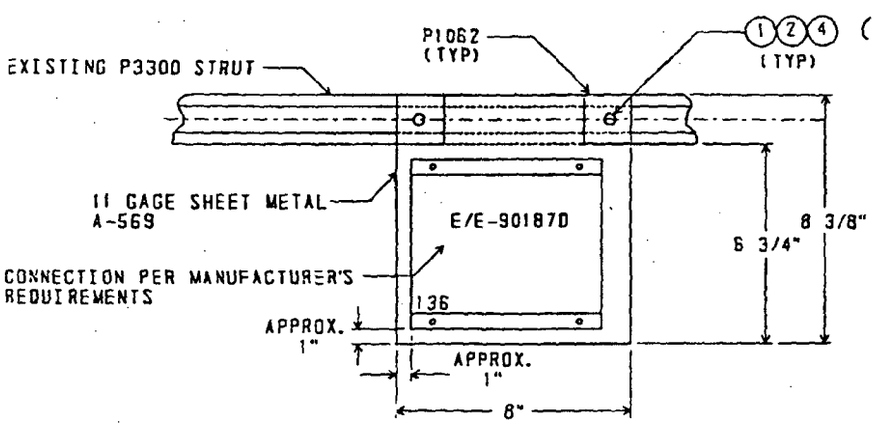


SECTION F-F

2 Electronics box
3 Power supply

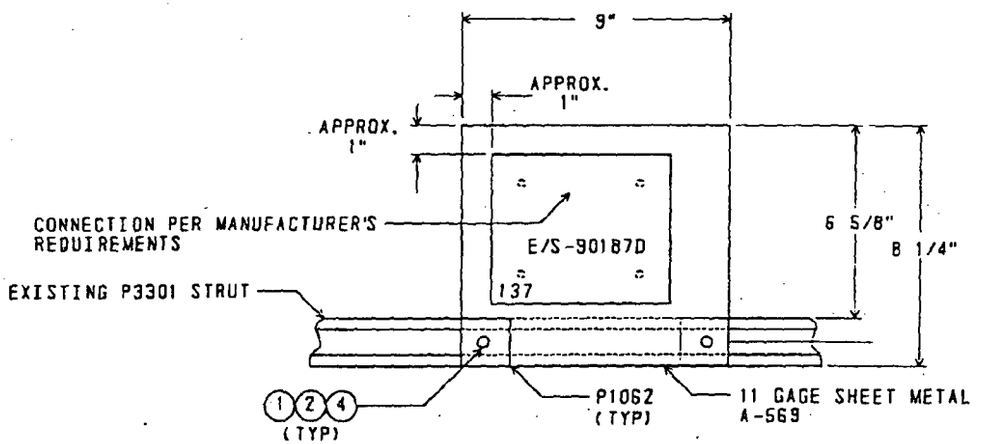


SECTION E-E



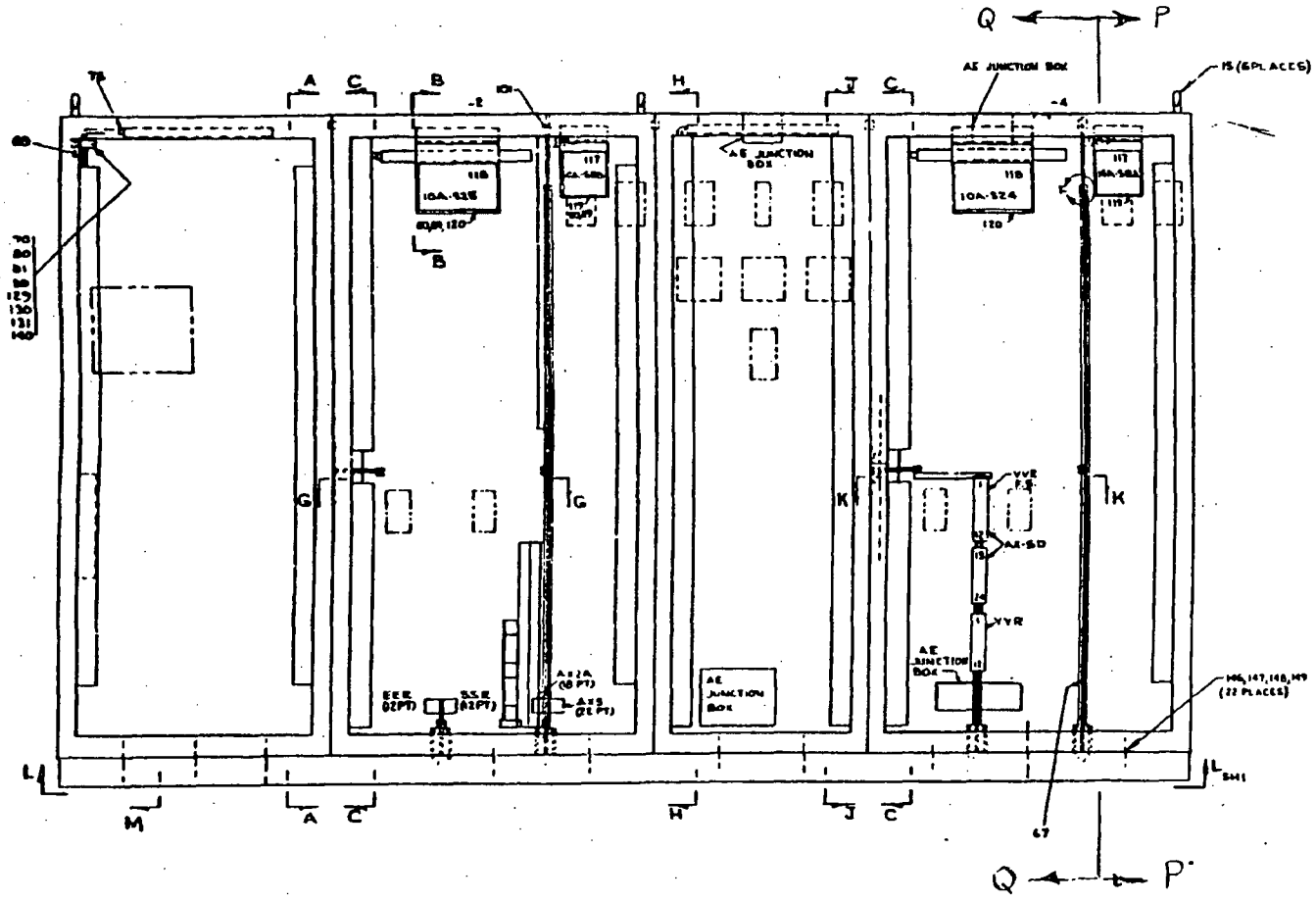
(See page 32 for item descriptions)

DETAIL 1



DETAIL 2

ROUTE 25011



PANEL 03 (pages 30 - 33)

INTERIM DRA... NOTICE

UNIT

C 1 2 3 ☒

PHILADELPHIA ELECTRIC COMPANY

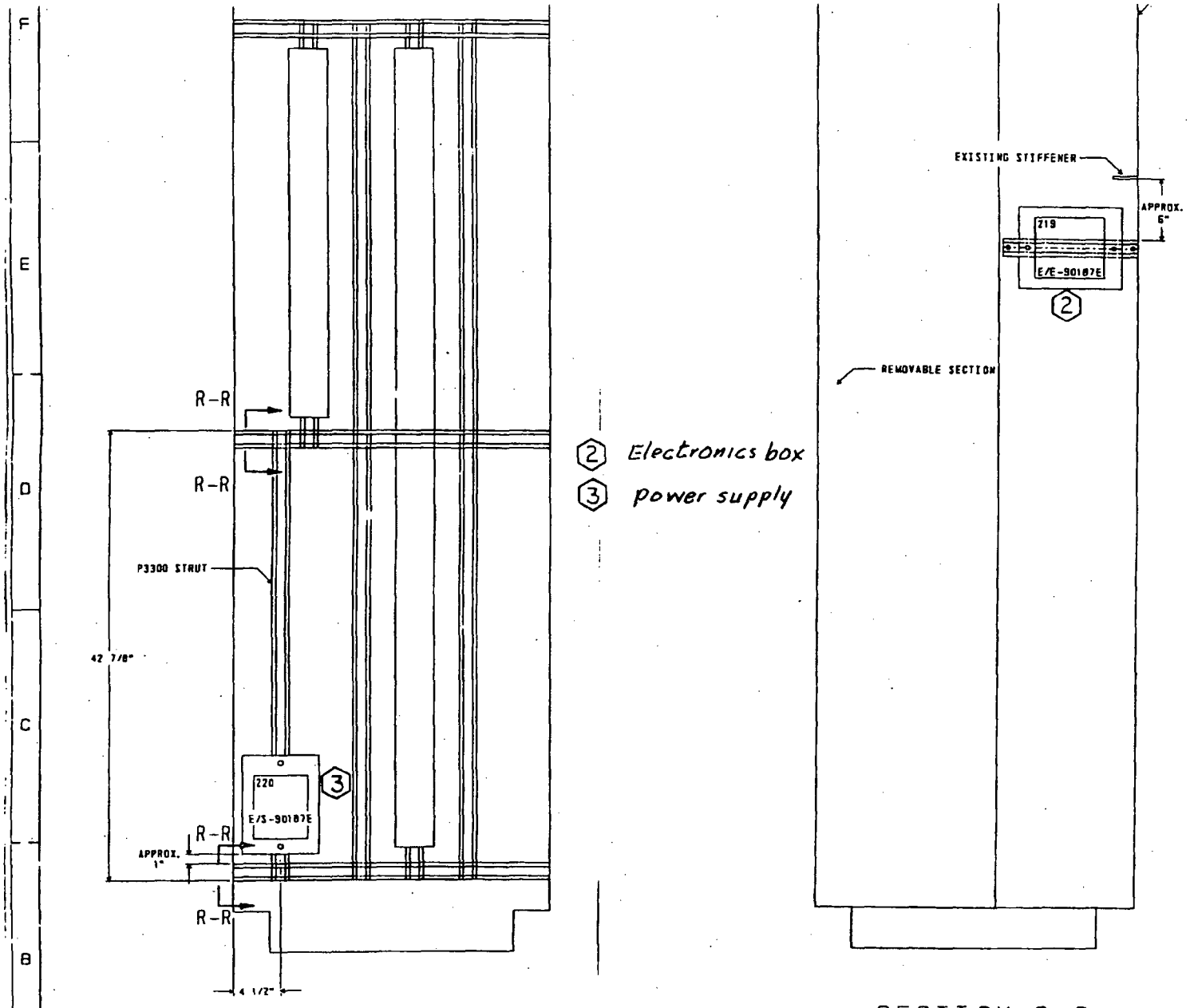
MOD	DRAWING	SHEET	REV.	IDCN
955G	M-1-EE-100	4	60	J

PRELIMINARY ISSUE ☐ DRAFT MOD ISSUE ☐ MOD ISSUE ☒

DATE	DESIGN	CHKD.	APPR.	STRL.
[redacted]	CRK			

PAGE 1 OF 1

DESCRIPTION:
E.A. 8615.0041
REF. 0239955 MOD 955G
ADDED: SECTIONS P-P & Q-Q



SECTION P-P

SECTION Q-Q

1

ROUTE 25011

NOTES:

1. ALL CONNECTIONS USING UNISTRUT BOLTS SHALL BE TORQUED TO THE FOLLOWING VALUES UNLESS OTHERWISE NOTED.

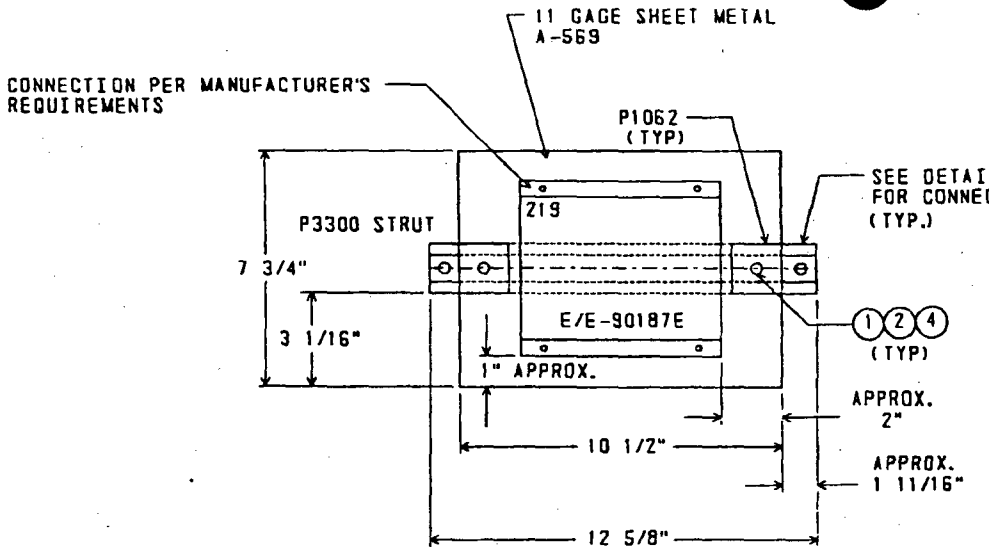
   1/4" BOLT 6 FT-LB.

   1/2" BOLT 50 FT-LB.

F

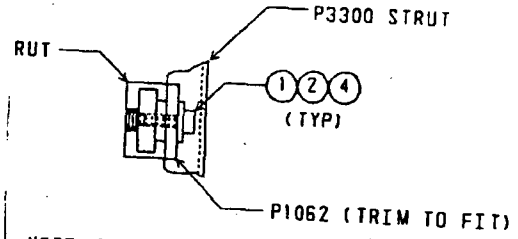
E

ITEM NUMBER	PART DISCRIPTION	CAT. NUMBER
①	HEX HEAD BOLT 1/4"X 1 1/2" (CUT TO 1" LENGTH)	HHCS02515OEG
②	1/4" WASHER	HFLW02SEG
③	FLAT PLATE	P1062
④	1/4" SPRING NUT	P4006-1420
⑤	HEX HEAD BOLT 1/4"X 3/4"	HHCS02507SEG
⑥	1/4" NUT	HHXN02SEG



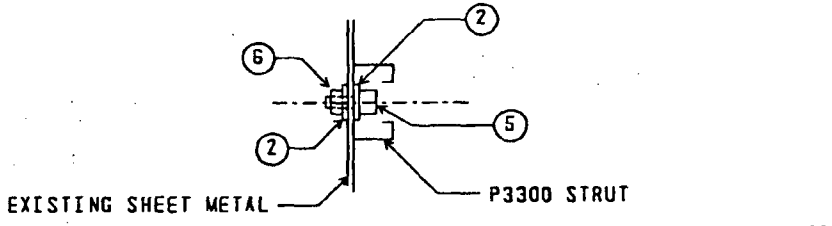
NOTE: DRILL 5/16" HOLE IN P3300
STRUT FOR BOLT PLACEMENT

DETAIL 1



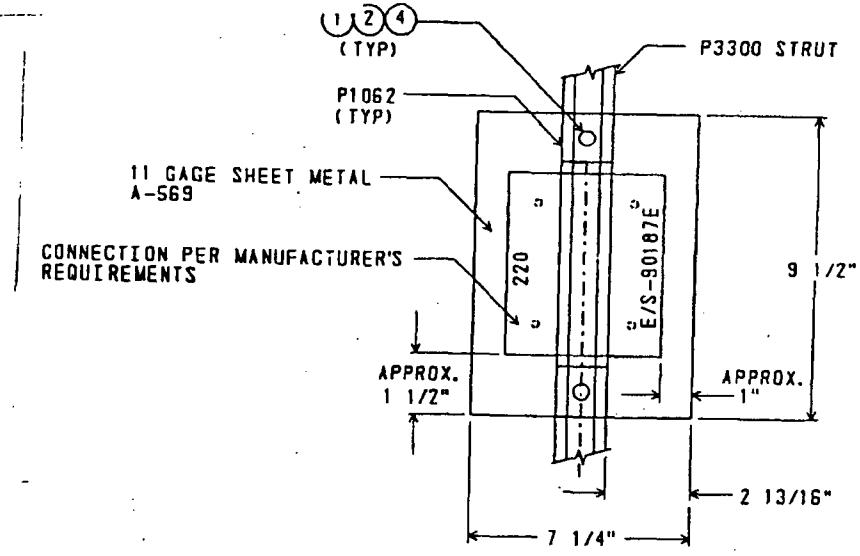
NOTE: DRILL 5/16" HOLE IN P3300
STRUT FOR BOLT PLACEMENT

SECTION R-R



NOTE: DRILL 5/16" HOLE IN P3300
STRUT FOR BOLT PLACEMENT

DETAIL 2



DETAIL 4

CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	34

4.0 References

1. TSD for Seismic Evaluation of Consoles 2(3)0C05A, 2(3)0C04A and 2(3)0C03 for MOD 955, Peach Bottom Atomic Power Station, Units 2 & 3. TSD no. P-0048.

2. PECo drawing 6280-M-1-EE-124(1), rev. 58. console 05A

3. PECo drawing 6280-M-1-EE-67, rev. 29. console 04A

4. PECo drawing 6280-M-1-EE-100, console 03

5. ASME Boiler and Pressure Vessel, Division 1, Section III, Appendix I, 1980

6. AISC-Manual of Steel Construction, 8th ed., 1980

7. Unistrut General Engineering Catalog No. 9, 1981

8. Final Safety Analysis Report. Vol. 1, Peach Bottom Atomic Power Station, Units 2 & 3.

9. Seismic Qualification of Class 1 Electrical Equipment, NEDO-10678,72NED81, Class 1, Nov. 1972, GE

10 General Project Requirements for Seismic Design and Analysis of Equipment and Equipment Supports for Peach Bottom Atomic Power Station, Units 2 & 3, PECo Spec. 11187-G-14.

11 Formulas for Stress and Strain, Roark and Young, 5th ed. McGraw-Hill.

12 Marks' Standard Handbook for Mechanical Engineers, 8th ed. McGraw-Hill.

13. Bechtel Corp letter to Philadelphia Electric Company, E.A.Patel to T.E.Shannon, "Contol Panel Anchorage Modification 2376," September 16, 1988, BLP 24646, Document Control No. 024749

14. General Electric Company Drawing No. 730E696, file no. 6280-M-I-EE-124-(2)-rev-59: annotated by PECo in three versions to highlight:
    a. All Q-list items per QLAR #115
    b. Equipment types and locations
    c. Panel known modifications

15. General Electric Seismic Qualification Reevaluation Class 1E Equipment, Rev. 4, 4/11/86.

5.0 Conclusions

Based on the analysis and evaluation presented in this calculation, the following conclusions can be made:

1. The mounting supports for the installation of new devices identified in MOD 955 are atructurally adequate to withstand earthquake loads.

2. The modifications to the consoles have been designed and proven to have no impact on the structural integrity of the consoles and the existing device qualifications.

3. Console 05A is concluded to have no unacceptable II/I interaction.

4. Seismic capability limits of existing Q devices on console 05A are tabulated in Section 9.0.

5. The support designs for the installation of new devices identified in MOD 955 are acceptable for units 2 and 3 consoles. However, for unit 2 console modifications, constructibility shall be reviewed to ensure that sufficient spaces are available at the identified locations for the installation of the new devices.

CALCULATION IDENTIFICATION NUMBER				
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19597	NM(C)	PS-049	N/A	36

6.0 Qualification of MOD 955 Supports/Braces

Support designs for MOD 955 proposed by PECo as stated in the previous section are shown on the attached sketches(section 3.0) in the order listed below:

Console 05A

1. 13 in. RWM CRT
2. Panel switch
3. RWM cable connector
4. Digital displays and associated electronics
5. Power supplies

Console 04A

1. Digital display
2. Electronics
3. Power supply

Console 03

Same as 04A

6.1 Method

In this section, conceptual designs for MOD 955 supports provided by PECo will be analyzed to the requirements of AISC (ref. 6) to ensure that they are structurally adequate to withstand seismic loads. In addition, these supports will also be verified to ensure that they are sufficiently rigid so that local modifications will not affect the nearby existing device qualifications.

To this end, the frequencies of the local frames or mounting plates will be verified to show that they are in the rigid range of seismic response spectra.

CALCULATION IDENTIFICATION NUMBER				
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19597	NM(C)	PM-049	N/A	37

Seismic Loads

Control room consoles are located at floor elevation 165 ft. in the Radwaste Building. For this analysis response spectra at elev. 165 ft. for maximum credible earthquake are used with a 2 % damping value for welded steel assemblies (ref. 8).

The appropriate acceleration values to be used depend on the frequency of the console to which the devices are mounted. The consoles are supplied by GE and are qualified with generic method as stated in reference 9. Based on this reference and the past experience with other operating plants, the consoles are most likely in the rigid range. However, for the evaluation of these modifications peak accelerations are used, since specific information regarding these consoles is not available.

Horizontal A = 1.32 x 2.4 x (1.5) =4.75 g (ref. 8,10)

Vertical Av = (2/3) A = 3.2 g

Supports are analyzed for seismic loads in N-S and vertical directions, and E-W and vertical directions. For each case, responses due to the horizontal and the vertical directions are added absolutely.

6.2 Analysis

6.2.1 Qualification of support for 13 in. RWM CRT(see sketches on pages 12 to 22)

The configuration for CRT support is shown on the attached sketches. The CRT is enclosed in a can (box) which is mounted at the front panel and supported at the back by a support frame. For qualification of this support, the following three parts of analyses will be performed:

Frequency evaluation
Support frame qualification
CRT can and tray mounting qualification

Frequency evaluation

a. Weight of CRT and mounting devices

Tray: 12 gage sheet metal t = .1046 in.(ref. 6)

13 x 14 = 182 sq in.
2((1/2)(10 + 3) x 13) = 169
351 x.1046 x.283 = 10.4 lb

Tray flange: 10 gage sheet metal t = .1345 in.(ref. 6)

2[1/2(18 - 13.75) x 12.5] = 53
14 x 1 = 14
67 x.1345 x.283 = 2.6 lb

Can: 12 gage

2 x 16.75 x(12.5 +17.125) = 992.4
x.1046 x.283 = 29.4 lb

Can flange: 12 gage
12 x 1 x 2 = 24
17.125 x 1 = 17
41 x.1046 x.283 = 1.2 lb

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

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CALCULATION IDENTIFICATION NUMBER				
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19597	NM(C)	PS-049	N/A	39

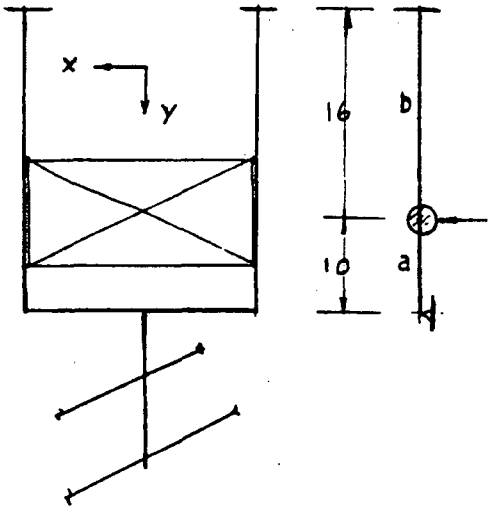
Collar flange: 10 gage

12.5 x 1.435 x2 = 36
16 x 1 = 16
52 x.1345 x.283 = 2.0

Total	45.6 lb
Weight of CRT	35 lb
Miscelleneous	9.4 lb
Total	90 lb

b. Frequency of supporting frame in X- direction

Consider that the total weight is equally distributed to the front panel and the unistrut frame.



$W = 90/2 = 45$ lb

$f = 1/(2\pi) \times \text{sqrt}[\, g/\Delta \,]$ (ref. 11)

$\Delta = Wa^2b^3(3L+a)/(12EIL\hat{}3)$ (ref. 6)

$= .000733$ in.

where

$I = .181$ for P3301 (ref. 7)

$E = 29000000.$ psi

$W = 45/2 = 22.5$ lb

$L = 26$ in.

$a = 10$ in.

$b = 16$ in.

$g = 386.4$ in/sq sec.

$f = 115$ Hz.

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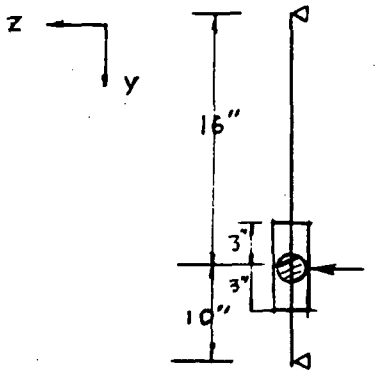
CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	40

c. Frequency of supporting frame in Z-direction (front-to-back)

The CRT is supported by the panel at the front and by the unistrut frame at the back. In the front-to-back direction, the front panel is braced with a box made of sheet metal, which is then connected to the frame. Thus, the front panel and the frame support unite together in resisting the motion in the Z-direction. For frequency estimation, however, the rigidity of the front panel will be totally neglected and the total weight will be conservatively attributed to the frame support and applied at a single point(not distributed +/- 3").



$$f = 1/(2\pi) \times \text{sqrt}(g/\Delta)$$

$$\Delta = Wa^2b^2/(3EIL) = .001732 \text{ in}$$

where

W = 45 lb
a = 10 in.
b = 16 in.
I = .294 in^4
L = 26 in.

f = 75 Hz.

Noted that the flxibility of the cross piece has been neglected by virtue of the other conservatisms.

d. Frequency of supporting frame in the vertical direction

Based on the support configuration, the support is much stiffer in the vertical direction than in the horizontal directions, since the frame is stiff in the vertical direction, and is connected to an existing unistrut which is welded to the top panel. Thus, the frequency in the vertical direction is higher than that in the horizntal directions.

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CALCULATION SHEET

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CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	41

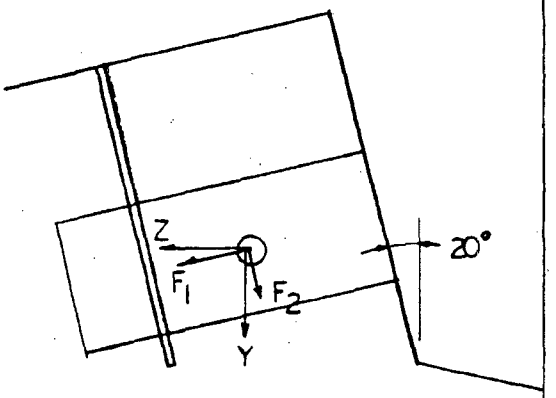
Support Frame Qualification

a. Support loads

The vertical bench board and support frame are slanted 20 degrees from the vertical. Therefore, support loads in x, y and z directions will be converted into the directions in line with the supporting directions.

Dead weight W = 90 lb

F1 = W sin 20 = 31 lb
F2 = W cos 20 = 85 lb



Seismic loads

y-direction

Fy = 90 x 3.2 = 288 lb
F1 = 99 lb
F2 = 271 lb

z-direction

Fz = 90 x 4.75 = 427
F1 = 427 x cos 20 = 401 lb
F2 = 427 x sin 20 = 146 lb

x-direction

Fx = 90 x 4.75 = 427 lb
F3 = 427 lb

Dead wt.+seismic load(x + y)

F1 = 31+99 = 130 lb
F2 = 85+271= 356
F3 = 427

Dead wt.+seismic load(y + z)

F1 = 31+99+401 = 531 lb
F2 = 85+271+146 = 502
F3 = 0

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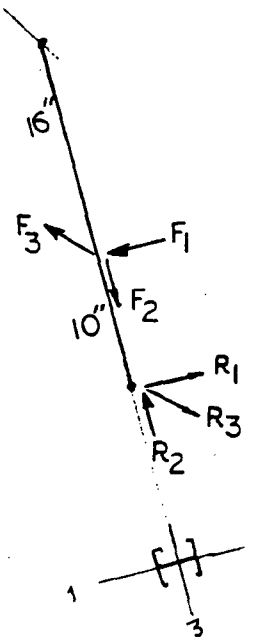
CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	42

b. Frame analysis due to dead wt. + seismic load(x +y)

The loads are considered equally distributed to the front panel and the support frame and then equally distributed to each of the two vertical members.

F1 = 130/4 = 32.5 lb
F2 = 356/4 = 89
F3 = 427/4 = 107



Vertical member-- P3301 (ref. 7)

A = .794 sq in.
Z1 = .207 cu in.
Z3 = .362 cu in.

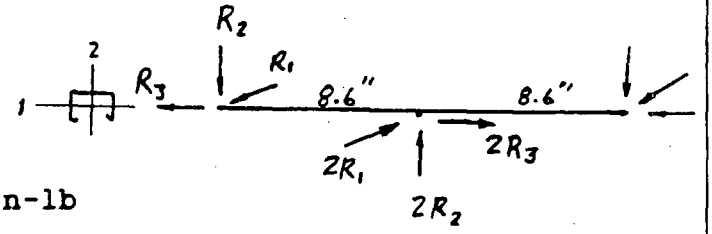
R1 = F1 x 16/26 = 20 lb
R2 = F2/2 = 44.5

$R3 = F3 x b^2/(2L^3) x (a + 2L)$
= 48

M3 = R1 x 10 = 200 in-lb
M1 = R3 x 10 = 480

R2/A = 56 psi
M3/Z3 = 552
M1/Z1 = 2319
Total = 2927 psi

Horizontal member--P3300 (ref. 7)



A = .397 sq in.
Z1 = .078 cu in.
Z2 = .181 cu in.

M1 = R2 x 8.6 = 382.7 in-lb
M2 = R1 x 8.6 = 172

R3/A = 121 psi
M1/Z1 = 4909
M2/Z2 = 950

Total = 5980 psi

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CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	43

Brace member--P3300

A = .397 sq in.
Z1 = .078 cu in.
Z2 = .181 cu in.

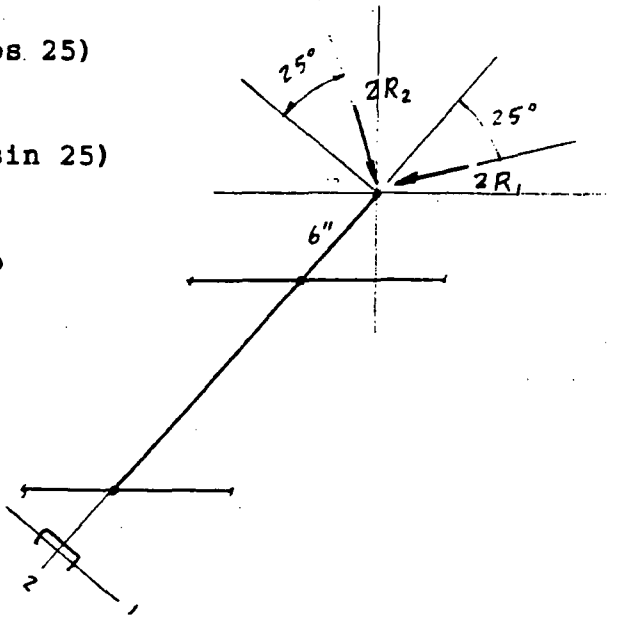
P1 = 2(R1 sin 25 +R2 cos 25)
= 98 lb

P3 = 2(R1 cos 25 + R2 sin 25)
= 74 lb

M2 = P1 x 6 = 588 in-lb
M1 = 2R3 x 6 = 576

P3/A = 186 psi
M2/Z2 = 3249
M1/Z1 = 7385

Total = 10820 psi



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CALCULATION SHEET

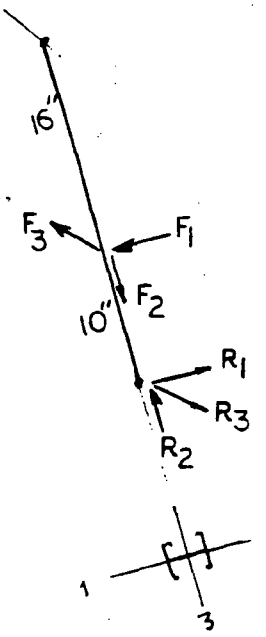
5010.65 11

CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	44

c. Frame analysis due to dead wt. + seismic load(y +z)

The loads are considered equally distrbuted to the front panel and the support frame and then equally distributed to each of the two vertical members.

F1 = 531/4 = 133 lb
F2 = 502/4 = 126
F3 = 0



Vertical member-- P3301 (ref. 7)

A = .794 sq in.
Z1 = .207 cu in.
Z3 = .362 cu in.

R1 = F1 x 16/26 = 82 lb
R2 = F2/2 = 63
R3 = 0

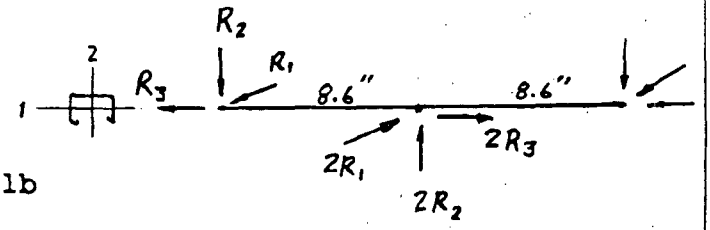
M3 = R1 x 10 = 820 in-lb

R2/A = 79 psi
M3/Z3 = 2265

Total = 2344 psi

Horizontal member--P3300 (ref. 7)

A = .397 sq in.
Z1 = .078 cu in.
Z2 = .181 cu in.



M1 = R2 x 8.6 = 542 in-lb
M2 = R1 x 8.6 = 705

R3/A = 0 psi
M1/Z1 = 6949
M2/Z2 = 3895

Total = 10844 psi

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CALCULATION SHEET

5010.65 12

CALCULATION IDENTIFICATION NUMBER				
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19597	NM(C)	PS-049	N/A	45

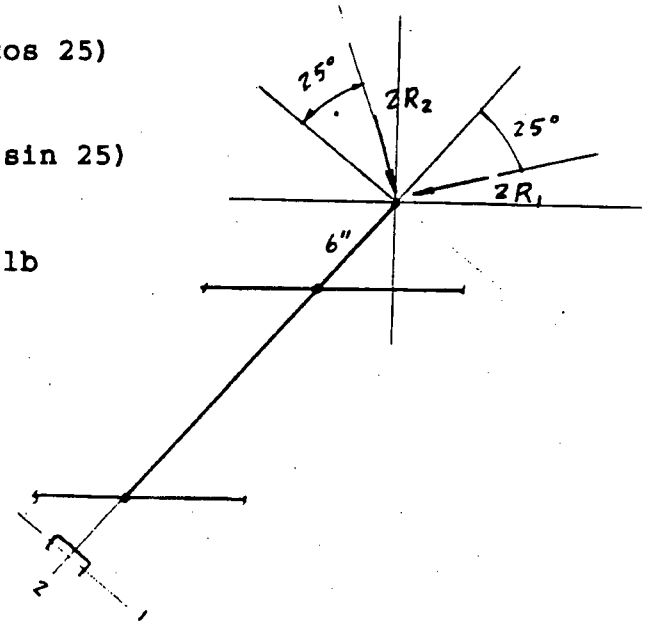
Brace member--P3300

A = .397 sq in.
Z1 = .078 cu in.
Z2 = .181 cu in.

P1 = 2(R1 sin 25 +R2 cos 25)
= 184 lb

P3 = 2(R1 cos 25 + R2 sin 25)
= 202 lb

M2 = P1 x 6 = 1104 in-lb



P3/A = 509 psi
M2/Z2 = 6099

Total = 6608 psi

d. Unistrut Connections

The above analyses show that unistrut members are subjected to a maximum applied load of less than 150 lbs. The design load data for typical unistrut channel connections as shown in reference 7 are 1000 lbs or larger. Therefore, the connection parts used in the support designs are adequate.

CRT can and tray qualification

The CRT is mounted to the bottom sheet metal of the tray by four screws. The tray is connected to two tracks , one on each side of the tray. The tracks are then mounted to the can which is mounted at the front panel and supported at the back by a frame. The detailed configuration is shown on the attached sketches.

a. CRT mounting

Weight of CRT = 35 lb

Dead wt + seismic load(y+z)

* F1 = 206
F2 = 195

Dead wt + seismic load(x+y)

* F1 = 50
F2 = 138
F3 = 166

CRT mounting screws: 4- 1/4" dia. screws

A = .0362 sq in. (ref. 12)

Tensile stress = F2/(4A) = 1347 psi
Shear stress = (F1 + F3)/(4A) = 1492 psi

Sheet metal bearing stress

12 gage, t = .1046 in.

Bearing stress = (F1 + F3)/(4td) = 2065 psi

* These loads derived using same methodology found in the previous section.

b. Tray mounting

Weight of tray = 10.4 + 2.6 = 13 lb
Weight of CRT = 35
Total 48 lb

Dead wt + seismic load(y+z)

* F1 = 283
F2 = 268

Dead wt + seismic load(x+y)

* F1 = 69
F2 = 190
F3 = 228

Force F2 is resisted by the tracks, and force F1 is resisted by the tray flange which bears against the front panel. Force F3 does not induce any load to the connecting screws between the tray and the tracks, since both sides of the tray bear against the tracks.

Tray mounting screws: 6-#5 screws, A =.0082 sq in.(ref. 12)

shear stress = F2/(6A) = 5447 psi

Track mounting screws: 8-1/4"-28 screws, A = .0362 sq in.

shear stress = (F2+F3)/(8A) = 1443 psi

Tray flange: 10 gage, t = .1345 in.

Tray opening H = 13 3/4"
Collar opening H = 15 1/8"
Moment arm a = (15 1/8 - 13 3/4)/2 = .6875 in.

M = F1 x a /2 = 97 in-lb
Z = 1/6 (bt^2) = 1/6 x [(10)(.1345)^2] = .03 cu in.
M/Z = 3243 psi

Weld: 1/8" fillet weld on two vertical sides is adequate

c. Can mounting

Dead wt + seismic load(y+z)	Dead wt + seismic load(x+y)
F1 = 531 lb	F1 = 130 lb
F2 = 502	F2 = 356
	F3 = 427

Connection between can and unistrut P3301

six 1/2" bolts: bolt strength is more than adequate.

Sheet metal bearing stress = [(F1+F2)/2]/(6td) = 1644 psi

Connection between can, console pl. and collar flange

Twelve 1/4" studs: bolt strength is more than adequate.

Sheet metal bearing stress = [(F2+F3)/2]/(12td) = 1248 psi

6.2.2 Qualification of Panel Switch Support

Panel switch is mounted to two brackets beneath the bottom sheet metal of the CRT can as shown on the attached sketches. The switch weighs 5 lb.

Frequency Evaluation

Moment of inertia of the brackets

$I = 1/12\ (2)(1/4)^3 = .0026$

$f = 1.732/(2\pi) \times \text{sqrt}[EIg/(WL^3)] = 413$ Hz (ref. 11)

where

$L = 2.75/2 = 1.375$ in.
$W = 5$ lb

Panel Switch Mounting

Dead + seismic load(y+z)	Dead + seismic load(x+y)
F1 = 30 lb	F1 = 7 lb
F2 = 28	F2 = 20
	F3 = 24

Brackets

$A = 1 \times .25 = .25$ sq in
$Z = (1)(1/4)^2/6 = .0104$ cu in.
$M = 30 \times 2.75/2 = 41.3$ in-lb

$F2/(2A) = 56$ psi
$M/(2Z) = 1986$
Total 2042 psi

Sheet metal

$Z = (1)(.1046)^2/6 = .00182$

$M/(2Z) = 11346$ psi

Weld: 1/8" fillet weld on both sides of the brackets is adequate.

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19597	NM(C)	PS-049	N/A	49

6.2.3 Qualification of Support for Digital Displays with Associated Electronics (Console 05A)

This design provides support for two digital displays and two electronics boxes. The digital displays are mounted on a cover plate and the electronics are mounted on a tray which is welded to the cover plate as shown in the attached sketches.

Weight of tray

cover plate: 10 gage

6 7/8 x9 1/8 = 63 sq in.
x .1345 x.283 = 2.4 lb

sides 2(4 x 9 3/8) = 75
bottom 6.75 x 9 3/8 = 63
138 x .1046 x.283 = 4.1

top tray 2(1.5 x 7) = 21
6.75 x 7 = 47
68 x .1046 x.283 = 2 lb

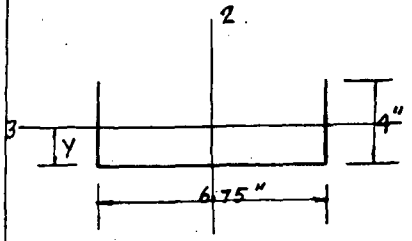
subtotal 9 lb

Digital displays
2 x 1 = 2

Electronics
2 x 2 = 4

Total 15 lb

Frequency Evaluation



y = 2(4 x 2)/(8 + 6.75) = 1.08 in.

I3 = 2[(4)^3 /12] = 10.67
2(4)(.92)^2 = 6.77
6.75 x(1.08)^2 = 7.87
25.31x.1046=2.65

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CALCULATION SHEET

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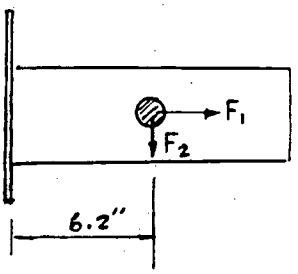
CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	50



W = 15 - 2 - 2.4 = 10.6 lb

f = 1.732/(2 π) x sqrt[EIg/(WL^3)
= 546 Hz

Tray Mounting

Dead wt + seismic load(y+z)	Dead wt + seismic load(x+y)
F1 = 89 lb	F1 = 22 lb
F2 = 84	F2 = 59
F3 = 0	F3 = 71

Envelope load

F1 = 89 lb
F2 = 84
F3 = 71

Mounting studs: four 1/4"-20 studs A = .0317 sq in.

Due to F2	M3 = 84 x 6.2 = 521 in-lb	
	T = M3/[2(4 7/8)]	= 53 lb
	V = 84/4	= 21
Due to F1	T = 89/4	= 22
Due to F3	M2 = 71 x 6.2 = 440 in-lb	
	T = M2/[2(7.125)]	= 31
	V = 71/4	= 18
Total	T = 53 + 22 + 31	= 106 lb
	V = 21 + 18	= 39

Tensile stress = T/A = 3344 psi
Shear stress = V/A = 1230

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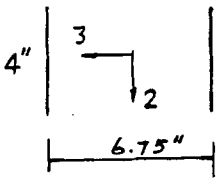
CALCULATION SHEET

5010.65 20

CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	51

Weld



A = 8
Z2 = 4x6.75 = 27
Z3 = 16/3 = 5.33

f = sqrt[(F1/A+M2/Z2+M3/Z3)^2 +(F2/A)^2
+ (F3/A)^2]
= 126 lb per in

w = f/(.707x18000) =.01 in.
1/8" filet weld is adequate.

6.2.4 Support for RWM Cable Connectors

Two cable connectors have the same weight as a power supply. This support is acceptable by comparison of the support configuration with the support for the power supply on console 04A, which is qualified in the next section.

6.2.5 Support for Power Supplies (Console 05A)
Supports for Electronics Boxes and Power supplies(Consoles 04A and 03)

Power supplies on console 05A, and electronics boxes and power supplies on consoles 04A & 03 are mounted separately from the associated digital displays. These supports are similar in configuration. Review of the individual device weights and their mounting configurations as shown in the sketches concludes that the support for power supply on console 04A is the governing case which envelops the remaining cases.

Frequency Evaluation

Mounting plate: 12 gage

I = (1/12)(9)(.1046)^3 = .000858

Weight

plate 9x6.63x.1046x.283 = 1.8 lb
power supply 4
5.8 lb

f = 1.732/(2 π) x sqrt[EIg/(WL^3)] L = 6.63/2 = 3.32 in.

= 59 Hz

Plate stress

M = (5.8x4.75)x3.32 = 91.5 in-lb
Moment due to eccentricity (1") of the power supply
= (4 x 3.2)(1) = 12.8
Total = 104.3

F= 5.8x3.2 = 18.6 lb
Z = I/(t/2) = .0164
A = 9x.1046 = .941 sq in
M/Z = 6360 psi
F/A = 20
6380 psi

Note: The mounting plate has been revised from 12 gage to 11 gage as shown on the drawing. This change is on the conservative side, and therefore, is acceptable.

6.2.6 Comparison of Calculated Stresses with Allowable Stresses

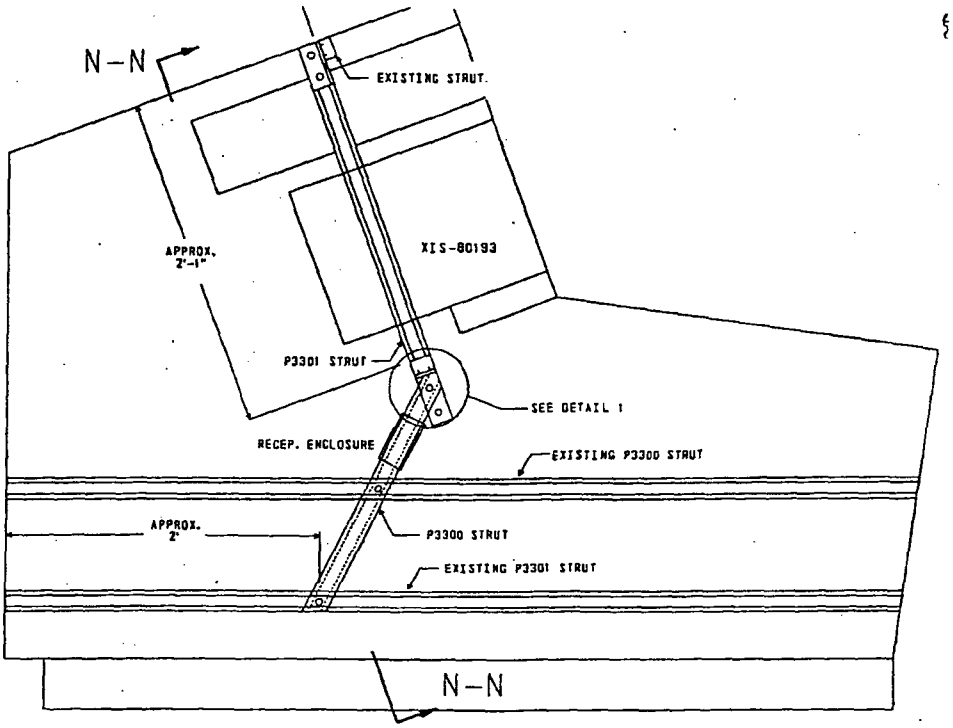
The calculated stresses shown above for sheet metals, screws and bolts are much lower than the allowable stresses given in section 3.0. Therefore, these device mounting supports are acceptable.

CALCULATION IDENTIFICATION NUMBER				
JOB NUMBER	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
19597	NM(C)	PS-049	N/A	52a

6.2.7 Deviation of Support Design for 13 in. RWM CRT for unit 2 Console 20C05A

The RWM CRT support for unit 2 console deviates slightly from the same support for unit 3 console. This deviation includes the orientation of the brace member to the support frame(see attached support sketches), ie., (1) the connection of the brace with the existing horizontal P3301 strut is approximately 2 ft. (instead of 1 ft. 4 in. for unit 3) from the back vertical panel, (2) the cross-sectional orientation of the brace is 180 degrees opposite to the brace for unit 3 console. This deviatin is necessary because of the space availability of unit 2 console. B

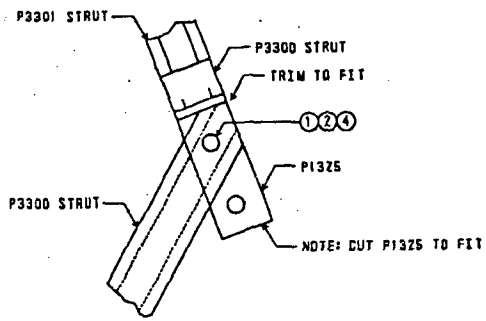
Review of the CRT support qualification for unit 3 console concludes that a sufficient design margin exists to compensate for the negligible effect caused by the minor deviation described above. Therefore, the CRT support design for unit 2 console is acceptable.



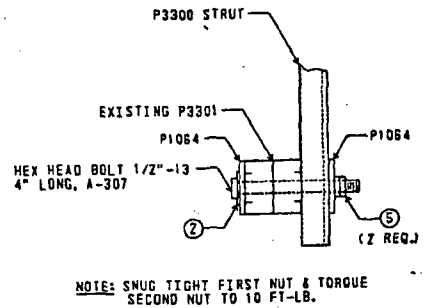
SECTION M-M

ITEM NUMBER	PART DISCRIPTION	CAT. NUMBER
①	HEX HEAD BOLT 1/2"X 1 3/16"	HHCS050119EG
②	1/2" WASHER	HFLW050EG
③	FLAT PLATE	P1064
④	1/2" SPRING NUT	P4010
⑤	1/2" NUT	HHXN050EG
⑥	HEX HEAD BOLT 1/2"X 1 3/4"	HHCS050175EG
⑦	HEX HEAD BOLT 1/4"X 3/4"	HHCS025075EG
⑧	1/4" SPRING NUT	P4006-1420
⑨	1/4" WASHER	HFLW025EG

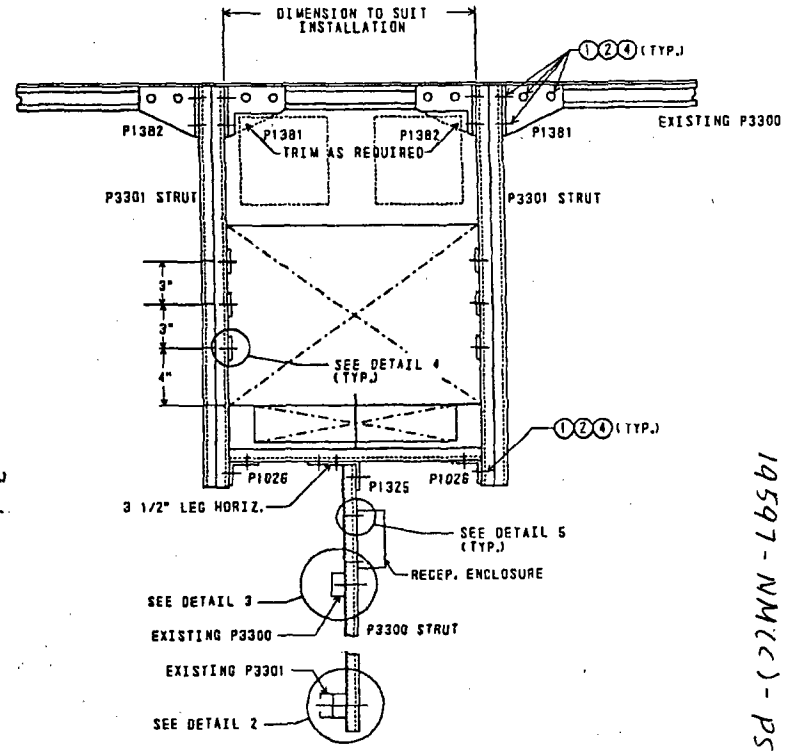
20C05A



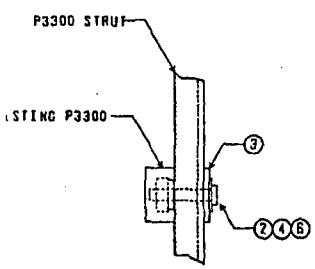
DETAIL 1



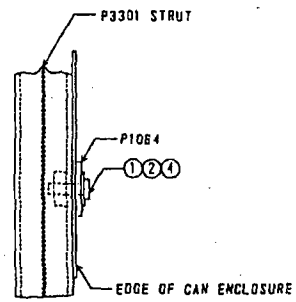
DETAIL 2



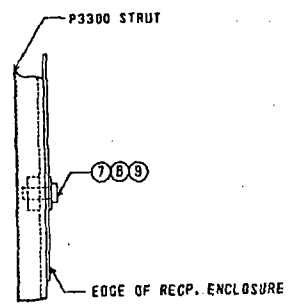
SECTION N-N



DETAIL 3



DETAIL 4



DETAIL 5

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Page 52c

6.2.8 Qualification of support for 6"x6" tracor westronics multipens recorder

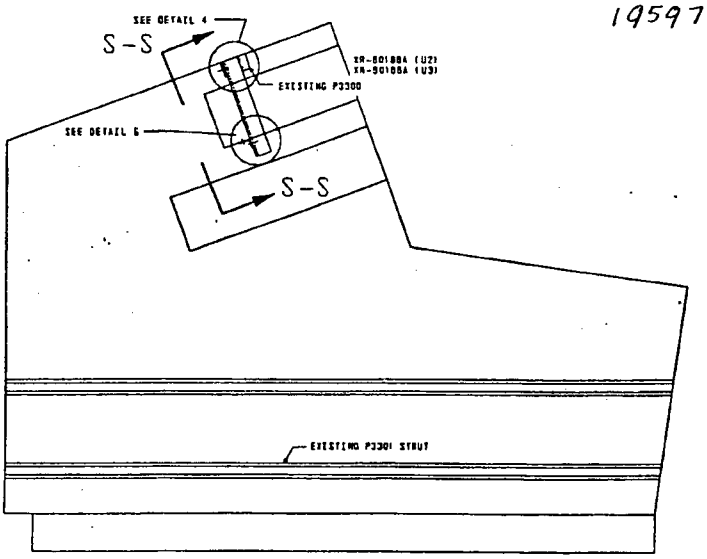
This modification involves replacement of the existing 6"x6" computer trend recorder with 6"x6" tracor westronics multipens recorder. The existing recorder weighs approximately 40 lbs, while the new recorder weighs only 20 lbs. The new recorder is mounted at the front panel and supported at the back by a support frame as shown on the attached sketches. Thus, the new recorder is better supported than the old one before the modification. Therefore, this modification will not affect the adjacent device qualification. (B)

Judging from the sizes of the structural members and bolts, the support frame is structurally adequate to support the new recorder, which weighs only 20 lbs.

6.2.9 Qualification of support for 6" x 6" computer trend recorder

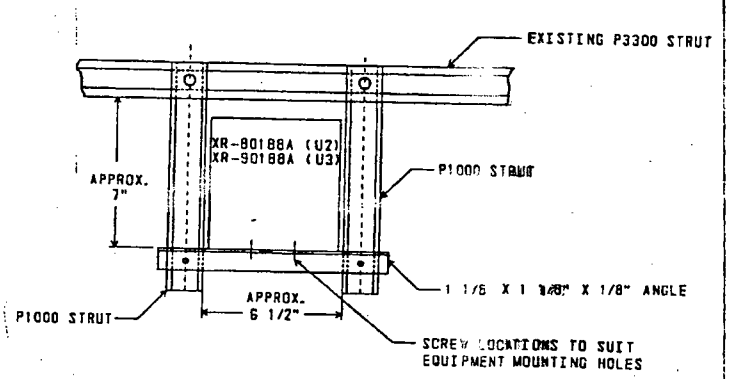
This modification involves the replacement of the existing RWM operator interface with a non-Q 6"x6" computer trend recorder. The new recorder weighs 20 lbs. and it is judged that the existing RWM weighs more than 20 lbs. since it is much larger in size. The cut out in the panel skin due to the RWM will be covered by an 11 gauge plate with mounting bolts/holes similar to the RWM installation. A smaller cut out in this 11 gauge plate will be made to accommodate the installation of the new trend recorder. The new recorder is mounted at the front of the panel and supported at the back by a support frame as shown on the sketches on pages 52f and 52g. Thus, the new recorder is better supported then the old one prior to this modification. Therefore, the installation of this computer trend recorder will not affect the adjacent device qualification. (2)

Judging from the sizes of the structural members and bolts, the support frame is structurally adequate to support the new trend recorder, which weighs only 20 lbs.



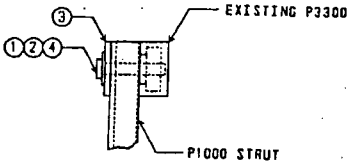
SECTION P-P

ITEM NUMBER	PART DISCRIPTION	CAT. NUMBER
①	HEX HEAD BOLT 1/2"X 2 1/2"	HHCS050Z50EG
②	1/2" WASHER	HFLW050EG
③	FLAT PLATE	P1064
④	1/2" SPRING NUT	P4010
⑤	HEX HEAD BOLT 1/4"X 1 1/2"	HHCS025150EG
⑥	1/4" WASHER	HFLW025EG
⑦	1/4" SPRING NUT	P4006-1420
⑧	1/4" NUT	HHXN025EG

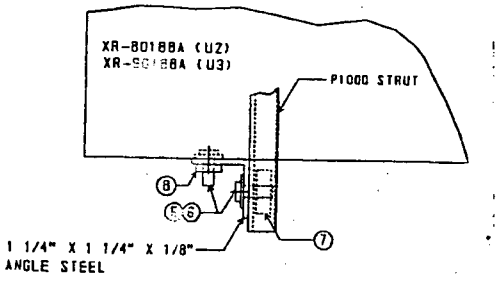


SECTION S-S

20C05A & 30C05A



DETAIL 4



DETAIL 5

PHILADELPHIA ELECTRIC COMPANY SERVICE

NUCLEAR GROUP

CALCULATION SHEET

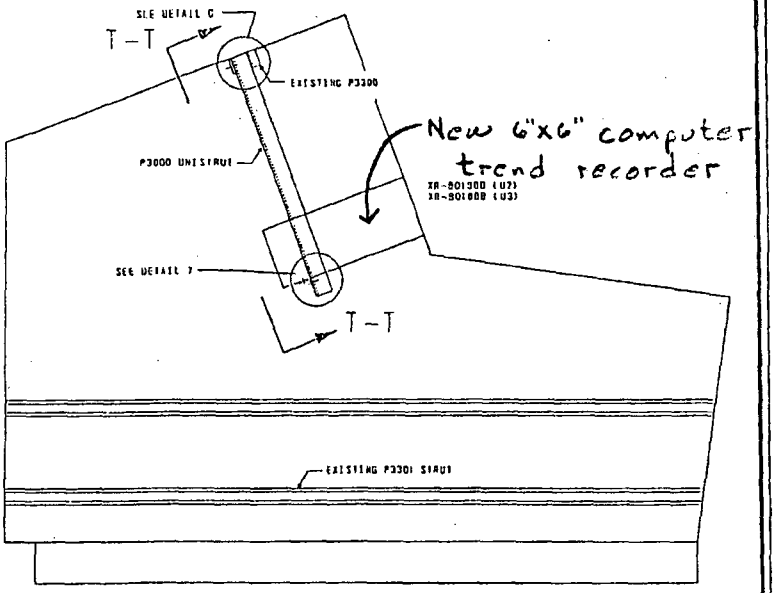
DOCTYPE:000

CALC NO PS-049 REV 2
PAGE 52F OF 60
ORIGINATOR T.M. Cook DATE 12-4-90
REVIEWER J.J. Wheeler DATE 12-4-90

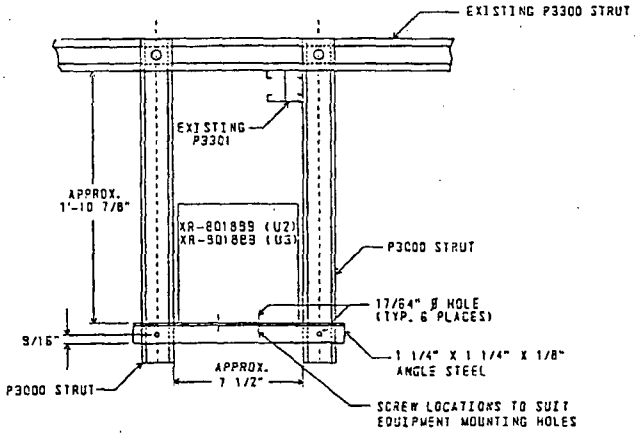
20C05A & 30C05A

ITEM NUMBER	PART DISCRIPTION	
①	HEX HEAD BOLT 1/2"X 1 1/2" A-307	*
②	1/2" SPRING NUT	
③	FLAT PLATE P1064	
④	HEX HEAD BOLT 1/4"X 1" A-307	*
⑤	1/4" SPRING NUT	
⑥	1/4" NUT	

* BOLT LENGTH MAY BE TRIMED AS REQ'D, PROVIDED FULL NUT ENGAGEMENT IS MAINTAINED.

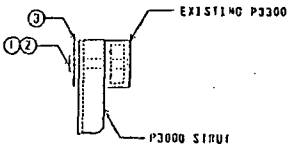


SECTION Q-Q

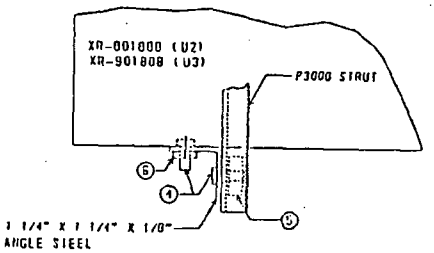


NOTE: UNLESS OTHERWISE NOTED, ALL DIMENSIONS SHALL HAVE A TOLERANCE OF ± 1/16"

SECTION T-T



DETAIL 6



DETAIL 7

2

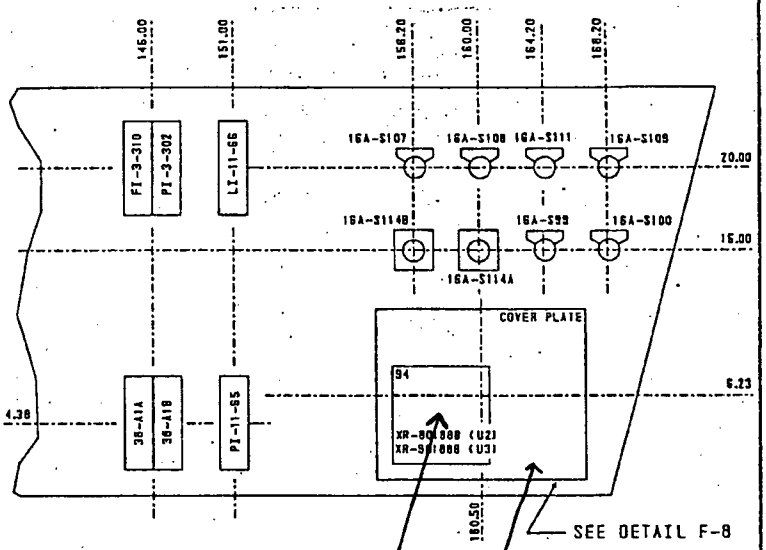
NUCLEAR GROUP

CALCULATION SHEET

DOCTYPE:000

CALC NO PS-049 REV 2
PAGE 52a OF 60
ORIGINATOR T. McCaskill DATE 12-4-90
REVIEWER [signature] DATE 12-4-90

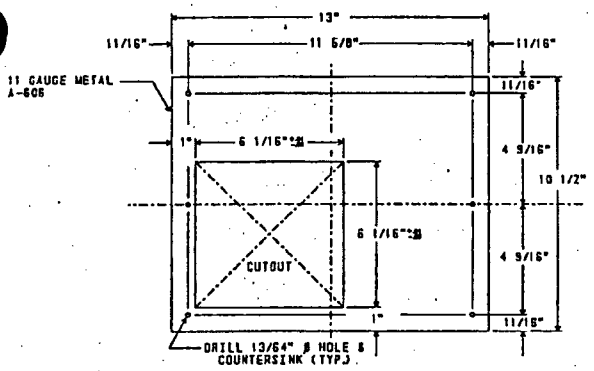
20C05A & 30C05A



Location of new computer trend recorder

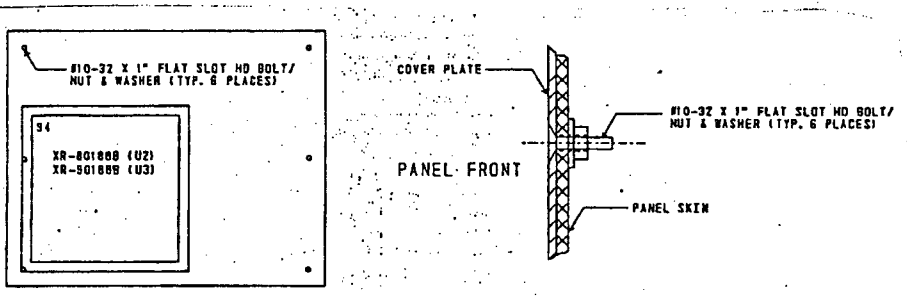
Location RWM operator interface which is being removed.

2



NOTE: UNLESS OTHERWISE NOTED, ALL DIMENSIONS SHALL HAVE A TOLERANCE OF ± 1/16".

DETAIL F-8



MOUNTING DETAIL XR-80188B & XR-90188B

7.0 Assessment of the Impact of the Modification on the Existing Q Console and Q Devices

MOD 955 involves replacement of the existing computer trend Gemax recorder with a new 13 inch RWM CRT, and installations of several other small devices such as, a panel switch, cable connectors, digital displays and associated electronics boxes and power supplies. The following sections assess the impact of these modications on the existing console and devices.

7.1 13 inch RWM CRT

The existing computer trend Gemax recorder weighs approximately 40 lbs, and its size is 6"x[illegible]th 22 inches protruded into the back of the pa[illegible] The replacement with the new CRT weighs 90 lbs(including the mounting tray and can), and it requires a [illegible]utout of 14" x 15" on the front panel to provide an op[illegible] for mounting this device. Larger opening we[illegible] the panel, and heavier weight increases the mass to [illegible] supporting structure. This, in turn, might alter t[illegible]cal dynamic characteristics of the panel if proper me[illegible]s are not taken.

To minimize such effect, a support frame is [illegible]stalled at the back of the panel to share the load and thereby reduce the load at the front panel to appr[illegible]imately the same as was before the modification. The [illegible]t panel is further reinforced by the CRT support can [illegible]h is connected to the support frame at the back. In addition, the support frame is braced to ensure that the frequencies in all three directions are in the rigid range of seismic response spectra, and that the support frame is structurally adequate to withstand seismic loads.

Thus, incorporation of the above design into the modification assures that the support structure is rigid, and that the front panel is properly reinforced and supports the same weight as it did before the modification. Therefore, the response of the new device due to seismic excitations will at least remain the

same as or smaller than it was before the modification, and thus, the adjacent devices and the console will not be affected by this modification.

The closest Q device to this modification is a single GE CR 2940 switch located approximately 1 ft. from the cutout and near a panel edge which provides a stiff support for the switch. This and other Q devices in the upper panel of the console are all switches and push buttons with very high seismic capacities in any event.

The overall weight being added to the console is negligible and no change can be expected in the overall console response as well.

7.2 Other Small Devices

Other modifications involve installation of small devices such as digital displays, panel switch, etc., which weigh from 1 lb to 5 lbs.

The mounting supports for these devices are made rigid to ensure that seismic responses are not amplified. In addition, the weights of the devices are negligibly small compared to the total weight of the console, therefore, the responses of these devices will be negligible and will not affect the integrity of the console and the adjacent devices.

7.3 6" x 6" Computer Trend Recorder

This new device is smaller and is judged to weigh less than the device it is replacing, the RWM operator interface. The new recorder also has a new rear support bracket further strengthen its mounting. Therefore, the installation of the computer trend recorder in place of the RWM operator interface will not impact the existing qualification of the Q devices in panel 05A.

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8.0 ASSESSMENT OF THE IMPACT OF THE FAILURE OF NON-Q DEVICES ON THE Q DEVICES AND THE CONSOLES AND RECOMMENDATIONS FOR ANY MODIFICATIONS IF REQUIRED (FOR 05A ONLY)

The installed console was seismically qualified with all devices in their original configuration. All original devices are therefore concluded to be acceptable from a II/I consideration. This includes confirmation of both structural integrity and the absence of unacceptable spatial interactions not involved with structural failure (breaking loose). Console modifications completed after installation have been assessed using information (1) provided by PECo and (2) obtained during a walkdown of the this specific console as well as other seismically qualified consoles and cabinets. Section 6.0 above confirms the integrity of Modification (MOD) 955. Console 05A is concluded to have no unacceptable II/I interactions.

8.1 DISCUSSION

The conclusion stated above is derived from the following:

8.1.1 The console and all devices installed at the time of plant installation were seismically qualified as a part of the original seismic qualification of the console. (The Task Scoping document, ref 1, states that "PECo has established that the existing consoles are Q commodities seismically qualified with all the devices attached.")

8.1.2 Console modifications performed subsequent to the installation of the seismically qualified configuration have been characterized as minor. This means either:

a. Minor changes involving inconsequential structural modifications (small holes being drilled or covered, or

b. Additions (or deletions) of inconsequential weight and/or size to the console, or

c. The exchange of like item for like item in which the new item is sufficiently similar to the replaced item (in size, weight, anchorage details, etc.) to be a basis to conclude that equivalent and satisfactory structural integrity exists.

The purpose of the walkdown is to confirm that such modifications are not significant for a II/I interaction assessment.

8.1.3 Reference 13 confirms basic console anchorage. No further assessment is required.

8.1.4 The process of review of non-Q modifications to console 05A is as follows:

a. As a result of the walkdown of this console and its prior seismic qualification, it was judged that spatial interaction (rattling) of any of the non-Q modifications with Q-devices was not credible. Structural failure (and falling) would be the only necessary concern as a precursor to any unacceptable II/I interaction.

b. With information from the walkdown, the non-Q modifications to the original configuration are confirmed as minor and, therefore, judged to be capable of remaining integral during an earthquake. Subsequent steps are also applied since it was not possible to precisely identify every modification. No II/I concern is concluded.

c. If the non-Q modification is sufficiently distant from any Q device(s) to be of no concern (even if structural failure and associated falling were to take place), an acceptable condition could be concluded to exist. Because potential failure paths could include safety-related wiring or interior devices not apparent from either the walkdown or available drawings, this option was not used for II/I assessment of this console.

d. If Q devices are inside the potential failure path of the non-Q modification (or if it is desirable to assure against possible structural failure) the non-Q modification must be assured against structural failure and any unacceptable spatial interaction by one of the following methods:

(1) Comparison with other devices qualified in this or other plant consoles combined with a judgement regarding panel location dependent response. Many added devices are identical (or sufficiently similar) to qualified devices. Structural integrity is easily inferred.

(2) If necessary and/or appropriate, utilize information from other plants (experience) to confirm structural integrity.

(3) Perform a case specific evaluation by either:
- calculation, or
- engineering judgement (insufficient weight, etc.).
All indicating lights are judged to be of sufficient weight/strength so as to be incapable of structural failure due to earthquake loading.

8.1.5 Modifications to the original installation were concluded to result in an acceptable console configuration. No potential II/I interactions were identified.

8.1.6 The modification (MOD) 955 outlined in Section 1.0 and the calculations presented in Section 6.0 confirm the structural integrity of the design and confirm an acceptable console configuration. No potential II/I interactions will result from this MOD.

8.2 DETAILED DISCUSSION

The upper (vertical) panel of the console contains the following Q-devices: (identification and location (X, Y) coordinates are according to Ref. 14, view F; locations of device clusters are approximate and provided for reference and information; see Figure 8-1 attached)

1. 2ea manual scram push buttons (84, 22)
2. 6ea GE CR2940 switches (160, 18)
3. 2ea GE CR115 switches (158, 15)
4. 1ea GE CR2940 switch (142.75, 2)

These devices are sufficiently isolated above or beside any identified modification to assure against any potential interaction. Structural failure of any non-Q device on the vertical panel will not occur and therefore will not create any unacceptable interaction with Q devices located below. Non-Q dial indicators (37ea G.E. 180), recorders (15ea 6x6 multipen), and local power indicators (16ea) are concluded to be structurally qualified because they are either (1) original equipment, or (2) similar to Q or non-Q devices installed in another Q commodity (e.g. ECCS panel or console 04A). Remaining non-Q devices (pushbutton switches, indicator lights, etc., were judged structurally qualified because they are either (1) original equipment, or (2) low weight, compact items with sufficient strength.

The lower (horizontal) panel of the console contains the following Q-devices: (identification and location (X, Y) coordinates are according to Ref. 14, view E; locations of device clusters are approximate and provided for reference and information; see Figure 8-1 attached)

5. 5ea GE CR2940 switches (159, 6) Unit 3; 4ea on Unit 2
6. 1ea SBLC pump switch (152, 15)
7. 2ea GE SBM switches (142, 14.84)
8. 3ea Neutron Monitoring System switches (129.75, 10)
9. 4ea IRM Power Range switch (110, 10)
10. 4ea IRM Power Range switch (58. 10)
11. 1ea GE SBM switch (96, 3.6)
12. 1ea Reactor Mode switch (70.75, 3.8)
13. 2ea GE SBM switches (24, 4.84)

These devices are concluded to be sufficiently isolated from any identified modification to assure against any potential interaction. Structural failure of any non-Q device on the horizontal panel will not occur and therefore will not create any unacceptable interaction with Q devices located below. Major non-Q devices include: the Manual/Auto HCS Stations (8ea 7-GEMAC, 1-L&N), the rod select matrix, switches (18ea G.E. SBM; 5 additional SBM switches are Q qualified), and Neutron Monitoring System bypass switches (6ea).

9.0 SEISMIC CAPABILITY LIMITS OF EXISTING Q DEVICES FROM SWEC/VENDOR DATA BASE (FOR 05A ONLY)

Reference 9 addresses the seismic qualification of "Class I" electric equipment on all standard product line reactors. It summarizes qualification data obtained by methods which "did not differ markedly" from IEEE 344-1971. Reference 15 provides data for switches similar to those used for the Peach Bottom consoles and represents test to more current requirements (i.e. multi-axis testing, etc.). Certain data have been extracted and compared below.

DEVICE	REFERENCE	MALFUNCTION LIMIT HOR-1	HOR-2	VERTICAL	DEVICE CLUSTER (FIG. 8-1)
Switch, type CR2940	15	20g	20g	20g	2, 4, 5
	9	20	20	20	
Switch SB-1	9	10	10	10	G.E. (typical)
Switch SBM	9	25	25	25	7, 11, 13
Range Switch	9	8.5	8.5	8.5	9, 10

All devices, including the remaining Q device clusters (1, 3, 6, 8, and 12) are seismically qualified to at least the specified plant levels.

TABLE 8-1

SUMMARY TABLE OF EQUIPMENT FOR CONSOLE(S) 2(3)0C05(A)
(extracted from Ref. 14 in the same order as annotations)

UPPER (VERTICAL) PANEL

15- 6x6 MULTIPEN RECORDERS
37- G.E. INDICATORS
22- G.E. CR2940 SWITCHES
(7- Q)

16- LOCAL POWER INDICATORS

- RWM OPERATOR INTERFACE (1)
(DELETED BY MOD 955)

2- MANUAL SCRAM PB's (5)
(2- Q)

4- ROD DISPLAY INDICATORS (8)
2- G.E. CR115 SWITCHES (9)
(2- Q)

LOWER (HORIZONTAL) PANEL

23- G.E.CR2940 SWITCHES
(5- Q)
23- G.E.SBM SWITCHES
(5- Q)
8- MANUAL/AUTO HCS STATIONS
8- IRM POWER RANGE SWITCHES
(8- Q)
6- NEUTRON MONITORING SYSTEM
BYPASS SWITCHES
(3- Q)
2- VALVE POSITION INDICATORS

1- REACTOR MODE SWITCH (2)
(1- Q)
1- SBLC PUMP SWITCH (3)
(1- Q)
4- RFPT LOCKOUT RELAYS(4)

1- ROD SELECT MATRIX (6)
4- ARI PUSH BUTTONS (7)

Client

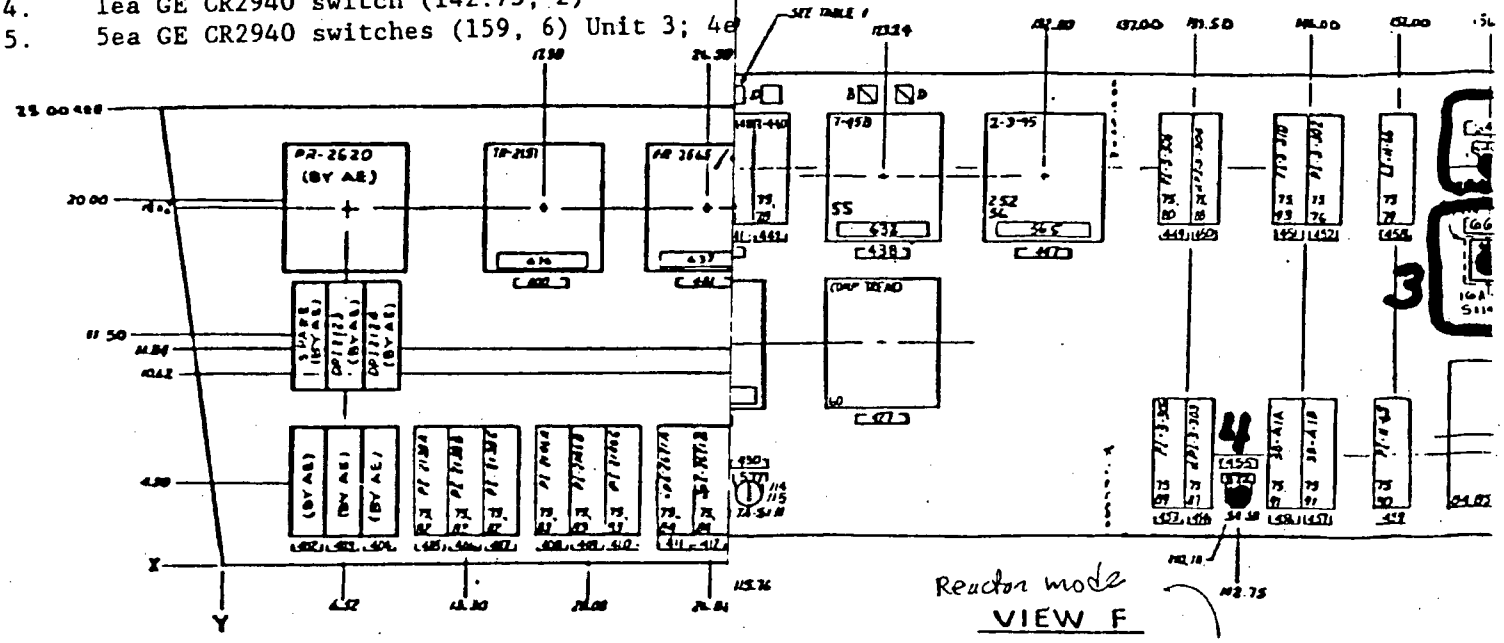
Subject or Apparatus

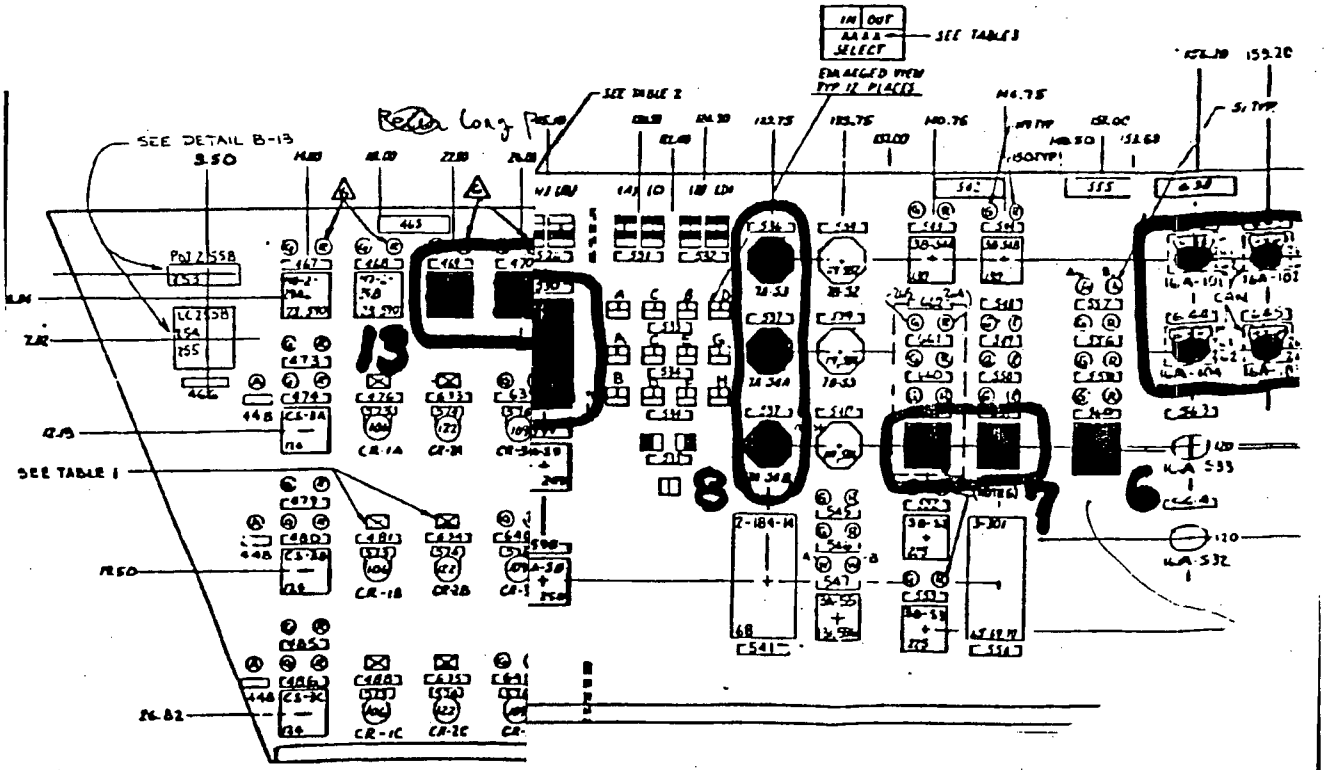
Based on

FIGURE 8-1

LIST OF Q DEVICES ON CONSOLES 2(3)0C05(A)

1. 2ea manual scram push buttons (84, 22)
2. 6ea GE CR2940 switches (160, 18)
3. 2ea GE CR115 switches (158, 15)
4. 1ea GE CR2940 switch (142.75, 2)
5. 5ea GE CR2940 switches (159, 6) Unit 3; 4e





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Preliminary _____
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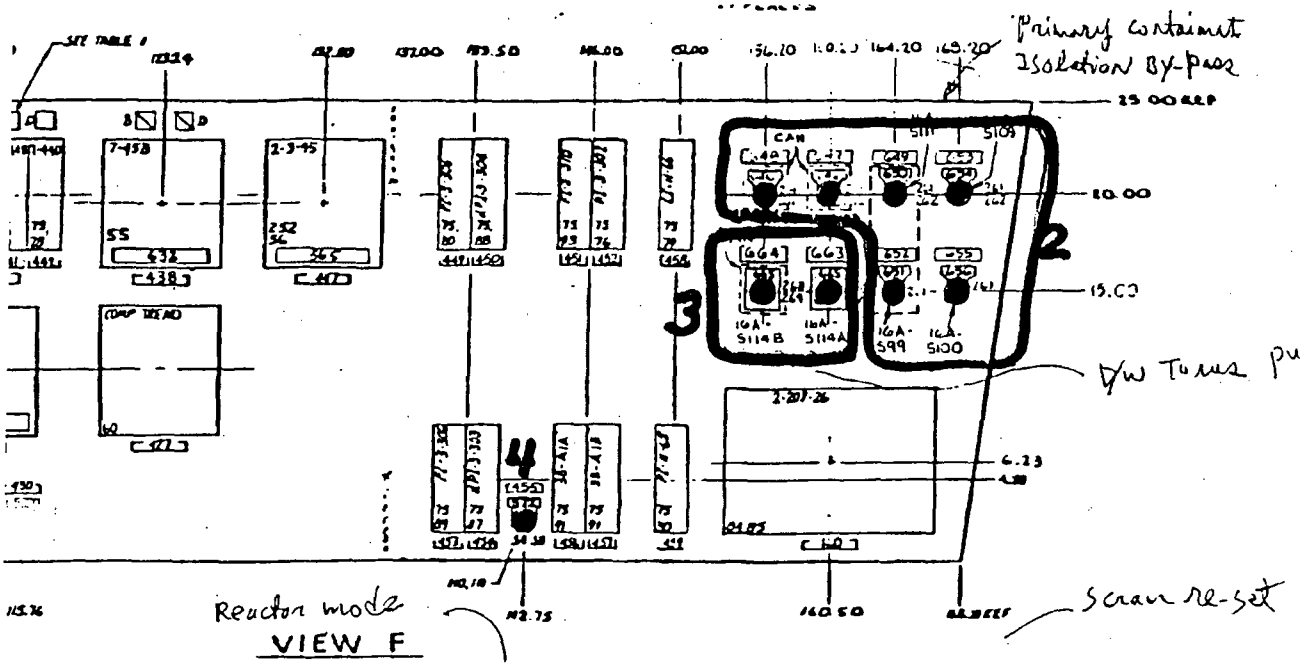
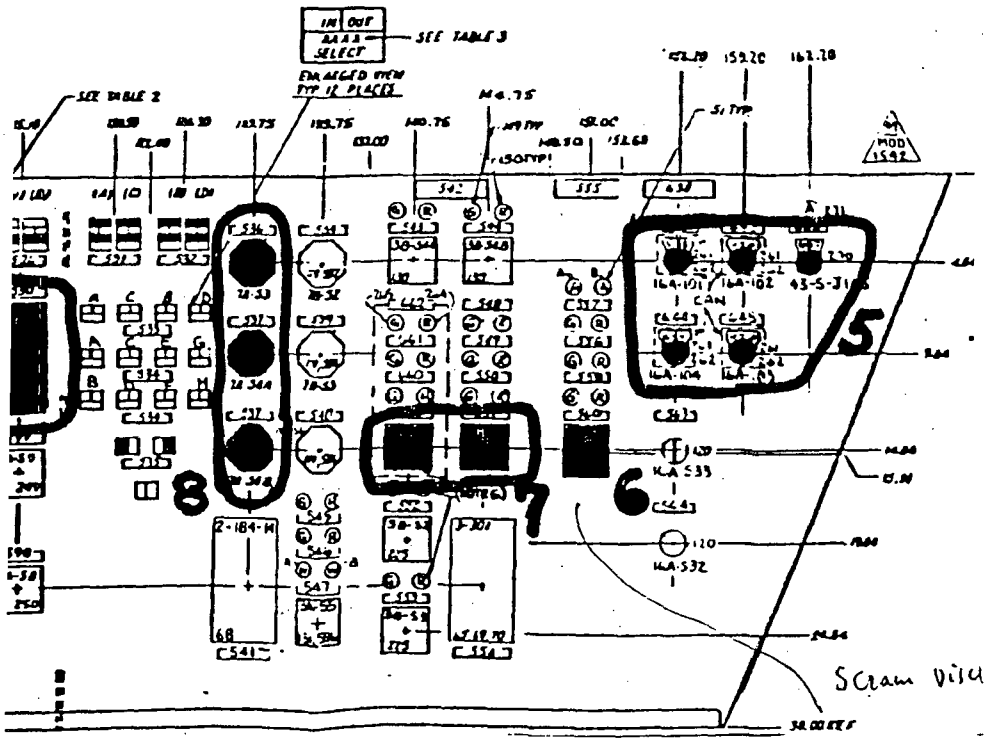
Client	Location	Est. No.	J.O. No.
Subject or Apparatus		Date	By
		Checked	By
Based on		Revised	By





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CALCULATION SHEET

Appendix 1

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CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 1
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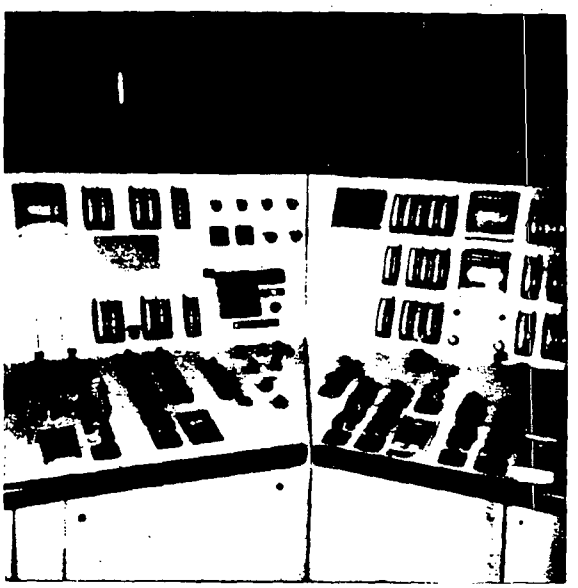

(REACTOR) 30C05A ←|→ (RECIRC/RWCU) 30C004A

30C05A (1)

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J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 2
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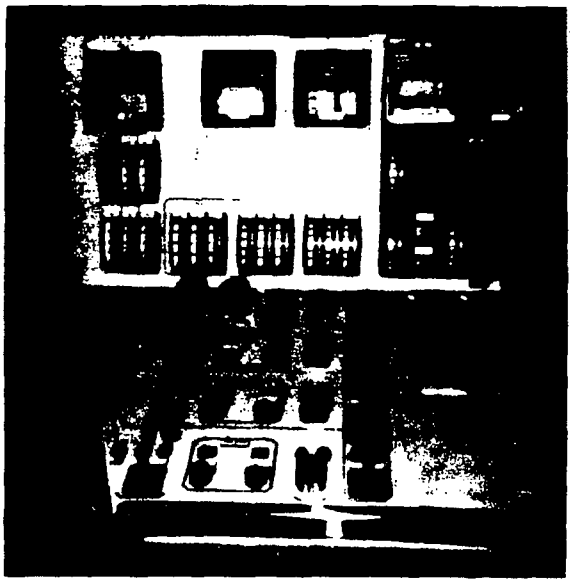

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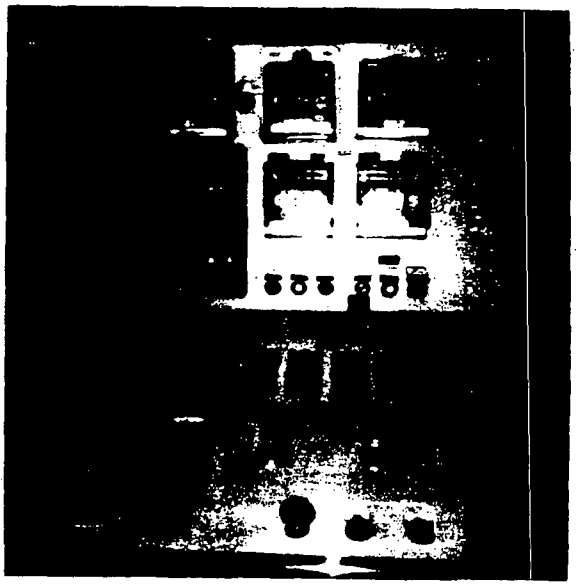

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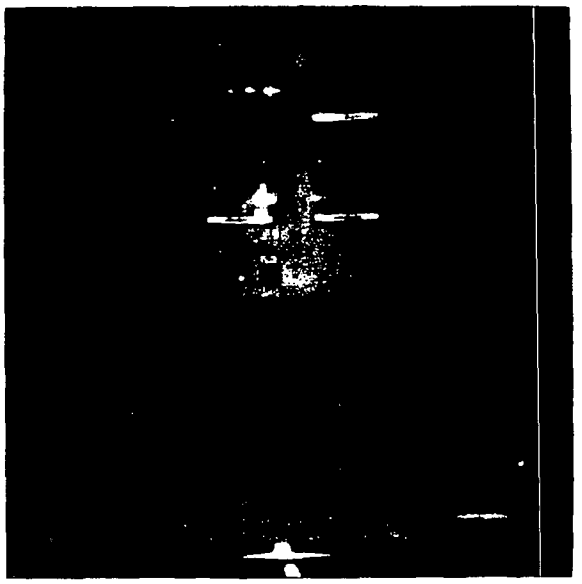

30C05A (3)

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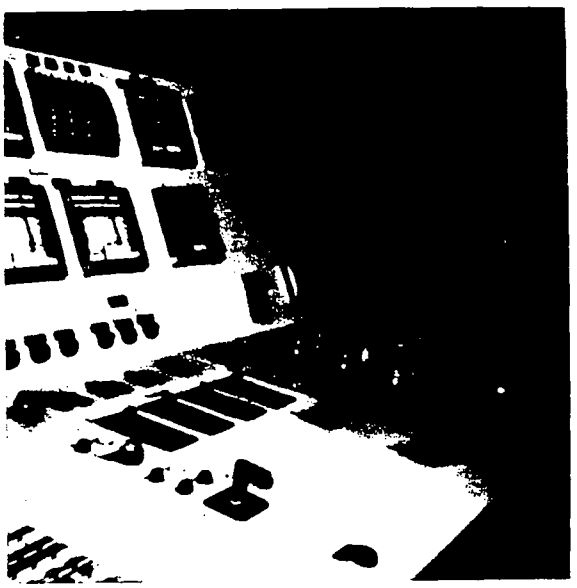

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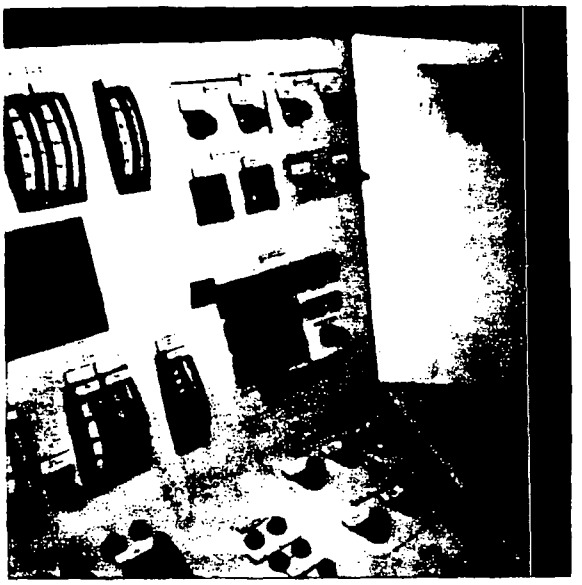

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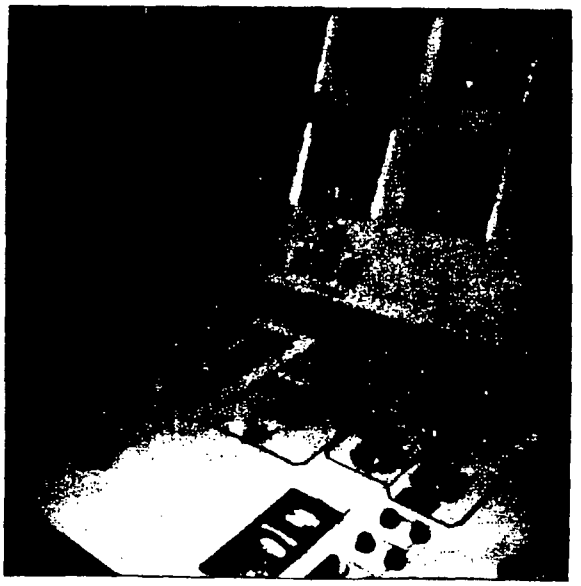

30C05A Q-devices

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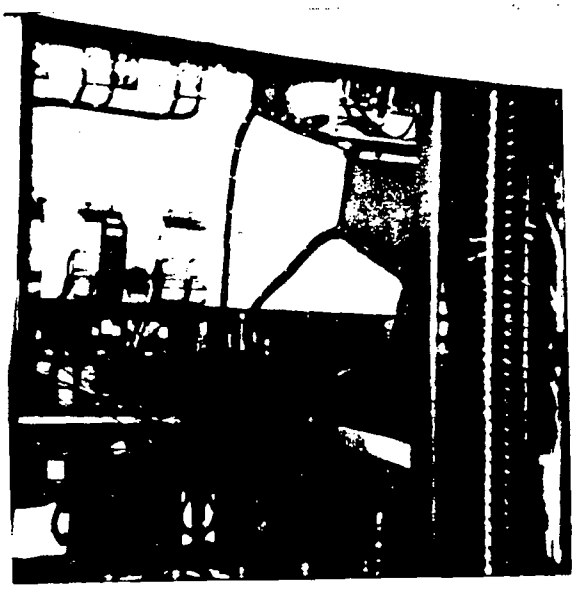

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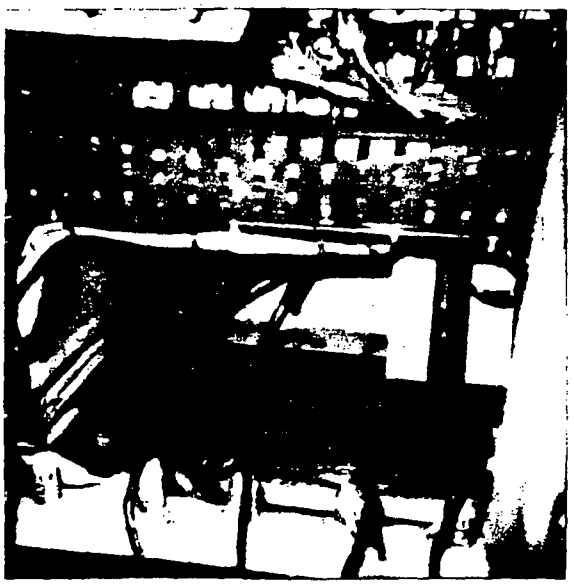

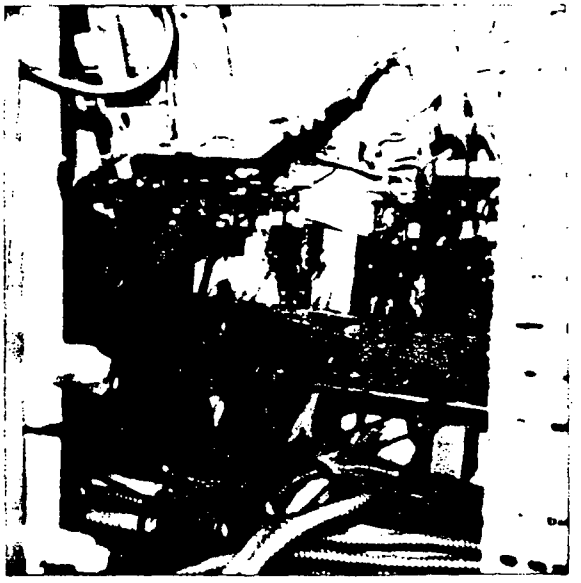

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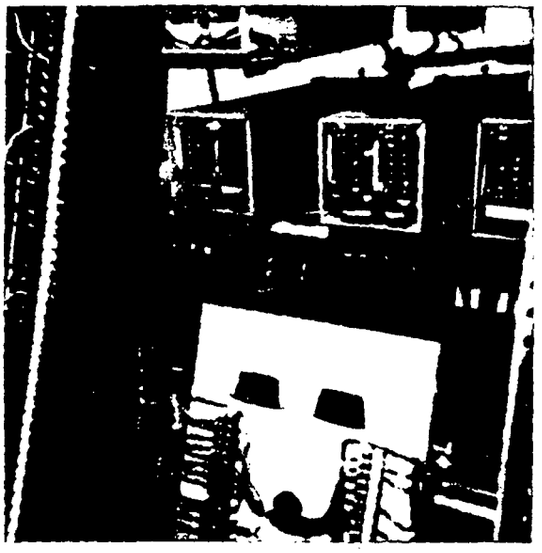

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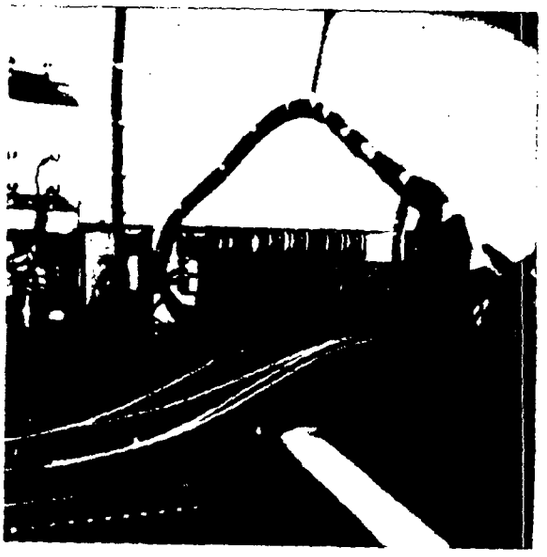

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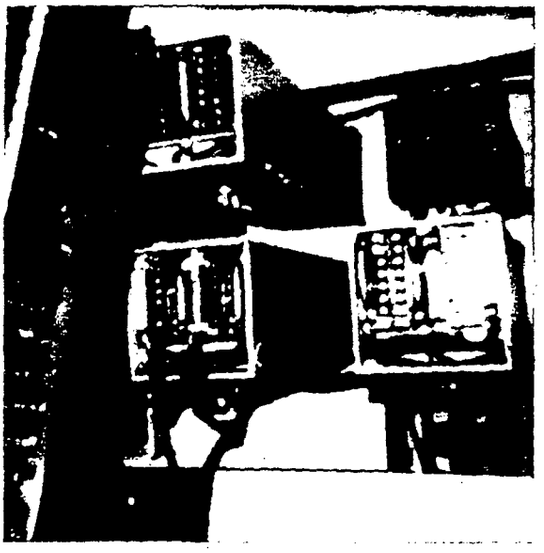

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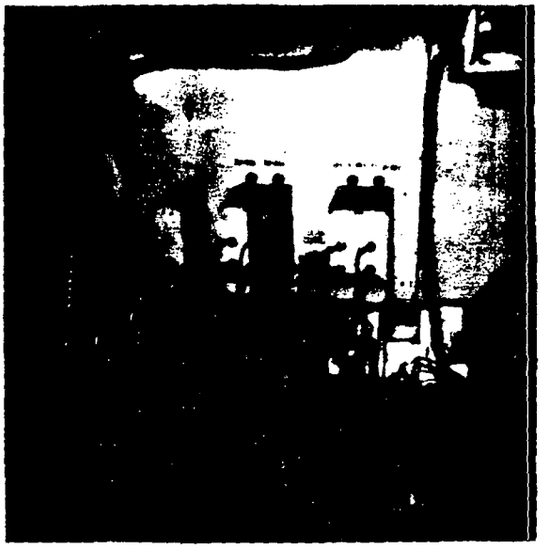

30C05A (NON-Q device suppt detail SAME)

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Appendix 1

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CALCULATION IDENTIFICATION NUMBER				
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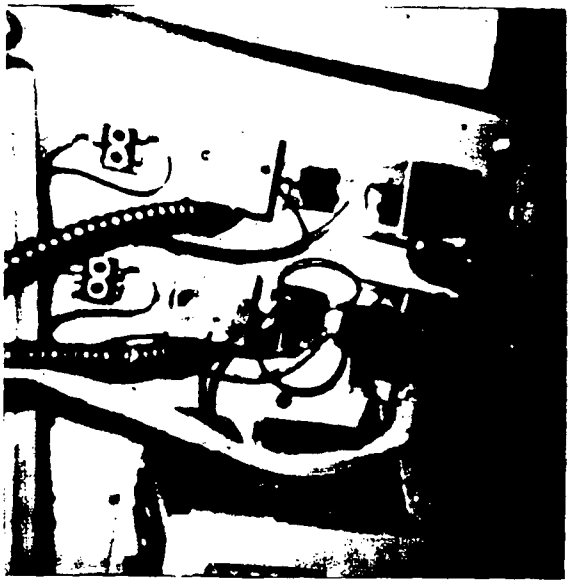
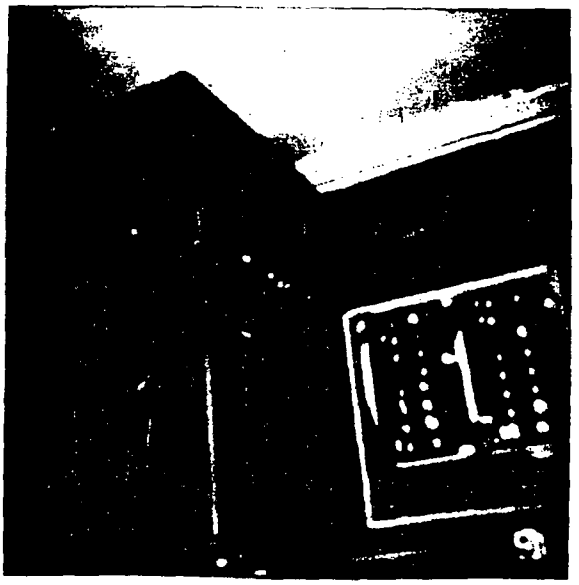
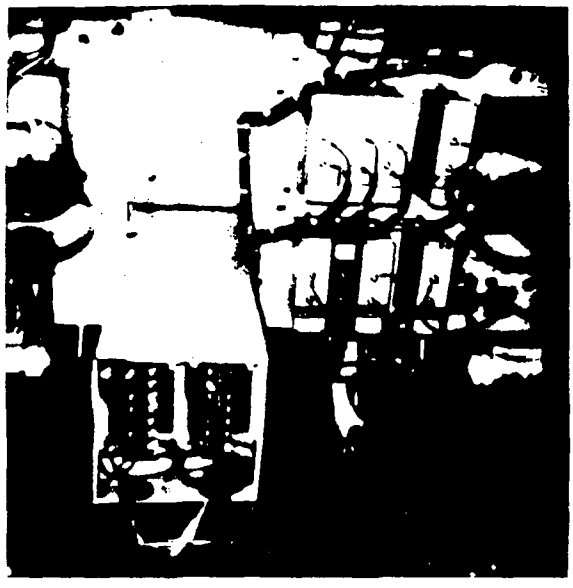


30C05A (From back, switch detail)

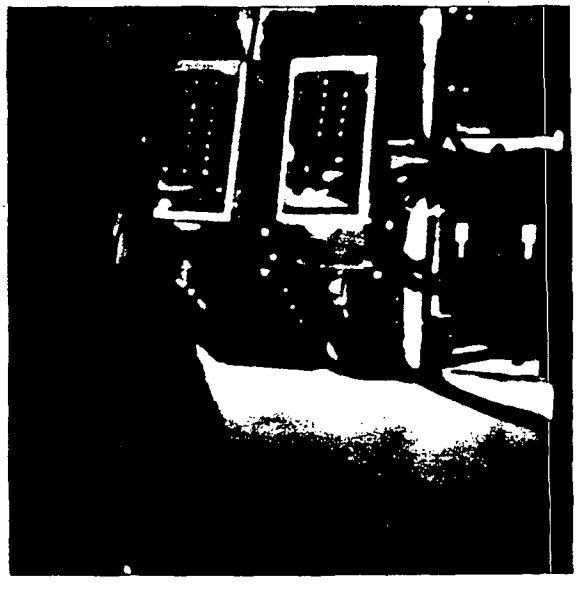
30C05A ~~22~~

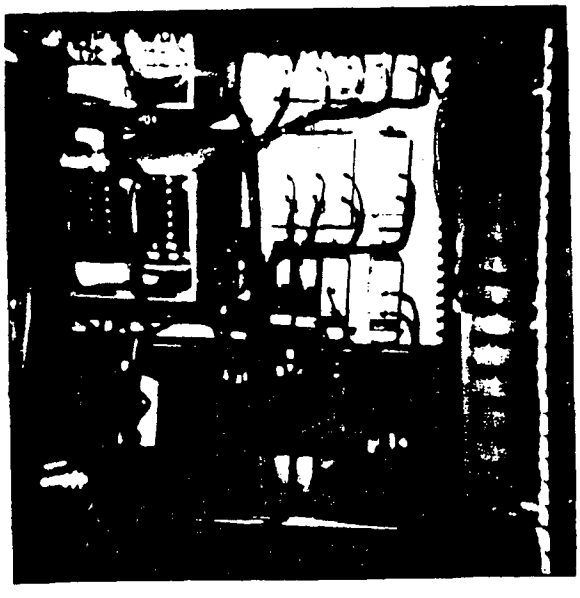




30 C004A (Q-device detail)

30 C004A (Q-device detail)





30C004A (Q-device detail)

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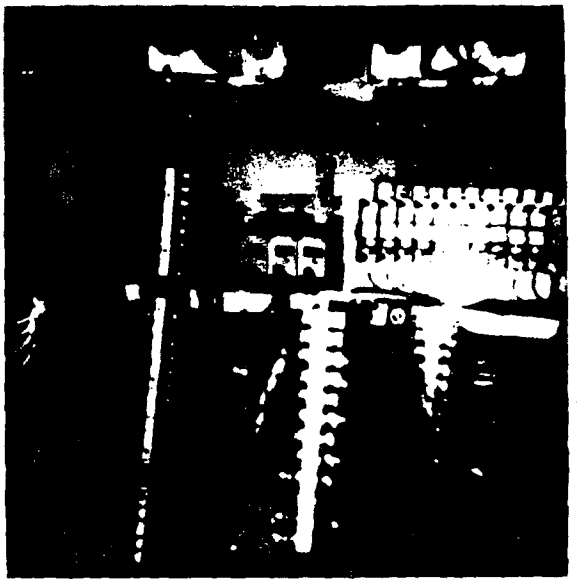

3PC07A (Q-concole suppt detail Sare)

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CALCULATION IDENTIFICATION NUMBER				
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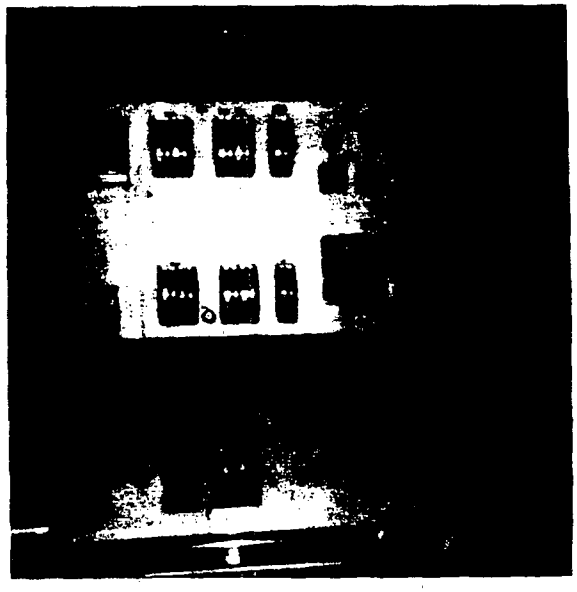

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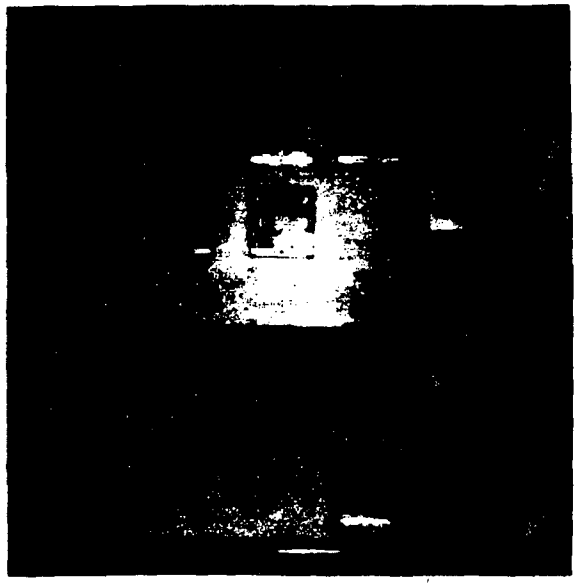

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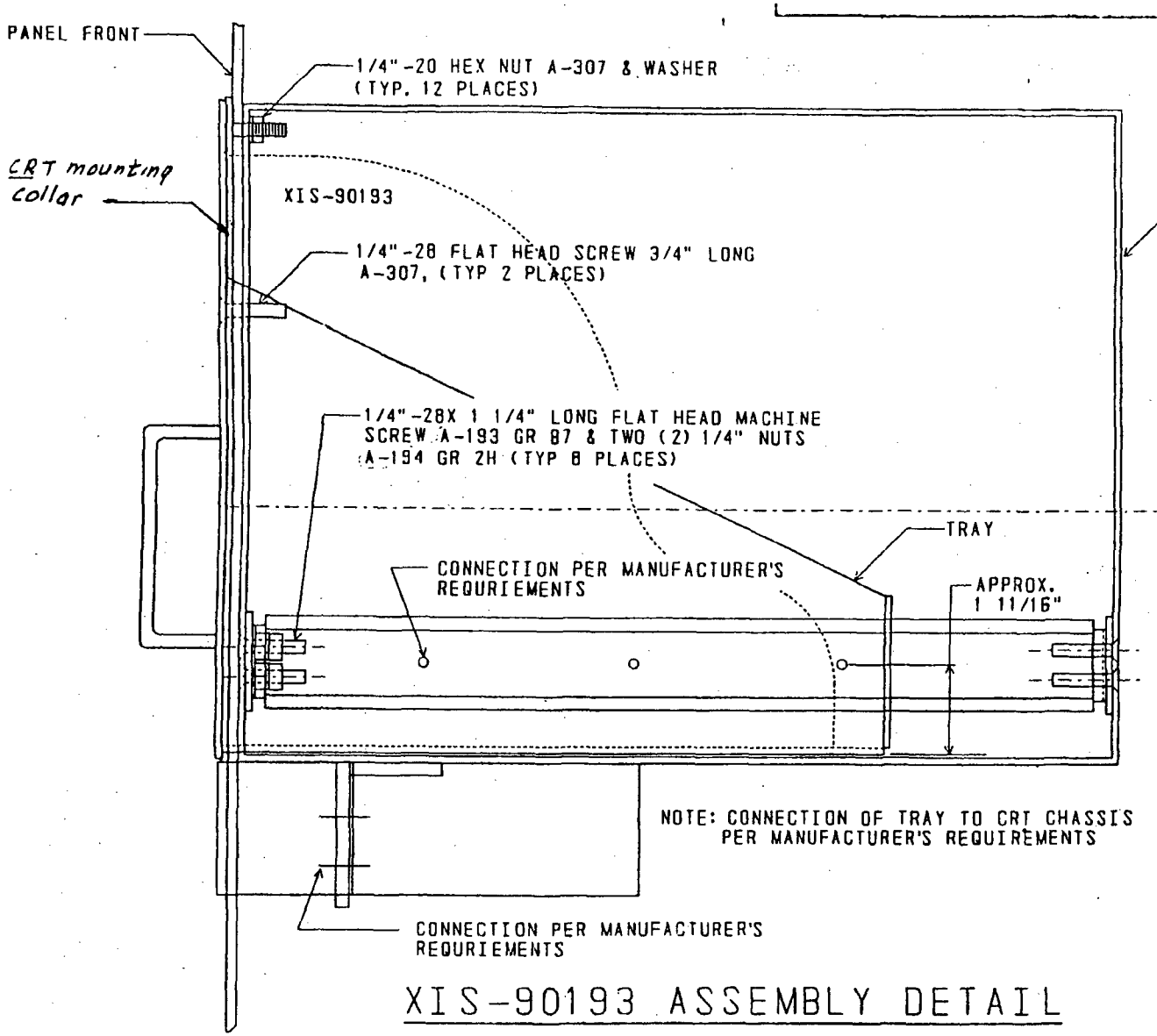

XIS-90193 ASSEMBLY DETAIL

ROUTE 25011

VOID

Attachment 1 Voided pages

page 1

INTERIM DRAWING CHANGE NOTICE

STATION		UNIT			
PBAPS	LGS	C	1	2	3
☒	☐	☐	☐	☐	☒

PHILADELPHIA ELECTRIC COMPANY

MOD	DRAWING	SHEET	REV.	IDCN
955G	M-1-EE-124	8	59	M

PRELIMINARY ISSUE ☐ DRAFT ISSUE ☐ MOD ISSUE ☒

DATE	DESIGN	CHKD.	APPR.	STRL.
[redacted]	KM	9/15	9/16 FJ	CHC

DESCRIPTION: PAGE 1 OF 1

86150041 0239955

MOD 955G

ADDED: ASSEMBLY DETAIL FOR DEVICE XIS-90193

Attachment 1 Voided Pages page 2

The lower (horizontal) panel of the console contains the following Q-devices: (identification and location (X, Y) coordinates are according to Ref. 14, view E; locations of device clusters are approximate and provided for reference and information; see Figure 8-1 attached)

5. 5ea GE CR2940 switches (159, 6) Unit 3; 4ea on Unit 2
6. 1ea SBLC pump switch (152, 15)
7. 2ea GE SBM switches (142, 14.84)
8. 3ea Neutron Monitoring System switches (129.75, 10)
9. 4ea IRM Power Range switch (110, 10)
10. 4ea IRM Power Range switch (58. 10)
11. 1ea GE SBM switch (96, 3.6)
12. 1ea Reactor Mode switch (70.75, 3.8)
13. 2ea GE SBM switches (24, 4.84)

VOID

These devices are concluded to be sufficiently isolated from any identified modification to assure against any potential interaction. Structural failure of any non-Q device on the horizontal panel will not occur and therefore will not create any unacceptable interaction with Q devices located below. Major non-Q devices include: the Manual/Auto HCS Stations (8ea 7-GEMAC, 1-L&N), the rod select matrix, switches (18ea G.E. SBM; 5 additional SBM switches are Q qualified), and Neutron Monitoring System bypass switches (6ea).

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Reference 9 addresses the seismic qualification of "Class I" electric equipment on all standard product line reactors. It summarizes qualification data obtained by methods which "did not differ markedly" from IEEE 344-1971. Reference 15 provides data for devices similar to those used for the Peach Bottom consoles and represents test to more current requirements (i.e. multi-axis testing, etc.). Certain data have been extracted and compared below.

DEVICE	REFERENCE	MALFUNCTION LIMIT		
		HOR-1	HOR-2	VERTICAL
Switch type CR2940	9	20 g	20 g	20 g
	15	20	20	20
Switch SB-1	15	10	10	10
Switch SBM	15	25	25	25
Range Switch	15	8.5	8.5	8.5