50-445

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 16, 1996

LICENSEE: Texas Utilities Electric Company

FACILITIES: Comanche Peak Steam Electric Station, Units 1 and 2

SUBJECT: SUMMARY OF MEETING WITH TEXAS UTILITIES ELECTRIC COMPANY (TU ELECTRIC) REGARDING LICENSE AMENDMENT REQUEST 96-005, INVERTERS AND BATTERY CHARGERS MODIFICATION (TAC NOS. M96242 AND M96243)

On October 2, 1996, members of the NRC staff met with representatives of Texas Utilities Electric Company (TU Electric) at NRC Headquarters in Rockville, Maryland to discuss the load calculations for the batteries and the emergency diesel generators (EDGs) as they related to the license amendment request (LAR) 96-005 dated July 31, 1996, (TXX-96432), as supplemented by letters dated August 23 and 27 (TXX-96447 and TXX-96451), and September 19, 1996 (TXX-96469). The supplemental letters documented the licensee response to NRC staff questions regarding the amendment request. The NRC staff requested this additional information because the licensee had not provided sufficient detail regarding battery and EDG loading in their original submittal.

The licensee started the meeting with a description of their proposed battery charger and inverter design modification and the need for a license amendment. The NRC staff asked the licensee to provide an overview of the battery and EDG loading calculations and the methodology used to perform the calculations. The NRC staff also requested that actual calculational values before and after the modifications be shown to demonstrate the required margins were maintained. The following calculations were discussed, 16345-EE(B)-053 Revision 5 CCN #8, "Sizing Verification- Class 1E Batteries and Battery Chargers," EE-CA-0007-3377 Revision 1, CCN #3, "Unit 1 Diesel Generator Database Report," and 16345-EE(B)-011 Revision 8, CCN #3, "Validation Of Cable Sizing Calculation - DC System for Class 1E Cables Based on Voltage Drop and Ampacities." (Attachments 2, 3, and 4 respectively). The NRC staff was satisfied with the licensee's discussion and the calculations presented at the meeting. However, the staff requested the licensee also provide some additional information specifically, a portion of calculation EE-CA-0007-3376 Revision 1 and battery charger cable size evaluations. The licensee faxed this additional information on October 3 and 4, 1996 (Attachments 5 and 6).

9610230059 961016
PDR ADOCK 05000445
P PDR

NRC FILE CENTER COPY

The licensee also provided information regarding a typographical error in their September 19, 1996 letter. The CCN number for 16345-EE(B)-53 Revision 5 should be 8 rather that 7.

Chandu P. Patel

for Timothy J. Polich, Project Manager
Project Directorate IV-1
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Docket Nos. 50-445 and 50-446

Attachments:
1. Meeting Attendees
2. Calculation 16345-EE(B)-053 Revision 5 CCN #8, dated September 30, 1996
3. Calculation EE-CA-0007-3377 Revision 1, CCN #3, dated September 30, 1996
4. Calculation 16345-EE(B)-011 Revision 8, CCN #3, dated September 16, 1996
5. Fax from I. Ahmed to T. Polich, dated October 3, 1996
6. Fax from M. Hussain to A. Pal, dated October 4, 1996

cc w/atts: See next page

The licensee also provided information regarding a typographical error in their September 19, 1996 letter. The CCN number for 16345-EE(B)-53 Revision 5 should be 8 rather that 7.

ORIGINAL SIGNED BY: C. Patel for
Timothy J. Polich, Project Manager
Project Directorate IV-1
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

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230001

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Mr. C. Lance Terry
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Glen Rose, TX 76043

MEETING ATTENDEES

NRC		
T. Polich	NRC/NRR/PD 4-1	301-415-1038
P. Gill	NRC/DE/EELB	301-415-3316
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I. Ahmad	TU Electric	817-897-8126
M. Hussain	TU Electric	817-897-6842
F. Powers	TU Electric	817-897-6447

ATTACHMENT 1

EDCN

Comanche Peak Steam Electric Station
CHANGE VERIFICATION CHECKLIST

DOCUMENT: Calc.16345-EE(B)-053,Rev.5, ~~CA~~ 8 Page 1 of 2

CHANGE CLASSIFICATION: CLASS I X CLASS II ___ NON-SAFETY ___

INPUT/IMPACT REQUIRED FROM:	*YES*	*NO*	*REVIEWER/STAKEHOLDER*	*COMPLETE*
ENGINEERING DISCIPLINES:				
CIVIL ENGINEERING		X		
CODES AND STANDARDS		X		
ELECTRICAL ENGINEERING		X		
INSTRUMENTATION & CONTROLS ENGINEERING		X		
MECHANICAL ENGINEERING		X		
NUCLEAR/MECHANICAL ENGINEERING ANALYSIS		X		
PROCUREMENT ENGINEERING		X		
SYSTEM ENGINEERING		X		
ENGINEERING IMPACTS:				
CIVIL ENGINEERING SYSTEMS INTERACTION		X		
CIVIL ENGINEERING - PIPING		X		
COMBUSTIBLE GAS CONTROL ENGINEER		X		
CONTAINMENT ANALYSIS ENGINEER		X		
DIGITAL SYSTEMS ENGINEERING		X		
ENGINEERING ALARA COORDINATOR		X		
ENVIRONMENTAL EVALUATION (STA-717)		X		
ENVIRONMENTAL EQUIP. QUALIFICATION ENGINEER		X		
FIRE PROTECTION ENGINEER		X		
HUMAN FACTORS ENGINEER		X		
MAINTENANCE ENGINEERING (PROGRAMS)		X		
MAINTENANCE ENGINEERING (TESTING)		X		
MECHANICAL EQUIPMENT ENGINEERING (MOVS)		X		
MECHANICAL EQUIPMENT ENGINEERING (COATINGS)		X		
NUCLEAR ANALYSIS & FUEL		X		
RADIATION ENVIRONMENT ENGINEER		X		
RADIOLOGICAL ENVIRONMENTAL ENGINEER		X		
RADIOLOGICAL ACCIDENT ENGINEER		X		
SEISMIC EQUIPMENT QUALIFICATION		X		
SITE FACILITIES ENGINEERING		X		

Comanche Peak Steam Electric Station

CHANGE VERIFICATION CHECKLIST

DOCUMENT: Calc.16345-EE(B)-053,Rev.5 CC N 8 Page 2 of 2

INPUT/IMPACT REQUIRED FROM:	*YES*	*NO*	*REVIEWER/STAKEHOLDER*	*COMPLETE*
ENGINEERING IMPACTS (CONTINUED):				
SOFTWARE QUALITY ASSURANCE		X		
STATION BLACKOUT ANALYSIS		X		
SYSTEMS INTERACTION (MECHANICAL) ENGINEER		X		
TORNADO VENTING ANALYSIS ENGINEER		X		
		X		
		X		
		X		
NON-ENGINEERING IMPACTS:				
CHEMISTRY		X		
ELECTRICAL MAINTENANCE		X		
INSTRUMENTATION & CONTROL MAINTENANCE		X		
MECHANICAL MAINTENANCE		X		
NUCLEAR TRAINING (SIMULATOR DESIGN)		X		
NUCLEAR TRAINING (PROGRAMS)		X		
OPERATIONS SUPPORT		X		
OPERATIONS WORK CONTROL		X		
OPERATIONS FIRE PROTECTION		X		
PLANT SUPPORT		X		
QUALITY ASSURANCE/QUALITY CONTROL		X		
RADIATION PROTECTION		X		
REGULATORY AFFAIRS		X		
		X		
		X		
		X		

Comments:

Prepared by: (print) MUNAWAR HUSSAIN (sign) [signature] Date: 9/29/96

Approved by: (print) IJAZ AHMAD (sign) [signature] Date: 9-30-96

Figure 7.2: Design Verification Form

Comanche Peak Steam Electric Station

DESIGN VERIFICATION

DOCUMENT: **Cal. 16345-EE(B)-053 Rev.5** cw & Page 1 of 1

AREA	*REQ'D?*	*METHOD NO.**	*COMMENTS?*	*VERIFIED BY: (print)*	*(sign)*	*DATE*
Mechanical Design	No					
I&C Design	No					
Electrical Design	Yes	1	No	Ajit Mukherjee		9/29/96
Civil Design	No					
Nuclear Design	No					
Other Design Verifier	No					

Comments:

Munawar Hussain 9/29/96

Prepared by: (print) Munawar Hussain (sign) Munawar Hussain Date: 9/29/96

Approved by: (print) Ijaz Ahmad (sign) Ijaz Ahmad Date: 9-30-96

*DV Methods are as follows: 1 - Design Review, 2 - Alternate Calculation, 3 - Qualification Test.

FIGURE 7.6
CALCULATION CHANGE NOTICE

CCN NO.	TYPE	CALCULATION NUMBER	REVISION NUMBER	CONFIRMATION REQUIRED
008	SWEC	16345-EE(B)-053	5	☐ YES ☒ NO

☒ DM 96-013 ☐ MM _____ ☐ Repair ONE Form _____ ☐ Paper Change Only | 5

Preparer(s): Munawar Hussain _____ Date: May/27/1996

Checker: Ajit Mukherjee _____ Date: 9/29/96

Engineering Supervisor: Ijaz Ahmad _____ Date: 9-30-96

REASON FOR CHANGE

DM 96-013 replaces :

1) Elgar 10 kVA Class 1E inverters with SCI 10kVA Class 1E inverters.
2) Westinghouse 7.5kVA NSSS Class 1E inverters with SCI 10kVA Class 1E inverters.
3) PCP 225 A Class 1E Battery Chargers with SCI 300 A Class 1E Battery Chargers.

The above DM also adds 10kVA Spare Inverter per train . The purpose of this CCN is to verify the adequacy of Class 1E Station Batteries and Battery Chargers when their associated inverters are powering the loads and the third inverter(Spare Inverter) is energised and drawing no load current.In order that this calculation also addresses the CPSES Station Blackout(SBO) concerns the temperature correction factor is changed from 1.04 to 1.064 based on the Battery Room temperature of 67 F instead of 70 F (Referencer CCN # 1 to Calculation EE-CA-0009-3025 R 0).This calculation does not distinguish between the DC loads imposed on the batteries in each mode of Plant operation and it only verifies the batteries adequacy for the worst DC loading. **

Battery sizing calculation is performed with 15% design margin per reference 1 of the calculation.

ASSOCIATED CALCULATION INFORMATION

SUPERSEDES (SUP)/ SUPPLEMENTS (SPL)	TYPE	NUMBER AND REVISION
SUP	TNEC	EE-CA-0009-3025 R 0

FILING INSTRUCTIONS:

Place this CCN infront of the calculation.

** This CCN adds Attachment 8 that determines the duty cycle dischage test curret values of the Class 1E batteries.

DESIGN CHANGE TRENDING CODE 1 / Q EEE* / A F / A

FIGURE 7.2
INDEX SHEET

TU ELECTRIC ENGINEERING

INDEX SHEET

CALCULATION NO.: 16345-EE(B)-053

PAGE 2

REV. No.	PAGES REVISED	PAGES ADDED	PAGES DELETED
5,CCN#8	3,4,4A,6A,8,9,10,11A,12,13,14, 15A,16,17,18,19A,20,21,22,23A, 24,25,26,27 & 28 RJH 9/30/96	Attachment 8 (Page1)	N/A RJH 9/30/96

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 3

CCN # 8 , Page 3 of 28

Objective :

These calculations are intended to verify the correct sizing of :

a) Batteries BT1ED1, BT1ED2,BT1ED3 and BT1ED4 and. also determine their duty cycle discharge test currents.
b) Battery Chargers BC1ED1-1,BC1ED1-2,BC1ED2-1,BC1ED2-2,BC1ED3-1,BC1ED3-2, BC1ED4-1 and BC1ED4-2 .

The above Batteries and Battery Chargers are used in the Class 1E DC Power System and their ratings are required to be verified for the Plant in Normal, LOCA coincident with loss of offsite power and in Station Blackout (SBO) condition.

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
16345	EE(B)	053 R5	XXX	4

ASSUMPTIONS

1. EACH BATTERY IS CAPABLE OF CARRYING THE ESSENTIAL LOAD CONTINUOUSLY FOR A PERIOD OF FOUR HOURS IN THE EVENT OF A TOTAL LOSS OF ONSITE AND OFFSITE AC POWER. CCN #008: and the swing Inverter no load current (1)
2. THE MINIMUM CELL VOLTAGE IS 1.75 V/CELL. This is the maximum load the battery will experience in any mode of plant operation. CCN # 8
3. IT IS ASSUMED THAT THE BATTERY IS FULLY CHARGED PRIOR TO INITIATION OF THE BATTERY DUTY CYCLE.
4. DELETED (2)
5. THE CHARGING SIZING CALCULATION ASSUMES THAT THE BATTERY CHARGER WILL RECHARGE THE COMPLETELY DISCHARGED BATTERY WITHIN 24 HOURS WHILE SIMULTANEOUSLY CARRYING THE CONTINUOUS DC LOADS.
6. THE CHARGER SIZING ALSO ASSUMES THAT ALL BOP INVERTERS ARE BEING SUPPLIED FROM THE AC SYSTEM DURING THE BATTERY RECHARGE PERIOD. RPS INVERTERS ARE CONSIDERED AS CONTINUOUS LOAD ON CHARGER SIZING. (5)
7. THE LOWEST BATTERY ROOM TEMPERATURE IS 70°F 67°F based on station Blackout DBD-ME-026 CCN# 8 (2)
8. THE WORST CASE BATTERY LOADING SENARIO IS INDICATED IN Bd. (5)

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
16345	EE (B)	053 R5	XXX	4A

ASSUMPTIONS (CONT)

8a DELETED

8b DELETED

8c DELETED

CCN# 008

8d LOSS OF ONSITE AND OFFSITE AC POWER

THE CONDITIONS WOULD REQUIRE THE BATTERY TO SUPPLY ALL THE 118V AC UPS, (the Swing Inverter no load current) AND 125V DC LOADS FOR 4 HOURS. NO LOAD SEQUENCING WOULD OCCUR SINCE NO DIESEL GENERATOR IS AVAILABLE TO SUPPLY AC LOADS. IN ADDITION, THE MOMENTARY CURRENT FOR ONE BREAKER CLOSURE AND THE INRUSH CURRENT FOR A SECOND BREAKER CLOSURE IS REQUIRED IN THE LAST MINUTE. THE LOADS CONSIDERED ARE THE WORST CASE LOADING FOR NORMAL, ABNORMAL OR ACCIDENT CONDITIONS. THIS SCENARIO IS THE BATTERY DUTY CYCLE BASIS.

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 6A

CCN # 8, PAGE 6/28

5. Gould Discharge Characteristics Curve TC-107011B

6. Gould Specification Data Sheet GB-3325E

7. ITE Metal Clad Switchgear Data 1B-8.2.7-4, Page11, Table 2

8. NEI Reebles -Electric Product INC Letter CVT-0056 (Field Flash)

9. DCN 5827 REV 0 — CCN # 001

10. DM # 93-061 — CCN # 003

11. DM 95-10 — CCN # 005

12. DM 94-022 & 94-023 , Instrument Air System Modifications — CCN # 006

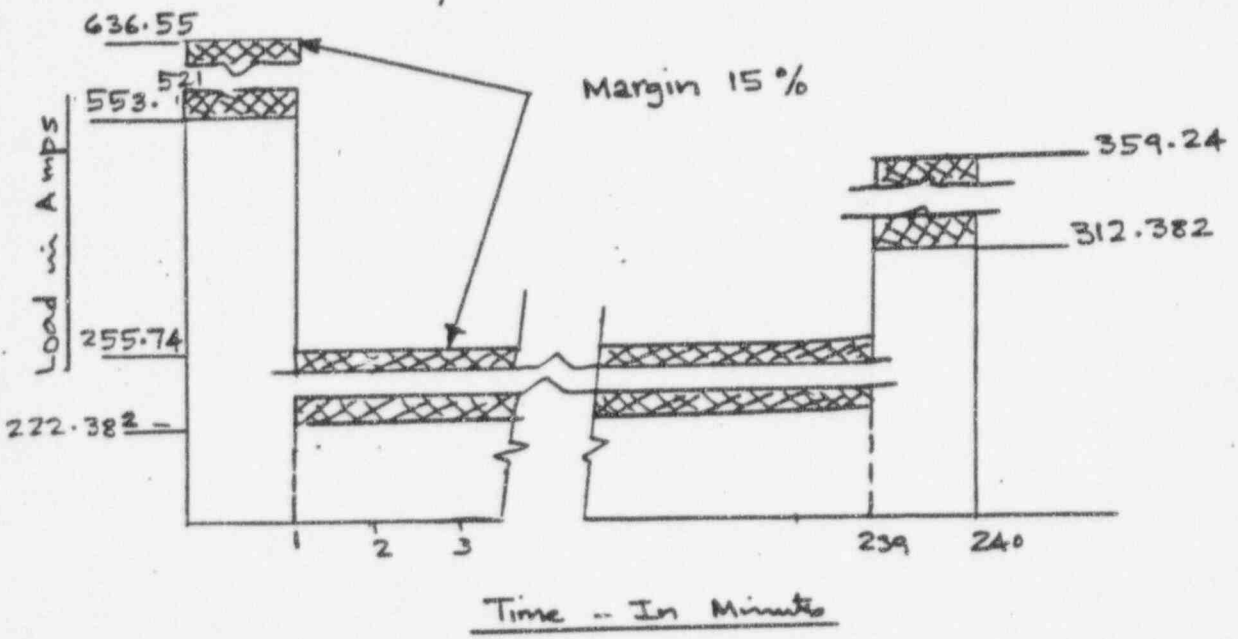
13. DM 96-013 , Replacement of inverters and addition of Swing inverters

CCN # 008

FIGURE 7.5
CALCULATION CONTINUATION SHEET

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 8

Battery Calculation-Battery BT1ED1 CCN # 8 , Page 7/28



Battery Load Cycle (Data from page 9)

Sizing based on data developed on page 10

Maximum Section size = 7.6/7.66 Positive Plates for NCX-1950 / NCN-27 Type Cells

Temperature Correction = X 1.064 (Ref. 1)

Design Margin = X 1.15 (Standard Design Margin Ref.1)

Aging Factor = X 1.25 (Ref. 1)

Cell size =11.62/11.72

Use next higher number of whole plates = 12

Minimum cell size = 1 + (2X 12) = 25

CCN# 8

Cell NCX -1950 or NCN-27 (27 Plates) is acceptable.

The potential design margin for NCX-1950 or NCN -27 = 13/7.6x1.064x1.25 = 1.28 or 28% for NCX-1950 Cell
and 13/7.66x1.064x1.25 = 1.27 or 27 % for NCN-27Cell

Where 13 is the number of positive plates.

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 9

CCN#8, Page 8/28

BATTERY LOADING TABLE- 1
125 V DC SWITCHBOARD 1ED1

Battery BT1ED1-Train A

Load Description	0-1 Min Amperes	1-239 Min Amperes	239-240 Min Amperes	Remarks
Dist Panel 1ED1-1 CP1-ECDPED-01	57.900	30.322	30.322	
Dist. Panel 1ED1-2 CP1-ECDPED-03	314.861	16.697	106.697	Page 9A and Note 4
Dist. Panel XED1-1 CPX-ECDPED-01	12.660	7.263	7.263	
RPS Inverter for 1PC1 TBX-ESELIV-01	75.520	75.520	75.520	CCN#6, Calc.EE(B)-037R4
BOP Inverter for 1EC1 CP1-ECIVEC-01	73.130	73.130	73.130	CCN#6,Calc.EE(B)-037R4
Spare Inverter No Load current (CP1-ECIVEC 1/3)	19.450	19.450	19.450	CCN#6,Calc.EE(B)-037R4
TOTAL :	553.521	222.382	312.382	

CCN#8

NOTES :

1. Load Data from input No. 2 except Dist. Panel 1ED1-2 which is developed on page 9A
2. The 0-1 minute load includes all steady state loads and the momentary currents.
3. The 1-239 minute load includes steady state loads only.
4. The 239-240 minute load includes steady state loads and the momentary currents (10 A) for 1 breaker closure and the inrush current (80A) for a second breaker closure.

Battery : BTIED1 Calculation: EE(B)-053, R5, Page 10

Lowest Expected Electrolyte Temp: °F 67 Minimum Cell Voltage: 1.75V Cell Mfg: Gould / GNB Cell Type: NCX-1950 NCN-27 Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity at T Min Rate (6A) Amps/Pos (R_T) or (6B) K Factor (K_T)	(7) Required Section Size (3) ÷ (6A) = Positive Plates or (3) x (6B) = Rated Amp Hrs — Pos Values	(7) — Neg Values
Section 1 — First Period Only — If A2 is greater than A1, go to Section 2.							
1	A1=553.521	A1−0=553.521	M1= 1	T=M1= 1	160/142	3.46/3.90	***
					Sec 1 Total	3.46/3.90	***
Section 2 — First Two Periods Only — If A3 is greater than A2, go to Section 3.							
1	A1=	A1−0=	M1=	T=M1+M2=			
2	A2=	A2−A1=	M2=	T=M2=			
					Sec 2 Sub Tot / Total		***
Section 3 — First Three Periods Only — If A4 is greater than A3, go to Section 4.							
1	A1=553.521	A1−0=553.521	M1= 1	T=M1+M2+M3=240	31.75/31.8	17.43/17.41	
2	A2=222.382	A2−A1= −331.139	M2=238	T=M2+M3= 239	31.87/31.9		10.39/10.38
3	A3=312.382	A3−A2=90	M3= 1	T=M3= 1	160/142	0.56/0.63	
					Sec 3 Sub Tot	17.99/18.04	10.39/10.38
					Total	7.6/7.66	***
Section 4 — First Four Periods Only — If A5 is greater than A4, go to Section 5.							
1	A1=	A1−0=	M1=	T=M1+...M4=			
2	A2=	A2−A1=	M2=	T=M2+M3+M4=			
3	A3=	A3−A2=	M3=	T=M3+M4=			
4	A4=	A4−A3=	M4=	T=M4=			
					Sec 4 Sub Tot / Total		***
Section 5 — First Five Periods Only — If A6 is greater than A5, go to Section 6.							

Note: RT values from Gould Discharge curve TC-107011B and GNB curve, attachment 2A, Page 3 of calc EE(B)-053

CCN# 8

ACCEPTABLE [illegible]

INIT [illegible] DATE 4/30/96

Work Sheet For Storage Batteries
Lead - Acid Voltage Profile Calc.

CCN#8

Battery Type: NEX 1950/NCN-27

Battery Number: BT1ED1

Length of Duty cycle: 240 minutes

Nominal Battery Voltage: 125 VDC

Number of positive plates: 13

Number of cells (Per cell): 60

* Ampere Hours per positive plate Vs Amp per positive plate data source: Gould TC-107011B

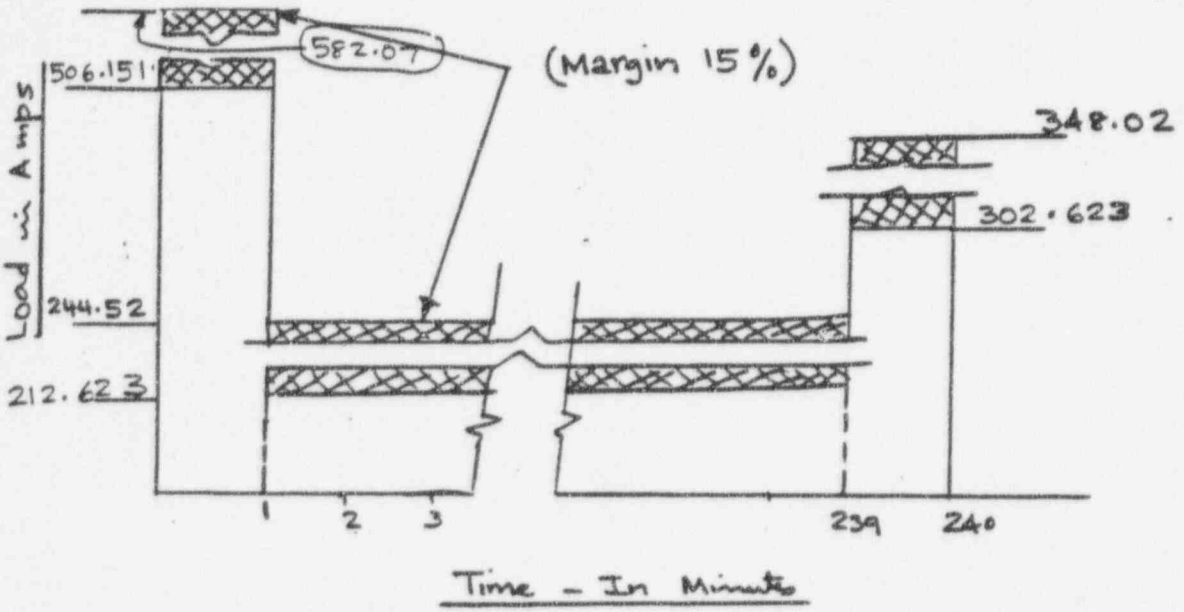
(1) Step	(2) Time in Min.	(3) Ampere Rate	(4) Adjusted Amps *	(5) (3) / No. of Plates Amps per Positive Plate	(6) (2) x (5) / 60 Amp Hours Per. Pos.	(7) Cumulative A.H. / Discharge	(8) Volts per Cell (5) at (7)	(9) Battery Voltage (8) x number of cells in Series
1	1	553.521	846.61	65.12	1.08	Beginning 0	1.91/1.86	114.6/111.6
						End 1.08	1.91/1.86	114.6/111.6
2	238	222.382	340.13	26.16	103.77	Begining 1.08	1.97/1.94	118.2/116.4
						End 104.85	1.85/1.87	111/112.2
3	1	312.382	477.79	36.75	0.61	Begining 104.85	1.81/1.81	108.6/108.6
						End 105.46	1.81/1.81	108.6/108.6
4	* Amp rate includes:							
5		25% For Aging Factor 6.4% For Temperature (67°F)						
6		15% Design Margin.						
7								
8								

* (For GNB (see curve attachment 2, Page 3) cell NCN-27)

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 12

CCN # 8 , Page 11/ 28

Battery Calculation - Battery BT1ED2



Battery Load Cycle (Data from page 13)

Sizing based on data developed on page 14

Maximum Section size = 7.29/7.35 Positive Plates for NCX-1950 / NCN-27 type cells.

Temperature Correction = X 1.064 (Ref. 1)

Design Margin = X 1.15 (Standard Design Margin Ref.1)

Aging Factor = X 1.25 (Ref. 1)

CCN#8

Cell size = 11.16/11.24

Use next higher number of whole plates = 12

Minimum cell size = 1 + (2 X 12) = 25

Cell NCX -1950 or NCN-27 (27 Plates) is acceptable.

The potential design margin for NCX-1950 or NCN -27 = 13/7.29x1.064x1.25 = 1.34 or *34 %* for NCX-1950 and 13/7.35x1.064x1.25 = 1.33 or 33 % for NCN-27

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 13

CCN # 8 , Page 12/ 28

CCN# 8

BATTERY LOADING TABLE- 2
125 V DC SWITCHBOARD 1ED2

Battery BT1ED2-Train B

Load Description	0-1 Min Amperes	1-239 Min Amperes	239-240 Min Amperes	Remarks
Dist Panel 1ED2-1 CP1-ECDPED-02	40.866	26.902	26.902	
Dist. Panel 1ED2-2 CP1-ECDPED-04	288.656	14.492	104.492	Page 13A and Note 4
Dist. Panel XED2-1 CPX-ECDPED-02	14.069	8.669	8.669	
RPS Inverter for 1PC2 TEX-ESELIV-02	74.47	74.47	74.47	CCN#6, Calc. EE(B)-037 R4
BOP Inverter for 1EC2 CP1-ECIVEC-02	68.64	68.64	68.64	CCN#6,Calc. EE(B)-037,R4
Swing Inverter No Load current (CP1-ECIVEC-2/4)	19.45	19.45	19.45	CCN # 6, Calc. EE(B)-037, R4
TOTAL :	506.151	212.623	302.623	

NOTES :

1. Load Data from input No. 2 except Dist. Panel 1ED2-2 which is developed on page 13A
2. The 0-1 minute load includes all steady state loads and the momentary currents.
3. The 1-239 minute load includes steady state loads only.
4. The 239-240 minute load includes steady state loads and the momentary currents (10 A) for 1 breaker closure and the inrush current (80A) for a second breaker closure.

Lowest Expected Electrolyte Temp: °F 67° Minimum Cell Voltage: 1.75V Cell Mfg: Gould/GNB Cell Type: NCX1950/NCN-27 Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) * Capacity at T Min Rate (6A) Amps/Pos (R_T) or (6B) K Factor (K_T)	(7) Required Section Size (3) ÷ (6A) = Positive Plates or (3)x (6B) = Rated Amp Hrs Pos Values	Neg Values
Section 1 — First Period Only — If A2 is greater than A1, go to Section 2.							
1	A1= 506.151	A1−0= 506.151	M1= 1	T=M1= 1	160/142	3.16/3.56	***
					Sec 1 Total	3.16/3.56	***
Section 2 — First Two Periods Only — If A3 is greater than A2, go to Section 3.							
1	A1=	A1−0=	M1=	T=M1+M2=			
2	A2=	A2−A1=	M2=	T=M2=			
					Sec 2 Sub Tot		
					Total		***
Section 3 — First Three Periods Only — If A4 is greater than A3, go to Section 4.							
1	A1=506.151	A1−0=506.151	M1= 1	T=M1+M2+M3=240	31.75/31.8	15.94/15.92	
2	A2=212.623	A2−A1= ←	M2= 238	T=M2+M3= 239	31.87/31.9	−	−9.21/9.20
3	A3=302.623	A3−A2= 90	M3= 1	T=M3= 1	160/142	0.56/0.63	
			−293.528		Sec 3 Sub Tot	16.5/16.55	−9.21/9.20
					Total	7.29/7.35	***
Section 4 — First Four Periods Only — If A5 is greater than A4, go to Section 5. * For curves reference, see page 8 of CCN#7							
1	A1=	A1−0=	M1=	T=M1+...M4=			
2	A2=	A2−A1=	M2=	T=M2+M3+M4=			
3	A3=	A3−A2=	M3=	T=M3+M4=			
4	A4=	A4−A3=	M4=	T=M4=			
					Sec 4 Sub Tot		
					Total		***
Section 5 — First Five Periods Only — If A6 is greater than A5, go to Section 6.							
1	A1=	A1−0=	M1=	T=M1+...M5=			

CCN#8

CCN # 8

Work Sheet For Storage Batteries
Lead - Acid Voltage Profile Calc.

Battery Type: NCX 1950/NCN-27 Battery Number: BT1ED2

Length of Duty cycle: 240 minutes
Nominal Battery Voltage: 125 VDC

Number of positive plates per cell : 13
Number of cells : 60

* Ampere hour per positive plate Vs Amp per positive plate data source: Gould curve TC-107011B

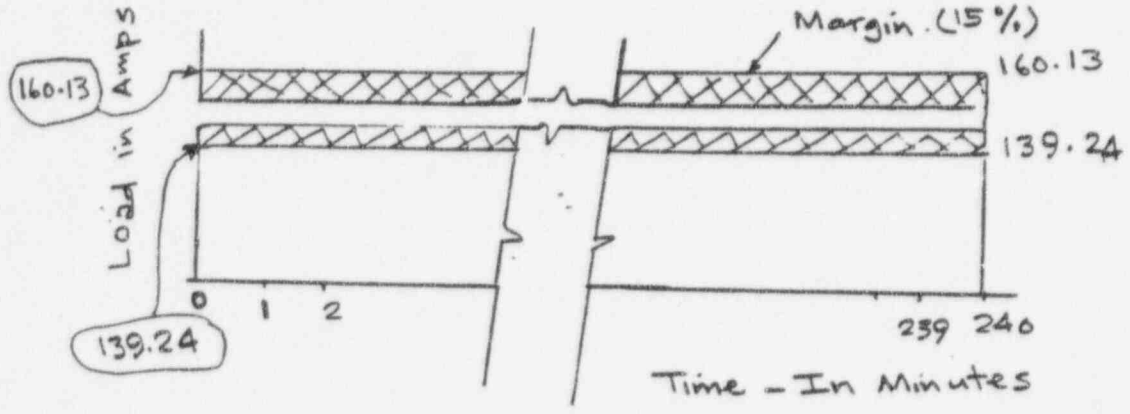
(1) Step	(2) Time in Min.	(3) Ampere Rate	(4) Adjusted Amps *	(5) (4) / No. of Plates Amps per Positive Plate	(6) (2) x (5) / 60 Amp Hours Per. Pos.	(7) Cumulative A.H. Discharge	(8) Volts per Cell (5) at (7)	(9) Battery Voltage (8) x number of cells in Series
1	1	506.151	774.16	59.55	0.99	Beginning 0	1.92/1.87	115.2 / 112.2
						End 0.99	1.92/1.87	115.2 / 112.2
2	238	212.623	325.21	25.02	99.25	Begining 0.99	1.97/1.94	118.2 / 116.4
						End 100.24	1.88/1.88	112.8 / 112.8
3	1	302.623	462.86	35.60	0.59	Begining 100.24	1.83/1.84	109.8 / 110.4
						End 100.83	1.83/1.84	109.8 / 110.4
4	* Amp rate includes:							
5		25 % For Aging Factor 6.4% For Temperature (67°F)				* For GNB cell NCN-27, see attachment 2A page 3		
6		15 % Design Margin.						
7								
8								

CCN # 8

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 16

CCN # 8 , Page 15/28

Battery Calculation - Battery BT1ED3



Battery load cycle (Data from page 17)

Sizing based on data developed on page 18

Maximum section size = 4.39/4.38 (For NCX-1200/NCN-17 Type Cells)

CCN#8

Temperature correction = X 1.064

Design Margin = X 1.15

Aging Factor = X 1.25

Cell Size = 6.71/6.7

Use next higher number of whole plates = 7

Minimum cell size = (1 + 2 X 7) = 15

Cell NCX_1200 or NCN-17 (17 Plates) is acceptable.

The potential design margin = 8/4.39x1.064x1.25 =1.37 or 37% margin for NCX-1200

8/4.38x1.064x1.25 = 1.37 or 37% margin for NCN-17

FIGURE 7.5
CALCULATION CONTINUATION SHEET

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 17

CCN # 8
Page 16/28

BATTERY LOADING TABLE- 3
125 V DC SWITCHBOARD 1ED3

Battery BT1ED3- Train A

Load Description	0-1 Min Amperes	1-240 Min Amperes
Dist. Panel 1ED3-1 CP1-ECDPED-05	0.35	0.35
RPS Inverter for 1PC3 TBX-ESELIV-03	42.50	42.50
BOP Inverter for 1EC5 CP1-ECIVEC-03	76.94	76.94
Swing Inverter No Load current (CP1-ECIVEC-1/3)	19.45	19.45 (Ref: Calc. 16345-EE(B)-037 Rev. 4, CCN # 6)
TOTAL :	139.24	139.24

CCN#8

NOTES :

1. Load Data from input No. 2
2. The 0-1 minute load includes all steady state loads and the momentary currents.
3. The 1-240 minute load includes steady state loads only.

Lowest Expected Electrolyte Temp: °F 67° Minimum Cell Voltage: 1.75V Cell Mfg: Gould/GNB Cell Type: NCX-1703/NCV-17 Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	* (6) Capacity at T Min Rate (6A) Amps/Pos (R_T) or (6B) K Factor (K_T)	(7) Required Section Size (3) ÷ (6A) = Positive Plates or (3)x (6B) = Rated Amp Hrs Pos Values	Neg Values
Section 1 — First Period Only — If A2 is greater than A1, go to Section 2.							
1	A1=139.24	A1−0=139.24	M1= 240	T=M1= 240	31.75/31.8	4.39/4.38	***
					Sec 1 Total	4.39/4.38	***
Section 2 — First Two Periods Only — If A3 is greater than A2, go to Section 3.							CCN#8
1	A1=	A1−0=	M1=	T=M1+M2=			
2	A2=	A2−A1=	M2=	T=M2=			
					Sec 2 Sub Tot / Total		***
Section 3 — First Three Periods Only — If A4 is greater than A3, go to Section 4.							
1	A1=	A1−0=	M1=	T=M1+M2+M3=			
2	A2=	A2−A1=	M2=	T=M2+M3=			
3	A3=	A3−A2=	M3=	T=M3=			
					Sec 3 Sub Tot / Total		***
Section 4 — First Four Periods Only — If A5 is greater than A4, go to Section 5.							
1	A1=	A1−0=	M1=	T=M1+...M4=			
2	A2=	A2−A1=	M2=	T=M2+M3+M4=			
3	A3=	A3−A2=	M3=	T=M3+M4=			
4	A4=	A4−A3=	M4=	T=M4=			
					Sec 4 Sub Tot / Total		***

ACCEPTABLE MARGINAL QUALITY INIT [illegible] DATE 9/30/91

* For curve reference, please see note on page 5 of CCN#7

Section 5 — First Five Periods Only — If A6 is greater than A5, go to Section 6.

Work Sheet For Storage Batteries
Lead - Acid Voltage Profile calc.

Battery Type: NCX 1200/NCN-17

Battery Number: BT1ED3

CCN#8

Lenght of Duty cycle: 240 minutes

Nominal Battery Voltage: 125 VDC

Number of positive plates per cell: 8

Number of cells = 60

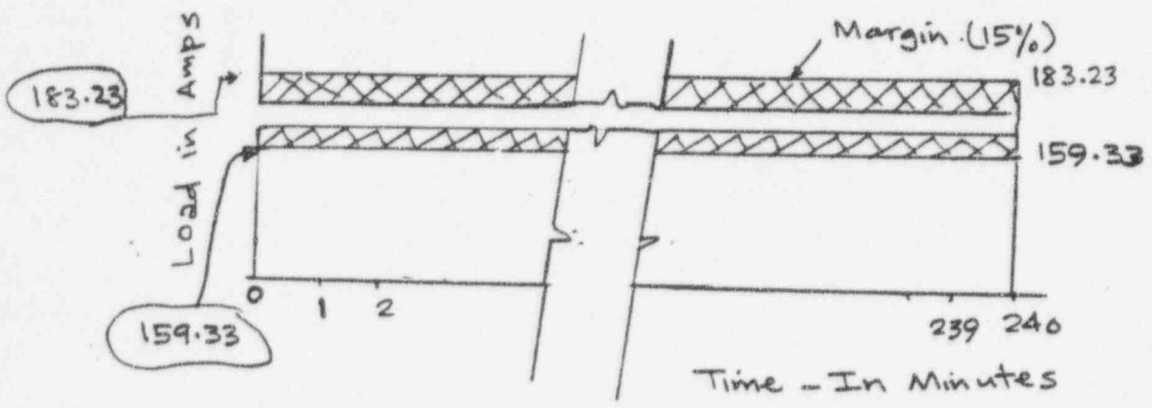
(1) Step	(2) Time in Min.	(3) Ampere Rate	(4) Adjusted Amps *	(5) (4) / No. of Plates = Amps per Positive Plate	(6) (2) x (5) / 60 = Amp Hours Per. Pos.	(7) Cumulative A.H. Discharge	(8) ** Volts per Cell (5) at (7)	(9) Battery Voltage (8) x number of cells in Series
1	240	139.24	212.97	26.62	106.49	Beginning 0	1.97/1.94	118.2/116.4
						End 106.49	1.86/1.86	111.6/111.6
2						Beginning		
						End		
3						Beginning		
						End		
4	* Amp rate includes:							
5		25 % For Aging Factor						
		6.4% For Temperature (67°F)						
6		15% Design Margin.						
7	**	For curve reference see page 5 of CCN#7						
8								

FIGURE 7.5
CALCULATION CONTINUATION SHEET

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 20

Battery Calculation - Battery BT1ED4

CCN # 8
Page 19/28



Battery load cycle (Data from page 21)

Sizing based on data developed on page 22

CCN#8

Maximum section size = 5.02/5.01

Temperature correction = X 1.064

Design Margin = X 1.15

Aging Factor = X 1.25

Cell Size = 7.68/7.7

Use next higher number of whole plates = 8

Minimum cell size = (1 + 2 X8) = 17

Cell NCX_1200 or NCN-17 (17 Plates) is acceptable.

The potential design margin = 8/5.02x1.064x1.25 = 1.198 or 19.8% Margin for NCX -1200

8/5.01x1.064x1.25 = 1.200 or 20 % Margin for NCN-17

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 21

CCN # 8
Page 20/28

BATTERY LOADING TABLE- 4
125 V DC SWITCHBOARD 1ED4

Battery BT1ED4- Train B

Load Description	0-1 Min Amperes	1-240 Min Amperes	
Dist. Panel 1ED4-1 CP1-ECDPED-06	0.35	0.35	CCN# 8
RPS Inverter for 1PC4 TBX-ESELIV-04	67.54	67.54	
BOP Inverter for 1EC6 CP1-ECIVEC-04	71.99	71.99	
Swing Inverter No Load current(CP1-ECIVEC 2/4)	19.45	19.45 (Ref:Calculation 16345-EE(B)-037 Rev.4, CCN #6)	
TOTAL :	159.33	159.33	

NOTES :

1. Load Data from input No. 2
2. The 0-1 minute load includes all steady state loads and the momentary currents.
3. The 1-240 minute load includes steady state loads only.

Lowest Expected Electrolyte Temp: °F 67° Minimum Cell Voltage: 1.75V Cell Mfg: Gould/GNB Cell Type: NCX-1200/NCN-17 Sized By:

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	* (6) Capacity at T Min Rate (6A) Amps/Pos (R_T) or (6B) K Factor (K_T)	(7) Required Section Size (3) ÷ (6A) = Positive Plates or (3)x (6B) = Rated Amp Hrs Pos Values	Neg Values
Section 1 — First Period Only — If A2 is greater than A1, go to Section 2.							
1	A1=159.33	A1−0=159.33	M1= 240	T=M1= 240	31.75/31.8	5.02/5.01	***
					Sec 1 Total	5.02/5.01	***
Section 2 — First Two Periods Only — If A3 is greater than A2, go to Section 3.							CCN#8
1	A1=	A1−0=	M1=	T=M1+M2=			
2	A2=	A2−A1=	M2=	T=M2=			
					Sec 2 Sub Tot Total		***
Section 3 — First Three Periods Only — If A4 is greater than A3, go to Section 4.							
1	A1=	A1−0=	M1=	T=M1+M2+M3=			
2	A2=	A2−A1=	M2=	T=M2+M3=			
3	A3=	A3−A2=	M3=	T=M3=			
					Sec 3 Sub Tot Total		***
Section 4 — First Four Periods Only — If A5 is greater than A4, go to Section 5.							
1	A1=	A1−0=	M1=	T=M1+...M4=			
2	A2=	A2−A1=	M2=	T=M2+M3+M4=			
3	A3=	A3−A2=	M3=	T=M3+M4=			
4	A4=	A4−A3=	M4=	T=M4=			
					Sec 4 Sub Tot Total		***
Section 5 — First Five Periods Only — If A6 is greater than A5, go to Section 6.							
1	A1=	A1−0=	M1=	T=M1+...M5=			

* For curves reference, see page 8 of CCN#7

ACCEPTABLE MARGIN INIT DK DATE 9/30/97

Work Sheet For Storage Batteries
Lead - Acid Voltage Profile Calc.

Battery Type: NCX 1200/NCN-17

Battery Number: BTIED4

CCN#8 Length of Duty cycle: 240 minutes

Nominal Battery Voltage: 125 VDC

Number of positive plates (per cell): 8

Number of cells: 60

Battery BTIED4

(1) Step	(2) Time in Min.	(3) Ampere Rate	(4) Adjusted Amps *	(5) (4) / No. of Plates Amps per Positive Plate	(6) (2) x (5) / 60 Amp Hours Per. Per.	(7) Cumulative A.H. / Discharge	(8) * Volts per Cell (5) at (7)	(9) Battery Voltage (8) x number of cells in Series
1	240	159.33	243.70	30.46	121.84	Beginning 0	1.97 / 1.93	118.2 / 115.8
						End 121.84	1.80 / 1.80	108.0 / 108.0
2						Begining		
						End		
3						Begining		
						End		
4								
5								
6								
7								
8								

* Amp rate includes:
25 % For Aging Factor
6.4 % For Temperature (67°F)
15 % Design Margin.

* For curve reference see page 8 of CCN #7

CCN #8

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 24

CCN #8, Page 23/28

Sizing - Battery Chargers BC1ED1-1 & BC1ED1-2

Notes :

1. Chargers BC1ED1-1 & BC1ED1-2 have the same rating (300 A) and both are connected to the bus 1ED1.One charger is used as a standby for the other. Either can be used to recharge the battery BT1ED1 .

2. The battery charger is required to supply the loads of BOP & NSSS inverters connected to the bus 1ED1, furnish the no load current of the swing inverter and recharge the battery after its duty cycle discharge .

CALCULATE THE MINIMUM CHARGER RATING AS FOLLOWS :

$$Ar = \frac{AH \times C}{T1} + Ac$$

Where Ar = Required minimum charger rating in amperes.

AH = Total ampere hours discharged from the battery during its specified duty cycle.

C = Constant to allow for ampere hour efficiency . Use 1.10.

Ac = Continuous battery load while charging , amperes.

T1 = Required minimum time for recharging.

Duty Cycle :	Amperes	Amperes x Minutes
First Minute	636.55	636.55
Next 238 Minutes	255.74	60866.12
Next 1 Minute	359.24	359.24

AH = Total Ampere Minutes/60 = 61861.91/60 = 1031.03

Ac = 222.382A (Design Margin is not considered) CCN#8

T1 = 24 Hours

$$Ar = \frac{AH \times C}{T1} + Ac = \frac{103.031 \times 1.1}{24} + 222.382 = 269.64 \text{ Amp}$$

Minimum battery charger size 269.64 Amps is required. 300 A Battery Charger is acceptable.

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 25

CCN # 8, Page 24/28

Sizing - Battery Chargers BC1ED2-1 & BC1ED2 -2

Notes :

1. Chargers BC1ED2-1 & BC1ED 2 -2 have the same rating (300 A) and both are connected to the bus 1ED2 .One charger is used as a standby for the other. Either can be used to recharge the battery BT1ED2 .

2. The battery charger is required to supply the loads of BOP & NSSS inverters connected to the bus 1ED2 , furnish the no load current of the swing inverter and recharge the battery after its duty cycle discharge .

CALCULATE THE MINIMUM CHARGER RATING AS FOLLOWS :

$$Ar = \frac{AHx\ C}{T1} + Ac$$

Where Ar = Required minimum charger rating in amperes.

AH = Total ampere hours discharged from the battery during its specified duty cycle.

C = Constant to allow for ampere hour efficiency . Use 1.10.

AC =Continuous battery load while charging ,amperes.

T1 = Required minimum time for recharging.

Duty Cycle :	Amperes	Amperes x Minutes
First Minute	582.07	582.07
Next 238 Minutes	244.52	58195.76
Next 1 Minute	348.02	348.02

AH = Total Ampere Minutes 59125.85 /60 = 985.43
Ac = 212.623 A (Design Margin is not considered)

T1 = 24 Hours

CCN#8

$$Ar = \frac{AH \times C}{T1} + Ac = \frac{985.43 \times 1.1}{24} + 212.623 = 257.79\ Amp$$

Minimum battery charger size 257.79 Amps is required. 300 A Battery Charger is acceptable.

CALC. NUMBER: 1634(-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 26

CCN #8, Page 25/ 28

Sizing - Battery Chargers BC1ED3-1 & BC1ED3 -2

Notes :

1. Chargers BC1ED3-1 & BC1ED3 -2 have the same rating (300 A) and both are connected to the bus 1ED3, One charger is used as a standby for the other. Either can be used to recharge the battery BT1ED3 .

2. The battery charger is required to supply the loads of BOP & NSSS inverters connected to the bus 1ED3 , furnish the no load current of the swing inverter and recharge the battery after its duty cycle discharge .

CALCULATE THE MINIMUM CHARGER RATING AS FOLLOWS :

$$Ar = \frac{AHx\ C}{T1} + Ac$$

Where Ar = Required minimum charger rating in amperes.

AH = Total ampere hours discharged from the battery during its specified duty cyclr.

C = Constant to allow for ampere hour efficiency . Use 1.10.

Ac = Continuous battery load while charging ,amperes.

T1 = Required minimum time for recharging.

Duty Cycle :	Amperes	Amperes x Minutes
First Minute	———	——
Next 240 Minutes	160.13	38,431.2
Next 1 Minute	——	———

AH = Total Ampere Minutes 38431.2 /60 = 640.52

Ac = 139.24 A (Design Margin is not considered)

CCN#8

T1 = 24 Hours

$$Ar = \frac{AH \times C}{T1} + Ac = \frac{640.52 \times 1.1}{24} + 139.24 = 168.6\ Amp$$

Minimum battery charger size 168.6 Amps is required. 300 A Battery Charger is acceptable.

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: 27

CCN #8, Page 26/28

Sizing - Battery Chargers BC1ED4-1 & BC1ED4 -2

Notes :

1. Chargers BC1ED4-1 & BC1ED4 -2 have the same rating (300 A) and both are connected to the bus 1ED4 . One charger is used as a standby for the other. Either can be used to recharge the battery BT1ED4 .

2. The battery charger is required to supply the loads of BOP & NSSS inverters connected to the bus 1ED4 , furnish the no load current of the swing inverter and recharge the battery after its duty cycle discharge .

CALCULATE THE MINIMUM CHARGER RATING AS FOLLOWS :

$$Ar = \frac{AHx\ C}{T1} + Ac$$

Where Ar = Required minimum charger rating in amperes.

AH = Total ampere hours discharged from the battery during its specifird duty cycle.

C = Constant to allow for ampere hour efficiency . Use 1.10.

Ac = Continuous battery load while charging.

T1 = Required minimum time for recharging.

Duty Cycle :	Amperes	Amperes x Minutes
First Minute	____	____
Next 240 Minutes	183.11	43,946.4
Next 1 Minute	____	____

AH = Total Ampere Minutes 43,946.4 /60 = 732.44

CCN#8

Ac = 159.33 A (Design Margin is not considered)

T1 = 24 Hours

$$Ar = \frac{AH \times C}{T1} + Ac = \frac{732.44 \times 1.1}{24} + 159.33 = 192.9\ Amp$$

Minimum battery charger size 192.9 Amps is required. 300 A Battery Charger is acceptable.

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 28
16345	EE(B)	053	XXX	

CONCLUSION

CCN # 008
Page 27/28

BATTERIES

BATTERIES BTIED1, 2, 3 & 4 ARE SIZED ADEQUATELY FOR THE DUTY CYCLE SPECIFIED, LOSS OF ONSITE & OFFSITE POWER FOR 4 HOURS.

15% STANDARD DESIGN MARGIN IS CONSIDERED IN CALCULATION TO DETERMINE MINIMUM NUMBER OF PLATES REQUIRED FOR BATTERY SYSTEM TO MEET THE BATTERY LOAD CYCLE FOR THE PERIOD OF 4 HOURS. (15% STANDARD DESIGN MARGIN IS BASED ON IEEE 485-1978)

FOLLOWING ARE THE POTENTIAL DESIGN MARGIN FOR THE EXISTING BATTERIES DUE TO THEIR CAPACITY.

BTIED1 - 40 % DESIGN MARGIN

BTIED2 - 45 % DESIGN MARGIN

BTIED3 - 35 % DESIGN MARGIN

BTIED4 - 35 % DESIGN MARGIN

CCN # 008

CCN # 008

BATTERY CHARGERS

360 A THE DERATED RATING 225 AMPS FOR THE FOLLOWING CHARGERS IS ADEQUATE TO MEET THE INTENDED LOADING OF CLASS 1E BAT. SYSTEM

BCIED1-1 & 1-2

BCIED2-1 & 2-2

BCIED3-1 & 3-2

BCIED4-1 & 4-2

CALC. NUMBER: 16345-EE(B)-053
REV NUMBER: 5
PAGE NUMBER: Attachment 8 , Page 1 of 1

CCN # 8 , Page 28 of 28

Objective : The objective of this Attachment is to determine the duty cycle test current values of the CPSES Class 1E Batteries.

Assumption : The battery room normal temperature is assumed to be 77 F

Condition : The battery room minimum temperature could become 67 F during Station Blackout transient (Ref : DBD- ME-026)

Methodology : The batteries load profile currents determined in calculation 16345-EE(B)-053 tables 1 , 2 ,3 and 4 are the load currents that the batteries will be required to furnish.The battery room temperature could be as low as 67 F , therefore for battery test purposes the above current values are converted to battery room normal temperature of 77 F by multiplying them with 1.064 (Ref: IEEE Std. 450-1980)

To preclude unscheduled testing of the batteries for minor DC load additions some margin is added to the above converted 77 F current values to determine the DUTY CYCLE TEST CURRENT VALUES . However, the above margin should not be large enough to challenge the standard design and aging margins included in the battery sizing calculations.

Calculation :

Battery Tag Number	0 - 1 Min Amperes	1-239 Min Amperes	239-240 Min Amperes	Remarks
BTED!	553.521 X 1.064 = 588.95	222.382X1.064 = 236.61	312.382x1.064 = 332.37	
Margin	+6.05	+ 8.39	+7.63	See Note
Test Currents	595	245	340	
BT1ED2	506.151X1.064 = 538.54	212.623X1.064 = 226.23	302.623X1.064 =321.99	
Margin	+ 11.46	+ 13.77	+ 8.01	
Test Currents	550	240	330	See Note
BT1ED3	139.24 X1.064 = 148.15	139.24 X1.064	139.24X1.064	
Margin	+ 11.85			
Test Current	160	160	160	See Note
BT1ED4	159.33X1.064 = 169.53	159.33	159.33	CCN# 5
Margin	5.47			
Test Currents	175	175	175	See Note

Note : With the above test currents the standard design margin of 15 % and aging margin of 25 % are maintained.

Comanche Peak Steam Electric Station
CHANGE VERIFICATION CHECKLIST

DOCUMENT: Calc. EE-CA-0007-3377 R 1, CCN #3 Page 1 of 2

CHANGE CLASSIFICATION: CLASS I X CLASS II ___ NON-SAFETY ___

INPUT/IMPACT REQUIRED FROM:	*YES*	*NO*	*REVIEWER/STAKEHOLDER*	*COMPLETE*
ENGINEERING DISCIPLINES:				
CIVIL ENGINEERING		X		
CODES AND STANDARDS		X		
ELECTRICAL ENGINEERING		X		
INSTRUMENTATION & CONTROLS ENGINEERING		X		
MECHANICAL ENGINEERING		X		
NUCLEAR/MECHANICAL ENGINEERING ANALYSIS		X		
PROCUREMENT ENGINEERING		X		
SYSTEM ENGINEERING		X		
ENGINEERING IMPACTS:				
CIVIL ENGINEERING SYSTEMS INTERACTION		X		
CIVIL ENGINEERING - PIPING		X		
COMBUSTIBLE GAS CONTROL ENGINEER		X		
CONTAINMENT ANALYSIS ENGINEER		X		
DIGITAL SYSTEMS ENGINEERING		X		
ENGINEERING ALARA COORDINATOR		X		
ENVIRONMENTAL EVALUATION (STA-717)		X		
ENVIRONMENTAL EQUIP. QUALIFICATION ENGINEER		X		
FIRE PROTECTION ENGINEER		X		
HUMAN FACTORS ENGINEER		X		
MAINTENANCE ENGINEERING (PROGRAMS)		X		
MAINTENANCE ENGINEERING (TESTING)		X		
MECHANICAL EQUIPMENT ENGINEERING (MOVS)		X		
MECHANICAL EQUIPMENT ENGINEERING (COATINGS)		X		1
NUCLEAR ANALYSIS & FUEL		X		
RADIATION ENVIRONMENT ENGINEER		X		
RADIOLOGICAL ENVIRONMENTAL ENGINEER		X		
RADIOLOGICAL ACCIDENT ENGINEER		X		
SEISMIC EQUIPMENT QUALIFICATION		X		
SITE FACILITIES ENGINEERING		X		

ATTACHMENT 3

Comanche Peak Steam Electric Station
CHANGE VERIFICATION CHECKLIST

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INPUT/IMPACT REQUIRED FROM:	YES	NO	REVIEWER/STAKEHOLDER	COMPLETE
ENGINEERING IMPACTS (CONTINUED):				
SOFTWARE QUALITY ASSURANCE		X		
STATION BLACKOUT ANALYSIS		X		
SYSTEMS INTERACTION (MECHANICAL) ENGINEER		X		
TORNADO VENTING ANALYSIS ENGINEER		X		
		X		
		X		
		X		
NON-ENGINEERING IMPACTS:				
CHEMISTRY		X		
ELECTRICAL MAINTENANCE		X		
INSTRUMENTATION & CONTROL MAINTENANCE		X		
MECHANICAL MAINTENANCE		X		
NUCLEAR TRAINING (SIMULATOR DESIGN)		X		
NUCLEAR TRAINING (PROGRAMS)		X		
OPERATIONS SUPPORT		X		1
OPERATIONS WORK CONTROL		X		
OPERATIONS FIRE PROTECTION		X		
PLANT SUPPORT		X		
QUALITY ASSURANCE/QUALITY CONTROL		X		
RADIATION PROTECTION		X		
REGULATORY AFFAIRS		X		
		X		
		X		
		X		

Comments:

Prepared by: (print) MUNAWAR HUSSAIN (sign) [signature] Date: 9/29/96

Approved by: (print) IJAZ AHMAD (sign) [signature] Date: 9-30-96

Figure 7.2: Design Verification Form

Comanche Peak Steam Electric Station
DESIGN VERIFICATION

DOCUMENT: Calc.EE-CA-0007-3377 R1,CCN #3 Page 1 of 1

AREA	REQ'D?	METHOD NO.*	COMMENTS?	VERIFIED BY: (print)	(sign)	DATE
Mechanical Design	No					
I&C Design	No					
Electrical Design	Yes	1	No	Ajit Mukherjee		9/29/96
Civil Design	No					
Nuclear Design	No					
Other Design Verifier	No					

Comments:

Prepared by: (print) Munawar Hussain (sign) _____ Date: 9/29/96

Approved by: (print) Ijaz Ahmad (sign) _____ Date: 9-30-96

*DV Methods are as follows: 1 - Design Review, 2 - Alternate Calculation, 3 - Qualification Test.

FIGURE 7.6
CALCULATION CHANGE NOTICE

DM 9/30/96

CCN NO.	TYPE	CALCULATION NUMBER	REVISION NUMBER	CONFIRMATION REQUIRED
003	ELE / ~~SWEC~~	EE-CA-0007-3377	001	☒ YES ☐ NO

☒ DM 96-013 ☐ MM ☐ FX ☐ NONE

Preparer(s): Munawar Hussain Date: Jun/27/1996

Checker: Ajit Mukherjee Date: 9-29-96

Engineering Supervisor: Ijaz Ahmad Date: 9-30-96

REASON FOR CHANGE

DM 96-013 :

1) Replaces 10 kVA Elgar inverters with 10kVA SCI inverters (both Class 1E and Non Class 1E).
2) Replaces 7.5 kVA Wesinghouse NSSS inverter with 10kVA Class 1E SCI inverters
3) Adds 10 kVA Class 1E SCI swing inverter per train.
4) Replaces 225 A PCP Class 1E battery chargers with 300 A SCI Class 1E battery chargers(pf=0.7 , efficiency =92%)

Above SCI Inverters do not have 480V AC input and they are a continuous load on the DC bus.The inverters are therefore required to be deleted from the MCCs.The SCI inverters have an efficiency of 80%.

In view of the above the calculation needs to be updated.

Attachment F. and attachments E1 , E2 (Qualification Runs) have not been revised,these will be updated in the next revision of the calculation.The Qualification Runs (attachments E1 & E2) use data from attachment F.

ASSOCIATED CALCULATION INFORMATION

SUPERSEDES (SUP)/ SUPPLEMENTS (SPL)	TYPE	NUMBER AND REVISION
NA	NA	NA

FILING INSTRUCTIONS:

Place this CCN infront of the calculation

DESIGN CHANGE TRENDING CODE 1 / Q EEE* / A F / A

FIGURE 7.2
INDEX SHEET

TU ELECTRIC ENGINEERING

INDEX SHEET

CALCULATION NO.: EE-CA-0007-3377

PAGE 2

REV. No.	PAGES REVISED	PAGES ADDED	PAGES DELETED
1, CCN#3	Attachment A, Page 2,3,5	NONE	NONE
	Attachment A-1, Page 2,3,4		
	Attachment B, Page 2,3,5		
	Attachment B-1, Page 2,3,4		
	Attachment C , Page 2,3,4		
	Attachment C-1,Page 2,3,4,5		
	Attachment D, Page 2,3,4		
	Attachment D-1,Page 2,3,4,5		
	Attachment 1 , Page 2,3,4,5		

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN A

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
Load Block 1 10 S											
1EA1	CENTRIF CHRG PP #11	TBX-CSAPCH-01	YES	600.000 HP	660.000 HP	10 S	1.421553	4.359751	15 S	0.000000	0.000000
1EB1	HVAC CENT WTR CHLR #5	CP1-CHCICE-05	NO	154.000 HP	154.000 HP	10 S	0.070636	0.702822	15 S	0.000000	0.000000
1EB1-1	CHG P TO RC SYS ISOL VLV	1-8106	YES	1.900 HP	1.800 HP	10 S	0.021158	0.010248	10 S	0.000000	0.000000
1EB1-1	CHG P MINIFLOW ISOL BYP VLV	1-8511A	YES	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB1-1	CHG P #2 MINIFLOW ISOL BYPASS VLV	1-8512A	NO	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB1-1	BORON INJ TK DISCH ISOL VLV	1-8801A	YES	1.900 HP	1.900 HP	10 S	0.021158	0.010248	10 S	0.000000	0.000000
1EB1-1	SI SYS P MINIFLOW ISOL VLV	1-8814A	NO	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB1-1	RHR P #1 MINI FLOW VLV	1-FCV-0610	NO	0.130 HP	0.130 HP	10 S	0.002444	0.001185	10 S	0.000000	0.000000
1EB1-1	SW TO MTR DRVN AFWP 01 VLV	1-HV-2480	NO	1.300 HP	1.300 HP	10 S	0.010847	0.005253	10 S	0.000000	0.000000
1EB1-1	CHM ADD TK ISOL VLV	1-LV-4754	NO	0.330 HP	0.330 HP	10 S	0.004201	0.002035	10 S	0.000000	0.000000
1EB1-1	INVERTER BOP IV1EC1	CP1-ECIVEC-01	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.010430	0.006463
1EB1-1	SUP INVERTER IV1EC3	CP1-ECIVEC-03	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.009671	0.005994
1EB1-1	SG LTG XFMR (PNL ESB1, ESB3)	CP1-ELTRET-01	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.022270	0.013802
1EB1-1	SG LTG XFMR(PNL ESBD1, ESB5, ESB7 & ESB9)	CP1-ELTRET-02	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.013090	0.008112

CCN#3

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN A

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START TIME	START MW	START MVAR	RUN TIME	RUN MW	RUN MVAR
1EB1-1	TRANSFORMER XFS1 (PANEL S1)	CP1-ELTRNT-26	NO	CCN#3 45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.034808	0.021671
1EB1-1	BATT CHGR BC1ED1-1	CP1-EPBCED-01	NO	300A DC ~~67.721 KVA~~	300A DC ~~67.721 KVA~~	10 S	0.000000	0.000000	10 S	0.036636 ~~0.025813~~	~~0.015858~~
1EB1-1	BATTERY CHARGER BC1ED3-1	CP1-EPBCED-05	NO	300A DC ~~67.721 KVA~~	300A DC ~~67.721 KVA~~	10 S	0.000000	0.000000	10 S	0.022907 ~~0.005830~~	0.037376 ~~0.009873~~ 0.023376
1EB1-1	BATTERY RM 1-1(A) EXH FAN 07	CP1-VAFNID-07	NO	1.500 HP	1.500 HP	10 S	0.006432	0.012445	20 S	0.000000	0.000000
1EB1-1	SG FL DRAIN SUMP #2 P 03	CP1-WPAPSS-03	NO	5.000 HP	5.000 HP	10 S	0.016125	0.036848	15 S	0.000000	0.000000
1EB1-1	SG FL DRAIN SUMP #2 P 04	CP1-WPAPSS-04	NO	5.000 HP	5.000 HP	10 S	0.016125	0.036848	15 S	0.000000	0.000000
1EB1-1	BORIC ACID TRANS P #1	TBX-CSAPBA-01	NO	CCN#3 20.780 HP	20.780 HP	10 S	0.066960	0.153469	15 S	0.000000	0.000000
1EB1-1	INVERTER CHNL I IV1PC1	TBX-ESELIV-01	NO	15.934 KVA	15.934 KVA	10 S	0.000000	0.000000	10 S	0.008887	0.003126
1EB2-1	BORON INJ. TK RM SUP FAN	CP1-VAFNCB-08	NO	3.000 HP	3.000 HP	10 S	0.009641	0.022091	20 S	0.000000	0.000000
1EB2-1	BORON INJ. TK RM SUP FAN	CP1-VAFNCB-09	NO	3.000 HP	3.000 HP	10 S	0.009641	0.022091	20 S	0.000000	0.000000
1EB2-1	BATTERY ROOM 1-2 UNIT HTR-02	CP1-VAHEUH-02	NO	25.000 KW	25.000 KW	10 S	0.000000	0.000000	10 S	0.025000	0.000000
1EB3-1	CHRG P MINIFLOW ISOL VLV	1-8110	YES	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB3-1	REFG WTRSTRG TK TO RHR P #1 ISOL VLV	1-8812A	NO	10.500 HP	10.500 HP	10 S	0.094410	0.045725	10 S	0.000000	0.000000
1EB3-1	SI SYS P MINIFLOW ISOL VLV	1-8814B	NO	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB3-1	CS P 01 RECIRC VLV	1-FV-4772-1	NO	0.700 HP	0.700 HP	10 S	0.008701	0.004699	10 S	0.000000	0.000000

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN A

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
1EB3-1	CENT CHRG P RM FAN CLR 03	CP1-VAAUSE-03	NO	3.000 HP	3.000 HP	10 S	0.009641	0.022091	20 S	0.000000	0.000000
1EB3-1	BATT RM 1-1(A) EXH FAN 08	CP1-VAFNID-08	NO	1.500 HP	1.500 HP	10 S	0.005432	0.012445	20 S	0.000000	0.000000
1EB3-1	BATTERY ROOM UNIT HTR	CP1-VAHEUH-03	NO CCN#3	25.000 KW	25.000 KW	10 S	0.000000	0.000000	10 S	0.025000	0.006300
1EB3-1	INVERTER CHAN III IV1PC3	TBX-ESELIV-03	NO	15.834 KVA	15.834 KVA	10 S	0.000000	0.000000	10 S	0.007448	0.004615
1EB3-2	RCP SEAL WTR ISOL VLV	1-8112	NO	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB3-2	RHR LP 1 INLET ISOL VLV	1-8701A	NO	4.000 HP	4.000 HP	10 S	0.033914	0.016425	10 S	0.000000	0.000000
1EB3-2	RHR LP 2 INLET ISOL VLV	1-8701B	NO	4.000 HP	4.000 HP	10 S	0.033914	0.016425	10 S	0.000000	0.000000
1EB3-2	FIRE PROT CNTMT ISOL VLV	1-HV-4076C	NO	1.330 HP	1.330 HP	10 S	0.012965	0.006289	10 S	0.000000	0.000000
1EB3-2	RCP THER BARR CLRS CCW CNTL ISOL VLV	1-HV-4696	NO	2.600 HP	2.600 HP	10 S	0.029714	0.014390	10 S	0.000000	0.000000
1EB3-2	RCP WTR AIR & LUBE OIL CLRS CCW ISOL VLV	1-HV-4701	NO	1.900 HP	1.900 HP	10 S	0.016117	0.007806	10 S	0.000000	0.000000
1EB3-2	CNTMT H2 PURGE AIR TO EXH UNITS ISOL VLV	1-HV-5541	NO	0.250 HP	0.250 HP	10 S	0.004278	0.002071	10 S	0.000000	0.000000
1EB3-2	CNTMT H2 PURGE AIR SUPPLY TO CNTMT ISO VLV	1-HV-5543	NO	0.260 HP	0.260 HP	10 S	0.004048	0.001961	10 S	0.000000	0.000000
1EB3-2	CHLD WTR RTN HDR/CHLD WTR CIRC PM	1-HV-6083	NO	1.300 HP	1.300 HP	10 S	0.012965	0.006289	10 S	0.000000	0.000000
1EB3-2	SG BLDG XFMR T1EC3-2 (PNL 1EC3-2)	CP1-EPTRET-05	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.026639	0.016509
1EB3-2	~~ISOL~~ Regulating XFMR T1EC3-3 (PNL 1EC3-3)	CP1-EPTRNT-28	NO	5.000 KVA	5.000 KVA	10 S	0.000000	0.000000	10 S	0.004004	0.002480

Printed on 01/30/95

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN A

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 1 10 S						
PRIOR LOAD:	0.000000	0.000000	0.000000	0.000000		
LOAD:	~~2.026830~~ 2.836732	~~7.306710~~ 6.649706	~~0.379112~~ 0.354112	~~0.198967~~ 0.218794		
LOSSES:	0.089092	0.630105	0.002566	0.008161	3.277472	
LOAD BLOCK SUBTOTAL:	~~2.915741~~ 2.925824	~~8.026815~~ 7.279811	~~0.381678~~ 0.351648 0.356678	~~0.206228~~ 0.226955	~~3.397420~~ 3.282502	~~8.233043~~ 7.486039
LOAD BLOCK: 2 15 S			0.349082 ~~0.354112~~			7.506766
PRIOR LOAD:	0.000000	0.000000	~~0.379112~~	~~0.198067~~ 0.218794		
LOAD:	~~1.987602~~ 1.96832	~~5.419903~~ 5.374721	~~0.660661~~ 0.544561	~~0.310130~~ 0.249541		
LOSSES:	0.064646	0.457206	0.006992	0.022235	2.433601	6.322497
LOAD BLOCK SUBTOTAL:	~~2.052248~~ 2.032966	~~5.876109~~ 5.831927	~~1.055765~~ 0.905665	~~0.530432~~ 0.469443	~~2.433631~~ 3.183013	6.301770 ~~6.406541~~
LOAD BLOCK: 3 20 S			0.900635	0.49057		
PRIOR LOAD:	0.000000	0.000000	~~1.048773~~ 0.893643	~~0.608197~~ 0.447608	0.468335	
LOAD:	0.727567	2.570032	0.505183 ~~0.511705~~	0.258049 ~~0.262129~~		
LOSSES:	0.029916	0.211578	0.010442	0.033203	2.166751	3.541197
LOAD BLOCK SUBTOTAL:	0.757483	2.781610	1.409268 ~~1.670960~~ 1.414298	0.759587 ~~0.803529~~ 0.738860	~~2.328463~~ 2.171981	~~3.592047~~ ~~3.585139~~
LOAD BLOCK: 4 25 S			1.398826 ~~1.403656~~	0.726384 ~~0.705657~~		
PRIOR LOAD:	0.000000	0.000000	~~1.660538~~	~~0.770226~~		
LOAD:	2.540099	8.051703	0.335087	0.133174		9.619672
LOSSES:	0.094556	0.668147	0.012600	0.040064	4.381168	
LOAD BLOCK SUBTOTAL:	2.634655	8.720050	1.746513 ~~1.908225~~ ~~1.751543~~	~~0.944264~~ 0.943564 0.899622	4.386198 ~~4.542880~~	~~9.598945~~ ~~9.662614~~
LOAD BLOCK: 5 30 S			1.733913 ~~1.736943~~	0.859558 ~~0.838631~~		
PRIOR LOAD:	0.000000	0.000000	~~1.895625~~	~~0.903500~~		
LOAD:	1.786818	5.656022	1.321891	0.435442		
LOSSES:	0.066433	0.469851	0.020910	0.066489	4.929965	
LOAD BLOCK SUBTOTAL:	1.853251	6.125873	~~3.238426~~ 3.076714	~~1.406431~~ 1.361489	4.934445 ~~5.081677~~	7.487362 ~~7.521304~~ 7.466635

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN A

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 6 75 S			3.055804 ~~3.060834~~	1.295000 ~~1.274273~~		
PRIOR LOAD:	0.000000	0.000000	~~3.217376~~	~~1.338942~~		
LOAD:	2.189232	5.000288	0.792020	0.338626		
LOSSES:	0.061136	0.432382	0.026078	0.082923	6.12427 ~~6.12430~~	7.14929 ~~7.12892~~
LOAD BLOCK SUBTOTAL:	2.250368	5.432670	~~4.035614~~ 3.873902	~~1.760491~~	~~6.285982~~	~~7.193161~~
			3.878432	1.695822		7.213958
LOAD BLOCK: 7 40 S			3.847824 ~~3.850854~~	1.633626 ~~1.612819~~	1.716549	
PRIOR LOAD:	0.000000	0.000000	~~4.009636~~	~~1.677668~~		
LOAD:	1.812732	4.730393	0.850607	0.368883		
LOSSES:	0.056737	0.401275	0.031641	0.100610	6.599541	
LOAD BLOCK SUBTOTAL:	1.869469	5.131668	4.730072 ~~4.891784~~	2.103119 ~~2.147061~~	~~6.604571~~ ~~6.761253~~	7.234787 ~~7.278729~~
			4.735102	2.062392		7.214406
LOAD BLOCK: 8 75 S			4.698431 ~~4.703461~~	2.002509 ~~1.961782~~		
PRIOR LOAD:	0.000000 0.070636	0.000000 0.702822	~~4.860143~~	~~2.046451~~		
LOAD:	~~0.000000~~	~~0.000000~~	0.271860	0.180079		
LOSSES:	0.000000	0.000000	0.033565	0.106730	5.074492 ~~5.078522~~	2.992140 ~~2.971413~~
LOAD BLOCK SUBTOTAL:	~~0.000000~~ 0.070636	~~0.000000~~ 0.702822	5.003856 ~~5.165568~~	2.289318 ~~2.333260~~	~~5.165568~~	~~2.933260~~
			~~5.006666~~	~~2.262591~~		
LOAD BLOCK: 9 90 S			4.970291 ~~4.975321~~	2.182588 ~~2.161861~~		
PRIOR LOAD:	0.000000	0.000000	~~5.132003~~	~~2.226530~~		
LOAD:	0.501550	1.149198	0.125100 ~~0.000000~~	0.060589 ~~0.000000~~		
LOSSES:	0.014043	0.099322	0.033565	0.106730	5.644549	
LOAD BLOCK SUBTOTAL:	0.515593	1.248520	5.128956 ~~5.165568~~	2.349907 ~~2.333260~~	~~5.681161~~	3.598427 ~~3.581780~~
			~~5.132166~~	~~2.329180~~		~~3.577740~~
LOAD BLOCK: 10 120 S			5.095391 ~~5.100481~~	2.243177 ~~2.222145~~		
PRIOR LOAD:	0.000000	0.000000	~~5.132003~~	~~2.226530~~		
LOAD:	0.586922	1.957526	0.393804	0.244057		4.722123
LOSSES:	0.022889	0.161880	0.036318	0.115483	6.135324	
LOAD BLOCK SUBTOTAL:	0.609811	2.119406	5.525513 ~~5.562125~~	2.602717 ~~2.586070~~	~~6.171936~~	~~4.705476~~
			~~5.530543~~	~~2.58199~~		

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN A

	STARTING		RUNNING		STARTING + RUNNING	
	MW	MVAR	MW	MVAR	MW	MVAR
LOAD BLOCK: 11 130 S			5.489195 ~~5.494225~~ ~~5.625987~~	~~2.466507~~ ~~2.470587~~ 2.487234		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.122825	0.265972	0.183433	0.113685		
LOSSES:	0.003281	0.023206	0.037601	0.119565	5.836335 ~~5.641365~~	3.009662 ~~2.993015~~
LOAD BLOCK SUBTOTAL:	0.126106	0.289178	5.710229 ~~5.746841~~ ~~5.715257~~	2.720484 ~~2.703837~~ 2.699759	5.872947	2.988935
LOAD BLOCK: 12 12 H			5.672628 ~~5.677658~~ ~~5.709240~~	2.600919 ~~2.580192~~ ~~2.584272~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.000000	0.000000	0.035241	0.021840		
LOSSES:	0.000000	0.000000	0.037848	0.120349		2.743108 ~~2.722381~~
LOAD BLOCK SUBTOTAL:	0.000000	0.000000	5.745717 ~~5.782329~~ ~~5.750747~~	2.743108 ~~2.726481~~ ~~2.722381~~	5.745717 ~~5.782329~~ ~~5.750747~~	~~2.726481~~
LOAD BLOCK: 13 5 D			5.707869 ~~5.712844~~ ~~5.744481~~	2.622759 ~~2.602032~~ ~~2.606112~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.005194	0.002518	0.000000	0.000000		
LOSSES:	0.000065	0.000457	0.037848	0.120349	5.750976 ~~5.756016~~ ~~5.787586~~	2.746083 ~~2.725356~~ ~~2.728436~~
LOAD BLOCK SUBTOTAL:	0.005259	0.002975	5.745717 ~~5.782329~~ ~~5.750747~~	2.743108 ~~2.726481~~ ~~2.722381~~		
LOAD BLOCK: 14 FINAL			5.707869 ~~5.712844~~ ~~5.744481~~	2.622759 ~~2.602032~~ ~~2.606112~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.002597	0.001259	0.000000	0.000000		2.744596
LOSSES:	0.000032	0.000229	0.037848	0.120349	5.748346 ~~5.753376~~ ~~5.784956~~	~~2.723869~~ ~~2.727849~~
LOAD BLOCK SUBTOTAL:	0.002629	0.001488	5.745717 ~~5.782329~~ ~~5.750747~~	2.743108 ~~2.726481~~ ~~2.722381~~		

OUT OF SEQUENCE RESTART OF LARGEST MOTORS
FINAL LOAD BLOCK SUBTOTAL:

STARTING		RUNNING		STARTING + RUNNING	
MW	MVAR	MW	MVAR	MW	MVAR
~~1.760524~~ 1.757895	5.589749 ~~5.591237~~	~~4.990849~~ 4.965067 4.960037	~~2.387683~~ ~~2.391768~~ 2.408141	~~6.767173~~ 6.722962 6.717932	7.998159 ~~7.977432~~ ~~7.98300~~

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN B

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
Load Block 1 10 S											
1EA2	CENTRIF CHRG PP #12	TBX-CSAPCH-02	YES	600.000 HP	660.000 HP	10 S	1.421563	4.359761	15 S	0.000000	0.000000
1EB2	HVAC CENT WTR CHLR #6	CP1-CHCICE-06	NO	154.000 HP	154.000 HP	10 S	0.670636	0.702822	15 S	0.000000	0.000000
1EB2-1	RCP SEAL WTR ISOL VLV	1-8100	NO	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB2-1	CHRG P TO RC SYS ISOL VLV	1-8105	YES	1.900 HP	1.900 HP	10 S	0.021158	0.010248	10 S	0.000000	0.000000
1EB2-1	BORON INJ TK DISCH ISOL VLV	1-8801B	NO	1.900 HP	1.900 HP	10 S	0.021158	0.010248	10 S	0.000000	0.000000
1EB2-1	FIRE PROT CNTMT ISOL VLV	1-HV-4075B	NO	1.300 HP	1.300 HP	10 S	0.012886	0.006239	10 S	0.000000	0.000000
1EB2-1	REFG WTR TO CS P 02 & 04	1-HV-4759	NO	1.600 HP	1.600 HP	10 S	0.020318	0.009841	10 S	0.000000	0.000000
1EB2-1	CNTMT H_2 PURGE AIR TO EXH UNITS ISOL VLV	1-HV-5540	NO	0.250 HP	0.250 HP	10 S	0.004201	0.002035	10 S	0.000000	0.000000
1EB2-1	CHLD WTR RTN HDR/CHLD WTR CIRC P	1-HV-6082	NO	1.300 HP	1.300 HP	10 S	0.012903	0.006289	10 S	0.000000	0.000000
1EB2-1	CHLD WTR SUP HDR/CNTMT CLG UNIT CLRS	1-HV-6084	NO	1.300 HP	1.300 HP	10 S	0.019554	0.009471	10 S	0.000000	0.000000
1EB2-1	CHEM ADD TK ISOL VLV	1-LV-4755	NO	0.330 HP	0.330 HP	10 S	0.004201	0.002035	10 S	0.000000	0.000000
1EB2-1	RAD MON SKID TRANSF CP1-RMTRNT-01	1-REK-5502/03/66	NO CCN#3	2.070 HP	2.070 HP	10 S	0.005432	0.012445	15 S	0.000000	0.000000
1EB2-1	INVERTER BOP IVIEC2	CP1-ECIVEC-02	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.009482	0.005876
1EB2-1	SUPS INVERTER IV1EC4	CP1-ECIVEC-04	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.008102	0.005640
1EB2-1	Bron Injection Tank Room Exhaust Fan	CP1-VAFNCB-09	NO	3.000 HP	3.000 HP	10S	0.009641	0.022091	20S	0.00000	0.00000
1EB2-1	Bron Injection Tank Room Supply Fan	CP1-VAFNCB-08	NO	3.000 HP	3.000 HP	10S	0.009641	0.022091	20S	0.00000	0.00000

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN B

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
1EB2-1	SG LTG XFMR (PNL ESB2, ESB4)	CP1-ELTRET-03	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.022185	0.013749
1EB2-1	SG LTG XFMR (PNL ESBD2, ESB6, ESB8, ESB10)	CP1-ELTRET-04	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.013615	0.008378
1EB2-1	XFMR XFS2 (PNL S2)	CP1-ELTRNT-27	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.035190	0.021805
1EB2-1	BATT CHGR BC1ED2-1	CP1-EPBCED-02	NO	300 Amp DC ~~67.321 KVA~~	300 Amp DC ~~67.321 KVA~~	10 S	0.000000	0.000000	10 S	0.035026 ~~0.035019~~	0.035734 ~~0.018019~~
1EB2-1	BATT CHGR BC1ED4-1	CP1-EPBCED-08	NO	300 Amp DC ~~67.321 KVA~~	300 Amp DC ~~67.321 KVA~~	10 S	0.000000	0.000000	10 S	0.026209 ~~0.026213~~	0.026739 ~~0.013613~~
1EB2-1	BATT RM 1-2(B) EXH FAN 09	CP1-VAFNID-09	YES	1.500 HP	1.500 HP	10 S	0.005432	0.012446	20 S	0.000000	0.000000
1EB2-1	SG FL DRAIN SUMP #1 P 01	CP1-WPAPSS-01	NO	*CCN#3 5.000 HP	5.000 HP	10 S	0.018162	0.041615	15 S	0.000000	0.000000
1EB2-1	SG FL DRAIN SUMP #1 P 02	CP1-WPAPSS-02	NO	5.000 HP	5.000 HP	10 S	0.018162	0.041615	15 S	0.000000	0.000000
1EB2-1	INVERTER CHAN II IVIPC2	TBX-ESELIV-02	NO	15.934 KVA	15.934 KVA	10 S	0.000000	0.000000	10 S	0.008752	0.006044
1EB4-1	CHRG P MINIFLOW ISOL VLV	1-8111	YES	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB4-1	CHRG P #2 MINIFLOW ISOL BYPASS VLV	1-8511B	NO	0.660 HP	0.660 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB4-1	CHGR P #1 MINIFLOW ISOL BYPASS VLV	1-8512B	NO	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB4-1	REFLG WTR STRG TK TO SI P VLV	1-8806	NO	1.300 HP	1.300 HP	10 S	0.021156	0.010248	10 S	0.000000	0.000000
1EB4-1	SI SYS P MINIFLOW ISOL VLV	1-8813	NO	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB4-1	RHR P #2 MINIFLOW VLV	1-FCV-0611	NO	0.130 HP	0.130 HP	10 S	0.002597	0.001259	10 S	0.000000	0.000000
1EB2-1	Battery Room Unit Heater -02	CP1-VAHEUH-02	NO	25.000 KW	25.000 KW	10 S	0.000000	0.000000	10 S	0.02500	0.000000

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN B

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
1EB4-1	SUPS BYPASS XFMR T1EC4	CP1-ECTRET-02	NO	25.000 KVA	25.000 KVA	10 S	0.000000	0.000000	10 S	0.006500	0.005268
1EB4-1	UPS & DIST RM FAN COIL UNIT	CP1-VAAUPR-07	NO	5.000 HP	5.000 HP	10 S	0.000000	0.000000	10 S	0.003880	0.002709
1EB4-1	CENT CHRG P RM FAN CLR 04	CP1-VAAUSE-04	NO	3.000 HP	3.000 HP	10 S	0.009841	0.022091	20 S	0.000000	0.000000
1EB4-1	BATT RM 1-2(B) EXH FAN 10	CP1-VAFNID-10	NO	1.500 HP	1.500 HP	10 S	0.005432	0.012445	20 S	0.000000	0.000000
1EB4-1	BORIC ACID TRANSFER P 2	TBX-CSAPBA-02	NO	20.780 HP	20.780 HP	10 S	0.066980	0.153469	15 S	0.000000	0.000000
1EB4-1	INVERTER CHANNEL IV IV1PC4	TBX-ESELIV-04	NO	15.934 KVA	15.934 KVA	10 S	0.000000	0.000000	10 S	0.008804	0.005467
1EB4-2	CNTMT H2 CNTLD PURGE EXH ISOL VLV	1-HV-5562	NO	0.330 HP	0.330 HP	10 S	0.004278	0.002071	10 S	0.000000	0.000000
1EB4-2	CNTMT H2 CNTLD PURGE SUPPLY ISOL VLV	1-HV-5563	NO	0.250 HP	0.250 HP	10 S	0.004278	0.002071	10 S	0.000000	0.000000
1EB4-2	SECURITY XFMR XFS3	CP1-ELTRNT-30	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.020825	0.012906
1EB4-2	SG BLDG XFMR T1EC4-2 (PNL 1EC4-2)	CP1-EPTRET-06	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.020927	0.012969
1EB4-3	SW PUMPHOUSE VENT EXH FAN 08	CPX-VAFNWV-08	NO	3.000 HP	3.000 HP	10 S	0.012255	0.028080	20 S	0.000000	0.000000
1EB4-3	SW PUMPHOUSE VENT EXH FAN 09	CPX-VAFNWV-09	NO	3.000 HP	3.000 HP	10 S	0.012255	0.028080	20 S	0.000000	0.000000
1EB4-4	DG FUEL OIL TRANSFER P	CP1-DOAPFT-03	NO	3.000 HP	3.000 HP	10 S	0.010697	0.024969	15 S	0.000000	0.000000
1EB4-4	DG FUEL OIL TRANSFER P	CP1-DOAPFT-04	NO	3.000 HP	3.000 HP	10 S	0.019045	0.043637	15 S	0.000000	0.000000
1EB4-4	DG RM FAN 29	CP1-VAFNAV-29	NO	40.000 HP	40.000 HP	10 S	0.145368	0.333075	20 S	0.000000	0.000000

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN B

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 1 10 S						
PRIOR LOAD:	0.000000	0.000000	0.000000	0.000000		
LOAD:	2.760417	7.313253	0.358234	0.216180		
LOSSES:	0.087549	0.619191	0.002511	0.007984	3.173753	7.517097
LOAD BLOCK SUBTOTAL:	2.847966	7.932444	0.260845	0.224164	3.208811	8.156608
LOAD BLOCK: 2 15 S						
PRIOR LOAD:	0.000000	0.000000	0.358234	0.216180		
LOAD:	1.970469	5.379735	0.671271	0.311130		
LOSSES:	0.064126	0.453530	0.006341	0.022070	2.981609	6.381387
LOAD BLOCK SUBTOTAL:	2.034595	5.829265	0.927742	0.549380	3.071131	6.378665
LOAD BLOCK: 3 20 S						
PRIOR LOAD:	0.000000	0.000000	0.920801	0.48585		
LOAD:	0.727567	2.570032	1.029685	0.527310		
LOSSES:	0.029916	0.211578	0.010344	0.032893	2.200393	3.562482
LOAD BLOCK SUBTOTAL:	0.757483	2.781610	1.546132	0.818252	2.202615	3.599862
LOAD BLOCK: 4 25 S						
PRIOR LOAD:	0.000000	0.000000	1.534788	0.765359		
LOAD:	2.540099	8.051303	0.335087	0.133174		
LOSSES:	0.094556	0.668747	0.012500	0.039747	4.414808	9.64095
LOAD BLOCK SUBTOTAL:	2.634655	8.720050	1.882375	0.938280	4.517030	9.678330
LOAD BLOCK: 5 30 S						
PRIOR LOAD:	0.000000	0.000000	1.863875	0.918533		
LOAD:	1.786818	5.656022	1.321891	0.435442		
LOSSES:	0.066433	0.469851	0.020802	0.066148	4.963597	7.508616
LOAD BLOCK SUBTOTAL:	1.853251	6.125973	3.212568	1.420123	5.066819	7.545996

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN B

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 6 35 S			3.089544 ~~3.098248~~ ~~3.191786~~	1.316595 ~~1.297466~~ ~~1.353975~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	2.189232	5.000288	0.792020	0.338626		
LOSSES:	0.061136	0.432382	0.025971	0.082581	6.157903 ~~6.166607~~ ~~6.260125~~	7.170472 ~~7.151343~~ ~~7.207652~~
LOAD BLOCK SUBTOTAL:	2.250368	5.432670	3.970535 ~~4.009767~~ 3.916239	1.737802 ~~1.775182~~ 1.716679		
LOAD BLOCK: 7 40 S			3.881564 ~~3.840268~~ ~~3.983786~~	1.655221 ~~1.636042~~ ~~1.692801~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	1.812732	4.730393	0.850607	0.368883		
LOSSES:	0.056737	0.401275	0.031533	0.100270	6.633173 ~~6.641877~~ ~~6.735395~~	7.256042 ~~7.226913~~ ~~7.283422~~
LOAD BLOCK SUBTOTAL:	1.869469	5.131668	4.763704 ~~4.865926~~ 4.772408	2.124374 ~~2.161764~~ 2.105245		
LOAD BLOCK: 8 75 S			4.732171 ~~4.746675~~ ~~4.834393~~	2.024104 ~~2.011475~~ ~~2.061484~~		
PRIOR LOAD:	0.000000 0.070636	0.000000 0.702822				
LOAD:	0.000000	0.000000	0.271860	0.180079		
LOSSES:	0.000000	0.000000	0.033460	0.106395	5.108127 ~~5.139713~~ ~~5.116891~~	3.0134 ~~2.994271~~ ~~2.947958~~
LOAD BLOCK SUBTOTAL:	0.000000 0.070636	0.000000 0.702822	5.037491 ~~5.139713~~ 5.046195	2.310578 ~~2.347958~~ 2.291119		
LOAD BLOCK: 9 90 S			5.004031 ~~5.012735~~ ~~5.106253~~	2.204183 ~~2.165654~~ ~~2.241563~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.501550	1.149198	0.125100 ~~0.000000~~	0.060589 ~~0.000000~~		
LOSSES:	0.014043	0.099322	0.033460	0.106395	5.678187 ~~5.655306~~ ~~5.666088~~	3.619687 ~~3.600558~~ ~~3.596478~~
LOAD BLOCK SUBTOTAL:	0.515593	1.248520	5.162591 ~~5.139713~~ 5.171295	2.371167 ~~2.347958~~ 2.352036		
LOAD BLOCK: 10 120 S			5.129131 ~~5.197835~~ ~~5.106253~~	2.264772 ~~2.245643~~ ~~2.241563~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.589672	1.958856	0.391864	0.242853		
LOSSES:	0.022912	0.162043	0.036200	0.115109	6.169779 ~~6.176483~~ ~~6.146901~~	4.743633 ~~4.720424~~ 4.724504
LOAD BLOCK SUBTOTAL:	0.612584	2.120899	5.557195 ~~5.534317~~ 5.565099	2.622734 ~~2.599625~~ 2.603605		

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS-OF-COOLANT ACCIDENT COINCIDENT WITH LOSS OF OFFSITE POWER
TRAIN B

	STARTING		RUNNING		STARTING + RUNNING	
	MW	MVAR	MW	MVAR	MW	MVAR
LOAD BLOCK: 11 130 S			5.520995 ~~5.529699~~	~~2.488496~~		
PRIOR LOAD:	0.000000	0.000000	~~5.438117~~	~~2.484410~~	2.507625	
LOAD:	0.083751	0.171472	0.183433	0.113685		
LOSSES:	0.002137	0.015116	0.037484	0.119193		2.927091
LOAD BLOCK SUBTOTAL:	0.085888	0.186588	5.741912 ~~5.719854~~ ~~5.750616~~	2.740503 ~~2.717294~~ ~~2.742374~~	5.8278 ~~5.804922~~ ~~5.836584~~	~~2.907462~~ ~~2.903882~~
LOAD BLOCK: 12 12 H			5.704428 ~~5.713132~~	2.62131 ~~2.602181~~		
PRIOR LOAD:	0.000000	0.000000	~~5.681650~~	~~2.598101~~		
LOAD:	0.000000	0.000000	0.006231	0.003861		
LOSSES:	0.000000	0.000000	0.037528	0.119332	5.748187	
LOAD BLOCK SUBTOTAL:	0.000000	0.000000	5.748187 ~~5.725309~~ ~~5.756891~~	2.744503 ~~2.721294~~ ~~2.725374~~	~~5.756691~~ ~~5.725309~~	2.744503 ~~2.721294~~ ~~2.725374~~
LOAD BLOCK: 13 5 D			5.710659 ~~5.719363~~	2.625171 ~~2.606042~~		
PRIOR LOAD:	0.000000	0.000000	~~5.687781~~	~~2.601962~~		
LOAD:	0.004736	0.002294	0.031875	0.019754		
LOSSES:	0.000059	0.000417	0.037751	0.120042		2.767678
LOAD BLOCK SUBTOTAL:	0.004795	0.002711	5.780285 ~~5.757407~~ ~~5.788989~~	2.764967 ~~2.741758~~ ~~2.745838~~	5.78508 ~~5.762202~~ ~~5.793784~~	~~2.746549~~ ~~2.744469~~
LOAD BLOCK: 14 FINAL			5.742534 ~~5.751238~~	2.644925 ~~2.625746~~		
PRIOR LOAD:	0.000000	0.000000	~~5.719656~~	~~2.621716~~		
LOAD:	0.002521	0.001221	0.000000	0.000000		
LOSSES:	0.000031	0.000222	0.037751	0.120042	5.782837	
LOAD BLOCK SUBTOTAL:	0.002552	0.001443	5.780285 ~~5.757407~~ ~~5.788949~~	2.764967 ~~2.741758~~ ~~2.745836~~	~~5.791541~~ ~~5.759989~~	2.76641 ~~2.743201~~ ~~2.747251~~

OUT OF SEQUENCE RESTART OF LARGEST MOTORS
FINAL LOAD BLOCK SUBTOTAL:

STARTING		RUNNING		STARTING + RUNNING	
MW	MVAR	MW	MVAR	MW	MVAR
1.757895 ~~1.760487~~	~~5.591192~~ 5.589749	~~4.971727~~ ~~5.003309~~ 4.994605	~~2.407080~~ ~~2.411114~~ 2.430269	~~6.732174~~ ~~6.761204~~ 6.7525	~~6.500689~~ ~~7.99825~~ 8.020018

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN A

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MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START TIME	START MW	START MVAR	RUN TIME	RUN MW	RUN MVAR
Load Block 1 10 S											
1EA1	CENTRIF CHRG PP #11	TBX-CSAPCH-01	YES	600.000 HP	660.000 HP	10 S	1.421553	4.359781	30 S	0.000000	0.000000
1EB1	HVAC CENT WTR CHLR #5	CP1-CHCICE-05	NO	154.000 HP	154.000 HP	10 S	0.370636	0.702822	30 S	0.000000	0.000000
1EB1-1	CHG P TO RC SYS ISOL VLV	1-8108	NO	1.900 HP	1.900 HP	10 S	0.021158	0.010248	10 S	0.000000	0.000000
1EB1-1	CHG P MINIFLOW ISOL BYP VLV	1-8511A	NO	0.700 HP	0.700 HP	10 S	0.009777	0.004734	10 S	0.000000	0.000000
1EB1-1	BORON INJ TK DISCH ISOL VLV	1-8801A	NO	1.900 HP	1.900 HP	10 S	0.021158	0.010248	10 S	0.000000	0.000000
1EB1-1	RHR P #1 MINI FLOW VLV	1-FCV-0610	NO	0.130 HP	0.130 HP	10 S	0.002444	0.001185	10 S	0.000000	0.000000
1EB1-1	INVERTER BOP IV1EC1	CP1-ECIVEC-01	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.010439	0.009483
1EB1-1	SUP INVERTER IV1EC3	CP1-ECIVEC-03	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.009671	0.005994
1EB1-1	SG LTG XFMR (PNL ESB1, ESB3)	CP1-ELTRET-01	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.022270	0.013802
1EB1-1	SG LTG XFMR(PNL ESBD1, ESB5, ESB7 & ESB9)	CP1-ELTRET-02	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.013090	0.008112
1EB1-1	TRANSFORMER XFS1 (PANEL S1)	CP1-ELTRNT-26	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.034808	0.021571
1EB1-1	BATT CHGR BC1ED1-1	CP1-EPBCED-01	NO	300 Amps DC 67.221 KVA	300 Amps DC 67.221 KVA	10 S	0.000000	0.000000	10 S	0.0366360 0.023573	0.037376 0.015008
1EB1-1	BATTERY CHARGER BC1ED3-1	CP1-EPBCED-05	NO	300 Amps DC 67.221 KVA	300 Amps DC 67.221 KVA	10 S	0.000000	0.000000	10 S	0.022907 0.005830	0.023370 0.009613
1EB1-1	BATTERY RM 1-1(A) EXH FAN 07	CP1-VAFNID-07	NO	1.500 HP	1.500 HP	10 S	0.005432	0.012445	30 S	0.000000	0.000000

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN A

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
1EB1-1	SG FL DRAIN SUMP #2 P 03	CP1-WPAPSS-03	NO	5.000 HP	5.000 HP	10 S	0.016125	0.036946	30 S	0.000000	0.000000
1EB1-1	SG FL DRAIN SUMP #2 P 04	CP1-WPAPSS-04	NO	5.000 HP	5.000 HP	10 S	0.016125	0.036946	30 S	0.000000	0.000000
1EB1-1	BORIC ACID TRANS P #1	TBX-CSAPBA-01	NO	20.780 HP	20.780 HP	10 S	0.066980	0.153469	30 S	0.000000	0.000000
1EB1-1	INVERTER CHNL I IV1PC1	TBX-ESELIV-01	NO	15.934 KVA	15.934 KVA	10 S	0.000000	0.000000	10 S	0.009887	0.006128
1EB2-1	BORON INJ. TK RM SUP FAN	CP1-VAFNCB-08	NO	3.000 HP	3.000 HP	10 S	0.009641	0.022091	30 S	0.000000	0.000000
1EB2-1	BORON INJ. TK RM SUP FAN	CP1-VAFNCB-09	NO	3.000 HP	3.000 HP	10 S	0.009641	0.022091	30 S	0.000000	0.000000
1EB2-1	BATTERY ROOM 1-2 UNIT HTR-02	CP1-VAHEUH-02	NO	25.000 KW	25.000 KW	10 S	0.000000	0.000000	10 S	0.025000	0.000000
1EB3-1	CNDS STG TK TO CNDS SYS M-U RJCT ISOL VLV	1-HV-2484	NO	0.330 HP	0.330 HP	10 S	0.002597	0.001259	10 S	0.000000	0.000000
1EB3-1	DG PACK A SERV WTR VLV	1-HV-4393	YES	0.125 HP	0.125 HP	10 S	0.002597	0.001259	10 S	0.000000	0.000000
1EB3-1	RHR HEXR 01 OUTLET CNTL VLV	1-HV-4572	NO	0.700 HP	0.700 HP	10 S	0.009701	0.004699	10 S	0.000000	0.000000
1EB3-1	VOL CNTL TK OUTLET ISOL VLV	1-LCV-0112B	NO	2.000 HP	2.000 HP	10 S	0.021158	0.010248	10 S	0.000000	0.000000
1EB3-1	CHLD WTR RECIRC P 05	CP1-CHAPCP-05	YES	25.000 HP	25.000 HP	10 S	0.071495	0.163815	30 S	0.000000	0.000000
1EB3-1	AIR DRYER CNTL PNL FDR	CP1-CIDYIA-01	NO	23.000 KW ~~17.500 KW~~	23.000 17.500 KW	10 S	0.000000	0.000000	10 S	0.023000 ~~0.017500~~	0.000000
1EB3-1	Bypass Transf (TIC 3) INSTRUMENT INVERTER IV1C3	CP1-EPTRNT-12 CP1-ECIVNC-02	NO	10.00 ~~22.368~~ KVA	10.00 ~~32.308~~ KVA	10 S	0.000000	0.000000	10 S	0.0085 ~~0.016968~~	0.005268 ~~0.011751~~
1EB3-1	SUPS BYPASS XFMR T1EC3	CP1-ECTRET-01	NO	25.000 KVA	25.000 KVA	10 S	0.000000	0.000000	10 S	0.009150	0.005689

CCN#3

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN A

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
1EB3-1	UPS & DIST RM FAN COIL UNIT	CP1-VAAUPR-01	NO	5.000 HP	5.000 HP	10 S	0.000000	0.000000	10 S	0.003869	0.002709
1EB3-1	CENT CHRG P RM FAN CLR 03	CP1-VAAUSE-03	NO	3.000 HP	3.000 HP	10 S	0.009641	0.022091	30 S	0.000000	0.000000
1EB3-1	BATT RM 1-1(A) EXH FAN 08	CP1-VAFNID-08	NO	1.500 HP	1.500 HP	10 S	0.005432	0.012445	30 S	0.000000	0.000000
1EB3-1	BATT RM 1-3(C) EXH FAN 11	CP1-VAFNID-11	NO	1.500 HP	1.500 HP	10 S	0.005432	0.012445	30 S	0.000000	0.000000
1EB3-1	BATTERY ROOM UNIT HTR	CP1-VAHEUH-03	9	25.000 KW	25.000 KW	10 S	0.000000	0.000000	10 S	0.025000	0.000000
1EB3-1	INVERTER CHAN III IV1PC3	TBX-ESELIV-03	NO	15.934 KVA	15.924 KVA	10 S	0.000000	0.000000	10 S	0.007446	0.004615
1EB3-2	CNTMT LTG XFMR (PNL SC1 & SC3)	CP1-ELTRNT-18	YES	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.016890	0.012327
1EB3-2	SG BLDG XFMR T1EC3-2 (PNL 1EC3-2)	CP1-EPTRET-05	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.036639	0.016509
1EB3-2	ISOL XFMR T1EC3-3 (PNL 1EC3-3)	CP1-EPTRNT-28	NO	5.000 KVA	5.000 KVA	10 S	0.000000	0.000000	10 S	0.004064	0.002480
1EB3-3	LIGHTING XFMR (PNL S4)	CP1-ELTRNT-31	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.018250	0.011309
1EB3-4	DG FUEL OIL TRANSFER P 01	CP1-DOAPFT-01	NO	3.000 HP	3.000 HP	10 S	0.010697	0.024969	30 S	0.000000	0.000000
1EB3-4	DG FUEL OIL TRANSFER P 02	CP1-DOAPFT-02	NO	3.000 HP	3.000 HP	10 S	0.010697	0.024969	30 S	0.000000	0.000000
1EB3-4	FUEL OIL DRIP RTN P	CP1-MEDGEE-01G	NO	1.000 HP	1.000 HP	10 S	0.005869	0.012990	30 S	0.000000	0.000000
1EB3-4	FUEL OIL BOOSTER P	CP1-MEDGEE-01N	YES	3.000 HP	3.000 HP	10 S	0.012255	0.028090	30 S	0.000000	0.000000
1EB3-4	RM ADJCNT TO RL MK-UP WTR STORAGE TK HTR	CP1-VAEHUH-25	NO	10.000 KW	10.000 KW	10 S	0.000000	0.000000	10 S	0.010000	0.000000

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN A

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 1 10 S						
PRIOR LOAD:	0.000000	0.000000	0.000000	0.000000		
LOAD:	2.573000	7.253644	0.511065	0.241109		
LOSSES:	0.087354	0.617814	0.003391	0.010781		
LOAD BLOCK SUBTOTAL:	2.660354	7.871458	0.514456	0.251890	3.175416	8.123348
LOAD BLOCK: 2 30 S						
PRIOR LOAD:	0.000000	0.000000	0.511065	0.241108		
LOAD:	2.064817	6.390417	0.740438	0.371184		
LOSSES:	0.075216	0.531966	0.008359	0.026581		
LOAD BLOCK SUBTOTAL:	2.140033	6.922383	1.259862	0.638864	3.399895	7.561237
LOAD BLOCK: 3 35 S						
PRIOR LOAD:	0.000000	0.000000	1.261603	0.612273		
LOAD:	2.189232	5.000288	0.880720	0.385995		
LOSSES:	0.061136	0.432382	0.014126	0.044918		
LOAD BLOCK SUBTOTAL:	2.250368	5.432670	2.146349	1.043186	4.396717	6.475856
LOAD BLOCK: 4 40 S						
PRIOR LOAD:	0.000000	0.000000	2.132223	0.998266		
LOAD:	1.507538	3.031105	0.650607	0.368883		
LOSSES:	0.048202	0.340911	0.018603	0.059154		
LOAD BLOCK SUBTOTAL:	1.555740	4.372016	2.801433	1.426305	4.357173	5.798321
LOAD BLOCK: 5 50 S						
PRIOR LOAD:	0.000000	0.000000	2.782630	1.367151		
LOAD:	0.734620	1.922712	0.523611	0.239104		
LOSSES:	0.023053	0.163040	0.022056	0.070133		
LOAD BLOCK SUBTOTAL:	0.757673	2.085752	3.328697	1.676388	4.086370	3.762140
			3.144322	1.625963		

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN A

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 6 60 S		3.122266				
PRIOR LOAD:	0.000000	0.000000	3.137759 → 3.306441	1.541566 → 1.696255	1.55583	
LOAD:	0.860110	1.970763	0.207866	0.114340		
LOSSES:	0.024083	0.170328	0.023477	0.074653	4.237802	
LOAD BLOCK SUBTOTAL:	0.884193	2.141091	3.753609 → 3.637784 → 3.369102	1.744823 → 1.796248 → 1.730579	4.253245 → 4.421877	3.885914 → 3.936339 → 3.827167
LOAD BLOCK: 7 75 S			3.330132			
PRIOR LOAD:	0.000000 → 0.070636	0.000000 → 0.702822	3.345625 → 3.614387	1.655426 → 1.720595	1.67017	
LOAD:	0.000000	0.000000	0.189262	0.117291		
LOSSES:	0.000000	0.000000	0.024807	0.078882	3.614837	
LOAD BLOCK SUBTOTAL:	0.000000 → 0.070636	0.000000 → 0.702822	3.544201 → 3.728376 → 3.550694	1.866343 → 1.916768 → 1.652099	3.630033 → 3.728376	2.569165 → 1.916768 → 2.554921
LOAD BLOCK: 8 85 S			3.519394 → 3.534887 → 3.703569	1.787461 → 1.779217 → 1.837886		
PRIOR LOAD:	0.000000	0.000000	0.125100	0.060589		
LOAD:	1.013975	3.927106	0.000000	0.000000		
LOSSES:	0.045426	0.321276	0.024807	0.078882	4.728702	
LOAD BLOCK SUBTOTAL:	1.059401	4.248382	3.669301 → 3.728376 → 3.684794	1.926932 → 1.916768 → 1.912688	4.744145 → 4.787777	6.175314 → 6.165150 → 6.161067
LOAD BLOCK: 9 90 S			3.644494 → 3.654987 → 3.703569	1.84805 → 1.838806 → 1.837886		
PRIOR LOAD:	0.000000	0.000000	0.537810	0.245033		4.655074
LOAD:	1.219279	2.267879	0.028351	0.090152	5.458772	4.644083
LOSSES:	0.028838	0.203960	4.210655 → 4.269730 → 4.226148	2.183235 → 2.173071 → 2.168991	5.517847 → 5.474265	4.644910
LOAD BLOCK SUBTOTAL:	1.248117	2.471839				
LOAD BLOCK: 10 120 S			4.182304 → 4.197747 → 4.241379	2.093083 → 2.076639 → 2.082919		
PRIOR LOAD:	0.000000 → 0.718784	0.000000 → 1.63149				
LOAD:	0.871381 → 1.981134		0.550220	0.300828		
LOSSES:	0.024240	0.171439	0.032111	0.102106	5.507659	
LOAD BLOCK SUBTOTAL:	0.893621 → 0.743024	2.152573 → 1.802929	4.764635 → 4.823710 → 4.760128	2.496017 → 2.486863 → 2.481773	5.523152 → 5.719331	4.298946 → 4.638426 → 4.284702

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN A

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 11 130 S			4.732524 ~~4.748617~~	~~2.374667~~	2.393911	
PRIOR LOAD:	0.000000	0.000000	~~4.791599~~	~~2.383747~~		
LOAD:	0.891636	1.504663	0.102178 ~~0.142377~~	0.063329 ~~0.088239~~		
LOSSES:	0.019589	0.138543	0.033112	0.105288	5.779039	
LOAD BLOCK SUBTOTAL:	0.911225	1.643206	4.867814 ~~4.887082~~ ~~4.883507~~	2.562528 ~~2.577274~~ 2.548264	~~5.794523~~ 5.878307	4.205734 ~~4.220480~~ ~~4.179449~~
LOAD BLOCK: 12 5 M			4.834702 ~~4.850195~~	2.45724 ~~2.642996~~		
PRIOR LOAD:	0.000000	0.000000	~~4.933970~~	~~2.471986~~		
LOAD:	0.024510	0.056160	0.173246	0.111483		
LOSSES:	0.000686	0.004854	0.034341	0.109197	5.057485	
LOAD BLOCK SUBTOTAL:	0.025196	0.061014	5.042289 ~~5.141557~~ ~~5.057782~~	2.67792 ~~2.692666~~ 2.663676	~~5.082978~~ 5.166753	2.738934 ~~2.753680~~ 2.722469
LOAD BLOCK: 13 30 M			5.007948 ~~5.023441~~	2.568723 2.554479		
PRIOR LOAD:	0.000000	0.000000	~~5.107216~~	~~2.583469~~		
LOAD:	0.406793	1.560252	0.004876	0.003020		
LOSSES:	0.018059	0.127722	0.034375	0.109306		4.369023
LOAD BLOCK SUBTOTAL:	0.424852	1.687974	5.047199 ~~5.146417~~ ~~5.062492~~	2.681049 ~~2.695795~~ 2.666805	5.503037 ~~5.571319~~ ~~5.487544~~	~~4.354779~~ ~~4.383789~~
LOAD BLOCK: 14 60 M			5.012824 ~~5.028317~~	2.571743 ~~2.557499~~		
PRIOR LOAD:	0.000000	0.000000	~~5.112092~~	~~2.586489~~		
LOAD:	0.000000	0.000000	0.667953	0.107807		
LOSSES:	0.000000	0.000000	0.038263	0.121668		2.501218
LOAD BLOCK SUBTOTAL:	0.000000	0.000000	5.71904 ~~5.818308~~ ~~5.734533~~	2.501218 ~~2.615964~~ ~~2.786974~~	5.71904 ~~5.818308~~ ~~5.734533~~	~~2.786974~~ ~~2.815964~~
LOAD BLOCK: 15 4 H			5.680777 ~~5.69627~~	2.67955 ~~2.665304~~		
PRIOR LOAD:	0.000000	0.000000	~~5.780845~~	~~2.694296~~		
LOAD:	0.717926	2.547941	-1.05813	-.482097		
LOSSES:	0.029648	0.209687	0.031287	0.099485	5.401508	5.054566
LOAD BLOCK SUBTOTAL:	0.747574	2.757628	4.653934 ~~4.753202~~ ~~4.669427~~	2.296938 ~~2.311684~~ ~~2.262694~~	~~5.417001~~ ~~5.500776~~	~~5.040322~~ 5.069312

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN A

	STARTING		RUNNING		STARTING + RUNNING	
	MW	MVAR	MW	MVAR	MW	MVAR
LOAD BLOCK: 16 FINAL			4.622647			
PRIOR LOAD:	0.000000	0.000000	~~4.638114~~ ~~4.721915~~	~~2.183209~~ ~~2.212199~~ 2.197453		
LOAD:	0.000000	0.000000	0.335087	0.133174		
LOSSES:	0.000000	0.000000	0.033446	0.106353	4.99118 ~~5.006673~~	2.43698 ~~2.46547~~
LOAD BLOCK SUBTOTAL:	0.000000	0.000000	4.99118 ~~5.090448~~ ~~5.006673~~	~~2.46547~~ ~~2.451726~~ ~~2.420736~~	~~5.090448~~	~~2.451726~~

2.43698

OUT OF SEQUENCE RESTART OF LARGEST MOTORS
FINAL LOAD BLOCK SUBTOTAL:

2.102282

STARTING		RUNNING		STARTING + RUNNING	
MW	MVAR	MW	MVAR	MW	MVAR
1.757895	5.589749	~~4.306786~~ ~~4.220993~~ 4.2055	~~2.088038~~ ~~2.117028~~	5.963395 ~~6.062863~~ ~~5.978888~~	~~7.677787~~ ~~7.70678~~ 7.692031

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN B

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
Load Block 1 10 S											
1EA2	CENTRIF CHRG PP #12	TSX-CBAPCH-02	YES	600.000 HP	660.000 HP	10 S	1.421663	4.389751	30 S	0.000000	0.000000
1EB2	HVAC CENT WTR CHLR #8	CP1-CHCICE-08	NO	154.000 HP	154.000 HP	10 S	0.070636	0.702822	30 S	0.000000	0.000000
1EB2-1	CHLD WTR RTN HDR/CHLD WTR CIRC P	1-HV-8082	NO	1.300 HP	1.300 HP	10 S	0.012865	0.006269	10 S	0.000000	0.000000
1EB2-1	RAD MON SKID TRANSF CP1-RMTRNT-01	1-REK-5502/03/06	NO	2.070 HP	2.070 HP	10 S	0.005432	0.012445	30 S	0.000000	0.000000
1EB2-1	INVERTER BOP IVIEC2	CP1-ECIVEC-02	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.009482	0.005876
1EB2-1	SUPS INVERTER IV1EC4	CP1-ECIVEC-04	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.009182	0.005840
1EB2-1	SG LTG XFMR (PNL ESB2, ESB4)	CP1-ELTRET-03	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.022186	0.013749
1EB2-1	SG LTG XFMR (PNL ESBD2, ESB6, ESB8, ESB10)	CP1-ELTRET-04	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.013616	0.008378
1EB2-1	XFMR XFS2 (PNL S2)	CP1-ELTRNT-27	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.036180	0.021809
1EB2-1	BATT CHGR BC1ED2-1	CP1-EPBCED-02	NO	300 Amps DC 67.221 KVA	300 Amps DC 67.221 KVA	10 S	0.000000	0.000000	10 S	0.035026 0.038868	0.435734 0.810519
1EB2-1	BATT CHGR BC1ED4-1	CP1-EPBCED-06	NO	300 Amps DC 67.221 KVA	300 Amps DC 67.221 KVA	10 S	0.000000	0.000000	10 S	0.026209 0.005826	0.026739 0.008813
1EB2-1	BATT CHGR BC1D2	CP1-EPBCND-02	NO	200 Amp DC 42.227 KVA	200 Amp DC 42.227 KVA	10 S	0.000000	0.000000	10 S	0.013565 0.017847	0.008467 0.011722
1EB2-1	BATT RM 1-2(B) EXH FAN 08	CP1-VAFNID-08	YES	1.500 HP	1.500 HP	10 S	0.005432	0.012445	30 S	0.000000	0.000000
1EB2-1	SG FL DRAIN SUMP #1 P 01	CP1-WPAPSS-01	NO	5.000 HP	5.000 HP	10 S	0.018162	0.041615	30 S	0.000000	0.000000
1EB2-1	Boron Inj Tk RM EXH FAN CP1-VAFNCB-01		NO	3.00 HP	3.00 HP	10 S	0.009641	0.022091	30S	0.00000	0.00000
1EB2-1	Boron Inj Tk RM SUP FAN CP1-VAFNCB-08		NO	3.00 HP	3.00 HP	10S	0.009641	0.022091	30 S	0.00000	0.00000

CCN#3

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN B

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
✓1EB2-1	SG FL DRAIN SUMP #1 P 02	CP1-WPAPSS-02	NO	5.000 HP	5.000 HP	10 S	0.018162	0.041615	30 S	0.000000	0.000000
✓1EB2-1	INVERTER CHAN II IVIPC2	TBX-ESELIV-02	NO	15.934 KVA	15.934 KVA	10 S	0.000000	0.000000	10 S	0.009752	0.009844
1EB4-1	RHR P #2 MINIFLOW VLV	1-FCV-0611	NO	0.130 HP	0.130 HP	10 S	0.002597	0.001259	10 S	0.000000	0.000000
1EB4-1	CNDS STG TK TO CNDS SYS M-U & RJCT ISL VLV	1-HV-2485	NO	0.330 HP	0.330 HP	10 S	0.002597	0.001259	10 S	0.000000	0.000000
1EB4-1	DG PACK B SERV WTR VLV	1-HV-4394	YES	0.125 HP	0.125 HP	10 S	0.002597	0.001259	10 S	0.000000	0.000000
1EB4-1	RHR HEXR 02 OUTLET CNTL VLV	1-HV-4573	NO	0.700 HP	0.700 HP	10 S	0.009701	0.004699	10 S	0.000000	0.000000
1EB4-1	REFLG WTRS TRG TK TO CHRG P VLV	1-LCV-0112E	NO	2.000 HP	2.000 HP	10 S	0.010947	0.005253	10 S	0.000000	0.000000
✓1EB4-1	CHLD WTR RECIRC P 08	CP1-CHAPCP-08	NO	25.000 HP	25.000 HP	10 S	0.071495	0.163815	30 S	0.000000	0.000000
✓1EB4-1	INSTRUMENT INVERTER IV1C2	CP1-ECIVNC-01	NO	22.308 KVA	22.308 KVA	10 S	0.000000	0.000000	10 S	0.015170	0.009401
✓1EB4-1	SUPS BYPASS XFMR T1EC4	CP1-ECTRET-02	NO	25.000 KVA	25.000 KVA	10 S	0.000000	0.000000	10 S	0.008509	0.005268
✓1EB4-1	BATT CHARGER BC1D4	CP1-EPBCND-04	NO	200 Amp DC 42.220 KVA	200 Amp DC 42.220 KVA	10 S	0.000000	0.000000	10 S	0.013565 0.013967	0.008407 0.011722
✓1EB4-1	UPS & DIST RM FAN COIL UNIT	CP1-VAAUPR-02	NO	5.000 HP	5.000 HP	10 S	0.000000	0.000000	10 S	0.003890	0.002709
✓1EB4-1	CENT CHRG P RM FAN CLR 04	CP1-VAAUSE-04	NO	3.000 HP	3.000 HP	10 S	0.009041	0.022091	30 S	0.000000	0.000000
✓1EB4-1	BATT RM 1-2(B) EXH FAN 10	CP1-VAFNID-10	NO	1.500 HP	1.500 HP	10 S	0.005432	0.012445	30 S	0.000000	0.000000
✓1EB4-1	BATT RM 1-3(C) EXH FAN 12	CP1-VAFNID-12	NO	1.500 HP	1.500 HP	10 S	0.005432	0.012445	30 S	0.000000	0.000000
1EB7-1	BATT RM UNIT HTR-02	CP1-VAHEUH-02	NO	25.00 KW	25.00 KW	10 S	0.080	0.080	10 S	0.025[illegible]	0.[illegible]

CCN#3

UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN B

MCC	EQUIP DESCRIPTION	TAG NUMBER	AUTO SEQUENCER START	NAMEPLATE HP (KW/KVA IF INDICATED)	BRAKE HP (KW/KVA IF INDICATED)	START			RUN		
						TIME	MW	MVAR	TIME	MW	MVAR
1EB4-1	BORIC ACID TRANSFER P 2	TBX-CSAPBA-02	NO	20.780 HP	20.780 HP	10 S	0.035980	0.153469	30 S	0.000000	0.000000
1EB4-1	INVERTER CHANNEL IV IV1PC4	TBX-ESELIV-04	NO	15.934 KVA	15.934 KVA	10 S	0.000000	0.000000	10 S	0.008004	0.005457
1EB4-2	CNTMT LTG XFMR (PNL SC2 & SC4)	CP1-ELTRNT-19	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.018550	0.012116
1EB4-2	SECURITY XFMR XFS3	CP1-ELTRNT-30	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.020835	0.012806
1EB4-2	SG BLDG XFMR T1EC4-2 (PNL 1EC4-2)	CP1-EPTRET-06	NO	45.000 KVA	45.000 KVA	10 S	0.000000	0.000000	10 S	0.020827	0.012962
1EB4-4	DG FUEL OIL TRANSFER P	CP1-DOAPFT-03	NO	3.000 HP	3.000 HP	10 S	0.010697	0.024969	30 S	0.000000	0.000000
1EB4-4	DG FUEL OIL TRANSFER P	CP1-DOAPFT-04	NO	3.000 HP	3.000 HP	10 S	0.018045	0.043637	30 S	0.000000	0.000000
1EB4-4	FUEL OIL DRIP RTN P	CP1-MEDGEE-02G	NO	1.000 HP	1.000 HP	10 S	0.005969	0.012990	30 S	0.000000	0.000000
1EB4-4	FUEL OIL BOOSTER P	CP1-MEDGEE-02N	NO	3.000 HP	3.000 HP	10 S	0.012255	0.028060	30 S	0.000000	0.000000
1EB4-4	RM ADJCNT TO REAC MKUP WTR STORAGE TK HTR	CP1-VAEHUH-28	NO	10.000 KW	10.000 KW	10 S	0.000000	0.000000	10 S	0.010000	0.000000
1EB4-4	RM ADJCNT TO COND WTR STORAGE TK HTR	CP1-VAEHUH-29	NO	10.000 KW	10.000 KW	10 S	0.000000	0.000000	10 S	0.010000	0.000000
1EB4-4	RM ADJCNT TO REFG WTR STORAGE TK HTR	CP1-VAEHUH-30	NO	7.500 KW	7.500 KW	10 S	0.000000	0.000000	10 S	0.007500	0.000000
1EB4-4	DG RM FAN 29	CP1-VAFNAV-29	NO	40.000 HP	40.000 HP	10 S	0.145366	0.333075	30 S	0.000000	0.000000
1EB4-4	DG RM FAN 30	CP1-VAFNAV-30	NO	40.000 HP	40.000 HP	10 S	0.145366	0.333075	30 S	0.000000	0.000000
1EB4-4	DG RM FAN 31	CP1-VAFNAV-31	NO	40.000 HP	40.000 HP	10 S	0.145366	0.333075	30 S	0.000000	0.000000

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN B

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 1 10 S						
PRIOR LOAD:	0.000000	0.000000	0.000000	0.000000		
LOAD:	~~2.651752~~ 2.494798	~~7.296483~~ 6.738143	~~0.462313~~ 0.477672 ~~0.510313~~	~~0.263576~~ 0.267874		
LOSSES:	0.087630	0.619763	0.003193	0.010153	3.068293 ~~3.100934~~	7.635633
LOAD BLOCK SUBTOTAL:	~~2.838782~~ 2.582428	~~8.016246~~ 7.357606	~~0.466506~~ 0.480865 ~~0.513506~~	~~0.273729~~ 0.278027	~~3.104288~~	~~8.289975~~ 7.631335
LOAD BLOCK: 2 30 S			0.477672 ~~0.510313~~	0.267874		
PRIOR LOAD:	0.000000	0.000000	~~0.462313~~ 0.623110	~~0.263576~~ 0.315395		
LOAD:	2.066880	6.391413	~~0.741628~~	~~0.371904~~	3.251064 ~~3.283705~~	7.532747 ~~7.526449~~
LOSSES:	0.075234	0.532092	0.008168	0.025973		
LOAD BLOCK SUBTOTAL:	2.142114	6.923505	1.10895 ~~1.212109~~ ~~1.141591~~	0.609242 ~~0.661463~~ ~~0.604944~~	~~3.356223~~	~~7.684958~~
LOAD BLOCK: 3 35 S			1.100782 ~~1.133423~~	0.583269 ~~0.578471~~		
PRIOR LOAD:	0.000000	0.000000	~~1.203941~~	~~0.635480~~		
LOAD:	2.189132	5.000288	0.880720	0.385995	4.245799 ~~4.279044~~	6.446225 ~~6.498438~~ 6.441927
LOSSES:	0.061136	0.432382	0.013929	0.044291		
LOAD BLOCK SUBTOTAL:	2.250368	5.432670	1.995431 ~~2.098590~~ ~~2.028042~~	1.013555 ~~1.065706~~ ~~1.009257~~	~~4.348958~~	
LOAD BLOCK: 4 40 S			1.981502 ~~2.014143~~	0.969264 ~~0.964966~~		
PRIOR LOAD:	0.000000	0.000000	~~2.004887~~	~~1.021475~~		
LOAD:	1.507538	4.031105	0.650607	0.368883	4.206259 ~~4.2384~~	5.768703 ~~5.820914~~ 5.764485
LOSSES:	0.048202	0.340911	0.018410	0.058540		
LOAD BLOCK SUBTOTAL:	1.555740	4.372016	2.650519 ~~2.753678~~ ~~2.683516~~	1.396667 ~~1.448838~~ ~~1.392384~~	~~4.209416~~	
LOAD BLOCK: 5 50 S			2.632109 ~~2.66475~~	1.338147 ~~1.333649~~		
PRIOR LOAD:	0.000000	0.000000	~~2.735208~~	~~1.390358~~		
LOAD:	0.734620	1.922712	0.523611	0.239104	3.935254 ~~3.967845~~	3.732517 ~~3.784728~~ 3.738219
LOSSES:	0.023053	0.163040	0.021861	0.069514		
LOAD BLOCK SUBTOTAL:	0.757673	2.085752	3.177581 ~~3.280746~~ ~~3.210222~~	1.646765 ~~1.698976~~ ~~1.642667~~	~~4.038413~~	

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN B

	STARTING MW	STARTING MVAR	RUNNING MW	RUNNING MVAR	STARTING + RUNNING MW	STARTING + RUNNING MVAR
LOAD BLOCK: 6 60 S			3.15572 ~~3.188361~~	~~1.572953~~ 1.577251		
PRIOR LOAD:	0.000000	0.000000	~~3.250879~~	~~1.629462~~		
LOAD:	0.159534	1.969441	0.207866	0.114340		3.905283
LOSSES:	0.024067	0.170214	0.023284	0.074037	4.270471	~~2.000985~~
LOAD BLOCK SUBTOTAL:	0.883601	2.139655	3.38687 ~~3.490029~~ 3.411514	1.765628 ~~1.867639~~ 1.796193	~~4.373690~~ 4.305112	~~3.957494~~
LOAD BLOCK: 7 75 S			3.363586 ~~3.346227~~	1.691591 ~~1.687293~~		
PRIOR LOAD:	0.000000 0.070636	0.000000 0.702822	~~3.466745~~	~~1.743802~~		
LOAD:	~~0.000000~~	~~0.000000~~	0.189262	0.117291		
LOSSES:	0.000000	0.000000	0.024615	0.078270	3.648099 ~~3.680622~~	2.589974 ~~2.58567~~
LOAD BLOCK SUBTOTAL:	~~0.000000~~ 0.070636	0.000000 0.702822	3.577463 ~~3.680622~~ 3.610164	1.887152 ~~1.939363~~ 1.866654	~~3.680622~~	~~1.939363~~
LOAD BLOCK: 8 85 S			3.552848 ~~3.585489~~	1.808882 ~~1.804564~~		
PRIOR LOAD:	0.000000	0.000000	~~3.656007~~ 0.12510	~~1.861093~~ 0.060589		
LOAD:	1.013975	3.927106	~~0.000000~~	~~0.000000~~		
LOSSES:	0.045425	0.321276	0.024615	0.078270	4.761964 ~~4.794605~~	6.196123
LOAD BLOCK SUBTOTAL:	1.059401	4.248382	3.702563 ~~3.680622~~ 3.735284	1.947741 ~~1.939363~~ 1.943443	~~4.740023~~	~~6.187745~~ 6.191825
LOAD BLOCK: 9 90 S			3.677948 ~~3.710589~~	1.869471 ~~1.865173~~		
PRIOR LOAD:	0.000000	0.000000	~~3.656007~~	~~1.861093~~		
LOAD:	1.219279	2.267879	0.537810	0.245033		
LOSSES:	0.028838	0.203960	0.028158	0.089536	5.492033 ~~5.524676~~	4.675879
LOAD BLOCK SUBTOTAL:	1.248117	2.471839	4.243916 ~~4.221976~~ 4.276597	~~2.195774~~ ~~2.195662~~ 2.186476	~~5.470093~~	~~4.667501~~ 4.660315
LOAD BLOCK: 10 120 S			4.215758 ~~4.248399~~	2.114504 ~~2.110286~~	2.20404	
PRIOR LOAD:	0.000000 0.718375	0.000000 1.626441	~~4.193817~~	~~2.106126~~		
LOAD:	~~0.877347~~	~~1.976085~~	0.548280	0.299624		
LOSSES:	0.024188	0.171072	0.031905	0.101450	5.538881 ~~5.591529~~	4.313091 ~~4.308793~~
LOAD BLOCK SUBTOTAL:	~~0.896535~~ 0.742938	~~2.147167~~ 1.797513	4.795943 ~~4.774602~~ 4.825584	2.515578 ~~2.507280~~ 2.511128	~~5.669537~~	~~4.854357~~

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN B

	STARTING		RUNNING		STARTING + RUNNING	
	MW	MVAR	MW	MVAR	MW	MVAR
LOAD BLOCK: 11 130 S			4.764038 / 4.796679 / ~~4.742897~~	2.414128 / 2.40483 / ~~2.405750~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.126627	0.269714	0.102123 / ~~0.142316~~	0.063296 / ~~0.088206~~		
LOSSES:	0.003337	0.023602	0.032906	0.104633	5.029031 / 5.061672 / ~~5.047283~~	2.875373 / ~~2.891905~~ / ~~2.871075~~
LOAD BLOCK SUBTOTAL:	0.129964	0.293316	4.899067 / ~~4.917319~~ / 4.931708	2.582057 / ~~2.608589~~ / 2.577759		
LOAD BLOCK: 12 5 M			4.866161 / ~~4.898802~~ / ~~4.884413~~	2.477424 / ~~2.473126~~ / ~~2.483956~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.024510	0.056160	0.017324	0.010737		
LOSSES:	0.000686	0.004854	0.033028	0.105021		2.654196 / ~~2.649898~~ / ~~2.676728~~
LOAD BLOCK SUBTOTAL:	0.025196	0.061014	4.916513 / ~~4.934765~~ / 4.949154	2.593182 / ~~2.609714~~ / ~~2.586584~~	4.941709 / ~~4.959961~~ / ~~4.974435~~	
LOAD BLOCK: 13 30 M			4.583485 / ~~4.914319~~ / ~~4.901737~~	2.488161 / ~~2.483263~~ / ~~2.504893~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.406793	1.560252	0.004876	0.003020		
LOSSES:	0.018059	0.127722	0.033062	0.105130	5.346275 / ~~5.378916~~ / ~~5.364527~~	4.284285 / ~~4.300817~~ / ~~4.279487~~
LOAD BLOCK SUBTOTAL:	0.424852	1.687974	4.921423 / ~~4.939675~~ / 4.954064	2.596311 / ~~2.612843~~ / ~~2.598013~~		
LOAD BLOCK: 14 60 M			4.888361 / ~~4.921002~~ / ~~4.906613~~	2.491181 / ~~2.486683~~ / ~~2.507713~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.000000	0.000000	0.667953	0.107807		
LOSSES:	0.000000	0.000000	0.036946	0.117481	5.59326 / ~~5.625401~~ / ~~5.611512~~	2.716469 / ~~2.733001~~ / ~~2.712171~~
LOAD BLOCK SUBTOTAL:	0.000000	0.000000	5.59326 / ~~5.611512~~ / ~~5.625401~~	2.716469 / ~~2.733001~~ / 2.712171		
LOAD BLOCK: 15 4 H			5.556314 / ~~5.588955~~ / ~~5.574566~~	2.598988 / ~~2.594469~~ / ~~2.615520~~		
PRIOR LOAD:	0.000000	0.000000				
LOAD:	0.717926	2.547941	-1.05813	-.482097		
LOSSES:	0.029648	0.209687	0.029970	0.095298	5.275728 / ~~5.308569~~ / ~~5.293980~~	4.469817 / ~~4.496348~~ / ~~4.465519~~
LOAD BLOCK SUBTOTAL:	0.747574	2.757628	4.528154 / ~~4.546406~~ / 4.560795	2.212189 / ~~2.228721~~ / 2.207891		

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UNIT 1
EMERGENCY DIESEL GENERATOR LOADING
LOSS OF OFFSITE (BLACKOUT) POWER
TRAIN B

	STARTING		RUNNING		STARTING + RUNNING	
	MW	MVAR	MW	MVAR	MW	MVAR
LOAD BLOCK: 16 FINAL			4.498184 ~~4.530825~~	2.116891 ~~2.112593~~		
PRIOR LOAD:	0.000000	0.000000	~~4.516436~~	~~2.133623~~		
LOAD:	0.000000	0.000000	0.335087	0.133174		
LOSSES:	0.000000	0.000000	0.032129	0.102165		2.35223
LOAD BLOCK SUBTOTAL:	0.000000	0.000000	4.86540 ~~4.883652~~ ~~4.898041~~	2.35223 ~~2.368762~~ ~~2.347932~~	4.86540 ~~4.883652~~ ~~4.898041~~	~~2.347932~~ ~~2.368762~~

OUT OF SEQUENCE RESTART OF LARGEST MOTORS
FINAL LOAD BLOCK SUBTOTAL:

STARTING		RUNNING		STARTING + RUNNING	
MW	MVAR	MW	MVAR	MW	MVAR
1.757895	5.589749	~~4.097972~~ ~~4.112361~~ 4.079720	~~2.013234~~ ~~2.034084~~ 2.017532	5.837615 ~~5.855867~~ ~~5.870256~~	~~7.602281~~ ~~7.623611~~ 7.607281

0

Unit 1
Emergency Diesel Generator Loading
Loss of coolant accident coincident with loss of offsite Power
TRAIN A

		STARTING + RUNNING		
		MW	MVAR	MVA
LOAD BLOCK : 1	10 S	3.277472	7.506766	8.191054
LOAD BLOCK : 2	15 S	2.933601	6.322497	6.969934
LOAD BLOCK : 3	20 S	2.166751	3.541197	4.151492
LOAD BLOCK : 4	25 S	4.381168	9.619672	10.57037
LOAD BLOCK : 5	30 S	4.929965	7.487362	8.964661
LOAD BLOCK : 6	35 S	6.124270	7.149219	9.413714
LOAD BLOCK : 7	40 S	6,599541	7.234787	9.792655
LOAD BLOCK : 8	75 S	5.074492	2.992140	5.890957
LOAD BLOCK : 9	90 S	5.644549	3.598427	6.693998
LOAD BLOCK : 10	120 S	6.135324	4.722123	7.742135
LOAD BLOCK : 11	130 S	5.836335	3.009662	6.566648
LOAD BLOCK : 12	12 H	5.745717	2.743108	6.366938
LOAD BLOCK : 13	5 D	5.750976	2.746083	6.372966
LOAD BLOCK : 14	FINAL	5.748346	2.744596	6.369952

OUT OF SEQUENCE RESTART OF LARGEST MOTORS
FINAL LOAD BLOCK SUBTOTAL :

STARTING + RUNNING		
MW	MVAR	MVA
6.717932	7.998159	10.445150

Unit 1
Emergency Diesel Generator Loading
Loss of coolant accident coincident with loss of offsite Power
TRAIN B

		STARTING + RUNNING		
		MW	MVAR	MVA
LOAD BLOCK : 1	10 S	3.173753	7.517097	8.159623
LOAD BLOCK : 2	15 S	2.981609	6.381387	7.043585
LOAD BLOCK : 3	20 S	2.200393	3.562482	4.187243
LOAD BLOCK : 4	25 S	4.414808	9.640950	10.603700
LOAD BLOCK : 5	30 S	4.963597	7.508616	9.000923
LOAD BLOCK : 6	35 S	6.157903	7.170472	9.451743
LOAD BLOCK : 7	40 S	6.633173	7.256042	9.831029
LOAD BLOCK : 8	75 S	5.108127	3.013400	5.930729
LOAD BLOCK : 9	90 S	5.678187	3.619687	6.733791
LOAD BLOCK : 10	120 S	6.169779	4.744633	7.783169
LOAD BLOCK : 11	130 S	5.827800	2.927091	6.521589
LOAD BLOCK : 12	12 H	5.748187	2.744503	6.369768
LOAD BLOCK : 13	5 D	5.785080	2.767678	6.413049
LOAD BLOCK : 14	FINAL	5.782837	2.766410	6.410478

OUT OF SEQUENCE RESTART OF LARGEST MOTORS
FINAL LOAD BLOCK SUBTOTAL:

STARTING + RUNNING		
MW	MVAR	MVA
6.752500	8.020018	10.484128

Unit 1
Emergency Diesel Generator Loading
Loss of offsite (BLACKOUT) Power
TRAIN A

		STARTING + RUNNING		
		MW	MVAR	MVA
LOAD BLOCK : 1	10 S	3.033005	7.499588	8.089681
LOAD BLOCK : 2	30 S	3.115720	7.510812	8.170260
LOAD BLOCK : 3	35 S	4.212542	6.425431	7.683207
LOAD BLOCK : 4	40 S	4.172998	5.747896	7.102973
LOAD BLOCK : 5	50 S	3.901995	3.711715	5.385387
LOAD BLOCK : 6	60 S	4.237802	3.885914	5.749721
LOAD BLOCK : 7	75 S	3.614837	2.569165	4.434823
LOAD BLOCK : 8	85 S	4.728702	6.175314	7.777861
LOAD BLOCK : 9	90 S	5.458772	4.655074	7.174114
LOAD BLOCK : 10	120 S	5.507659	4.298946	6.986791
LOAD BLOCK : 11	130 S	5.779039	4.205734	7.147411
LOAD BLOCK : 12	5 M	5.067485	2.738934	5.760309
LOAD BLOCK : 13	30 M	5.503037	4.369023	7.026505
LOAD BLOCK : 14	60 M	5.71904	2.801219	6.368221
LOAD BLOCK : 15	4 H	5.401508	5.054566	7.397630
LOAD BLOCK : 16	FINAL	4.991180	2.43698	5.554345

OUT OF SEQUENCE RESTART OF LARGEST MOTORS
FINAL LOAD BLOCK SUBTOTAL:

STARTING + RUNNING		
MW	MVAR	MVA
5.963395	7.692031	9.732904

Unit 1
Emergency Diesel Generator Loading
Loss of offsite (BLACKOUT) Power
TRAIN B

		STARTING + RUNNING		
		MW	MVAR	MVA
LOAD BLOCK : 1	10 S	3.068293	7.635633	8.229053
LOAD BLOCK : 2	30 S	3.251064	7.532747	8.204371
LOAD BLOCK : 3	35 S	4.245799	6.446225	7.718849
LOAD BLOCK : 4	40 S	4.206259	5.768703	7.139366
LOAD BLOCK : 5	50 S	3.935254	3.732517	5.423828
LOAD BLOCK : 6	60 S	4.270471	3.905283	5.786895
LOAD BLOCK : 7	75 S	3.648099	2.589974	4.473991
LOAD BLOCK : 8	85 S	4.761964	6.196123	7.814617
LOAD BLOCK : 9	90 S	5.492033	4.675879	7.212924
LOAD BLOCK : 10	120 S	5.538881	4.313091	7.020111
LOAD BLOCK : 11	130 S	5.029031	2.875373	5.793006
LOAD BLOCK : 12	5 M	4.941709	2.654196	5.609389
LOAD BLOCK : 13	30 M	5.346275	4.284285	6.851113
LOAD BLOCK : 14	60 M	5.593260	2.716469	6.218019
LOAD BLOCK : 15	4 H	5.275728	4.969817	7.247923
LOAD BLOCK : 16	FINAL	4.865400	2.352230	5.404175

OUT OF SEQUENCE RESTART OF LARGEST MOTORS
FINAL LOAD BLOCK SUBTOTAL:

STARTING + RUNNING		
MW	MVAR	MVA
5.837615	7.607281	9.588977

Comanche Peak Steam Electric Station

CHANGE VERIFICATION CHECKLIST

DOCUMENT: **CALC# EE(B)-011R8,CCN #03** Page 1 of 2

CHANGE CLASSIFICATION: CLASS I X CLASS II ___ NON-SAFETY ___

INPUT/IMPACT REQUIRED FROM:	*YES*	*NO*	*REVIEWER/STAKEHOLDER*	*COMPLETE*
ENGINEERING DISCIPLINES:				
CIVIL ENGINEERING		X		
CODES AND STANDARDS		X		
ELECTRICAL ENGINEERING		X		
INSTRUMENTATION & CONTROLS ENGINEERING		X		
MECHANICAL ENGINEERING		X		
NUCLEAR/MECHANICAL ENGINEERING ANALYSIS		X		
PROCUREMENT ENGINEERING		X		
SYSTEM ENGINEERING		X		
ENGINEERING IMPACTS:				
CIVIL ENGINEERING SYSTEMS INTERACTION		X		
CIVIL ENGINEERING - PIPING		X		
COMBUSTIBLE GAS CONTROL ENGINEER		X		
CONTAINMENT ANALYSIS ENGINEER		X		
DIGITAL SYSTEMS ENGINEERING		X		
ENGINEERING ALARA COORDINATOR		X		
ENVIRONMENTAL EVALUATION (STA-717)		X		
ENVIRONMENTAL EQUIP. QUALIFICATION ENGINEER		X		
FIRE PROTECTION ENGINEER		X		
HUMAN FACTORS ENGINEER		X		
MAINTENANCE ENGINEERING (PROGRAMS)		X		
MAINTENANCE ENGINEERING (TESTING)		X		
MECHANICAL EQUIPMENT ENGINEERING (MOVS)		X		
MECHANICAL EQUIPMENT ENGINEERING (COATINGS)		X		1
NUCLEAR ANALYSIS & FUEL		X		
RADIATION ENVIRONMENT ENGINEER		X		
RADIOLOGICAL ENVIRONMENTAL ENGINEER		X		
RADIOLOGICAL ACCIDENT ENGINEER		X		
SEISMIC EQUIPMENT QUALIFICATION		X		
SITE FACILITIES ENGINEERING		X		

Comanche Peak Steam Electric Station

CHANGE VERIFICATION CHECKLIST

DOCUMENT: **CALC# EE(B)-011R8,CCN #03** Page 2 of 2

INPUT/IMPACT REQUIRED FROM:	*YES*	*NO*	*REVIEWER/STAKEHOLDER*	*COMPLETE*
ENGINEERING IMPACTS (CONTINUED):				
SOFTWARE QUALITY ASSURANCE		X		
STATION BLACKOUT ANALYSIS		X		
SYSTEMS INTERACTION (MECHANICAL) ENGINEER		X		
TORNADO VENTING ANALYSIS ENGINEER		X		
		X		
		X		
		X		
NON-ENGINEERING IMPACTS:				
CHEMISTRY		X		
ELECTRICAL MAINTENANCE		X		
INSTRUMENTATION & CONTROL MAINTENANCE		X		
MECHANICAL MAINTENANCE		X		
NUCLEAR TRAINING (SIMULATOR DESIGN)		X		
NUCLEAR TRAINING (PROGRAMS)		X		
OPERATIONS SUPPORT		X		
OPERATIONS WORK CONTROL		X		
OPERATIONS FIRE PROTECTION		X		
PLANT SUPPORT		X		
QUALITY ASSURANCE/QUALITY CONTROL		X		
RADIATION PROTECTION		X		
REGULATORY AFFAIRS		X		
		X		
		X		
		X		

Comments:

Prepared by: (print) AJIT MUKHERJEE (sign) [signature] Date: 9-16-96

Approved by: (print) IJAZ AHMAD (sign) [signature] Date: 9-16-96

Figure 7.2: Design Verification Form

Comanche Peak Steam Electric Station

DESIGN VERIFICATION

DOCUMENT: **CALC.# EE(B)-011R8,CCN#03** | Page 1 of 1

AREA	*REQ'D?*	*METHOD NO.**	*COMMENTS?*	*VERIFIED BY: (print)*	*(sign)*	*DATE*
Mechanical Design						
I&C Design						
Electrical Design	Yes	1	No	MUNAWAR HUSSAIN	[signature]	9/14/96
Civil Design						
Nuclear Design						
Other Design Verifier						

Comments:

Prepared by: (print) AJIT MUKHERJEE (sign) [signature] Date: 9-16-96

Approved by: (print) IJAZ AHMAD (sign) [signature] Date: 9-16-96

*DV Methods are as follows: 1 - Design Review, 2 - Alternate Calculation, 3 - Qualification Test.

FIGURE 7.6
CALCULATION CHANGE NOTICE

CCN NO.	TYPE	CALCULATION NUMBER	REVISION NUMBER	CONFIRMATION REQUIRED
003	SWEC	16345-EE(B)-011	8	☐ YES ☒ NO (DM 9/25/96)
☒ DM 96-013	☐ MM	☐ FX		☐ NONE

Preparer(s): AJIT MUKHERJEE Date: Jul/16/1996
Checker: MUNAWAR HUSSAIN Date: 9/14/96
Engineering Supervisor: IJAZ AHMAD Date: 9-16-96

REASON FOR CHANGE

PER DM # 96-013 , SWING (SPARE) INVERTERS ARE BEING ADDED TO DC BUSES , INVERTER CKTS. ARE BEING REARRANGED AND 225 AMP BATTERY CHARGERS ARE BEING REPLACED BY 300 AMP RATING (REF. DWG # E1-OO18-02 & 02A , AND E1-0020-02 & 02A).

THEREFORE, THIS CALC. NEEDS TO BE REVISED.

ASSOCIATED CALCULATION INFORMATION

SUPERSEDES (SUP)/ SUPPLEMENTS (SPL)	TYPE	NUMBER AND REVISION
N/A	N/A	N/A

FILING INSTRUCTIONS: NONE

DESIGN CHANGE TRENDING CODE 1 / Q EEE* / A F / B

FIGURE 7.2
INDEX SHEET

TU ELECTRIC ENGINEERING

INDEX SHEET	CALCULATION NO.: EE(B)-011	PAGE 2

REV. No.	PAGES REVISED	PAGES ADDED	PAGES DELETED
R - 08 / CCN # 003	Page 4A, 7, 8, 9, 10 Attach #3, Page 2, 5, 8, 10 Attach #10, Page 3	~~NONE~~ 5 AK M 2/23/96 Page 10.1, 10.2, 10.3 & 10.4	~~NONE~~ 24, 25, 26 & 27

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CCN # 003
Page 3 of 20

A 5010.85

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
16345	EE(B)	011R8	XXX	4A OF

Rev # 69
9/27/94

REFERENCES AND INPUTS

3.31 FVM 89-E6-83

3.41 FVM 89-E6-103

3.42 FVM 89-E6-119

3.43 FVM 89-E6-121

3.44 FVM 89-E6-124

3.45 FVM 89-E6-133

3.51 IOC-E-039 (SEE ATTACH. # 1)

3.53 IOC-E-290

3.54 CABLE PULL CARDS

3.55 DCN 5827, REV. 0 R8

3.56 DCA 91172, Rev. 1

3.57. DM # 96-013 (SPEC # CPES-E-1063R0, & SCI Dwgs. CCN #003

3.58 Calc. # 16345-EE(B)-037 R0, CCN # 6

3.59 DBD-EE-052

NOTE :- Voltage drop for battery charger feeds to conservatively DC switchboard has been calculated based on max^m. current (current limiting condition). CCN #003

A 5010.05

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO. 16345	DIVISION & GROUP EE (B)	CALCULATION NO. 011 R8	OPTIONAL TASK CODE XXX	PAGE 7 OF 69

SUPPLEMENT TO CALC VII-8

CABLE SIZE BASED ON VOLTAGE DROP

CABLE # EO-102531 FROM BATT. CHGR BC1ED1 TO SWBD - 1ED1

Cable size is 2-1/c #750 MCM

DC resistance is taken from Ref 3.7 Page 4 (Table 1-3 & 1-4 Page 3)

DC resistance of Cable per 1000' = 0.0148 Ω

Multiplying by the correction factor for resistance at 75°C = 0.0148 × 1.193

= 0.0177 ohm

Actual length of Cable from (REF. 3.51) = 34' (one way) △6

∴ Total resistance of Cable = $(0.0177)\frac{34}{1000} \times 2$

= 0.00120 Ω

△7 Rated output of Battery Charger = 225 A (Ref 3.14)

∴ Voltage drop in Cable EO-102531

△7 = (225 A)(0.00120 ohm)

= 0.270 V DC which is with in acceptable range (see Page 11 of This Calc)

CCN # 003

NOTE :- This Supplemental Calc Page is in addition to Calc VII-8 Rev 5 Appendix B sheet B4.

For this see Page #10.1 | CCN #003

△6

A 5010.85

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO. 16345	DIVISION & GROUP EE(B)	CALCULATION NO. 011 R8	OPTIONAL TASK CODE XXX	PAGE 8 OF 69

SUPPLEMENT TO CALC VII-8

CABLE # EO-102532 FROM BATT. CHGR BC1ED1-2
TO DC SWBD 1ED1 Cable Size 2-1/c #750 MCM

From Ref. 3.7 Page 4, DC Resistance of Cable /1000' = (0.0148)(1.193)
= 0.0177 ohm

Actual Length (REF. 3.51 ') = 32' (one way) 6

∴ Total resistance of Cable = $(0.0177)\left(\frac{32}{1000}\right)(2)$
= 0.0011 ohm 6

7 Rated output of Battery Charger: 225 A

Voltage drop in Cable EO-102532 = (225A)(0.0011Ω)
= 0.25 VDC 6
which is acceptable

CABLE # EG-102591 FROM BATT. CHGR BC1ED2-1
To DC SWBD 1ED2 Cable Size 2-1/C #750 MCM

DC resistance of Cable per 1000' (Same as above) = 0.0177 ohm

Actual Length (REF 3.51 ') = 29.' (one way) 6

Total resistance of Cable = $(0.0177)\left(\frac{29}{1000}\right)(2)$
= .0010 ohm

7 Voltage Drop in Cable EG-102591 = (225)(.0010) = 0.225 VDC 6
which is acceptable.

CABLE # EG-102592 FROM BATT CHGR BC1ED2-2
TO DC SWBD 1ED2 Cable Size 2-1/c #750 MCM

DC resistance of Cable per 1000' (Same as above) = 0.0177 ohm

Actual Length of Cable (REF 3.51) = 33' (one way)
Total Resistance of Cable = $(0.0177)\left(\frac{33}{1000}\right)(2)$
= 0.0012 ohm

7 ∴ Voltage drop in Cable EG-102592 = (225A)(.0012Ω) = .27 VDC
which is acceptable

Conclusion :- Use 1/c 750 MCM per pole for Cables
EO-102531, EO-102532, EG-102591 & EG-102592

Note : This Supplemental Calc Page is an addition to
Calc VII-8 Rev. 5 Appendix B Sheet B4 6

For This Add page #10.1 CEN #003

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

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▲ 5010.05

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 9 OF 69
16345	EE(B)	D11R8	XXX	

SUPPLEMENT TO CALC VII-8

BATT CHGR BC1ED3-1 & BC1ED3-2 TO SWBD 1ED3

Cable Size based on voltage drop

CABLE # EO-103141 FROM BATT CHGR BC1ED3-1 TO DC SWBD 1ED3 Cable Size = 2-1/c #750MCM

DC resistance of Cable per 1000' (Same as on Page 8) = 0.0177 ohm

Actual Length of Cable (REF. 3.51) = 42' (one way) Δ

Total resistance of Cable = $(0.0177)\left(\frac{42}{1000}\right)(2)$

= 0.0015 ohm

7 Voltage drop in Cable = (225A)(0.0015 Ω)

= 0.34 VDC

which is acceptable

CABLE #EO-103142 FROM BATT. CHGR BC1ED3-2 TO DC SWBD 1ED3

Cable Size = 2-1/c # 750 MCM

DC resistance of Cable per 1000' = 0.0177 Ω

Actual Length of Cable (REF 3.51) = 52' (one way) Δ

TOTAL RESISTANCE OF CABLE = $(0.0177)\left(\frac{52}{1000}\right)(2)$

= 0.0018 Ω

7 VOLTAGE DROP IN CABLE = (225A)(0.0018Ω)

= 0.405 V DC

WHICH IS ACCEPTABLE

For this Calc see Page #10.1 CCN #003

NOTE : THIS Supplemental Calc Page is an addition to Calc VII-8 Rev. 5 Appendix B Sheet B4.

CCN #003

Δ2

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

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Page 7 of 20

▲ 5010.65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 10 OF 69
16345	EE(B)	011 R8	XXX	

SUPPLEMENT TO CALC VII-8

CABLE # EG-103146 FROM BATT ~~CHGR~~ BC IED4-1
TO DC SWBD 1ED4 Cable Size = 2-1/c #750 MCM

DC resistance of Cable per 1000' = 0.0177 Ohm
Actual length of Cable (REF. 3.51) = 42' (ONE WAY)

Total resistance of Cable = $(0.0177)\frac{(42)}{1000}(2)$
$= 0.0015\ \Omega$

7 Voltage drop in Cable EG-103146 = (225)(0.0015)
= 0.34 VDC

which is acceptable

CABLE # EG-103147 FROM BATT. CHGR BC IED 1-2
TO DC SWBD 1ED4 Cable Size = 2-1/c #750 MCM
DC resistance of Cable per 1000' = 0.0177 ohm
Actual length of Cable (REF. 3.51) = 47' (oneway)

Total Resistance of Cable = $(0.0177)\frac{(47)}{1000}(2)$
$= .0017\ \Omega$

7 ∴ Voltage drop in Cable EG-103147 = (225)(.0017)
= 0.38 VDC

which is acceptable

Conclusion: Use 1/c 750 MCM per pole for Cables
EO-103141, EO-130142, EG 103146
and EG 103147

2 CAN #003

Note:- This Supplemental Calc Page is an addition to Calc VII-8 Rev.5 Appendix E Sheet B4.

For Ties see Page # 10.1

6

* TABLE - 1

CABLE #	From	To	Pnl # /Bkr size/Ckt#	Cable size	Cable lngth	Cable impd	Bkr. accpt	Cable accpt	Remarks
EΦ102531	BCIED1-1	1ED1	1ED1/500A/2-8	2-1/c#750MCM	50'-0"	0.177Ω/1000ft	Y	Y	DWG#E1-0020
EΦ102532	↓ -2	↓	1ED1/500A/2-9	↓	↓	↓	↓	↓	↓
EΦ102534	1V1PC1		1ED1/150A/2-10	2-1/c#2/0		0.101Ω/1000ft			
EΦ199483	1V1EC-1/3		1ED1/150A/2-11	↓		↓			
EΦ102539	1V1EC1		1ED1/150A/2-13	↓		↓			
EG102591	BCIED2-1	1ED2	1ED2/500A/2-8	2-1/c#750MCM		0.177Ω/1000ft			DWG#E1-0020-A
EG102592	↓ -2	↓	1ED2/500A/2-9	↓		↓			↓
EG102594	1V1PC2		1ED2/150A/2-10	2-1/c#2/0		0.101Ω/1000ft			
EG102599	1V1EC2		1ED2/150A/2-13	↓		↓			
EG199491	1V1EC-2/4	↓	1ED2/150A/2-11	↓		↓			
EΦ103141	BCIED3-1	1ED3	1ED3/500A/2-9	2-1/c#750MCM		0.177Ω/1000ft			DWG#E1-0018-02
EΦ103142	↓ -2	↓	1ED3/500A/2-9	↓		↓			↓
EΦ102535	1V1PC3		1ED3/150A/2-10	2-1/c#2/0		0.101Ω/1000ft			
EΦ103144	1V1EC3		1ED3/150A/2-13	↓		↓			
EΦ199482	1V1EC3-1/3	↓	1ED3/150A/2-11	↓		↓			
EG103146	BCIED4-1	1ED4	1ED4/500A/2-8	2-1/c#750MCM		0.177Ω/1000ft			DWG#E1-0018-2A
EG103147	↓ -2	↓	1ED4/500A/2-9	↓		↓			↓
EG102595	1V1EC4		1ED4/150A/2-10	2-1/c#2/0		0.101Ω/1000ft			
EG103149	1V1PC4		1ED4/150A/2-13	↓		↓			
EG199490	1V1EC4-2/4	↓	1ED4/150A/2-11	↓	↓	↓	↓	↓	↓

* For details See Pages 10.2 Thru 10.4

CCN # 003

FIGURE 7.4
CALCULATION CONTINUATION SHEET

CALC. NUMBER: 16345-EE(B)-011
REV. NUMBER: 8
PAGE NUMBER: 10.2 of 69

Voltage drop Calculation / Ampacity

a) Cable # EG 102531 & 532 (SWBD 1ED1)
EG 103141 & 142 (SWBD 1ED3)
EG 102591 & 592 (SWBD 1ED2)
EG 103146 & 147 (SWBD 1ED4)
[Ref Table 1)

Size = 2-1/C # 750 MCM
Impd. = 0.177 Ω / 1000 ft (Ref 3.59)
Lenght = 50 ft each Cable (max^m.)
Type of Laying = Random lay in Tray. Conduit stubs while entering SWBD / Battery Charger. NO Thermolag

Ampacity of Cable = 608 A (Ref 3.59, Table 4)
Max^m. load of Charger = 375A (Ref. 3.57)*

Therefore 2-1/C #750 mcm Cable Size is acceptable since

375A < 608A.

(A) Voltage drop = $2 \times 50 \times 375 \times 0.177 / 1000$ V = 6.638 V
Voltage drop Calc for 135 V DC at battery charger ≈ 6.64 V

Min. voltage available at SWBD = (135 - 6.64V)
= 128.36 V [135V = Float voltage]
Voltage drop is acceptable and

Therefore, Cable size 2-1/C #750 mcm is acceptable.

BKR Size 600AF/500A is acceptable as it will protect the cable and max^m. load 375A is ≈ 80% of 500A BKR Size.

* SCI Dwg # 10-102879 SH 1

ECN #603

FIGURE 7.4
CALCULATION CONTINUATION SHEET

CALC. NUMBER: 16345-EE(B)-011
REV. NUMBER: 3
PAGE NUMBER: 10.3 of 69

(b) Cable # E♀102534, E♀199483, E♀102539 (SWBD 1ED1)
EG102594, EG102599, EG199491 (SWBD 1ED2)
E♀102535, E♀103144, E♀199482 (SWBD 1ED3)
EG102595, EG103149, EG199490 (SWBD 1ED4)
[Ref. Table 1].

Size of Cable = 2-1/C # 2/0 AWG
Length of each Cable = 50 ft (max^m.)
Imp. of Cable = 0.101 Ω/1000 ft
Type of laying = Random Lay in tray, no thermolag, Conduit Stub while entering Sw. BD / Inverter

Ampacity of Cable = 154 A [Ref. 3.59, Table 4]
Max^m input Current of inverter = 125A (Ref. 3.57*) at 100V & therefore at 105V, Inv. Current ≈ 119A and nominal load Current (output of) Inverters ≈ 83A [Ref 3.57*]

Therefore Cable size is acceptable.

Voltage drop = $\frac{2 \times 119.0 \times 50 \times 0.101}{1000}$ V = 1.2V

Therefore Voltage at Inverter = (125 - 1.20)V
= 123.80 V which is acceptable
[125V min. voltage assumed per spec. (Ref. 3.57)

150A BKR is acceptable as 150A > 1.25 × 119A
i.e 150A > 149A.

* SCI Dwg # 10-102879 SH1

CCN #003

CEN #003
Page 11 of 40

FIGURE 7.4
CALCULATION CONTINUATION SHEET

CALC. NUMBER: 16345-EE(B)-011
REV. NUMBER: B
PAGE NUMBER: 10.4 of 67

CEN #003

(B) Voltage drop Calculation based on min^m. Battery Volt = 105V

a) All DC switch. Puls except the inverters have been evaluated based on 105V Battery terminal voltage and found that the available voltage are acceptable (see Pages 12 Thru 19).

b) voltage drop for Inverters :- IVIPC1, 2, 3 & 4 and IVIEC1, 2, 3 & 4 — All inverters are 10 KVA supplied by SCI, min 100V & max^m. 140V DC input Ref 3.57.

① max^m. voltage drop from switch to Inverter = 1·2V based on 105V at Battery terminal (see page 10.3)

② Min^m. voltage available at DC switch(s) when battery terminal voltage 105V = 104·38V (See Pages 12, 15, 18 & 19)

Therefore, minimum voltage available at Inverter(s) terminal = (104·38 - 1·2) VDC
= 103·18 VDC

Min^m. voltage required for Inverter(s) = 100 V DC (Ref. 3·57, Spec # CPES-1063 R0).

Therefore, based on min^m. Battery terminal voltage 105V DC (at the end of duty cycle) available, the Cable sizes are acceptable and also the voltage drop(s) is acceptable.

This page will replace pages 24, 25, 26 & 27. During next revision, pages will be renumbered.

A 8010.85

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 24 OF 69
16345	EE (B)	011 R8	XXX	

SUPPLEMENT TO CALC VII-B

1. 7.5KVA STATION INVERTER 1VIPC1 (CLASS 1E)
(TAG NO. TBX-ESLIV-01)
7.5KVA STATION INVERTER 1VIPC3 (CLASS 1E)
(TAG NO. TBX-ESLIV-03)

(a) Cable Size Based on Ampacity:

6 1. Cable is routed in conduit and in tray with total length of 22' & 24' (one way) from (REF. 3.51)

2. Conductor overcurrent protection is provided by a 100/15 amp trip thermal magnetic breaker Therefore the cable required in accordance with reference 2-3 article 240-3 is as follows.
Cable required size/Type = #2 AWG 2/C

FROM CALC. 037, PG. 39, AMP. LOAD = 68.11A(2), FOR CABLE AMPACITY CONSIDERATION, AND 74.59A(2) FOR VOLTAGE DROP CONSIDERATION

5 6 ∴ FROM DBD-EE-052, ATTACHMENT #4, REV. 2, THE AMPACITY OF THIS CABLE, IN CONDUIT WITH FIRE STOP, IS 92A WHICH IS ACCEPTABLE. (ALSO, SEE ATTACHMENT #10 OF THIS CALC.)

(b) Cable Size based on Voltage drop

NOTES (1) AVERAGE LOAD (2) MAXIMUM LOAD

For Cable # E0-102534 & E0-102535

1. Minimum required design voltage at inverter is 105 VDC
2. Battery terminal voltage is taken at the end of the duty cycle (4 Hours) just prior to restoration of A.C. power (111.0 VDC)
3. From Page 12, 18 of this Calc, max voltage drop between Battery and Switchboard is 0.618 VDC
Therefore Minimum voltage at SWBD = 111.0 − 0.618
= 110.382 VDC
4. Based on Size 2/c #2 1Per pole Dc resistance per 1000' = 0.2016 Ω
Length of Cable E0-102535 = 24' (one way) from (REF. 3.51) and Considering the larger Cable
DC resistance of Cable = $0.2016 \left(\frac{24}{1000}\right) \times 2 = 0.0097\ \Omega$
Worst Case Current at 105 VDC
From Calc 037, PAGE 39 = 74.59A
7 ∴ Voltage drop in Cable = 74.59 × 0.0097
= .7235 VDC
Which is with in reasonable limits and is acceptable.
7 ∴ Minimum voltage = 110.382 − .7235 = 109.658 VDC

7 CONCLUSION :- Use 2/C #2 AWG Cable from 125 VDC SWBD to Inverters 1VIPC1 and 1VIPC3

NOTE :- This Supplemental Calc. Page replaces Calc VII-B Rev. 5 Appendix 'E' Sheet E4 and E5.

6

This page deleted (CCN #003)

A 5010.85

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 25 OF 69
16345	EE(B)	011 R8	XXX	

(This Page deleted — CEN #003)

2. 10KVA STATIC INVERTER (VIEC) (CLASS 1E)

(TAG NO CPI-ECIVEC-01)

a. Cable Size Based on Ampacity

5 6 1. Cable # EO-102539 is routed in Conduit and Tray with total length of 25' (one way) see (REF. 3.51)

2. Conductor over current protection is provided by a 125A trip Thermal magnetic breaker Therefore, The Cable Size required in accordance with reference 2.3 Article 240.3 of Calc VII-8 Rev.5 is as follows

Cable required Size) Type # 2/0 AWG 2 x 1/c

10 ∴ FROM CALC. 37, PG. 34A, AMP. LOAD = 80.71A FOR CABLE AMPACITY CONSIDERATION, AND 88.39A FOR VOLTAGE DROP CONSIDERATION FROM DBD-EE-052, ATTACHMENT #4, REV. 2, THE AMPACITY OF THIS CABLE, IN CONDUIT WITH FIRE STOP, IS 157A WHICH IS ACCEPTABLE (ALSO SEE ATTACHMENT #10 OF THIS CALC.)

b. Cable Size based on Voltage drop

For Cable # EO-102539

1. Minimum required design voltage at inverter is 105 VDC
2. Battery terminal voltage is taken at the end of the duty Cycle (4 Hours) just prior to restration of A.C. power (111.0 VDC)
7 3. From Page 12 of this Calc, maximum voltage drop between Battery and Switchboard is 0.618 VDC
7 Therefore minimum voltage at SWBD 1ED1 = 111.0 - .618
4. Based on Size 2-1/c # 2/0 1 Per Pole = 110.382 VDC
DC resistance per 1000' = 0.10057 Ω
Length of Cable EO-102539 = 25' (one way)
DC resistance of Cable = $0.10057 \times \frac{25}{1000} \times 2$ Ref attach #1

Worst Case current at = 0.0050 ohms
105 VDC from Calc 037, PAGE 34A = 88.39A
Voltage drop in cable EO-102539 = 88.39 x 0.0050 = 0.44 VDC
which is within reasonable limits and is acceptable

7 ∴ Minimum voltage = 110.382 − 0.44 = 109.942 VDC

6

CONCLUSION : Use # 2/0 AWG 2x1/c Cable from SWBD 1ED1 to 1VIEC1

NOTE :- This supplement Calc Page replaces Calc. VII-8 Rev. 5 Appendix 'E' Sheet E6 and E7

A 9010.85

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 26 of 69
16345	EE(B)	011 RB	XXX	

This Page Added CON #003

SUPPLEMENT TO CALC VII-B

1. 7.5 KVA STATIC INVERTER 1VIPC2 (CLASS 1E)
(TAG NO. TBX-ESE LIV-02)
7.5 KVA STATIC INVERTER 1VIPC4 (CLASS 1E)
(TAG NO. TBX-ESE LIV-04)
Cable # EG-102594 and EG-102595

See Calculation for 7.5 KVA Inverters 1VIPC1 and 1VIPC3, on page 24 of This Calculation
Reference and assumptions are identical for inverters 1VIPC1, 1VIPC2, 1VIPC3 & 1VIPC4
Since the longest length is for 1VIPC2 (31') (REF. 3.5.1)
and max Current output at 105VDC from CALC037, PAGE 39 = 74.59A

∴ Maximum Voltage drop = $0.2016 \times \frac{31}{1000} \times 2 \times 74.59 = 0.932$ VDC
(See Page 24)

∴ Minimum voltage at Inverter = $111.0 - 0.442 - 0.932 = 109.626$ VDC
(SEE PAGES 11, 15, 19)

CONCLUSION :- Use 2/c #2 AWG Cable from 125 VDC Switchboard to inverters 1VIPC2 & 1VIPC4
Ampacity is 92 Amps which is acceptable ref attach #10

2. 10 KVA STATIC INVERTER 1VIEC2 (CLASS 1E)
(Tag No. CP1-ECIVEC-02)
Cable # EG-102599

See Calculation for 10 KVA inverter 1VIEC1 on Page 25 of This Calc

Reference and assumptions are identical for inverters 1VIEC1 and 1VIEC2
Since length of the feeder for 1VIEC2 is 32'

∴ Maximum Voltage drop = $0.10057 \times \frac{32'}{1000} \times 2 \times 81.70$
(See Page 25)
$= 0.526$ VDC
Which is within acceptable range (Ref Page 11)

∴ Minimum Voltage = $111.0 - 0.442 - 0.526 = 110.032$ VDC
(See Page 11) (See Page 15)

CONCLUSION : Use # 2/0 AWG 2x1/c Cable from 125 VDC SWBD 1ED2 to inverter 1VIEC2
Ampacity is 157 A is acceptable See attach #10

Note:- This Supplemental Calc Page replaces Calc VII-B Rev. 5 appendix E sheet E9.

A 5010.05

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE 27 of 39
16345	EE(B)	011 R8	XXX	

SUPPLEMENT TO CALC VII-8

125 VDC SWITCHBOARD 1ED3

1. 10KVA SUPS 1VIEC3

a) Circuit Breaker Sizing :

Assume the inverter to be 100% loaded. From Ref. 27 SH.E2A of Calc. VII-8 Rev.5, the current input to the inverter is indicated by the vendor to be 110A.

However, the calculated current required at 105 V DC is 83.7A (SEE CALC.-37, PG.34A). Therefore the 110A is a conservative upper limit for the current drawn by the inverter

Size the breaker for 110A and select the next available standard size.

Use 225AF/125AT G/E TYPE THFK Breaker.

b) Cable size based on ampacity :-

CABLE # EO-103144 FROM SWBD 1ED3 TO 10KVA INVERTER 1VIEC3

1. Cable is routed in Conduit and Tray (maintaining spacing) with total length of 64'. (REF. 3.51)

2. The Cable is protected by a 125A breaker Refer to table 2 Page 12 of Calc VII-8 Rev. 5 and select # 210 Cable which is good for 157A in conduit with fire stop, from DBD-EE-052 REV. 2, ATTACHMENT # 4.

NOTE :- This Supplemental Calc. Page replaces Calc VII-8 Rev. 5 Appendix 'E' Sheet-E49.

This page deleted Cen # 003

CCN #003

Note * - 12500 VA load has been assumed which is more than calculated value ref. Calc. 16345-EE(B)-037R4. CCN #6 as conservatism and this will avoid frequent Calc. Change due to change of loading.

12500 = 100V x 125A - see SCI Drwg # 10-1028795H1

LOAD LIST TABULATION

Page No. 1
11/02/98

COMANCHE PEAK ELECTRICAL DATABASE
J.O. 16345 ISSUE 002 Dated 10/13/98
CLASS 1E 125v DC LOAD LIST - Report CPEB-EL53
Sorted by (Panelboard, Circuit Number)

Item No.	Panel Board	Ckt No.	Load Description	Tag / Spin Number	Train	Load Data (Watts)	Full Load Current (Amps)	Momentary Current (Amps)	CB/ Fuse Rating	CB Frame Size	Data Input Number(s)	Remarks	Outline Drawing	Date Last Update
** Panelboard 1EB1														
275	1EB1	1-1	BATTERY BT1EB1	CP1-EPBTEB-01	A	0.00	0.000	0.00	1200	0		FUSE	E1-0020 CP-7	11/02/98
276	1EB1	1-2	DC PNL 1EB1-1	CP1-ECDPEB-01	A	900.28	7.263	5.40	200	0	6*	FUSE NOTE 4	E1-0020 CP-7	11/02/98
236	1EB1	1-3	SPARE			0.00	0.000	0.00	100	0		FUSE	E1-0020 CP-7	11/02/98
237	1EB1	1-4	SPARE			0.00	0.000	0.00	100	0		FUSE	E1-0020 CP-7	11/02/98
277	1EB1	1-5	DC PNL 1EB1-2	CP1-ECDPEB-03	A	2034.29	16.440	366.00	200	0		FUSE NOTE 4	E1-0020 CP-7	11/02/98
238	1EB1	1-6	SPARE			0.00	0.000	0.00	200	0		FUSE	E1-0020 CP-7	11/02/98
278	1EB1	1-7	DC PNL 1EB1-1	CP1-ECDPEB-01	A	3813.30 *12500	30.906 109	25.41	200 150	0		FUSE NOTE 4	E1-0020 CP-7	11/02/98
61	1EB1	2-10	INVERTER IVIPC1	TBX-ESELIV-01	A	~~7852.00~~	~~68.110~~	0.00	~~100~~	225	7 & 26	FULL LOAD AT 115VDC	E1-0020 CP-7	11/02/98
4 60	1EB1	2-11	~~SPARE~~ ~~INVERTER IVIPC2~~ INVERTER IVIEC1/3	~~TBX-ESELIV-02~~ CP1-ECIVEC-05	~~A~~	~~7852.00~~ 0.00 *12500	~~68.110~~ 0.00 109	0.00	~~100~~ 150	225	~~7 & 26~~	~~FULL LOAD AT 115VDC~~ Full load at 115V DC	E1-0020 CP-7	11/02/98
239	1EB1	2-12	FUTURE			0.00	0.000	0.00	0	225			E1-0020 CP-7	11/02/98
62	1EB1	2-13	INVERTER IVIEC1	CP1-ECIVEC-01	A	9201.70 * 12500	~~80.710~~ 109	0.00	~~225~~ 150	225	25 & 6	ACTUAL LOAD AT 115VDC	E1-0020 CP-7	11/02/98
200	1EB1	2-14	SPARE			0.00	0.000	0.00	30	100			E1-0020 CP-7	11/02/98
241	1EB1	2-15	SPARE			0.00	0.000	0.00	30	100			E1-0020 CP-7	11/02/98
242	1EB1	2-16	FUTURE			0.00	0.000	0.00	0	100			E1-0020 CP-7	11/02/98
243	1EB1	2-17	FUTURE			0.00	0.000	0.00	0	100			E1-0020 CP-7	11/02/98
279	1EB1	2-8	BAT CHGR BC1EB1-1	CP1-EPBCEB-01	A	0.00	0.000	0.00	400	400			E1-0020 CP-7	11/02/98
280	1EB1	2-9	BAT CHGR BC1EB1-2	CP1-EPBCEB-03	A	0.00	0.000	0.00	400	400			E1-0020 CP-7	11/02/98
4	** Subtotal **					~~13804~~ -31723.2	~~203.027~~ -271.139	396.81						

CCN #003

STONE & WEBSTER ENGINEERING CORPORATION
CALCULATION SHEET
CALC. 16345-EE(B)-011R8 ATTACHMENT #3, PAGE 2 OF 13
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APPENDIX

J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
16345	EE(B)	037	XXX	3 PAGE 11

CALCULATION IDENTIFICATION NUMBER

* See Note on page 2, attach. #3 of this Calc. | CCN #003

Page No. 4
11/02/88

LOAD LIST TABULATION

LONGNECKE PEAK ELECTRICAL DATABASE
J.O. 16345 ISSUE 002 Dated 10/13/88
CLASS 1E 125v DC LOAD LIST - Report CPED-EL5A
Sorted by (Panelboard, Circuit Number)

Item No.	Panel Board	Ckt No.	Load Description	Tag / Spin Number	Train	Load Data (Watts)	Full Load Current (Amps)	Momentary Current (Amps)	CB/ Fuse Rating	CB Frame Size	Data Input Number(s)	Remarks	Oneline Drawing	Date Last Update
** Panelboard 1EB2														
201	1EB2	1-1	BATTERY BT1EB2	CP1-EPBTEB-02	B	0.00	0.000	0.00	1200	0		FUSE	E1-0020BLA CP2	11/02/88
202	1EB2	1-2	BC PNL 1EB2-1	CP1-ECBPEB-02	B	1084.00	8.669	5.40	200	0		FUSE NOTE 4	E1-0020BLA CP2	11/02/88
204	1EB2	1-3	SPARE			0.00	0.000	0.00	100	0		FUSE	E1-0020BLA CP2	11/02/88
205	1EB2	1-4	SPARE			0.00	0.000	0.00	100	0		FUSE	E1-0020BLA CP2	11/02/88
203	1EB2	1-5	BC PNL 1EB2-2	CP1-ECBPEB-04	B	1779.02	14.235	342.00	200	0		FUSE NOTE 4	E1-0020BLA CP2	11/02/88
206	1EB2	1-6	SPARE			0.00	0.000	0.00	200	0		FUSE	E1-0020BLA CP2	11/02/88
204	1EB2	1-7	BC PNL 1EB2-1	CP1-ECBPEB-02	B	* 3381.50	27.076	11.80	200	0		FUSE NOTE 4	E1-0020BLA CP2	11/02/88
						* 12500	109		150			CCN #003		
84	1EB2	2-10	INVERTER IV1PC2	TB1-EBB1.IV-02	B	~~7992.80~~	~~68.110~~	0.00	~~100~~ 150	225	7,26	FULL LOAD AT 115VDC	E1-0020BLA CP2	11/02/88
4	83	1EB2	2-11 ~~SPARE~~ ~~INVERTER IV1PC4~~ INVERTER IV1EC2/4	CP1-ECIVEC-06 ~~TB1-EBB1.IV-04~~	* 12500 ~~0.00~~	~~0~~ ~~7992.80~~	109 ~~0.000~~ ~~68.110~~	0.00	150 ~~100~~	225	~~7,26~~	Full load ~~FULL LOAD AT 115VDC~~ at 115VDC	E1-0020BLA CP2	11/02/88
247	1EB2	2-12	FUTURE		*	0.00	0.000	0.00	0	225			E1-0020BLA CP2	11/02/88
						12500	109		150					
82	1EB2	2-13	INVERTER IV1EC2	CP1-ECIVEC-02	B	~~8870.40~~	~~79.396~~	0.00	125	225	25,6	ACTUAL LOAD AT 115VDC	E1-0020BLA CP2	11/02/88
248	1EB2	2-14	SPARE			0.00	0.000	0.00	30	100			E1-0020BLA CP2	11/02/88
249	1EB2	2-15	SPARE			0.00	0.000	0.00	30	100			E1-0020BLA CP2	11/02/88
250	1EB2	2-16	FUTURE			0.00	0.000	0.00	0	100			E1-0020BLA CP2	11/02/88
251	1EB2	2-17	FUTURE			0.00	0.000	0.00	0	100			E1-0020BLA CP2	11/02/88
205	1EB2	2-8	BAT CHGR BC1EB2-1	CP1-EPBCEB-02	B	0.00	0.000	0.00	400	400			E1-0020BLA CP2	11/02/88
206	1EB2	2-9	BAT CHRG BC1EB2-2	CP1-EPBCEB-04	B	0.00	0.000	0.00	400	400			E1-0020BLA CP2	11/02/88
4	** Subtotal **					~~22655.8~~ ~~20488.4~~	~~182.68~~ ~~260.796~~	357.20				CCN #003		

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* See Note on page 2, attach 3, of this Calc. | CCN #003

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11/02/98

LOAD LIST TABULATION

COMANCHE PEAK ELECTRICAL DATABASE
J.O. 16345 ISSUE 002 Dated 10/13/98
CLASS 1E 125v DC LOAD LIST - Report CPEB-EL3A
Sorted by (Panelboard, Circuit Number)

Item No.	Panel Board	Ckt No.	Load Description	Tag / Spin Number	Train	Load Data (Watts)	Full Load Current (Amps)	Momentary Current (Amps)	CB/ Fuse Rating	CB Frame Size	Data Input Number(s)	Remarks	Oneline Drawing	Date Last Update
** Panelboard 1EB3														
207	1EB3	1-1	BATTERY BT1EB3	CP1-ETBTEB-03	A	0.00	0.000	0.00	1000	0		FUSE	E1-0010-2 CPS	11/02/98
232	1EB3	1-2	SPARE			0.00	0.000	0.00	200	0		FUSE	E1-0010-2 CPS	11/02/98
233	1EB3	1-3	SPARE			0.00	0.000	0.00	100	0		FUSE	E1-0010-2 CPS	11/02/98
234	1EB3	1-4	SPARE			0.00	0.000	0.00	100	0		FUSE	E1-0010-2 CPS	11/02/98
235	1EB3	1-5	SPARE			0.00	0.000	0.00	200	0		FUSE	E1-0010-2 CPS	11/02/98
236	1EB3	1-6	SPARE			0.00	0.000	0.00	200	0		FUSE	E1-0010-2 CPS	11/02/98
208	1EB3	1-7	DC PNL 1EB3-1	CP1-ECEPEB-05	A	* 43.70	0.350	0.00	200	0		FUSE	E1-0010-2 CPS	11/02/98
257	1EB3	2-10	SPARE → INVERTER 1VIPC3	TBX-ESELIV-03	A	* 12500	109		150	225		Full load at 115 V DC	E1-0010-2 CPS	11/02/98
4 258	1EB3	2-11	~~SPARE~~ INVERTER ~~1VIPC3~~	~~TBX-ESELIV-03~~ A		~~7852.40~~	~~68.110~~		150	225	7.26	FULL LOAD AT 115 VDC	E1-0010-2 CPS	11/02/98
259	1EB3	2-12	FUTURE			0.00	0.000	0.00	0	225			E1-0010-2 CPS	11/02/98
104	1EB3	2-13	INVERTER 1VIEC3	CP1-ECIVEC-03	A	* 12500	109	0.00	150	225	25.4	ACTUAL LOAD AT 115VDC	E1-0010-2 CPS	11/02/98
260	1EB3	2-14	SPARE			0.00	0.000	0.00	30	100			E1-0010-2 CPS	11/02/98
261	1EB3	2-15	SPARE			0.00	0.000	0.00	30	100			E1-0010-2 CPS	11/02/98
262	1EB3	2-16	FUTURE			0.00	0.000	0.00	0	100			E1-0010-2 CPS	11/02/98
263	1EB3	2-17	FUTURE			0.00	0.000	0.00	0	100			E1-0010-2 CPS	11/02/98
289	1EB3	2-8	BAT CHGR BC1EB3-1	CP1-EPBCEB-03	A	0.00	0.000	0.00	400	400			E1-0010-2 CPS	11/02/98
290	1EB3	2-9	BAT CHGR BC1EB3-2	CP1-EPBCEB-07	A	0.00	0.000	0.00	400	400			E1-0010-2 CPS	11/02/98
4	** Subtotal **					~~16666.60~~ ~~8888.70~~	~~144.890~~ ~~76.700~~	0.00				CCN #003		

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STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

CALCULATION IDENTIFICATION NUMBER

J.O.OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
16345	EE(B)	037	XXX	17

* See note on Page 2, attach. #3 of this Calc. | CCN # 003 |

STONE & WEBSTER ENGINEERING CORPORATION — APPENDIX

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CALC. 16345-EE(B)-011 R8 ATTACHMENT # 3 PAGE 10 OF 13

J.O. OR W.O. NO.	DIVISION & GROUP	CALCULATION NO.	OPTIONAL TASK CODE	PAGE
16345	EE(B)	037	XXX	19

CALCULATION IDENTIFICATION NUMBER

Page No. 9
11/02/88

LOAD LIST TABULATION

COMANCHE PEAK ELECTRICAL DATABASE
J.O. 16345 ISSUE 002 Dated 10/13/88
CLASS 1E 125v DC LOAD LIST - Report CPEB-EL5A
Sorted by (Panelboard, Circuit Number)

Item No.	Panel Board	Ckt No.	Load Description	Tag / Spin Number	Train	Load Rate (Watts)	Full Load Current (Amps)	Momentary Current (Amps)	CB/ Fuse Rating	CB Frame Size	Rate Input Number(s)	Remarks	Oneline Drawing	Rate Last Update
** Panelboard 1EB4														
291	1EB4	1-1	BATTERY BT1EB4	CP1-EPSTEB-04	B	0.00	0.000	0.00	1000	0		FUSE	E1-0010-02A CP2	11/02/88
264	1EB4	1-2	SPARE			0.00	0.000	0.00	200	0		FUSE	E1-0010-02A CP2	11/02/88
265	1EB4	1-3	SPARE			0.00	0.000	0.00	100	0		FUSE	E1-0010-02A CP2	11/02/88
266	1EB4	1-4	SPARE			0.00	0.000	0.00	100	0		FUSE	E1-0010-02A CP2	11/02/88
267	1EB4	1-5	SPARE			0.00	0.000	0.00	200	0		FUSE	E1-0010-02A CP2	11/02/88
268	1EB4	1-6	SPARE			0.00	0.000	0.00	200	0		FUSE	E1-0010-02A CP2	11/02/88
292	1EB4	1-7	BC PNL 1EB4-1	CP1-ECBPEB-06	B	* 43.70	0.350	0.00	200	0		FUSE	E1-0010-02A CP2	11/02/88
295	1EB4	2-10	SPARE			0.00	0.000	0.00	100	225			E1-0010-02A CP2	11/02/88
269	1EB4	2-11	SPARE		B	7830.00	68.110	0.00	150	225	7,26	FULL LOAD AT 115VDC	E1-0010-02A CP2	11/02/88
270	1EB4	2-12	FUTURE			0.00	0.000	0.00	0	225			E1-0010-02A CP2	11/02/88
106	1EB4	2-13	INVERTER 1VIEC4	CP1-ECIVEC-04	B	4833.40	42.030	0.00	125	225	25.4	ACTUL LOAD AT 115VDC	E1-0010-02A CP2	11/02/88
271	1EB4	2-14	SPARE			0.00	0.000	0.00	30	100			E1-0010-02A CP2	11/02/88
272	1EB4	2-15	SPARE			0.00	0.000	0.00	30	100			E1-0010-02A CP2	11/02/88
273	1EB4	2-16	FUTURE			0.00	0.000	0.00	0	100			E1-0010-02A CP2	11/02/88
274	1EB4	2-17	FUTURE			0.00	0.000	0.00	0	100			E1-0010-02A CP2	11/02/88
293	1EB4	2-8	BAT CHGR BC1EB4-1	CP1-EPBCEB-06	B	0.00	0.000	0.00	400	400			E1-0010-02A CP2	11/02/88
294	1EB4	2-9	BAT CHGR BC1EB4-2	CP1-EPBCEB-08	B	0.00	0.000	0.00	400	400			E1-0010-02A CP2	11/02/88
** Subtotal **						16310.00	141.790	0.00						

INVERTER 1VIEC4 TBX-ELEUV-04 12500 109 150

INVERTER 1VIPC4 TBX-ESELIV-04 B 7830.00 68.110 150

IVIEC2/4 CP1-ECIVEC-06 * 12500 109

1VIPC4 TBX-ESELIV-04 * 12500 109 150

Full load at 115VDC

CCN #003

CCN #003

APPENDIX

STONE & WEBSTER ENGINEERING CORPORATION

CALCULATION SHEET

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A 5010 65

CALCULATION IDENTIFICATION NUMBER				
J.O. OR W.O. NO. 16345	DIVISION & GROUP EE(B)	CALCULATION NO. 011 R8	OPTIONAL TASK CODE XXX	PAGE ___

ATTACHMENT # 10 PAGE 3 OF 9

TABLE 'A'

SR No.	CALC Page	Cable NO	Mark NO	Cable Size	Limiting Raceway	Full Load Amp	Brkr or Fuse Rating	Ampacity	Remarks (for NOTES, see P 8.9)
1	6	EO-130666	W109	500 MCM	CFS	297.5	—	384	CCN #
2	7	EO-102531	W108	750 MCM	CFS	~~225~~ 300	~~400~~ 500	486	003
3	8	EO-102532	W108	750 MCM	CFS	~~225~~ 300	~~400~~ 500	486	
4	8	EG-102591	W208	750 MCM	CFS	~~225~~ 300	~~400~~ 500	486	
5	8	EG-102592	W208	750 MCM	CFS	~~225~~ 300	~~400~~ 500	486	
6	9	EO-103141	W108	750 MCM	CFS	~~225~~ 300	~~400~~ 500	486	
7	9	EO-103142	W108	750 MCM	CTHLG	~~225~~ 300	~~400~~ 500	428	
8	10	EG-103146	W208	750 MCM	CFS	~~225~~ 300	~~400~~ 500	486	
9	10	EG-103147	W208	750 MCM	CFS	~~225~~ 300	~~400~~ 500	486	
10	12	EO-102544	W118	2/0	TTHLG	30.50	200	99	NOTE 1
11	13	EO-102538	W109	500 MCM	TTHLG	16.44	200	267	R8
12	14	EO-102533 & EO-102545	W118	2/0	TFS	7.26	200	118	NOTE 1
13									
14	—	EO-202533	W118	2/0	—	—	—	—	UNIT 2 CABLE, N/A TO CALC.
15	15	EG-102604	W218	2/0	TFS	27.08	200	118	NOTE 1
16	16	EG-102598 M	W208	750 MCM	CFS	14.235	200	486	
17	16	EG-102598 N	W208	750 MCM	CFS	14.235	200	486	
18	17	EG-102593 & EG-102605	W218	2/0	TFS	8.67	200	118	NOTE 1
19									
20	—	EG 202593	W218	2/0	—	—	—	—	UNIT 2 CABLE N.A TO CALC.

TU ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION
ELECTRICAL AND INSTRUMENTATION & CONTROLS ENGINEERING - CPSES E09

FAX NUMBER (817)897-8745

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DATE: 10 / 3 / 96

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Name Phone/Ext. Number

Telecopy No.: (301) 415-3861

From: IJAZ AHMAD / (817) 897-8126
Name Phone/Ext. Number

No. of Pages (including Cover Sheet): 13

Comments:

ATTACHMENT 5

13.7 KW
3.6
+ 33.0

50.3 KW

With respect to the 7000 KW rating of the diesel generator, these losses are equivalent to approximately 0.75 %. Therefore, in addition to the 1.25 % losses for the running condition identified above, an additional 0.75% or a total of 2.00 % of load is used for running losses to account for all losses down to the 120V level.

13. Losses are calculated as a percentage of the sum of running and starting MVA as explained in Items 11 and 12. At each load step, the prior running load is carried forward from the preceding time step. The prior load is increased at the next time step by the addition of the incremental motor loading from the preceding time step.

MVA values are calculated using vector addition as follows:

$$MVAt = \sqrt{(MWr + MWs)^2 + (MVARr + MVARs)^2}$$

where:

MVAt	=	total MVA for the time step
MWr	=	running MW
MWs	=	starting MW
MVARr	=	running MVAR
MVARs	=	starting MVAR

14. In some instances, equipment is determined to have a starting requirement based on manual operation or system flow, temperature etc. rather than an actual LOCA or Blackout start signal. However as discussed in Item no. 3 above, the conservative loading approach was adopted with "as required" loads starting at the initial time step.

→ 15. The Emergency Diesel Generator loading (load block by load block) will be compared to the following:

a. Per IEEE 387, section 5.1.2(5) (Reference 3), the maximum voltage dip on load acceptance shall not exceed the minimum requirement which is 20% of rated voltage, except for the initial voltage dip resulting from the energization of two 2000/2667 KVA, 6900/480V switchgear transformers upon application of the first load block at 10 seconds (Assumption 11).

From the test report, (Input 6), Page 25, for the initial loading of 1700 KW load, the voltage dipped to 6075 V (88%), which is within the required criteria.

b. The maximum frequency dip on load acceptance shall not exceed 5 percent of rated frequency per Regulatory Guide 1.9 (Reference 5).

From the factory test report (Input 6), Page 25, frequency was found to dip to 59.5 cycles for the initial loading of 1700 KW load and is within the requirements of Regulatory Guide 1.9.

c. Two seconds (40 % of the 5 second load step interval) is the maximum recovery time from 80 % voltage to 90 % voltage, and from 95% frequency to 98% frequency, following the maximum load acceptance voltage and frequency dips as required by Regulatory Guide 1.9.

From the factory test report (Input 6), Page 25, voltage recovery from 88% to 100% occurs within 0.44 seconds for the initial loading of a 1700 KW load. From Page 26 of Input 6, frequency recovery from 57.6 cycles to 98 % of 60 cycles occurs within 3.24 seconds for the initial loading of 1700 KW load with a prior loading of 5600 KW which exceeds 40% of the next step increment (5 seconds). However, voltage and frequency sufficiently recovered prior to the application of new load at the next step.

d. The largest load block factory test report (Input 6, simulated blackout test) calculated values are:

MVA	11.758
MW	8.560
MVAR	8.061

In accordance with Attachment B, the MVA will be used as acceptance criteria.

16. Adjustments are made for the following:

a. Out of sequence starting of the largest motor, Component Cooling Water Pump

b. Reduction in Containment Spray Pump requirement (840 to 660 HP) after 25 seconds of operation (Input 15)

c. Securing Aux. Feedwater Pumps and HVAC Chillers upon initiation of Residual Heat Removal Pumps (Inputs 12 and 14)

d. As-built test data kVA for selected loads (Attachment G) is derived from actual test records using empirical data for voltage and current as follows:

$$kVA = \frac{\sqrt{3} \times E(AVG) \times I(AVG)}{1000}$$

ATTACHMENT B

IMO DELAVAL, INC. LETTER DATED 4/21/88

Calculation No. EE-CA-0007-3376
Revision No. 0 1

JAB
11/28/94

Imo Delaval Inc.
Enterprise Engine Division
Enterprise Way and 66th Avenue
P. O. Box 2161
Oakland, CA 94621
415 877 7491

April 21, 1988

STONE & WEBSTER ENGINEERING CORPORATION
245 Summer Street
Boston, Massachusetts 02107

Attention: Rocky Schustrin

Gentleman:

I have compared the factory sequential loading test results with the loading sequence outlined in the Stone and Webster telefax of 4/8/88, and can report as follows:

1. LOCA loading transients are less severe than blackout loading transients. Therefore, the analysis is confined to the latter sequence.

2. The response curve for the factory sequential loading test (2.6.6.1A) shows that a significant margin existed above the specified minimum response. Those specifications required that voltage not dip below 20% of rated voltage and it must recover to 100% of rated within 2 seconds. Frequency dip must not exceed 5% of rated frequency, and must recover to 98% within 2 seconds. The values therefore are 6.9 KV rated, 5.52 KV minimum, 60 HZ rated, 57 HZ minimum, recovering to 58.8 HZ within two seconds. The minimum voltage experienced at the factory was 6.075 KV at step #1, while the minimum frequency in all steps, except #6, was 58.6 HZ. Step 6 will be addressed below. Voltage recovery occurred at less than one second, except for step 1, where it required a little over one second, while frequency recovery was worst case at step 4, requiring .96 seconds. It must be remembered that frequency deviation is caused by changes in generator shaft torque absorption, and this is a function of KW, KVAR not playing a role.

3. Frequency control is in part a function of the system's ability to change the rate of heat release in the engine cylinders. This ability remains rather constant as long as the upper end of the control range is not

encountered. The engine's fuel injection pumps have a mechanical stop at 48 MM of fuel pump rack travel because it was determined by test that injection spray characteristics deteriorate significantly above this travel, to the extent that even though more fuel can be injected, it results in more smoke and not more shaft torque. Full rated load of 7000 KW can be developed using 38 MM of fuel rack travel, allowing 10 MM for governing.

Therefore, any load transient which requires the governing system to call for more than 48 MM of fuel rack travel will cause a larger than normal frequency dip and require a larger than normal recovery time. It is obvious that any given transient applied from a higher base load level will approach this stop more closely than if applied from a lower base load level. Such was the case at step 6, where a transient of about 24% of rated KW capacity was applied to a base load of about 75% of rated KW capacity. Note that step 4 is also a transient of about 24%, but since it was applied at a 50% base level, frequency control was much better.

4. Voltage control is a function of the system's ability to change the excitation current in the generator windings. The regulating device senses KVA, and since compound excitation is used, loan current is utilized in providing field current. It follows then, that at step 1, where there is no base load current, voltage excursions will be greatest upon application of a transient load. The factory test results confirm this, with a 9009 KVA application at step 1 producing a larger voltage change than the 9445 KVA transient applied at step 6.

5. Comparison of the two sequences shows the S & W loading step #1 will apply 9388 KVA to the system, or 4.2% more than the factory test. Since, over small increments, the excitation response can be considered linear, the voltage should dip 4.2% more than in the factory test, or to 6.042 KV, still well within specification. Step

2, 6 and 7 of the S & W sequence will apply significantly more KVA than the factory test, but well below the 9445 KVA of the factory's step #6. Therefore, the voltage response will still be within specification.

6. Step 2 of the S & W sequence will apply 0.9% more of rated capacity in KW to the engine than did the factory test. But since this step produced a frequency dip of only 0.6 HZ, and it is applied at very low base loading, there is plenty of margin to accomodate this small increase. All other S & W load steps are less severe than the factory test with respect to the engine loading and these steps diminish in size as higher base loads are developed. Therefore, there will be no problem expected with this sequence with respect to frequency control.

7. It is assumed, in the above discussion, that the "after 4 hours" base load of 6232 KW will be developed in several small steps. If on the contrary, it is developed by applying a single step, such as to raise the load 1538 KW from the base of 67% of rated KW, then the upper end of the frequency control range could be encountered, with the result being similiar to the data noted in the factory test traces at step 6. The final step load will occur at 6232 KW, or 89% of rated KW, and will elevate the base load by 5%, and should produce results similiar to step 7 of the factory test.

Regards,

Maurice Lowrey

Maurice Lowrey
Senior Design Engineer, P.E.

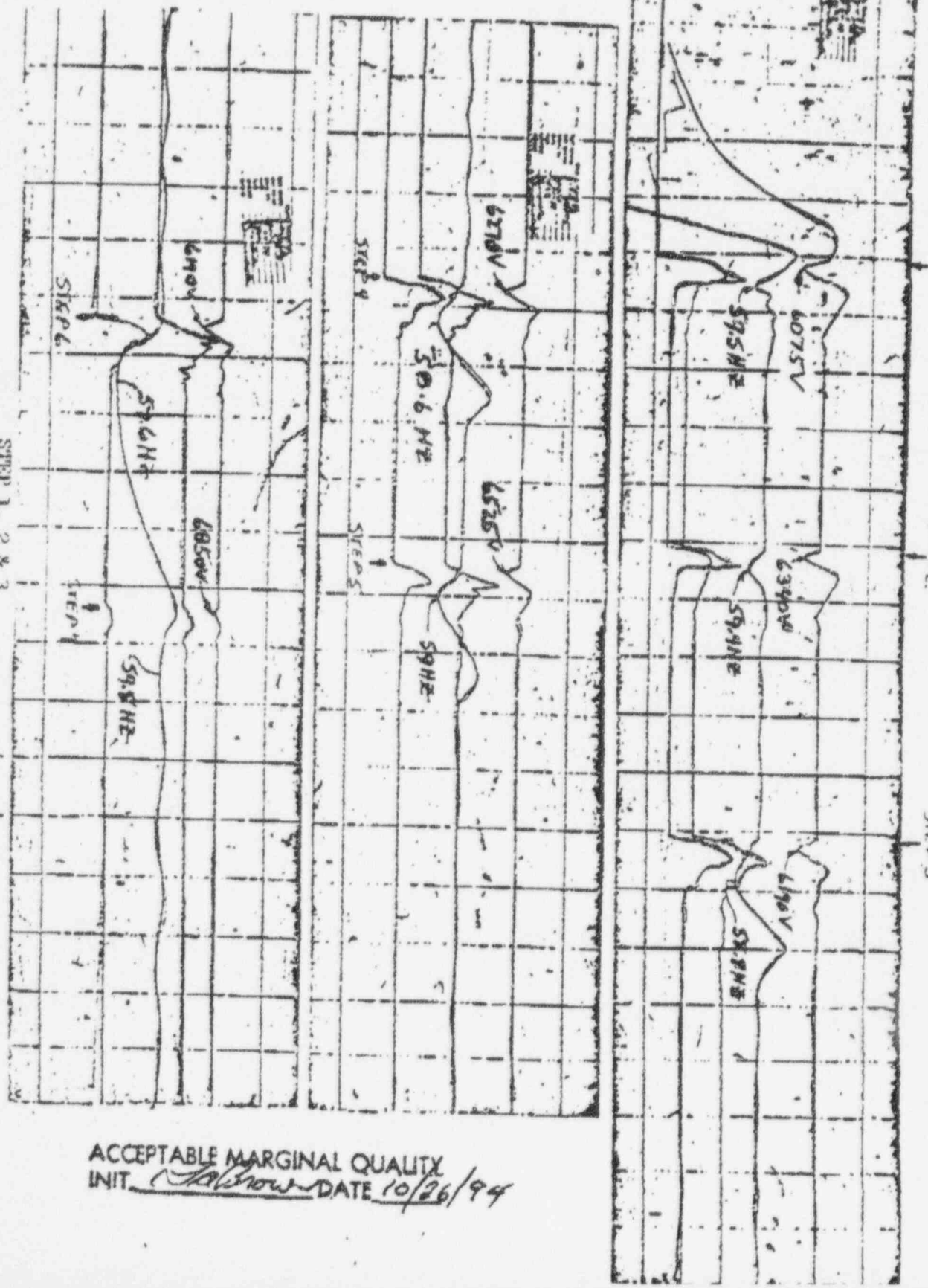
ML/sc

cc: C. Renfro
J. Manno

CR042101.Q

Calculation No. EE-CA-0007-3376
Revision No. 0/1

Attachment B
Page 5 of 7



ACCEPTABLE MARGINAL QUALITY
INIT. [illegible] DATE 10/26/94

Calculation No. EE-CA-0007-3376
Revision No. 1

JAB 11/26/94

CALCULATION SHEET

STONE & WEBSTER ENGINEERING CORPORATION

J.O./W.O./CALCULATION NO.	REVISION	PAGE
16345.03		2 OF 3

PREPARER/DATE	REVIEWER/CHECKER/DATE	INDEPENDENT REVIEWER/DATE
R. Shuttin / 4/8/88		

SUBJECT/TITLE: CPSES DIESEL GEN. LOADING - LOCA LOADS

QA CATEGORY/CODE CLASS:

STARTING & RUNNING LOADS - LOCA (DBA)

LOCA LOADING

ATTACHMENT IV
16345-EE(B)-096 R1
Pg 6 of 7

STEP	TIME SECONDS	CALCULATED				REMARKS
		BASE KW	BASE P.F.	STARTING KVA	STARTING P.F.	
1	10	0	—	8228	0.303	
2	15	1184 (784)	0.906	4402	0.286	16.9%
3	20	1664 (320)	0.907	3222	0.285	
4	25	1916 (252)	0.911	9984	0.297	
5	30	2866 (950) (550)	0.922	6455	0.292	13.6%
6	35	3652 (786)	0.921	5998	0.382	
7	40	4343 (691)	0.913	5585	0.290	
8	75	5091 (748) (170)	0.911	1249	0.146	
9	90	5217 (126)	0.911	3826	0.246	
10	100	5394 (177)	0.906	2687	0.265	
—	>100	8706 (312)	0.901	1794	0.84	
—	—	5945 (239)	0.904	—	—	FINAL LOADING

Calculation No. EE-CA-0007-3376
Revision No. 0 1

Attachment B
Page 7 of 7

ANSI N45.2.11 JOB 11/28/94	QUALITY CLASSIFICATION 1S15.03		
PREPARER/DATE R SHUSTRIN / 4/2/98	REVIEWER/CHECKER/DATE	REVISION	PAGE 3 OF 3
E.I.C. EQT/ TITLE CPSES DIESEL GEN LOADING - BLACKOUT (NO LOCA)	INDEPENDENT REVIEWER/DATE	QA CATEGORY/CODE CLASS QA CATEGORY I	

STARTING & RUNNING LOADS - BLACKOUT (NO LOCA)

ATTACHMENT II
16345-EE(B)-096R1
Pg 5 of 7

BLACKOUT LOADING

STEP	TIME SECONDS	CALCULATED BASE KW	CALCULATED BASE P.F	STARTING KVA	STARTING P.F	REMARKS
1	10	0	—	9388	0.300	
2	30	1418	0.895	7976	0.274	
3	35	2369	0.898	6205	0.376	
4	40	3059	0.892	5088	0.279	
5	50	3651	0.894	2825	0.293	
6	60	3875	0.891	2785	0.200	
7	75	4121	0.891	1464	0.154	
8&9	85	4247	0.891	797	0.200	
10	90	4247	0.891	6714	0.257	
—	2100	4694	0.890	7215	0.251	
—	AFTER 4 HOURS	6232	0.894	2617	0.268	
—	—	6582	0.896	—	—	FINAL LOAD IN D.G.

ACCEPTABLE MARGINAL QUALITY
INIT [illegible] DATE 10/26/94

Requirements: < 20% V dip for 2 sec → 5520 V
< 5% to dip for 2 sec (98%)
57 → 58.8 →

55 =
6762 → 7032
58.8 → 61.2

100% rejection: 7590 V max

Battery Charger Cable Size Evaluation

Output Cable:

Cable type & size	2-1/c 750 MCM, 600V, Jacketed cable
Cable routing	Tray (random fill)
Cable ampacity	
Tray (Note 1)	608 A
Charger current limit	375 A DC

The cable is acceptable.

Input Cable:

Cable type & size	2/0 Triplex, 600V, Jacketed
Cable routing	Conduit and Tray (random fill)
Cable ampacity	
Conduit (Note 2)	182A (146 A with thermolag)
Tray (Note 1)	154A (106 A with thermolag)
Minimum input current (Note 3) (at charger current limit)	99A

Cable is acceptable.

Notes:

1. Ampacity of cable in tray is calculated using J. Stople's method which is the basis of ICEA Pub No. P-54-440. The ampacities are calculated for an equivalent cable depth of 1-15" and ambient temp of 50°c.
2. Ampacity of cable in conduit is based on IPCFA Pub No. P-46-426. The ampacity is corrected for conduit grouping factor of 0.92 and 50°c ambient correction factor of 0.894.
3. Thermolaged cable derate factors:

   For cables in conduit - 0.80
   For cables in tray - 0.69

TABLE 4 - 600 V POWER CABLE AMPACITY

AMPACITY OF CABLE IN 50 DEG. C. AMBIENT

CABLE	TRAY-MAINTAINED SPACING			TRAY-RANDOM LAY (NOTE 2)			CONDUIT (THREE CONDUCTORS)			WALL/FLOOR	SLEEVE
	TRAY	FIRESTOP	THERMOLAG (NOTE 2)	TRAY ↓	FIRESTOP	THERMOLAG (NOTE 2) ↓	CONDUIT ↓	FIRESTOP	THERMOLAG ↓	FIRESTOP (NOTE 3)	FIRESTOP (NOTE 4)
→ 1/C-750KCMIL	858	502	391	598	565	420	535	486	428	579	565
1/C-500KCMIL	589	459	270	420	391	290	428	384	341	436	391
1/C-350KCMIL	405	364	198	311	289	215	343	308	275	344	289
1/C-4/0AWG(*)	248	221	148	188	175	130	249	219	189	216	175
1/C-W/0AWG(*)	181	163	100	127	118	88	182	157	148	158	118
TRI-4/0AWG	248	221	148	228	212	157	249	219	189	238	212
→ TRI-2/0AWG	181	163	100	154	143	106	182	157	148	158	143
TRI-2AWG	138	104	30	78	73	54	116	88	83	97	73
3/C-4AWG	N/A	N/A	N/A	84	60	44	81	68	65	N/A	60
3/C-6AWG	N/A	N/A	N/A	46	43	32	62	52	49	N/A	43
3/C-8AWG	N/A	N/A	N/A	29	27	20	48	39	37	N/A	27
3/C-10AWG	N/A	N/A	N/A	18	17	12	33	28	28	N/A	17
3/C-12AWG	N/A	N/A	N/A	12	11	8	25	21	20	N/A	11
2/C-2AWG	101	91	69	108	108	75	110	92	88	85	100
2/C-6AWG	N/A	N/A	N/A	52	48	38	62	52	49	N/A	46
2/C-8AWG	N/A	N/A	N/A	35	33	24	46	39	37	N/A	33
2/C-10AWG	N/A	N/A	N/A	22	20	15	33	28	28	N/A	20
2/C-12AWG	N/A	N/A	N/A	13	12	8	25	21	20	N/A	12

NOTES

1. (*) - Denotes ampacity in tray-maintained spacing columns based on 1/C cables bundled together in 2 or 4 wire circuits.
2. Ampacities based on values calculated in 16345/6-EE(B)-078.
3. Ampacities in this column are for cables in tray with maintained spacing going through a sleeve with a firestop.
4. Ampacities in this column are for cables in tray with random lay going through a sleeve with a firestop.
5. Ampacities listed under "Firestop" column are based on SF-20 silicone foam firestop.

OCT-03-96 THU 11:45 MECH ENGR FAX NO. 8178970868 P.13

TU ELECTRIC

COMANCHE PEAK STEAM ELECTRIC STATION
ELECTRICAL AND INSTRUMENTATION & CONTROLS ENGINEERING - CPSES E09

FAX NUMBER (817)897-8745

Verification Phone Number (817)897-8139

DATE: 10 / 4 / 96

Telecopy to: Amar Pal / 301 415 2760
Name Phone/Ext. Number

Telecopy No.: 301 415 2444

From: MUNAWAR HUSSAIN / (817) 897 - 6642
Name Phone/Ext. Number

No. of Pages (including Cover Sheet): 4

Comments:

ATTACHMENT 6

CPSES Unit 2 Battery Charger Cable Size Evaluation

Output Cable:

Cable type and size	2-1/C 750 MCM, 600 V jacketed cable
Cable routing	Tray (random fill)
Cable Ampacity	
Tray (Note 1)	608 Ampere
Charger output current	225 Ampere
Charger Current limit value	250 Ampere

The cable is acceptable.

Input Cable :

Cable type & size	2/0 Triplex, 600 V, jacketed
Cable routing	Conduit and Tray (random fill)
Cable Ampacity	
Conduit (Note 2)	182 Ampere(146 A with thermolag)
Tray (Note 1)	154 Ampere(106 A with thermolag)
Input current of the battery charger based on its nameplate rating.	85 Amps

The cable is acceptable.

CPSES UNITS 1 AND 2
CABLE PHILOSOPHY AND SIZING CRITERIA

TABLE 4 - 600 V POWER CABLE AMPACITY

AMPACITY OF CABLE IN 50 DEG. C. AMBIENT

CABLE	TRAY-MAINTAINED SPACING			TRAY-RANDOM LAY (NOTE 2)			CONDUIT (THREE CONDUCTORS)			WALL/FLOOR	SLEEVE
	TRAY	FIRESTOP	THERMOLAG (NOTE 2)	TRAY ↓	FIRESTOP	THERMOLAG (NOTE 2) ↓	CONDUIT ↓	FIRESTOP	THERMOLAG ↓	FIRESTOP (NOTE 3)	FIRESTOP (NOTE 4)
→ 1/C-750KCMIL	658	592	301	600	565	420	535	466	428	578	505
1/C-500KCMIL	509	458	270	420	391	290	426	364	341	438	391
1/C-350KCMIL	405	364	189	311	289	215	343	306	275	344	289
1/C-4/0AWG(*)	248	221	148	188	175	130	249	219	189	216	175
1/C-1/0AWG(*)	181	163	100	127	118	88	182	157	146	156	118
TRI-4/0AWG	248	221	148	228	212	157	249	219	189	216	212
→ TRI-2/0AWG	181	163	100	154	143	108	182	157	146	156	143
TRI-2AWG	116	104	50	78	73	54	116	98	93	97	73
3/C-4AWG	N/A	N/A	N/A	64	60	44	81	68	65	N/A	60
3/C-6AWG	N/A	N/A	N/A	46	43	32	62	52	49	N/A	43
3/C-8AWG	N/A	N/A	N/A	29	27	20	46	39	37	N/A	27
3/C-10AWG	N/A	N/A	N/A	18	17	12	33	28	26	N/A	17
3/C-12AWG	N/A	N/A	N/A	12	11	8	25	21	20	N/A	11
2/C-2AWG	101	91	69	108	100	75	110	92	88	85	100
2/C-6AWG	N/A	N/A	N/A	52	48	36	62	52	49	N/A	48
2/C-8AWG	N/A	N/A	N/A	35	33	24	46	39	37	N/A	33
2/C-10AWG	N/A	N/A	N/A	22	20	15	33	28	28	N/A	20
2/C-12AWG	N/A	N/A	N/A	13	12	9	25	21	20	N/A	12

NOTES

1. (*) - Denotes ampacity in tray-maintained spacing columns based on 1/C cables bundled together in 2 or 4 wire circuits.
2. Ampacities based on values calculated in 86345/6-EE(B)-078.
3. Ampacities in this column are for cables in tray with maintained spacing going through a sleeve with a firestop.
4. Ampacities in this column are for cables in tray with random lay going through a sleeve with a firestop.
5. Ampacities listed under "firestop" column are based on SF-20 silicone foam firestop.

Notes:

1. Ampacity of cable in tray is calculated using J. Stople's method which is the basis of ICEA Pub No. P-54-440. The ampacities are calculated for an equivalent cable depth of 1-15" and ambient temp of 50°c.
2. Ampacity of cable in conduit is based on IPCFA Pub No. P-46-426. The ampacity is corrected for conduit grouping factor of 0.92 and 50°c ambient correction factor of 0.894.
3. Thermolaged cable derate factors:

   For cables in conduit - 0.80
   For cables in tray - 0.69

OCT-04-96 FRI 15:01 MECH ENGR FAX NO. 8178970868 P. 03