Enclosure 2 to JAFP-05-0179
Entergy Nuclear Operations, Inc. – FitzPatrick
Docket No. 50-333

Calculation JAF-CALC-ELEC-02610
"125VDC Station Battery "B" Sizing & Voltage Drop" revision 2

ATTACHMENT 9.2 CALCULATION COVER PAGE

CALCULATION COVER PAGE

☐IP-2	☐IP-3	☒JAF	☐PNPS
Calculation No. JAF-CALC-ELEC-02610	Revision 2	Sheet 1 of 1	
Title: 125VDC Station Battery "B" Sizing & Voltage Drop		☒ QR ☐ NQR	
Discipline: Electrical		Design Basis Calculation? ☒ Yes ☐ No	
This calculation supercedes/voids calculation: None			
Modification No./Task No/ER No: None			
☒ No software used ☐ Software used and filed separately (Include Computer Run Summary Sheet) ☐ Software used and filed with this calculation			
System No./Name: 071 Component No./Name: 71SB-2 (Attached additional pages if necessary)			

Print / Sign

REV #	STATUS (Prel. Pend, A, V, S)	PREPARER	REVIEWER/DESIGN VERIFIER	OTHER REVIEWER/ DESIGN VERIFIER	APPROVER	DATE
2	A	Alex Barton	Sung Kim	NR	Aaric Mitchell	5/16/03

CALCULATION SUMMARY PAGE

Page 1 of 1

Calculation No. JAF-CALC-ELEC-02610 Revision No. 2

CALCULATION OBJECTIVE: 1) To establish aging and design margin for the "B" Station Battery from the voltage drop and sizing calculation. (2) To establish testing profile and acceptance criteria for "B" Station Battery discharge testing to satisfy Technical Specifications.
CONCLUSIONS: See Section 3 Pages 15 thru 17
ASSUMPTIONS: Assumptions are addreset in section 2 of the calculation and threy do not need verification.
DESIGN INPUT DOCUMENTS: See Section 4, pages 18 and 19
AFFECTED DOCUMENTS: MST-71.20, MST-71.24
METHODOLOGY: See Section 1.3, page 7

ATTACHMENT 9.6 CALCULATION RECORD OF REVISIONS

RECORD OF REVISIONS

Calculation Number: JAF-CALC-ELEC-02610 Page 1 of 1

Revision No.	Description of Change	Reason For Change
0	See Revision Summary In Calculation	See Revision Summary In Calculation
1	See Revision Summary In Calculation	See Revision Summary In Calculation
2	See Revision Summary In Calculation	See Revision Summary In Calculation

ATTACHMENT 9.7 — CALCULATION IMPACT REVIEW PAGE

CALCULATION IMPACT REVIEW PAGE

Date: 5/05/03 ☒ QR ☐ NQR

(Note: X indicates required distribution)

To:	__ Mechanical Engineering	__ Licensing	__ Operations
	__ I&C Engineering	X Elect Maintenance	__ Chemistry
	__ Electrical Engineering	__ I&C Maintenance	__ HP/Radiological
	__ Civil Engineering	__ Mech Maintenance	__ Computer Applications
	X System Engineering	__ Component Engineering	__ Rad Engineering
	__ Reactor Engineering	__ Program Engineering	__ ISI Engineering
	__ DBD Owner _____	__ Nuclear Engineering	__ IST Engineering
	__ DBD Owner _____ (name)	__ EQ	__ (Other)

From: Alex Barton (x6622)
(Print Name and Phone extension

Calculation No.: JAF-CALC-ELEC-02610 Revision No. 2

Title: 125VDC Station Battery "B" Sizing and Voltage Drop Calculation

Reference: _____

Date Response Required: _____

MESSAGE: Work organizations are requested to review the subject calculation (parts attached) to identify impacted calculations, procedures, Technical Specifications, FSAR sections, other design documents (e.g. EQ files, DBD, Appendix R, ISI/IST, PRA, MOVs/AOVs, etc.), and other documents which must be updated because of the calculation results. Also provide the name of the individual responsible for the action and the tracking number. Sign and return the form to the originator.

IMPACT REVIEW RESULTS:

Affected Documents	Responsible Individual	Tracking Number
MST71.20		
MST71.24		

☐ Process Applicability Determination required and attached.

Responding Supervisor/Manager (or designee): Michael Durr Michael Durr 5/6/03
Name/Signature Date

ATTACHMENT 9.7 — CALCULATION IMPACT REVIEW PAGE

CALCULATION IMPACT REVIEW PAGE

Date: 5/05/03 ☒ QR ☐ NQR

(Note: X indicates required distribution)

To:	__	Mechanical Engineering	__	Licensing	__ Operations
	__	I&C Engineering	X	Elect Maintenance	__ Chemistry
	__	Electrical Engineering	__	I&C Maintenance	__ HP/Radiological
	__	Civil Engineering	__	Mech Maintenance	__ Computer Applications
	X	System Engineering	__	Component Engineering	__ Rad Engineering
	__	Reactor Engineering	__	Program Engineering	__ ISI Engineering
	__	DBD Owner _____	__	Nuclear Engineering	__ IST Engineering
	__	DBD Owner _____ (name)	__	EQ	__ (Other)

From: Alex Barton (x6622)
(Print Name and Phone extension

Calculation No.: JAF-CALC-ELEC-02610 Revision No. 2

Title: 125VDC Station Battery "B" Sizing and Voltage Drop Calculation

Reference: _____

Date Response Required: _____

MESSAGE: Work organizations are requested to review the subject calculation (parts attached) to identify impacted calculations, procedures, Technical Specifications, FSAR sections, other design documents (e.g. EQ files, DBD, Appendix R, ISI/IST, PRA, MOVs/AOVs, etc.), and other documents which must be updated because of the calculation results. Also provide the name of the individual responsible for the action and the tracking number. Sign and return the form to the originator.

IMPACT REVIEW RESULTS:

Affected Documents	Responsible Individual	Tracking Number
MST71.20		PCR 03-2396
MST71.24		PCR 02-2397

☐ Process Applicability Determination required and attached.

Responding Supervisor/Manager (or designee) ~~Bret Hoover~~ Bret Hoover 5/8/03
Name/Signature Date

CALCULATION SHEET

Entergy Nuclear Northeast			
Calculation No. JAF-CALC-ELEC-02610		**Revision:** 2	
Subject:	71 ELECTRICAL DISTRIBUTION	**Page** 1 **of** 21	
	125 VDC STATION BATTERY "B" SIZING &	**Computed by:** A Barton	**Date:** 4/30/03
	VOLTAGE DROP	**Checked by:** S Kim	**Date:** 4/30/03

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Revision Summary

Revision 2

1) Revised Appendix 1 for Mark Numbers to agree with the ECRIS database.
2) Unscheduled jumper cables were added to Emergency Lighting Panels 71LPEEBDC1, 71LPEHB1, 71LPEADC2, 71LPERDC3 and 71LPERW1.
3) Stop Time for SBO for panels 71LPEHB1, 71LPERDC3 and 71LPERW1 was changed from 60 min to 30 min in accordance with AOP-49.
4) Additional loads for Emergency Lighting Panels 71LPEEBDC1, 71LPEHB1, 71LPEADC2, 71LPERDC3 were added per CR-JAF-2002-05367 and ST-16J6 dated 11-01-02
5) Revised load for 71DC-B3 Ckt. 24 for 71UPS-7 from 650 watts to 875 watts per JE-02-174
6) For 23MOV-25 HPCI minimum flow bypass valve removed loading beyond 30 minutes for SBO per AOP-49 Revision
7) Added Torque Switch Trip current for MOV closing. The value is increased from FLA to 50 % of LRA.

Revision 1

1) Resistances for containment cables were changed to 90°C and external to the Reactor Building to 40°C in accordance with Reference 4.10.
2) Walkdown feeder cables to 71DC-B1, B2, B3, B4, B4, 93ECP-B, and 93ECP-D changed lengths accordingly.
3) Incorporated the following ACTS:

   i. ACT-98-35189 (Conductor Temperatures & most limiting ADS cable length)
   ii. ACT-98-35193 (Misapplication of EQ voltage criteria)
   iii. ACT-98-30907 (SSFI-97-10 & 11)
   iv. ACT-98-37362 (Describe Scenario)
   v. ACT-99-43846 (SWGR Trip & Close Coil Voltage Drop)
   vi. ACT-99-45065 (Minimum Voltage for Sizing Calculation not Conservative)
   vii. ACT-99-45320 (SSFE RFI #039 items 1,3,4,5 & 6)
   viii. ACT-99-45925 (Inrush Currents for MOVs)

4) Incorporate ACT-00-47872 (Backup SCRAM Solenoids)
5) Incorporate Design Change JD-00-144 (ESW Pump Motor Breaker Control Cable and terminates spare wire to 71DC-B4)

6) Revised SBO timing for initiation of Lo-Lo level based on PTE-96-002 (9/16/96 event at JAF)
7) Incorporated Addendum 0B (SRV Electric Lift Design Change M1-97-070)
8) Incorporated Addendum 0D (EDG EGM Power Supply Design Change JE-00-115)
9) Incorporated Addendum 0F (Added RHR SW Pump Motor Breakers to LOCA profile per DER-01-03565)
10) Revised minimum required voltage to Topaz Inverters 23INV-79, 13INV-801B and 06INV-1B to 101.5VDC to agree with ICRs (nominal setpoint of 100.75)
11) Revised continuous control to eliminate having it in the calc twice.
12) Control loads for pumps and MOVs were added
13) Stroke times for HPCI MOVs were increased based on BWROG Methodology per NEDC-32958 and Engineering Judgment
14) Used actual loading measurements for HPCI Inverter 23INV-79, Feedwater Inverter 06INV-1B, Steam Leak Detection Inverter 13INV-801B and the EDG EGM power supplies 93P/S-B & D. Added nameplate loading for RHRSW Motor Cooling Water Return Solenoids 10SOV-101B & D (missing load).
15) Explanation and source of data for MOV Inrush Currents.
16) Revise minimum design battery electrolyte temperature from 60°F to 65°F per Technical Specifications.
17) Revised Battery Sizing Calculation based on a new minimum required battery voltage.
18) Revised starting of 31P-7B (RFPT Emergency Lube Oil Pump). The starting of this pump was moved conservatively to 15 second start for LOCA and 17second start for SBO. Previous revision was not conservative and not appropriate based on actual plant response.
19) Eliminated 94P-2(M) for LOCA because main oil pump and turning gear oil pump maintains pressure.
20) Moved ESW pump motor breaker closure to occur between 2 and 3.9 seconds. This will capture either the demand closure from loss of RBC pressure or EDGs reaching 400RPM.
21) Add a closure of 1 RBC Pump Motor breaker. This breaker will automatically be demanded to close upon loss of AC power.
22) Added Loading for Hydrogen & Stator Cooling panel (71DC-B3 ckt #3).
23) Added a generator trip due to either anti-motoring or reverse power.
24) Revised undervoltage trip circuit for H02 & H04 to initiate between 0.1 seconds and 3 seconds.
25) Revised tripping of recirc MG set exciter breaker to trip at 17 seconds. This is consistent with OP-27.
26) Added closing of 23MOV-25 during tripping of HPCI and added an additional cycling of 23MOV-25 to SBO for an additional restart of HPCI. Also, revised the start time for opening of 23MOV-25 to start 19 seconds after HPCI initiation.

27) Deleted torus swapover because a tripping of HPCI envelopes the loading requirements of swapover.
30) Added cycling of 23MOV-57 & 58 due to suppression pool swell at the onset of a LOCA.
31) Revised 23P-141 start time to coincide with steam being admitted to HPCI turbine and concurrently with 23MOV-25 cycling.
32) 23P-150 sequencing was changed because when HPCI trips this pump restarts. Additionally, cycling based on lube oil pressures per ST-4N & 4P
33) Added actual emergency lighting loads per field measurement. Included resistance of unscheduled cable between JB and Emergency Lighting Panel.
34) Deleted Emergency Lighting panels 71EEBDC1 and 71LPEADC2 loading was extended to 240 minutes for SBO because AOP-49 doesn't require this load to be stripped.
35) Revised AOP-49 actions that commenced at 30 minutes to complete at 30 minutes.
36) Added 71DC-B1 circuit 3 (Anti motoring circuit which trips the main turbine and 10042/10052 breakers).
37) Changed the duration for 71DC-B1 circuits 15 and 17. These are the trip coils for 71PCB-10042 & 71PCB-10052. Removed from SBO because the primary trip circuit off of "A" Station Battery trips the breakers during SBO.
38) Added 71DC-B1 circuits 11 and 18 as momentary loads due to the 10042 and 10052 backup trip circuits
39) Added loading for 71MOD-10031 to 71DC-B1Ckt # 19
40) Overload heater resistances for pumps was added
41) Heater resistances at the BMCC's were adjusted to 55°C per EQ report
42) Revised 71DC-B2 circuit 1 to reflect actual loading
43) Eliminated the Core Spray logic circuit (71DC-B2 Ckt #5) from SBO
44) Eliminated the 80% diversity factor assumption. It was unknown whether assumption was conservative or not.
45) Measured loading for HPCI EGM power supply 23TU-3-12 and the HPCI Inverter 23INV-79 from WR-01-05258-00 and Wr-01-10999-00 and used in Appendix 2.
46) Added 23SOV-53 & 54 to 71DC-B2 ckt #10 as a random load (not originally included)
47) Added tripping of "B" Recirc MG set field breaker to occur at 17 seconds per OP-27 to 71DC-B2 ckt #12.
48) Added tripping of "A" Recirc MG set field breaker to also occur at 17 seconds per OP-27 to 71DC-B2 ckt # 13. This is included because of the assumed single failure of "A" Station Battery.
49) Decreased the loading on the ATTS power supply because of actual loading (71DC-B2 ckt #16). Provided justification
50) Moved opening of 38MOV-VB2 to agree with simulator
51) Revised loading to annunciator to agree with Atomatic study.

52) Added closure of 600V AK breakers for 66FN-12B, 66FN-5B, 67FN-6B, 67FN-5B and 87P-23B. If these are in standby, they will receive an auto start signal.
53) Reduced loading on 71INV-1B based on expected demand
54) Reduced loading on 23E/S-200B based on expected demand
55) Revised per feedback from Operations/Operations Training. See JTRG-02-102

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	VOLTAGE DROP	Checked by: S Kim	Date: 4/30/03

1. PURPOSE/OBJECTIVE/METHOD OF ANALYSIS

1.1. Purpose

Note: The original calculation was prepared in accordance with DCM-2A. This revision contains all the attributes of ENN-DC-126, however, not necessarily in the same format. Due to the complexity and length of this calculation it will remain in the same format. Since formatting and content is stated as a "should", the compelling reason to do otherwise is as stated above. Section 2 contains both Design Inputs and Assumptions. Unverified assumptions will be identified by an Action Item to track future verification.

1.1.1. To calculate the required size of the 125VDC Station Batteries "B" for LOCA and SBO scenarios.

1.1.2. To compute the voltage drop throughout the 125 VDC electrical distribution system during postulated LOCA and SBO scenarios.

1.2. Objective

1.2.1. To verify the "B" Station Battery is adequately sized to perform its intended safety function.

1.2.2. To verify that the voltage "seen" at the terminals of critical components during the LOCA and SBO scenarios is adequate to insure that these critical components can perform their intended safety function.

1.2.3. To establish the design basis for the acceptance criteria for Station Battery Discharge Testing. Acceptance Criteria for Battery Capacity Margin is defined as:

> Adequate margin must be maintained in the battery to maintain high enough voltage throughout the loading scenarios to allow the components fed by the battery to perform their safety functions. The battery must be able to perform their safety function with a capacity greater than 80% and with an electrolyte temperature as low as 65°F. This accounts for the 8% temperature margin and 25% aging margin. An additional 5% design margin has been added to the voltage drop profile calculation. (Appendix 4).

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1.3. Method of Analysis

1.3.1. The battery discharge is assumed to last for 2 hours because of the Loss of Battery Charger (LOBC) for a Loss of Coolant Accident (LOCA) concurrent with a Loss of Offsite Power (LOOP) per UFSAR Section 8.7. (2) The battery discharge is assumed to last for 4 hours during a Station Blackout (SBO) per UFSAR 8.11. See Appendix 11(LOOP/LOCA) and Appendix 12 (SBO) for additional discussion regarding basis for scenarios.

Justification of the loads and timing during the discharge period(s) are identified in Appendix 2, Appendix 11, Appendix 12 , Appendix 14 and Appendix 15 . Voltages at the battery terminals for each successive time period are determined using the manufacturers discharge curve (see Appendix 7) for the NCN type cells. This voltage is dependent on the instantaneous current supplied by the battery and the cumulative amp-hours discharge. Voltage drops at distribution panels, MCCs, and individual loads are calculated by subtracting the IR drop from the upstream voltage. Since the load currents are dependent on the source voltage (see detailed discussion in section 1.3.2.), and the source voltage is dependent on the load currents this calculation becomes circular in nature. An Excel spreadsheet is set up to perform recursive iterations until a steady state solution is achieved. Approximately 20 to 30 iterations are used as this yields solutions with accuracies of a hundredth of a volt or less. The solution showing the voltage and current for each load is shown in Appendix 4.

1.3.2. The following parameters are presented in Appendix 4:

1.3.2.1 Load Center Voltage

The load center (i.e. Battery Control Board, MCC, etc.) voltage is computed by taking the sum of the currents on the respective panel, multiplying this current by the resistance of the cable feeding the load center and subtracting this voltage from the source voltage.

1.3.2.2 Load Voltage

This is the voltage across individual loads. It is similar to the computation for load center voltage (section 1.3.2.1). The current the load is drawing (section 1.3.2.3) is multiplied by the feeder resistance (the cable from the load center to the load) and subtracted from the load center voltage.

Voltages at the battery terminals for each successive time period are determined using the manufacturers discharge curve. A detailed discussion of determining these voltages for each successive time period is presented in section 1.3.4.

1.3.2.3 Current

The current for each load is calculated depending on the type of load:

For constant VA (wattage) loads (Motors, MOVs, etc.) the wattage determined from the manufacturer's nominal values is divided by the calculated load voltage.

For constant resistance loads (relay coils, lighting, heaters, etc.) the admittance determined from the manufacturer's nominal values is multiplied by the calculated load voltage.

The inrush current of constant VA loads (motors) is considered a constant resistance load and the admittance is calculated by dividing the rated inrush current by the motor nameplate voltage. The starting admittance is multiplied by the calculated load voltage to obtain the actual inrush current.

1.3.2.4 Motors

Motors are conservatively assumed to be constant KVA devices even in cases where the motor might be considered to be in saturation. Unless otherwise noted, the minimum required voltage for running and starting of DC motors was based on IEEE 946-1992, which is 80% of nominal.

1.3.2.5 Sizing Calculation

The sizing calculation utilizes the largest load for any given 1-minute interval. 5% design margin has been included in the voltage profile in Appendix 4. The minimum voltage is obtained from the voltage drop calculation.

1.3.3 The various columns of the Cable Data section (Appendix 1, page 2 through 40) are determined as follows:

1.3.3.1 Conductors per Cable

The number of conductors feeding the load as found in Reference 4.2.

1.3.3.2 Cable Mark No.

This is the code used by Reference 4.2 to identify a particular cable type (see Appendix 1, page 1).

1.3.3.3 Cable Length

The circuit length is taken as twice the cable length (the total circuit length).

1.3.3.4 R/1000' (resistance per 1000 feet)

Determined through tables in Reference 4.1. The values are tabulated in Appendix 1, page 4. Cable resistances are based on 50°C in the Reactor Building. Cables inside containment are based on 90°C. All other cable resistances are based on 40°C. See Reference 4.10.

1.3.3.5 R_{bkr} (breaker resistance)

R_{bkr} is the circuit breaker resistance as specified by the single lines and section 2.12.

1.3.3.6 R_{tot} (total resistance)

R_{tot} is the cable length multiplied by the corresponding value in the R/1000' column (which is divided by 1000 to get the ohms per foot) plus R_{bkr}.

There is a twisting multiplier on multiple conductor cables (see Appendix 1).

1.3.4 The voltage profile for the battery is calculated using the GNB discharge curve for NCN cells and IEEE-485 1997. The results are shown in Appendix 4.

1.3.4.1 The currents are calculated using a 25% combination aging/design factor, 8% temperature correction factor and a 5% design margin. The temperature correction factor is based on 65°F. These corrected currents simulate the battery voltage profile at 80% capacity and 65°F battery room temperature. It is calculated by multiplying the Ampere Rate by 1.25 (for aging/design margin to 80% capacity) and by 1.08 (temperature correction factor, Reference 4.3).

1.3.4.2 Amps per positive plate: The adjusted amps divided by the number of positive plates in the battery. As per Appendix 7, total plates for Gould battery NCN-33 is 33, therefore the number of positive plates is 16.

1.3.4.3 Amp hours per positive plate: The time period in minutes (or seconds) multiplied by the Amps per positive plate divided by 60 minutes per hour (or 3600 seconds per hour).

1.3.4.4 Cumulative Amp hour discharge: This is a summation of the amount of discharge in the present time period being analyzed plus all the previous periods analyzed.

1.3.4.5 Volts per cell: This is a data point picked off the manufacturer's data curves (Appendix 7) based on Amps per positive plate vs. Cumulative amp hour discharge.

1.3.4.6 Battery Voltage: Volts per cell times the number of cells in series which for "B" Station Battery is 60.

1.3.5 Minimum voltage values for a component in most cases are based on manufacturer's data. For certain components such as motors, typically the information is not available. For these components, industry standards will be used. The minimum voltage values are shown in Appendix 5. Appendix 5 also identifies whether or not the minimum voltage is acceptable.

1.3.6 Each component was reviewed to determine if the minimum voltage is consistent with the Environmental Qualification Program. The only components within the scope of the Environmental Qualification Program are the ADS solenoid valves and MOV's. The minimum voltages specified in Appendix 5 are consistent with the Environmental Qualification Program or the MOV Program.

1.3.7 Sizing sheets were developed as shown in Appendix 9 also in accordance with IEEE-485. Minimum battery voltage for the sizing sheets are determined based

on the following:

1.3.7.1 Using the voltage profile detailed results (Appendix 4), establish the voltage margin between calculated voltage at each load and the minimum allowed voltage for the same load.

1.3.7.2 Assuming a positive margin (i.e. calculated voltage is higher at the load than minimum allowed), the margin is subtracted from the battery voltage to obtain the minimum allowed battery voltage which will ensure operability of the load. It is acceptable to subtract this margin because our mixture of loads is primarily resistive and as the voltage is reduced at the battery, the total load (current) is also reduced. A reduction in battery voltage/load current will result in slightly less than the same voltage drop to the load. Therefore, this is a conservative approach. In cases where the margin is negative, the load is evaluated for acceptability at the less than minimum allowed voltage. Assuming operability can be maintained at the less than minimum calculated voltage, this battery voltage then becomes the minimum allowed battery voltage for that specific load. Evaluation of loads is included in Appendix 6.

1.3.7.3 Once the minimum allowed battery voltages for each load has been determined, this voltage becomes the minimum battery voltage used in the sizing calculation.

1.3.8 Appendix 3 represents the voltage profile of the battery during a discharge test using the aging and temperature margins shown on pages 1 and 3 of Appendix 9 (LOCA and SBO sizing sheets)

2. DESIGN INPUTS/ASSUMPTIONS

2.1 NORMAL PLANT OPERATION

The unit is at 100% power, there are no LCOs and the switchyard and all plant buses are in their normal configuration. Emergency crossties and feeds are not utilized. The batteries are fully charged.

2.2 LOCA/LOOP

Loss of Coolant Accident (LOCA) with concurrent Loss of Offsite Power (LOOP) occurs with the battery charger not available for 2 hours following the start of a

LOCA/LOOP. The unit enters the event from normal plant operation as defined in 2.1. The battery duty cycle length is 2 hours. (See Appendix 11 for description of LOCA/LOOP Scenario)

2.3 STATION BLACK OUT

See Appendix 12 for description of SBO scenario.

2.4 For HPCI MOV & Pump sequencing see Appendix 15 . MOV inrush currents were obtained from votes testing. These values were then adjusted to account for cable resistance when the readings were taken to determine rated terminal inrush current (this is included in Appendix 8). Several VOTES tests were reviewed to determine the inrush currents for MOV's. The best available information was used. This information is included in Appendix 8.

2.5 Stroke times for 12MOV-18, 23MOV-14, 23MOV-16, 23MOV-19, 23MOV-25, 27MOV-122 and 38MOV-VB2 were developed from BWROG DC MOV Methodology (Reference 4.24). The stroke times were increased by 10% (except 12MOV-18) for margin to account for any variance in bus voltage, valve parameters, etc. These calculations are not intended to yield exact results but rather a reasonable estimate of increase in stroke time. The Bus voltages assumed for the entire stroke is approximately the minimum shown in Appendix 4 during the time the valve operates. Using this method ensures that even if the final calculation (or even a future revision) shows the bus voltage dropping below the values used in the BWROG methodology in Appendix 8, that it will not affect the overall results of this calculation.

2.6 Per tech manual G080-0213 the coil resistance of an HGA relay is 3650ohms. Therefore, its relay burden used in this calculation is 125vdc/3650ohms (0.034Amps). Per tech manual G080-0234 the burden of an HFA relay is 7.8 watts (cold) at 125vdc. Per tech manual G080-1076 the relay burden of an HMA relay is 2.7watts (5800ohms). Per tech manual G080-C019 the relay burden of an HLA relay is 4.3 watts.

2.7 Cable resistance values are based on manufacturer's data at a temperature of 50°C in the Reactor Building, 90°C inside containment and 40°C outside the Reactor Building (See Reference 4.10 for basis).

2.8 Upon the loss of AC power, this calculation considers the batteries fully charged.

2.9 Loads have a nominal rating of 125 Volts unless otherwise noted (see Appendix 2).

2.10 As per Reference 4.7, the length of three conductor cables must be increased by 4% to account for twisting of the conductor in the cable. The same multiplier has been applied to all cables with three or more conductors to be bounding (see Appendix 1).

2.11 All panel internal wiring is assumed to be #14AWG unless otherwise shown on the drawing. 4.16KV switchgear and 600V load center internal wiring is included in this calculation. Wiring for EDG skid mounted equipment was also included in this calculation. In some cases internal panel wiring was not included as part of the circuit run. The additional voltage drop due to internal panel wiring is considered to be minimal and is enveloped by the aggregate conservatism and design margin included in this calculation. This is considered appropriate engineering judgment and needs no further justification.

2.12 Circuit breaker resistances shown below are based on the measured data (Reference 4.8) and IEEE Std 241-1983, Table 70 (Reference 4.9).

Breaker Size	Resistance /Pole (Ohms)	Remarks
15A/20A	0.005	Based on Reference 4.8, (Resistance for 20A breaker conservatively assumed to be same as 15A breaker.)
25A	0.004	Based on Reference 4.8
30A	0.003	Based on Reference 4.8
40A/60A/70A	0.002	Based on Reference 4.8 (Resistance for 70A breaker conservatively assumed to be same as 60A breaker.)
100A/125A	0.0005	Based on Reference 4.8
200A	0.0003	Based on Reference 4.8
225A/250A/300A	0.0002	Based on Reference 4.8
400A	0.00012	Based on Reference 4.8
600A	0.00007	Based on Reference 4.9

Also note that both legs of the circuit were considered when calculating breaker resistance in Appendix 1. Therefore, breaker resistances shown are multiplied by 2.

2.13 The continuous control loads are considered to be 40 amps at 132 volts of battery bus voltage. 40amps is considered conservative as charger outputs are consistently 30 amps or below under normal operating conditions. Supporting information is shown in Appendix 13. During the course of development, where practical, a separate line item

was added and this current was removed from the 40amp continuous control line item. The summation of all continuous control load equals 40amps.

2.14 Based on maintenance procedures associated with the station batteries the specific gravity of the batteries is maintained within a close tolerance of 1.205 to 1.215. The manufacturer indicates that maintaining the battery within this close tolerance provides assurance that the capacity of the battery is not adversely affected (Ref. 4.4).

2.15 Minimum voltage values and current values for the component loads in the calculation are from manufacturers data and reference material (Appendix 8). The minimum voltages for the components are evaluated and tabulated in Appendix 5.

2.16 The input data for the Gould NCN-33 battery is from GNB battery catalog information (Appendix 7).

2.17 Rated inrush currents for reduced voltage starters are assumed to be 250% of FLA unless actual testing shows higher values. This assumption has been validated by calculating expected inrush currents using the motor transient resistance. The methodology to determine armature transient resistance is from the GE Industrial Power Handbook section 171. Inrush currents are calculated in Appendix 14 . The RFPT lube oil pump was tested 11/2/81 in accordance with TIL-914. The inrush was 141amps (243%). Appendix 14 calculates the inrush to be 145amps (250%). This further provides validation of the methodology. Duration of inrush currents for a RVNR starter is specified in Appendix 14 . The inrush currents for motors without reduce voltage starters are conservatively assumed to last for 1 second. This is consistent with VOTES testing and field experience.

2.18 Minimum relay pickup voltages used are the cold pickups values if the vendor specifies a difference between cold and hot. Similarly, dropout voltages used are the hot dropouts if the vendor specifies a difference between hot and cold. Typically, relays are in standby (i.e. cold) when they are called upon to pickup. The hot dropouts are used because they are more conservative.

2.19 For GE IC2800-1600 series General Purpose Contactors, the pickup voltage is 65% and the dropout is 15%. This is based on Tech manual G080-1022 and Paul Quinn to Brian Marks Memo (dated 9/21/92) in Appendix 8. The voltage rating of these contactors is 120VDC based on GE Control Accessory Catalog GEA-6621C (excerpt attached in Appendix 8).

2.20 For GE IC2800-A501AB23C Time Delay Contactors, the pickup and dropout voltages

were obtained from GE and included in Appendix 8. The voltage rating is 120VDC based on GE Control Accessory Catalog GEA-6621C (excerpt attached in Appendix 8).

2.21 For GE IC2820-A100 and A200 series General Purpose Relays, the pickup and dropout voltages are based on GE Control Accessory Catalog GEA-6621C (excerpt attached in Appendix 8). Pickup is 63% of rated voltage. Dropout is 20% of the rated voltage. The rated voltage is 120VDC based on GE Control Accessory Catalog GEA-6621C (excerpt attached in Appendix 8). Therefore the pickup is (0.63 x 120) 75.6vdc and the dropout is (0.20 x 120) 24vdc (tech manual G080-0702 indicates this value for A100 to be less than 10% of pickup, therefore, 24vdc is conservative).

2.22 MOV seating current during the end of closing stroke is assumed conservatively to be 50% of Locked Rotor Inrush current and the duration is 1 second. (Ref. 4.25)

3. SUMMARY/CONCLUSIONS

3.1. Summary/Conclusions

The worst case scenarios are for a loss of coolant accident (LOCA) with the loss of a battery charger (LOBC) for 2 hours due to Loss of Offsite Power (LOOP). This is accompanied by an initiation of high pressure coolant injection (HPCI) and reactor core isolation cooling (RCIC) for mitigation of a LOCA. This is in conjunction with a loss of AC power and Battery Charger 71BC-1B.

3.1.1. The minimum voltages (manufacturer's requirement and calculated) for each critical component (Cat I & M) are shown in the tables of Appendix 5. Any components not meeting the manufacturers' requirement is identified in Appendix 5 and is evaluated for impact in Appendix 6.

3.1.2. All loads that drop below their minimum voltage requirements as shown in Appendix 5. These were evaluated in Appendix 6. The minimum battery voltage from the voltage drop study using IEEE-485 methodology was identified (109.65 VDC for LOCA and 109.86 VDC for SBO). This voltage was then compared to calculated battery voltage for the entire duty cycle. This voltage was

then assumed for the entire duty cycle and all loads were verified to remain operable for the entire duty cycle. This summary of this evaluation is in Appendix 6 in between the battery voltage and pickups/dropouts using the methodology in section 1.3.7. For LOCA, a minimum battery voltage of 109.7VDC (1.828 VPC) was evaluated against all loads to ensure operability. For SBO a minimum Battery voltage of 109.86 VDC (1.831 VPC) was evaluated against all loads to ensure operability. The results of this review are included in Appendix 6.

3.1.3. The voltage profile is based on 8% temperature margin and 25% aging margin. Appendix 9 contains IEEE-485 sizing sheets that utilize the current discharge profiles contained in Appendix 3 of this calculation and 109.7 VDC minimum voltage for LOCA and 109.86 VDC for SBO. The maximum load during any 1-minute period was conservatively assumed to be the load for the entire 1-minute period. Minimum voltages were evaluated in using the methodology in section 1.3.7. The sizing sheets demonstrate the batteries have 8% temperature margin (for 65°F), 25% aging margin, and 4% design margin for LOCA. For SBO there is 8% temperature margin, 25% aging margin, and 4.6% design margin.

3.1.4. The load profile for the 71SB-2 battery is presented in the table below. The table also indicates the recommended test currents for the modified performance and service test.

During the Battery Service Test (presently MST-71.20) the battery terminal voltage shall not drop below 109.7V (level 1 Acceptance Criteria). During MST-71.24 battery terminal voltage shall not drop below 109.7V during the first 2 hours (level 1 Acceptance Criteria). Once 2 hours has passed in MST-71.24, the test shall continue until 109.7V has been reached. 550 AMPS is the 3 Hour Rate at 1.828 Volts per cell (109.7V).

The Table below indicates the battery load profile for LOCA scenario service and modified performance discharge test currents.

Time Duration:	1st Minute	1 – 120 Minutes	120 - end	NA
Calculated Current	980.96	444.76	NA	NA
Test Current for Service Test (Currently MST-71.20)	1010	450	NA	NA
Test Current for Modified Performance Test (Currently MST- 71.24)	1010*	550**	550**	

*Do not temperature correct the 1st Minute of MST-71.24.

**Do not temperature correct below 65°F. The Modified Performance Test cannot be performed with electrolyte temperatures below 65°F.

During RO15, Service Test was performed for "B" Station Battery in accordance with MST-071.20. The test discharge current was 980 amps for the first minute and 400 amps for the 1 hour 59 minutes duration of remaining LOCA duty cycle. The newly calculated value in this revision is 980.96 amps for the first minute and 444.76 amps for the 1 hour 59 minutes duration of remaining LOCA duty cycle. New values are greater 0.96 amps for the first minute and 44.76 amps for the remaining hours than the service discharge test amps performed during RO15 resulting in validity question of the previous testing. The main reason of the increased current value for the first minute is due to additional emergency light bulb replacement resulting in approximately 16 amps increase. However, light bulb replacement will

not be performed until RO16 (or after RO16). This gives 15 amps margin over the RO15 test amps.
The main reason of the increased current value for the remaining 1 hour 59 minutes is due to the increased 23MOV-19 close seating current. The calculation Rev.1 didn't model seating current during the end of closing stroke over steady state current. However, MP-059.37, MOV Diagnostic Testing using "VOTES" System, requires to verify close current not to exceed 50 % of locked rotor/inrush current. In the battery calculation, 50% was used for conservatism. Actual test data for 23MOV-19 during RO15 was 38.38 %. If reflecting this actual data, the total battery current is reduced to 405.83 amps.
This reveals still 5.83 amps above the tested value. Based on the duty cycle (Appendix 4), the duration of exceeding the 400-amp test current is just 1 second. This occurs between t=1 min. 9.4 seconds and t= 1 min 10.4 seconds time period (Actual duration of elevated seating current is significantly less than 1 second). Except for this 1 second duration in the duty cycle, the highest battery discharge current is 318 amps, which is well below the 400-amp test value in RO15. There are no other loads in the duty cycle which are required to initiate at the same time as the seating of 23MOV-19. The dropout margins are significant and would not be adversely affected by this additional load. The lowest voltage with 402 amps during the time between 1 minute and 2 minute was 117.9 volts per the RO15 test data. For the duty cycle revision 2 calculation, during the same time period (of between 1 and 2 minutes) the lowest voltages are calculated to be 116.49 volts and 116.24 volts for the battery discharge currents of 402 amps and 445 amps, respectively. The acceptance criteria of the minimum voltage is 109.7 volts. Based on the above evaluation and the test data during RO15, it is concluded that the RO15 surveillance test is acceptable as is.

3.1.5. Open Items

1) Review JAF-CALC-ELEC-2548 to determine status and portions that have been included in JAF-CALC-ELEC-02610 that are no longer valid in JAF-CALC-ELEC-2548 (e.g. battery sizing, 2548 charger sizing is valid). (ACTS-00-53589)

2) ACT-02-65612 has been initiated to update the DC MOV Degraded Voltage Calculation

Entergy Nuclear Northeast			
Calculation No. JAF-CALC-ELEC-02610		Revision: 2	
Subject:	71 ELECTRICAL DISTRIBUTION	Page 19 of 21	
	125 VDC STATION BATTERY "B" SIZING &	Computed by: A Barton	Date: 4/30/03
	VOLTAGE DROP	Checked by: S Kim	Date: 4/30/03

4.0 REFERENCES

4.1 Engineering data, copper and aluminum conductor electrical cables, Okonite bulletin (Appendix 8)

4.2 ECRIS, dated 3/30/99.

4.3 IEEE 485-1997, IEEE Recommended Practice for sizing Lead-Acid Batteries for Stationary applications

4.4 Gould battery data for Battery NCN-33 (Appendix 7)

4.5 Operating Procedure OP-43 125V DC Power System

4.6 NEMA Standard ICS-2-1978

4.7 EPRI Reference series, Volume 4, Wire and Cable

4.8 Tabulation of Circuit Breaker Resistance Measured Data (Appendix 10)

4.9 IEEE Std 241-1983, IEEE Recommended Practice for Electrical Power Systems in Commercial Buildings.

4.10 Report No. JAF-RPT-ELEC-03375, Revision 1, Basis for Conductor Temperatures for 125VDC Voltage Drop Calculations

4.11 JAF-CALC-ELEC-01488, Revision 4, 4KV Emergency Bus Loss of Voltage, Degraded Voltage and Time Delay Relay Uncertainty and Setpoint Calculation.

4.12 AOP-49, Revision 10, "Station Blackout"

4.13 IEEE 946-1992, IEEE Recommended Practice for the Design of DC Auxiliary Power systems for Generating Stations

4.14 JAF-CALC-RWCU-01824, Revision 4, Reduced Voltage Analysis for 12MOV-13 (Appendix 5)

4.15 JAF-CALC-HPCI-01825, Revision 2, Reduced Voltage Analysis for 23MOV-14

4.16 JAF-CALC-HPCI-01826, Revision 5, Reduced Voltage Analysis for 23MOV-16 (Appendix 5)

4.17 JAF-CALC-HPCI-02094, Revision 3, Reduced Voltage Analysis for 23MOV-19 (Appendix 5)

4.18 JAF-CALC-HPCI-02164, Revision 2, Reduced Voltage Analysis for 23MOV-25 (Appendix 5)

4.19 JAF-CALC-HPCI-01994, Revision 1, Reduced Voltage Analysis for 23MOV-57 (Appendix 5)

4.20 JAF-CALC-HPCI-01995, Revision 2, Reduced Voltage Analysis for 23MOV-58 (Appendix 5)

4.21 JAF-CALC-CAD-03201, Revision 0, Reduced Voltage Analysis for 27MOV-122 (Appendix 5)

4.22 JAF-RPT-ELEC-02534, Revision 0, Report on operability of loads fed from 71SB-1 and 71SB-2

4.23 References to drawings are noted where the reference is used.

4.24 BWR Owners Group Dc Motor Performance methodology NEDC-32958 Rev. 0

4.25 MP-059.37, Revision 9, MOV Diagnostic Testing using "VOTES" System

Entergy Nuclear Northeast			
Calculation No. JAF-CALC-ELEC-02610		Revision: 2	
Subject:	71 ELECTRICAL DISTRIBUTION	Page 21 of 21	
	125 VDC STATION BATTERY "B" SIZING &	Computed by: A Barton	Date: 4/30/03
	VOLTAGE DROP	Checked by: S Kim	Date: 4/30/03

5.0 APPENDICES

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 1
Cable Data

CABLE & WIRE DATA

Cable mark Number	Conductors per cable	Wire Size	Type	Nominal DC Resistance in Ohms per 1000'			
				(@25° C)	(@40° C)	(@50° C)	(@90° C)
NFE-02	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-05	2	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NFE-08	2	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFE-09	3	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFE-13	3	4 AWG	Cu	0.2690	0.2845	0.2949	0.3364
NFE-21	3	1/0 AWG	Al	0.1680	0.1780	0.1846	0.2111
NFE-22	3	3/0 AWG	Al	0.1050	0.1112	0.1154	0.1320
NFE-23	3	4/0 AWG	Al	0.0836	0.0886	0.0919	0.1051
NFE-24	3	350MCM	Al	0.0505	0.0535	0.0555	0.0635
NFE-25	3	500MCM	Al	0.0354	0.0375	0.0389	0.0445
NFE-26	3	750MCM	Al	0.0236	0.0250	0.0259	0.0297
NFE-30	3	350MCM	Cu	0.0320	0.0338	0.0351	0.0400
NFE-55	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-61	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-62	3	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-63	5	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-64	7	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-65	9	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-66	12	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-67	1	500MCM	Cu	0.0222	0.0235	0.0243	0.0278
NFE-68	1	500MCM	Cu	0.0222	0.0235	0.0243	0.0278
NFF-09	4	4 AWG	Cu	0.2690	0.2845	0.2949	0.3364
NFF-15	12	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NFF-16	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-18	2	4 AWG	Cu	0.2690	0.2845	0.2949	0.3364
NFF-21	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-22	3	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-24	5	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-25	7	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-26	9	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-27	12	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-28	2	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFF-30	1	2 AWG	Cu	0.1690	0.1788	0.1853	0.2113
NFF-31	2	6 AWG	Cu	0.4270	0.4517	0.4681	0.5340
NFF-32	4	6 AWG	Cu	0.4270	0.4517	0.4681	0.5340
NFF-33	2	4 AWG	Cu	0.2690	0.2845	0.2949	0.3364
NFF-34	1	4/0 AWG	Al	0.0836	0.0886	0.0919	0.1051
NFF-35	12	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NFF-48	4	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NFF-51	1	750MCM	Al	0.0236	0.0250	0.0259	0.0297
NFF-64	2	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFF-89	4	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFF-90	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-50	7	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-51	9	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-52	12	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-28	12	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-04	1	500MCM	Cu	0.0222	0.0235	0.0243	0.0278
NGG-14	3	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NGG-30	2	2 AWG	Cu	0.1690	0.1788	0.1853	0.2113
NGG-31	3	2 AWG	Cu	0.1690	0.1788	0.1853	0.2113
NGG-33	3	6 AWG	Cu	0.4270	0.4517	0.4681	0.5340
NGG-34	3	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NGG-37	2	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NGG-47	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-48	3	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-49	5	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-50	7	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-51	9	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGH-08	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
SIS-14	1	14 AWG	Cu	2.7300	2.8878	2.9930	3.4138
SIS-12	1	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
SIS-8	1	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491

125V DC Battery Control Board 71BCB-2B

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
A01	71SB-2 Battery B	1STBBBL001	NFE-25	100	1	3	1.04	0.0375	0.0013	SE-10B
	(@Battery Rooms)	1STBBBL002	NFE-25	87	1	3	1.04	0.0375	0.0011	
		Interier Jumpers***							0.000488	
		Shunt Resistance***							0.000033	
									0.0030 *	
A02	71LPEEBDC1 Emer Lgt Pnl									SE-9PF
	25 Amp Breaker (ohms)								0.0080	PEDB
	(@Electric Swgr Bay)	1ELTBNK014	NFF-30	490	2	1	1.00	0.1788	0.1752	
		Unscheduled	NFF-30	2	2	1	1.00	0.1788	0.0007	
									0.1839 *	
A03	71LPEHB1 Emer Lgt Pnl									SE-9PF
	15 Amp Breaker (ohms)								0.0100	PEDB
	(@Turbine Building)	1ELTBNK015	NFF-31	135	1	2	1.00	0.4517	0.1220	
		Unscheduled	NFF-31	12	1	2	1.00	0.4517	0.0108	
									0.1428 *	
A04	71DC-B4 DG Rm Dist Cab									SE-10AW
	225 Amp Breaker (ohms)								0.0004	PEDB
	(@EDG Buildng)	1SCBBBK006****	NFE-30	753	1	3	1.04	0.0338	0.0398	
									0.0402 *	
A05	71LPEADC2 Emer Lgt Pnl									SE-9PE
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@ Control Room)	1ELTBNK001	NFF-30	425	2	1	1.00	0.1788	0.1520	
		Unscheduled	NFF-30	50	2	1	1.00	0.1788	0.0179	
									0.1738 *	
A06	71DC-B5 RR Dist Cab									SE-10BD
	125 Amp Breaker (ohms)								0.0010	PEDB
	(@Relay Room)	1SCBBBK005****	NFF-33	200	2	2	1.00	0.2845	0.0569	
									0.0579 *	
A07	71LPERDC3 Emer Lgt Pnl									SE-9PG
	15 Amp Breaker (ohms)								0.0100	PEDB
	(@Reactor Building)	1ELTBNK016**	NFF-32	861	1	4	1.04	0.4681	0.4192	
		Unscheduled	NFF-30	2	2	1	1.00	0.1788	0.0007	
									0.4299 *	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

*** Interier Jumpers Resistance was obtained from typical readings recorded in WRs 95-04978-00, 95-07560-00, 96-05156-00 and 97-06984-00

**** Actual cable length was verifyed by walkdown

125V DC Battery Control Board 71BCB-2B(Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
A08	71LPERW1 Emer Lgt Pnl									SE-9PG
	25 Amp Breaker (ohms)								0.0080	PEDB
	(@Radwaste Building)	1ELTBNK017	NFF-30	650	2	1	1.00	0.1788	0.2324	
		Unscheduled	NFF-30	2	2	1	1.00	0.1788	0.0007	
								*	0.2411	
	25 Amp Breaker (ohms)								0.0080	
	25ASP-4 Aux Shut Down Pnl	1PCIBBK042	NGG-37	50	1	2	1.00	1.1424	0.1142	
	(@Administration Building)	1PCIBBK043	NGG-37	200	1	2	1.00	1.1424	0.4570	
								*	0.5792	
B02	71DC-B3 RR Dist Cab									SE-10M
	100 Amp Breaker (ohms)								0.0010	PEDB
	(@Relay Room)	1SCBBBK003***	NFF-30	88	2	1	1.00	0.1788	0.0315	
								*	0.0325	
B03	71DC-B2 RR Dist Cab									SE-10K
	100 Amp Breaker (ohms)								0.0010	PEDB
	(@Relay Room)	1SCBBBK004***	NFF-30	182	2	1	1.00	0.1788	0.0651	
								*	0.0661	
B04	71DC-B1 RR Dist Cab									SE-10H
	100 Amp Breaker (ohms)								0.0010	PEDB
	(@Relay Room)	1SCBBBK002***	NFF-30	99	2	1	1.00	0.1788	0.0354	
								*	0.0364	
B05	71BMCC-4 React Bldg MCC									
	200 Amp Breaker (ohms)								0.0006	PEDB
	(@Reactor Building)	1DMSBBL005**	NGG-04	350	1	1	1.00	0.0243	0.0085	ECRIS
		1DMSBBL006**	NGG-04	350	1	1	1.00	0.0243	0.0085	
								*	0.0176	
B06	600v SwgrBus 11600 (71L16)									SE-10AW
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Reactor Building)	1L1EBBK004**	NGG-14	455	1	3(1sp)	1.04	0.7444	0.7045	
								*	0.7085	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

*** Actual cable length was verifyed by walkdown

125V DC Battery Control Board 71BCB-2B(Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
C01	71BMCC-2 React Bldg MCC 400 Amp Breaker (ohms) (@Reactor Building)								0.0002	PEDB
		1DMSBBK015**	NFE-68	300	1	2	1.00	0.0243	0.0146	ECRIS
		1DMSBBK005**	NFE-26	173	1	3(1sp)	1.04	0.0259	0.0093	
								*	0.0242	
C02	31P-7B RFPT Emer Oil Pmp 100 Amp Breaker (ohms) (@Turbine Building) O.L. Heater @ 50° C								0.0010	SE-10D PEDB
		1RFPBNL002 F71.9B	NFE-21	375	1	3	1.04	0.1780	0.1388	
								0.0015	0.0015	
								*	0.1413	
	31P-7B Emer Oil Pmp Cntr (@Turbine Building)	1RFPBNC239	NFF-24	590	1	5	1.04	1.8194	2.2328	
		1RFPBNC240	NFF-26	270	1	9	1.04	1.8194	1.0218	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	3.3248	
D01	71BMCC-6 React Bldg MCC 300 Amp Breaker (ohms) (@Reactor Building)								0.0004	PEDB
		1DMSBBL001**	NGG-04	384	1	1	1.00	0.0243	0.0093	ECRIS
		1DMSBBL002**	NGG-04	384	1	1	1.00	0.0243	0.0093	
		1DMSBBL003**	NGG-04	384	1	1	1.00	0.0243	0.0093	
		1DMSBBL004**	NGG-04	384	1	1	1.00	0.0243	0.0093	
								*	0.0191	
D02	94P-2 Emer Bearing Oil Pmp 250 Amp Breaker (ohms) (@Turbine Building) O.L. Heater @ 50° C (2 in parallel)								0.0004	SE-10E PEDB
		1TMXNNK028 F71.9B	NFE-24	180	1	3	1.04	0.0535	0.0200	
								0.0008	0.0008	
								*	0.0212	
	94P-2 Bearing Oil Pmp Cntr (@Turbine Building)	1TMXNNC141	NFF-26	273	1	9	1.04	1.8194	1.0331	
		1TMXNNC143	NFF-21	200	1	2	1.00	1.8194	0.7278	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	1.8306	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

125V DC Power Panel 71DC-B1

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
3	Gen. & Transf. Prim. Protect. 20 Amp Breaker (ohms)								0.0100	FE-3CG PEDB
	(@Control Room)	1UPRNNC062	NFF-21	120	1	2	1.00	1.8194	0.4367	
		1UPRNNC036	NFF-21	320	1	2	1.00	1.8194	1.1644	
		1UPRNNC037	NGG-47	90	1	2	1.00	1.8194	0.3275	
		1UPRNNC038	NGG-47	97	1	2	1.00	1.8194	0.3530	
		1UPRNNC039	NGG-47	103	1	2	1.00	1.8194	0.3748	
		1UPRNNC040	NGG-47	105	1	2	1.00	1.8194	0.3821	
		1UPRNNC041	NFF-21	105	1	2	1.00	1.8194	0.3821	
		1UPRNNC045	NFF-21	225	1	2	1.00	1.8194	0.8187	
								*	0.2605	
		1UPRNNC042	NFF-21	225	1	2	1.00	1.8194	0.8187	
		1UPRNNC046	NFF-21	225	1	2	1.00	1.8194	0.8187	
								*	0.4094	
		1UPRNNC043	NFF-21	725	1	2	1.00	1.8194	2.6382	
		1UPRNNC047	NFF-21	725	1	2	1.00	1.8194	2.6382	
								*	1.3191	
		1UPRNNC043	NFF-21	725	1	2	1.00	1.8194	2.6382	
		1UPRNNC047	NFF-21	725	1	2	1.00	1.8194	2.6382	
								*	1.3191	
		1UPRNNC044	NFF-21	750	1	2	1.00	1.8194	2.7291	
		1UPRNNC048	NFF-21	750	1	2	1.00	1.8194	2.7291	
								*	1.3646	
	Jumper cable from RU-4 to RU-3	Unscheduled	NFF-15	10	1	12	1.04	1.1424	0.0238	
		1UPRNNC032	NFF-15	1241	1	12	1.04	1.1424	2.9489	
		1UPRNNC034	NFF-48	176	1	4	1.04	1.1424	0.4182	
		1UPRNNC035	NFF-48	245	1	4	1.04	1.1424	0.5822	
								*	0.2434	
		1UPRNNC033	NFF-48	240	1	4	1.04	1.1424	0.5703	
								*	11.5074	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-B1

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
7	115kV Bus Diff & Bkr Failure									FE-3DL
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Relay Room)	1ZLCNNC011	NFF-28	55	1	2	1.00	0.7182	0.0790	
	Jumper cable from RL-5 to RL-3	Unscheduled	NFF-27	25	1	12	1.04	1.8194	0.0946	
								*	0.1776	
11	345kV Bkr 10042 Backup Trip									FE-3BS
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Relay Room)	1YL2NNC043	NFF-64	110	1	2	1.00	0.7182	0.1580	
		1YL2NNC020	NFF-15	1340	1	12	1.04	1.1424	3.1842	
		1YL2NNC026	NFF-15	375	1	12	1.04	1.1424	0.8911	
		1YL2NNC031	NFF-15	335	1	12	1.04	1.1424	0.7960	
		1YL2NNC035	NFF-15	432	1	12	1.04	1.1424	1.0265	
								*	6.0599	
15	71PCB-10042 345kV Bkr Trip Ckt									FE-2AG
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Yard)	1YL2NNC022	NFF-18	100	1	2	1.00	0.2845	0.0569	
		1YL2NNC021	NFF-18	1370	1	2	1.00	0.2845	0.7797	
		1YL2NNC017	NFF-18	1340	1	2	1.00	0.2845	0.7626	
		1YL1NNC121	NFY-28	40	1	12	1.04	1.8194	0.1514	
								*	1.7545	
17	71PCB-10052 345kV Bkr Trip Ckt									FE-2AH
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Yard)	1YL1NNC024	NFF-18	101	1	2	1.00	0.2845	0.0575	
		1YL1NNC023	NFF-18	1150	1	2	1.00	0.2845	0.6545	
		1YL1NNC021	NFF-09	1270	1	4	1.04	0.2845	0.7517	
		1YL1NNC077	NFF-48	80	1	4	1.04	1.1424	0.1901	
		Unscheduled	NGG-47	25	1	2	1.00	1.8194	0.0910	
								*	1.7487	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-B1

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
18	345kV Bkr 10052 Backup Trip									FE-3BT
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Relay Room)	1YL1NNC025	NFF-64	140	1	2	1.00	0.7182	0.2011	
		1YL1NNC039	NFF-15	1270	1	12	1.04	1.1424	3.0178	
		1YL1NNC042	NFF-15	310	1	12	1.04	1.1424	0.7366	
		1YL1NNC040	NFF-15	268	1	12	1.04	1.1424	0.6368	
		1YL1NNC041	NFF-15	302	1	12	1.04	1.1424	0.7176	
									* 5.3140	
19	71MOD-10031 345kV Disc. Switch Open									FE-2AS
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Yard)	1YG1NNC008	NFE-61	76	1	2	1.00	1.8194	0.2766	
		1YG1NNC007	NFE-65	180	1	9	1.04	1.8194	0.6812	
		1YG1NNC004	NFF-15	988	1	12	1.04	1.1424	2.3477	
		1YG1NNC009	NFF-15	240	1	12	1.04	1.1424	0.5703	
		1YG1NNC010	NFF-15	172	1	12	1.04	1.1424	0.4087	
		1YG1NNC020	NFE-61	175	1	2	1.00	1.8194	0.6368	
	Jumper cable from RU-4 to RU-3	Unscheduled	NFF-27	10	1	12	1.04	1.8194	0.0378	
									* 4.9631	
	71MOD-10031 Motor									
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Yard)	1YL1NNC001	NFF-64	785	1	2	1.00	0.7182	1.1277	
		Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
									* 1.1460	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-B2

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
1	Feed to 09-33 Panel									FE-3DE
	20 Amp Breaker (ohms)								0.010	PEDB
	(Panel 09-33 @ Relay Room)	1CICBBC107	NFF-21	70	1	2	1.00	1.8194	0.2547	
								*	0.2647	
	RCIC Chanel B Relay Logics	1CICBBC700	NFY-50	115	1	7	1.04	1.8194	0.4352	
								*	0.4352	
	ADS System Alt. Pwr Logic	1ADSBBC020	NFF-21	70	1	2	1.00	1.8194	0.2547	
		1ADSBBC005	NFF-24	100	1	5	1.04	1.8857	0.3922	
								*	0.6469	
	ADS System 6 SOV Load	1ADSBCC002**	NFF-21	60	1	2	1	1.8857	0.2263	FE-3FV
	(@Primary Cont.)	1ADSARC006**	NFF-24	75	1	5	1.04	1.8857	0.2942	
		1ADSARC081**	NFF-24	255	1	5	1.04	1.8857	1.0002	
		1ADSARC070**	NGG-49	60	1	5	1.04	1.8857	0.2353	
		1ADSARC060**	NGG-49	60	1	5	1.04	1.8857	0.2353	
		1ADSARC003**	NFF-24	385	1	5	1.04	1.8857	1.5101	
		16X-101B***	SIS-12	15	1	1	1.04	2.1508	0.0671	
								*	3.5685	
	02SOV-71E1	1ADSBCC002**	NFF-21	60	1	2	1	1.8857	0.2263	FE-3FV
	(@Primary Cont.)	1ADSARC006**	NFF-24	75	1	5	1.04	1.8857	0.2942	
		1ADSARC081**	NFF-24	255	1	5	1.04	1.8857	1.0002	
		1ADSARC070**	NGG-49	60	1	5	1.04	1.8857	0.2353	
		1ADSARC060**	NGG-49	60	1	5	1.04	1.8857	0.2353	
		1ADSARC003**	NFF-24	385	1	5	1.04	1.8857	1.5101	
		16X-101B***	SIS-12	15	1	1	1.04	2.1508	0.0671	
		1ADSARC021***	NFF-21	120	1	2	1.00	2.1508	0.5162	
		Unscheduled***	NFF-21	10	1	2	1.00	2.1508	0.0430	
								*	4.1277	
	RHR Chanel B Logic	1RHRBBC711	NFY-51	115	1	9	1.04	1.8194	0.4352	FE-3DF
								*	0.4352	
	ADS Low Level Logic	1ADSBBC700	NFY-50	115	1	7	1.04	1.8194	0.4352	FE-3DF
								*	0.4352	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

*** Cable resistance based on 90C due to cables entering containment

125V DC Power Panel 71DC-B2 (Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
2	Syst & Back-Up Scram Intlk									FE-FQ
	20 Amp Breaker (ohms)								0.010	PEDB
	(@ Reactor Building)	1RPSBJK002**	NFF-21	80	1	2	1.00	1.8857	0.3017	
		1RPSBMC001**	NFF-21	450	1	2	1.00	1.8857	1.6971	
		1RPSBMC002**	NFF-21	50	1	2	1.00	1.8857	0.1886	
								*	2.1974	
5	Core Spray Chnl B Logic (Pnl 09-47)									FE-3FU
	20 Amp Breaker (ohms)								0.010	PEDB
	(@Relay Room)	1CSPBBC151	NFF-21	65	1	2	1.00	1.8194	0.2365	
		1CSPBBC700	NFY-52	110	1	12	1.04	1.8194	0.4163	
								*	0.6628	
6	Feed to 09-39 Panel									FE-3FP
	20 Amp Breaker (ohms)								0.0100	PEDB
	Feed to 09-39 Panel	1HPIBBC057**	NFF-21	65	1	2	1.00	1.8857	0.2451	
								*	0.2551	
	HPCI Relay Logic (Pnl 09-39)	1HPIBBC061**	NFF-21	52	1	2	1.00	1.8857	0.1961	
								*	0.1961	
	23SOV-102 (@Reactor Building)	1HPIBBC170**	NGG-47	340	1	2	1.00	1.8857	1.2823	
		Unscheduled**	NGG-47	25	1	2	1.00	1.8857	0.0943	
								*	1.3766	
9	RFPT 31FPD-5B Trip and Reset									FE-3FD
	20 Amp Breaker (ohms)								0.0100	PEDB
		1RFPBNC152	NFF-21	120	1	2	1.00	1.8194	0.4367	
		1RFPBNC157	NFF-22	130	1	3	1.04	1.8194	0.4920	
		1RFPBNC244	NFF-21	191	1	2	1.00	1.8194	0.6950	
		1RFPBNC242	NFF-24	780	1	5	1.04	1.8194	2.9518	
		Unscheduled	NFF-21	25	1	2	1.00	1.8194	0.0910	
	31SOV-12B(@Turbine Bldg)							*	4.6765	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

125V DC Power Panel 71DC-B2 (Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
10	Feed to 09-3 Panel									FE-3BM
	20 Amp Breaker (ohms)								0.0100	PEDB
		1RHRBBC334**	NFF-28	150	1	2	1.00	0.7444	0.2233	
								*	0.2333	
	Position Indicators Lights	1HPIBBC110**	NFF-24	780	1	5	1.04	1.8857	3.0594	
	(@ Control Room)							*	3.0594	
	HPCI Inverter 23INV-79 (Pnl 09-3)	Unscheduled**	SIS-14	10	1	2	1.00	2.9930	0.0599	
	(@ Control Room)							*	0.0599	
	Pwr Supply 23TU-3-12 (Pnl 09-39)	1HPIBBC112**	NFF-21	150	1	2	1.00	1.8857	0.5757	
	(@Relay Room)	Unscheduled**	SIS-14	10	1	2	1.00	2.9930	0.0599	
								*	0.6356	
	23SOV-53 & -54	1HPIBBC099**	NFF-21	735	1	2	1.00	1.8857	2.7720	
	(@Reactor Building)	1HPIBBC100**	NFF-21	600	1	2	1.00	1.8857	2.2628	
								*	5.0348	
11	Rx Recirc Pmp 02-184P-3B									FE-10AZ
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@MG Room)	1RWRBNK043**	NFF-28	175	1	2	1.00	0.7444	0.2605	
		1RWRBNK044**	NFF-28	60	1	2	1.00	0.7444	0.0893	
	O.L. Heater @ 50° C	C8.67A						0.0286	0.0286	
	Fluid Drv Emer Lube Oil Pmp Mtr							*	0.3885	
	Rx Recirc Pmp 02-184P-3B Cntr	1RWRBNK043**	NFF-28	175	1	2	1.00	0.7444	0.2605	
		1RWRBNC035**	NFF-26	60	1	9	1.04	1.8857	0.2353	
								*	0.5059	
12	RWR MG Set B Exiter Fld CB									FE-3CL
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@MG Room)	1RWRBNC049**	NFF-28	165	1	2	1.00	0.7444	0.2457	
		Unscheduled**	SIS-14	10	2	1	1.00	2.9930	0.0599	
								*	0.3155	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

125V DC Power Panel 71DC-B2 (Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
13	RWR MG Set A Exiter Fld CB 20 Amp Breaker (ohms) (@MG Room)	 1RWRBNC050** Unscheduled**	 NFF-28 SIS-14	 305 10	 1 2	 2 1	 1.00 1.00	 0.7444 2.9930	0.0100 0.4541 0.0599 * 0.5240	FE-3CL PEDB
14	Steam Leak Det Sys Logic (09-21) 20 Amp Breaker (ohms) (@Control Room)	 1LKDBBC001	 NFF-21	 125	 1	 2	 1.00	 1.8194	0.0100 0.4549 * 0.4649	FE-3CS PEDB
16	ECCS Cabinet Pwr (09-96) 20 Amp Breaker (ohms) (@Relay Room)	 1SCBBBC001	 NFE-08	 60	 1	 2	 1.00	 0.7182	0.0100 0.0862 * 0.0962	FE-3TD PEDB
22	RB CCW Cont Isol Va (Pnl 09-75) Feed 20 Amp Breaker (ohms) (@Reactor Building)	 1RBCBBC700**	 NFE-55	 116	 1	 2	 1.00	 1.8857	0.0100 0.4375 * 0.4475	FE-3EW PEDB
	15SOV-130B (@Reactor Bldg)	1RBCBBC708** 1RBCBBC709**	NGG-50 NFE-55	279 81	1 1	7 2	1.04 1.00	1.8857 1.8857	1.0943 0.3055 * 1.3998	
23	27MAP Monitoring Analysis Panel 20 Amp Breaker (ohms) (@Relay Room)	 1HPIBBC146	 NGG-47	 120	 1	 2	 1.00	 0.7182	0.0100 0.1724 * 0.1824	FE-3SG PEDB
24	71INV-1B Inverter Pnl 40 Amp Breaker (ohms) (@Relay Room)	 1PCPBBC189	 NGG-34	 150	 1	 3	 1.04	 0.7182	0.0040 0.2241 * 0.2281	SE-3SAD PEDB

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

125V DC Power panel 71DC-B3

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
1	ESW Lockout Matrix Ckt. 1ESWB04									FE-3FG
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1ESWBBC131**	NFF-21	175	1	2	1.00	1.8857	0.6600	
		1ESWBBC134**	NFF-22	526	1	3	1.04	1.8857	2.0631	
		1ESWBBC135**	NFF-21	12	1	2	1.00	1.8857	0.0453	
								*	2.7784	
03	94EHC H_2 & Stator Cooling Panel									FE-2S
	20 Amp Breaker (ohms)								0.0100	PEDB
		1GSCNNC001	NFE-05	672	1	2	1	1.1424	1.5354	
								*	1.5454	
05	SRV Electric Lift Cab 09-ECCS2-EP									FE-3AAS
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1SCBBBC002	NGH-08	150	1	2	1.00	1.8194	0.5458	
								*	0.5558	
6	Standby Gas Treat Cont B (27MAP)									FE-3SG
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1SGTBBC010	NFF-21	185	1	2	1	1.8194	0.6732	
		1SGTBBC077	NFE-63	129	1	5	1.04	1.8194	0.4882	
								*	1.1714	
13	38MOV-VB2 Cond Vac									SE-10AY
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Turbine Building)	1VACBNK022	NFF-21	390	1	2	1.00	1.8194	1.4191	
	OL Heater	N-25						0.0551	0.0551	
	Total Res.							*	1.4843	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

125V DC Power panel 71DC-B3

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
17	71H02 4160V SWGR Bus 10200 40 Amp Breaker (ohms) (@Electric Bay)	1HONBNK001	NFF-31	420	1	2	1.00	0.4517	0.0040 0.3794 * 0.3834	SE-8D PEDB
18	71H04 4160V SWGR Bus 10400 40 Amp Breaker (ohms) (@Electric Bay)	1HONDNK001	NFF-33	480	1	2	1.00	0.2845	0.0040 0.2732 * 0.2772	SE-8X PEDB
19	71L34 600V SWGR Bus 13400 40 Amp Breaker (ohms) (@Electric Bay)	1L3NBNK002	NFF-28	454	1	2	1.00	0.7182	0.0040 0.6522 * 0.6562	SE-9CE PEDB
22	Annunciator Panel 40 Amp Breaker (ohms) (@Relay Room)	1ANNNNC499	NFF-31	260	1	2	1.00	0.4517	0.0040 0.2349 * 0.2389	FE-7B PEDB
24	Interposing Relay Cab 09IR-1 40 Amp Breaker (ohms) (@Relay Room)	1ANNNNC498	NFF-31	270	1	2	1.00	0.4517	0.0040 0.2439 * 0.2479	FE-7F PEDB

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-B4

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
2	93FPBD EDG B&D Para Cont Pnl									FE-14B
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@EDG Building)	1EDGBBK001	NFF-21	90	1	2	1.00	1.8194	0.3275	
								*	0.3375	
	TBRX1 or VSRX1	1EDGBBC068	NFF-22	140	1	3	1.04	1.8194	0.5298	
	TBRX2 or VSRX2	1EDGDBC068	NFF-22	135	1	3	1.04	1.8194	0.5109	
	TD8M	1EDGBBC029	NFF-24	65	1	5	1.04	1.8194	0.2460	
7	71L26 600V SWGR Bus									SE-9CE
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Electric Bay)	1L2EBBK004	NGG-14	315	1	3	1.04	0.7182	0.3529	
								*	0.3569	
8	71H06 4160V SWGR Bus									SE-8AU
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@EDG Building)	1HOEBBK001	NFF-33	65	1	2	1.00	0.2845	0.0370	
								*	0.0410	
11	Panel 93ECP-B									FE-14B
	100 Amp Breaker (ohms)								0.0010	PEDB
	(@EDG Building)	1EDGBBK036**	NFF-28	137	1	2	1.00	0.7182	0.1968	
								*	0.1978	
	93ECP-B Emergency Diesel Generator Engine Control Panel Loads Cables:									
	K1	1EDGBBC186	NGG-51	225	1	9	1.04	1.8194	0.8515	
		1EDGBBC185	NGG-51	175	1	9	1.04	1.8194	0.6623	
		1EDGBBC016	NFF-25	906	1	7	1.04	1.8194	3.4287	
		1EDGBBC024	NFF-21	142	1	2	1.00	1.8194	0.5167	
		1EDGBBC040	NFF-21	50	1	2	1.00	1.8194	0.1819	
								****	5.4591	
	FFR	1EDGBBC019	NFF-21	135	1	2	1.00	1.8194	0.4912	
	SOV-1B	Unscheduled	SIS-14	40	1	2	1.00	2.8878	0.2310	
	SOV-2B	Unscheduled	SIS-14	25	1	2	1.00	2.8878	0.1444	
	ESS-B	Unscheduled	SIS-14	35	1	2	1.00	2.8878	0.2021	
	93GS-5B Gov Booster Pmp	Unscheduled	SIS-12	15	1	2	1.00	1.8194	0.0546	
	93P-4B Fuel Oil Pmp	Unscheduled	SIS-12	10	1	2	1.00	1.8194	0.0364	

* Total resistance of the circuit path for this load

** Actual cable length was verified by walkdown

125V DC Power Panel 71DC-B4

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
11	93EGP-B Emer Diesel Gen Cont. Pnl. (@EDG Building)									FE-14B
(Cont'd	93EDG-B Field Flash	1EDGBBK044	NFF-30	80	2	1	1.00	0.1788	0.0286	
								*	0.0296	
	93EDG- B Field Flash	Limiting Resistor							2.5000	
	Rectifier Asembly	Silicon Rectifier CR56 (P/N 1N3296)							0.0055	
		1EDGBBL008	NFF-34	120	2	1	1.00	0.0886	0.0213	
	Field Flash Resistance								0.4910	1.12-23
								*	3.0474	
	93P/S-B	1EDGBBC064	NFF-21	155	1	2	1.00	1.8194	0.5640	
12	Panel 93ECP-D									FE-14D
	100 Amp Breaker (ohms)								0.0010	PEDB
	(@EDG Building)	1EDGDBK040**	NFF-28	103	1	2	1.00	0.7182	0.1480	
	93EGP-D Emer Diesel Gen Cont. Pnl	(@EDG Building)						*	0.1490	
	K1	1EDGDBC183	NGG-51	235	1	9	1.04	1.8194	0.8893	
		1EDGDBC184	NGG-51	235	1	9	1.04	1.8194	0.8893	
		1EDGDBC167	NFF-25	936	1	7	1.04	1.8194	3.5422	
		1EDGDBC024	NFF-21	155	1	2	1.00	1.8194	0.5640	
		1EDGDBC031	NFF-21	50	1	2	1.00	1.8194	0.1819	
								*	6.0668	
	FFR	1EDGDBC019	NFF-21	132	1	2	1.00	1.8194	0.4803	
	SOV-1D	Unscheduled	SIS-14	40	1	2	1.00	2.8878	0.2310	
	SOV-2D	Unscheduled	SIS-14	25	1	2	1.00	2.8878	0.1444	
	ESS-D	Unscheduled	SIS-14	35	1	2	1.00	2.8878	0.2021	
	93GS-5D Gov Booster Pmp	Unscheduled	SIS-12	15	1	2	1.00	1.8194	0.0546	
	93P-4D Fuel Oil Pmp	Unscheduled	SIS-12	10	1	2	1.00	1.8194	0.0364	

* Total resistance of the circuit path for this load

** Actual cable length was verifyed by walkdown

125V DC Power Panel 71DC-B4

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
12	93EGP-D Emer Diesel Gen Cont. Pnl. (@EDG Building)									FE-14D
(Cont'd	93EDG-D Field Flash	1EDGDBK044	NFF-30	50	2	1	1.00	0.1788	0.0179	
								*	0.0189	
	93EDG- B Field Flash	Limiting Resistor							2.5000	
	Rectifier Asembly	Silicon Rectifier CR56 (P/N 1N3296)							0.0055	
		1EDGDBL008	NFF-34	114	2	1	1.00	0.0886	0.0202	
	Field Flash Resistance								0.4910	1.12-23
								*	3.0356	
	93P/S-D	1EDGDBC064	NFF-21	122	1	2	1.00	1.8194	0.4439	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-B5

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
01	Feedwater Inverter 06INV-1B									FE-3CT
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Control Room)	1FWCNNC009	NFE-21	300	1	2	1.00	0.1780	0.1068	
								*	0.1168	
04	09ARI-1B Alt. Rod Insertion.									FE-3EAA
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Control Room)	1ARIBBC001	NGG-47	125	1	2	1.00	1.8194	0.4549	
		1RWRBNC701	NGG-49	35	1	5	1.04	1.8194	0.1325	
		1RWRANC702	NGG-47	215	1	2	1.00	1.8194	0.7824	
								*	1.3797	
20	71L14 600V SWGR Bus 11400									SE-9WZ
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Reactor Building)	1L1NBNK001**	NFF-28	570	1	2	1.00	0.7444	0.8486	
								*	0.8526	
22	71L24 600V SWGR Bus 12400									SE-9WZ
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Turbine Building)	1L2NBNK001	NFF-28	385	1	2	1.00	0.7182	0.5531	
								*	0.5571	
24	71L44 600V SWGR Bus 14400									SE-9WZ
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Turbine Building)	1L4NBNK001	NFF-28	750	1	2	1.00	0.7182	1.0774	
								*	1.0814	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

125V DC 71BMCC-2 React Bldg MCC

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OA2	23MOV-14									SE-10AF
	70 Amp Breaker (ohms)								0.0040	PEDB
	Armature (A1)	1HPIBBK037	NFE-22	90	1	3	1.04	0.1154	0.0108	
	Armature (A2)	1HPIBBK037	NFE-22	90	1	3	1.04	0.1154	0.0108	
	Series (S1)	1HPIBBK037	NFE-22	90	1	3	1.04	0.1154	0.0108	
	Series (S2)	1HPIBBK005	NFF-33	120	1	2 (1sp)	1.00	0.2949	0.0354	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-08	10	2	2	1.00	0.7444	0.0298	
	OL Heater @ 55° C		K21.3B					0.0072	0.0072	PEDB
	Total Res.								* 0.1088	
	23MOV-14 Control (Open)									SE-10AF
	70 Amp Breaker (ohms)								0.0040	PEDB
		1HPIBBC001	NFF-24	120	1	5	1.04	1.8857	0.4707	
		1HPIBBC002	NFF-24	15	1	5	1.04	1.8857	0.0588	
		1HPIBBC003	NFE-64	625	1	7	1.04	1.8857	2.4514	
		1HPIBBC004	NFF-21	145	1	2	1.00	1.8857	0.5469	
	Total Res.								* 3.5318	
OB1	23MOV-17									SE-10AH
	15 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1HPIBBK010	NFF-21	260	1	2	1.00	1.8857	0.4903	
		1HPIBBK039	NFF-31	250	1	2	1.00	0.4681	0.1170	
	Armature (A2)	1HPIBBK010	NFF-21	260	1	2	1.00	1.8857	0.4903	
		1HPIBBK039	NFF-31	250	1	2	1.00	0.4681	0.1170	
	Series (S1)	1HPIBBK011	NFF-21	260	1	2	1.00	1.8857	0.4903	
		1HPIBBK040	NFF-31	250	1	2	1.00	0.4681	0.1170	
	Series (S2)	1HPIBBK011	NFF-21	260	1	2	1.00	1.8857	0.4903	
		1HPIBBK040	NFF-31	250	1	2	1.00	0.4681	0.1170	
	OL Heater @ 55° C		K6.42A					0.0643	0.0643	PEDB
	Total Res.								* 0.4522	

* Total resistance of the circuit path for this load

125V DC 71BMCC-4 React Bldg MCC

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OB1	23MOV-25									SE-10AN
	30 Amp Breaker (ohms)								0.0060	PEDB
	Armature (A1)	1HPIBBK025	NFF-21	150	1	2	1.00	1.8857	0.2829	
	Armature (A1)	1HPIBBK049	NFF-33	150	1	2	1.00	0.2949	0.0442	
	Armature (A2)	1HPIBBK025	NFF-21	150	1	2	1.00	1.8857	0.2829	
	Armature (A2)	1HPIBBK049	NFF-33	150	1	2	1.00	0.2949	0.0442	
	Series (S1)	1HPIBBK026	NFF-21	150	1	2	1.00	1.8857	0.2829	
	Series (S1)	1HPIBBK050	NFF-33	150	1	2	1.00	0.2949	0.0442	
	Series (S2)	1HPIBBK026	NFF-21	150	1	2	1.00	1.8857	0.2829	
	Series (S2)	1HPIBBK050	NFF-33	150	1	2	1.00	0.2949	0.0442	
	O.L. Heater @ 55° C		K42.5B					0.0023	0.0023	PEDB
	Total Res.								* 0.1613	
	23MOV-25 Control (Open)									
	30 Amp Breaker (ohms)								0.0060	
		1HPIBBC029	NFE-64	150	1	7	1.04	1.8857	0.5883	
		1HPIBBC030	NFF-24	15	1	5	1.04	1.8857	0.0588	
		1HPIBBC716	NGG-47	7	1	7	1.04	1.8857	0.0275	
		1HPIBBC160	NGG-50	142	1	7	1.04	1.8857	0.5570	
		1HPIBBC161	NGG-51	50	1	9	1.04	1.8857	0.1961	
		1HPIBBC031	NFF-26	511	1	9	1.04	1.8857	2.0043	
		1HPIBBC032	NFF-24	145	1	5	1.04	1.8857	0.5687	
		1HPIBBC104	NFF-21	650	1	2	1.00	1.8857	2.4514	
		Unscheduled	SIS-14	7	1	2	1.00	1.8194	0.0255	
	Total Res.								* 6.4836	
	23MOV-25 Control (Close)									
	30 Amp Breaker (ohms)								0.0060	
		1HPIBBC029	NFE-64	150	1	7	1.04	1.8857	0.5883	
		1HPIBBC030	NFF-24	15	1	5	1.04	1.8857	0.0588	
		1HPIBBC716	NGG-47	7	1	7	1.04	1.8857	0.0275	
		1HPIBBC160	NGG-50	142	1	7	1.04	1.8857	0.5570	
		1HPIBBC161	NGG-51	50	1	9	1.04	1.8857	0.1961	
		1HPIBBC042	NFF-21	123	1	2	1.00	1.8857	0.4639	
		Unscheduled	SIS-14	7	1	2	1.00	1.8194	0.0255	
	Total Res.								* 1.9231	

* Total resistance of the circuit path for this load

125V DC 71BMCC-4 React Bldg MCC (Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OB2	12MOV-18									SE-10R
	25 Amp Breaker (ohms)								0.0080	PEDB
	Armature (A1)	1PCIBBK029	NFE-25	227	1	3	1.04	0.0389	0.0092	
	Armature (A2)	1PCIBBK029	NFE-25	227	1	3	1.04	0.0389	0.0092	
	Series (S1)	1PCIBBK029	NFE-25	227	1	3	1.04	0.0389	0.0092	
	Series (S2)	1PCIBBK030	NFF-34	600	1	2	1.00	0.0919	0.0551	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-08	10	2	2	1.00	0.7444	0.0298	
	O.L. Heater @ 55° C		L19.9B					0.0065	0.0065	PEDB
	Total Res.							*	0.1270	
	12MOV-18 Control (Close)									
	15 Amp Breaker (ohms)								0.0100	
		1PCIBBC005	NFE-64	775	1	7	1.04	1.8857	3.0398	
		1PCIBBC305	NGG-47	7	1	2	1.00	1.8857	0.0264	
		1PCIBBC006	NFF-24	10	1	5	1.04	1.8857	0.0392	
		1PCIBBC260	NGG-51	298	1	9	1.04	1.8857	1.1688	
		1PCIBBC261	NGG-51	130	1	9	1.04	1.8857	0.5099	
		1PCIBBC007	NFF-26	636	1	9	1.04	1.8857	2.4946	
		1PCIBBC008	NFF-26	110	1	9	1.04	1.8857	0.4314	
	Total Res.							*	7.7201	
OC1	23MOV-57									SE-10AP
	15 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1HPIBBK051	NFE-05	260	1	2	1.00	1.1840	0.3079	
	Armature (A2)	1HPIBBK051	NFE-05	260	1	2	1.00	1.1840	0.3079	
	Series (S1)	1HPIBBK028	NFF-21	150	1	2	1.00	1.8857	0.2829	
	Series (S1)	1HPIBBK029	NFF-21	150	1	2	1.00	1.8857	0.2829	
	Series (S2)	1HPIBBK028	NFF-21	150	1	2	1.00	1.8857	0.2829	
	Series (S2)	1HPIBBK029	NFF-21	150	1	2	1.00	1.8857	0.2829	
	O.L. Heater @ 55° C		K23.6B					0.0060	0.0060	PEDB
	Total Res.							*	0.9146	

* Total resistance of the circuit path for this load

125V DC 71BMCC-4 React Bldg MCC (Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OC1 (Cont'd)	23MOV-57 Control (Open)									SE-10AP
	15 Amp Breaker (ohms)								0.0100	PEDB
		1HPIBBC033	NFF-25	150	1	7	1.04	1.8857	0.5883	
		1HPIBBC034	NFF-24	30	1	5	1.04	1.8857	0.1177	
		1HPIBBC035	NFF-25	675	1	7	1.04	1.8857	2.6475	
		1HPIBBC036	NFF-24	145	1	5	1.04	1.8857	0.5687	
								*	3.9323	
	23MOV-57 Control (Close)									
	15 Amp Breaker (ohms)								0.0100	PEDB
		1HPIBBC033	NFF-25	150	1	7	1.04	1.8857	0.5883	
		1HPIBBC034	NFF-24	30	1	5	1.04	1.8857	0.1177	
		1HPIBBC035	NFF-25	675	1	7	1.04	1.8857	2.6475	
		1HPIBBC036	NFF-24	145	1	5	1.04	1.8857	0.5687	
								*	3.9323	
OC2	23MOV-58									SE-10AQ
	15 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1HPIBBK052	NFF-31	110	1	2	1.00	0.4681	0.0515	
	Armature (A2)	1HPIBBK052	NFF-31	110	1	2	1.00	0.4681	0.0515	
	Series (S1)	1HPIBBK031	NFF-21	240	1	2	1.00	1.8857	0.4526	
	Series (S1)	1HPIBBK032	NFF-21	240	1	2	1.00	1.8857	0.4526	
	Series (S2)	1HPIBBK031	NFF-21	240	1	2	1.00	1.8857	0.4526	
	Series (S2)	1HPIBBK032	NFF-21	240	1	2	1.00	1.8857	0.4526	
	O.L. Heater @ 55° C		K6.42A					0.0643	0.0643	PEDB
	Total Res.							*	0.6299	

* Total resistance of the circuit path for this load

125V DC 71BMCC-4 React Bldg MCC (Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OC2 (Cont'd)	23MOV-58 Control (Open)									
	15 Amp Breaker (ohms)								0.0100	PEDB
		1HPIBBC037	NFE-64	240	1	7	1.04	1.8857	0.9413	
		1HPIBBC038	NFF-24	20	1	5	1.04	1.8857	0.0784	
		1HPIBBC039	NFF-26	665	1	9	1.04	1.8857	2.6083	
		1HPIBBC040	NFF-24	145	1	5	1.04	1.8857	0.5687	
								*	4.2068	
	23MOV-58 Control (Close)									
	15 Amp Breaker (ohms)								0.0100	PEDB
		1HPIBBC037	NFE-64	240	1	7	1.04	1.8857	0.9413	
		1HPIBBC038	NFF-24	20	1	5	1.04	1.8857	0.0784	
		1HPIBBC039	NFF-26	665	1	9	1.04	1.8857	2.6083	
		1HPIBBC040	NFF-24	145	1	5	1.04	1.8857	0.5687	
								*	4.2068	
OE1	27MOV-122									SE-9AAH
	40 Amp Breaker (ohms)								0.0040	PEDB
	Armature (A1)	1PCPBBK066	NFE-13	365	1	3	1.04	0.2949	0.1119	
	Armature (A1)	1PCPBBK071	NFE-09	17	1	3	1.04	0.7444	0.0132	
	Armature (A2)	1PCPBBK066	NFE-13	365	1	3	1.04	0.2949	0.1119	
	Armature (A2)	1PCPBBK071	NFE-09	17	1	3	1.04	0.7444	0.0132	
	Series (S1)	1PCPBBK065	NFE-13	365	1	3	1.04	0.2949	0.1119	
	Series (S1)	1PCPBBK070	NFE-09	17	1	3	1.04	0.7444	0.0132	
	Series (S2)	1PCPBBK065	NFE-13	365	1	3	1.04	0.2949	0.1119	
	Series (S2)	1PCPBBK070	NFE-09	17	1	3	1.04	0.7444	0.0132	
	O.L. Heater @ 55° C		C22.8B					0.0057	0.0057	PEDB
	Total Res.							*	0.5102	

* Total resistance of the circuit path for this load

125V DC 71BMCC-4 React Bldg MCC (Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OE1 (Cont'd)	27MOV-122 Control (Open)									SE-9AAH
	40 Amp Breaker (ohms)								0.0040	PEDB
		1PCPBBC065	NFE-64	380	1	7	1.04	1.8857	1.4905	
		1PCPBBC103	NFE-63	25	1	5	1.04	1.8857	0.0981	
		1PCPBBC102	NFE-66	400	1	12	1.04	1.8857	1.5689	
		1PCPBBC104	NFE-63	525	1	5	1.04	1.8857	2.0592	
	Total Res.							*	5.2206	
	27MOV-122 Control (Close)									
	40 Amp Breaker (ohms)								0.0040	PEDB
		1PCPBBC065	NFE-64	380	1	7	1.04	1.8857	1.4905	
		1PCPBBC103	NFE-63	25	1	5	1.04	1.8857	0.0981	
		1PCPBBC102	NFE-66	400	1	12	1.04	1.8857	1.5689	
	Total Res.							*	3.1614	
OE2	23P-150									SE-10AT
	100 Amp Breaker (ohms)								0.0010	PEDB
		1HPIBBK034	NFF-32	160	1	4(1sp)	1.04	0.4681	0.1558	
	O.L. Heater @ 55° C		F65.8B					0.0174	0.0174	PEDB
	Total Res.							*	0.1742	
	23P-150 Control									SE-10AT
	100 Amp Breaker (ohms)								0.0010	PEDB
		1HPIBBC044	NFF-24	530	1	5	1.04	1.8857	2.0788	
		1HPIBBC045	NFF-21	145	1	2	1.00	1.8857	0.5469	
		1HPIBBC046	NFF-21	600	1	2	1.00	1.8857	2.2628	
	Total Res.							*	4.8895	

* Total resistance of the circuit path for this load

125V DC 71BMCC-6 React Bldg MCC

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OA1	23MOV-16									SE-10AG
	70 Amp Breaker (ohms)								0.0040	PEDB
	Armature (A1)	1HPIBBK038	NFE-25	227	1	3	1.04	0.0389	0.0092	
	Armature (A2)	1HPIBBK038	NFE-25	227	1	3	1.04	0.0389	0.0092	
	Series (S1)	1HPIBBK038	NFE-25	227	1	3	1.04	0.0389	0.0092	
	Series (S2)	1HPIBBK008	NFE-21	220	1	3	1.04	0.1846	0.0141	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-08	10	2	2	1.00	0.7444	0.0298	
	O.L. Heater @ 55° C		K21.3B					0.0072	0.0072	PEDB
	Total Res.								* 0.0826	
	23MOV-16 Control (Open)									
	70 Amp Breaker (ohms)								0.0040	PEDB
		1HPIBBC005	NFE-64	200	1	7	1.04	1.8857	0.7845	
		1HPIBBC164	NGG-51	245	1	9	1.04	1.8857	0.9610	
		1HPIBBC165	NGG-51	245	1	9	1.04	1.8857	0.9610	
		1HPIBBC007	NFF-26	388	1	9	1.04	1.8857	1.5218	
		1HPIBBC008	NFF-24	145	1	5	1.04	1.8857	0.5687	
		1HPIBBC006	NFF-24	175	1	5	1.04	1.8857	0.6864	
		1HPIBBC715	NGG-47	166	1	2	1.00	1.8857	0.6261	
	Total Res.								* 6.1134	
	23MOV-16 Control (Close)									
	70 Amp Breaker (ohms)								0.0040	PEDB
		1HPIBBC166	NGG-48	260	1	3	1.04	1.8857	0.5099	
		1HPIBBC005	NFE-64	200	1	7	1.04	1.8857	0.7845	
		1HPIBBC164	NGG-51	245	1	9	1.04	1.8857	0.9610	
		1HPIBBC165	NGG-51	245	1	9	1.04	1.8857	0.9610	
		1HPIBBC007	NFF-26	388	1	9	1.04	1.8857	1.5218	
		1HPIBBC008	NFF-24	145	1	5	1.04	1.8857	0.5687	
		1HPIBBC006	NFF-24	175	1	5	1.04	1.8857	0.6864	
		1HPIBBC715	NGG-47	166	1	2	1.00	1.8857	0.6261	
	Total Res.								* 6.6233	

* Total resistance of the circuit path for this load

125V DC 71BMCC-6 React Bldg MCC (Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OA2	23MOV-19									SE-10AJ
	125 Amp Breaker (ohms)								0.0010	PEDB
	Armature (A1)	1HPIBBK041	NFE-25	120	1	3	1.04	0.0389	0.0049	
	Armature (A2)	1HPIBBK041	NFE-25	120	1	3	1.04	0.0389	0.0049	
	Series (S1)	1HPIBBK041	NFE-25	120	1	3	1.04	0.0389	0.0049	
	Series (S2)	1HPIBBK042	NFF-51	110	1	1	1.00	0.0259	0.0029	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-08	10	2	2	1.00	0.7444	0.0298	
	O.L. Heater @ 55° C (2 in parallel)		F43.0B					0.0174	0.0174	PEDB
	Total Res.								* 0.0656	
	23MOV-19 Control (Open)									
	125 Amp Breaker (ohms)								0.0010	PEDB
		1HPIBBC130	NFE-64	110	1	7	1.04	1.8857	0.4314	
		1HPIBBC014	NFF-24	15	1	5	1.04	1.8857	0.0588	
		1HPIBBC015	NFE-64	700	1	7	1.04	1.8857	2.7456	
		1HPIBBC016	NFF-21	145	1	2	1.00	1.8857	0.5469	
	Total Res.								* 3.7837	
	23MOV-19 Control (Close)									
	125 Amp Breaker (ohms)								0.0010	PEDB
		1HPIBBC130	NFE-64	110	1	7	1.04	1.8857	0.4314	
		1HPIBBC014	NFF-24	15	1	5	1.04	1.8857	0.0588	
		1HPIBBC015	NFE-64	700	1	7	1.04	1.8857	2.7456	
		1HPIBBC121	NFF-21	140	1	2	1.00	1.8857	0.5280	
	Total Res.								* 3.7649	

* Total resistance of the circuit path for this load

125V DC Power Panel 71HO2

LOAD I.D.	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10202	Norm. supply from 4kV Transf 71T-4X	1HONBNC002	NFF-27	440	1	12	1.04	1.8194	1.6651	SE-8D
	(Trip)	1HONBNC003	NFF-24	119	1	5	1.04	1.8194	0.4503	
		Unscheduled	SIS-8	4	1	1	1.00	0.7182	0.0057	
		Unscheduled	SIS-14	16	1	1	1.00	2.8878	0.0924	
								*	2.2136	
4kV Bkr 71-10210	Reac Recirc PP 02-2P-1B (Trip)	1RWRBNC082**	NFE-62	430	1	3	1.04	1.8857	1.6866	SE-8F
	(For LOCA)	1RWRBNC703**	NGG-48	150	1	3	1.04	1.8857	0.5883	
		Unscheduled**	SIS-8	4	2	1	1.00	0.7444	0.0060	
		Unscheduled**	SIS-14	10	2	1	1.00	2.9930	0.0599	
								*	2.3407	
	React Recirc Pmp 02-2P-1B (Trip)	Unscheduled	SIS-8	4	2	1	1	0.7182	0.0057	
	(For SBO)	Unscheduled	SIS-14	10	2	1	1	2.8878	0.0578	
								*	0.0635	
4kV Bkr 71-10212	Res. Supply from 4kV Transf 71T-2X	1HONBNC012	NFF-27	495	1	12	1.04	1.8194	1.8733	SE-8E
	(Trip)	1HONBNC013	NFF-24	118	1	5	1.04	1.8194	0.4466	
		1HONBNC018	NFF-21	55	1	5	1.00	1.8194	0.2001	
	Jumper wires from RL-3 to RL-5	Unscheduled	SIS-12	10	1	12	1.04	1.8194	0.0378	
		Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	2.6213	
Ckt. 1HONBO3	4kV Bus 10200 UV.	1HONBNC006	NFF-24	495	1	5	1.04	1.8194	1.8733	SE-8D
		Unscheduled	SIS-8	4	2	1	1	0.7182	0.0057	
		Unscheduled	SIS-14	10	2	1	1	2.8878	0.0578	
									1.9368	

* Total resistance of the circuit path for this load

** All resistances are based on 50° C cable temperature due to cable entering Reactor Building

125V DC Power Panel 71H04

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10402	Norm Supply from 4kV 'Transf 71T-4Y (Trip)	1HONDNC002	NFF-27	536	1	12	1.04	1.8194	2.0284	SE-8Q
		1HONDNC003	NFF-24	138	1	5	1.04	1.8194	0.5222	
		Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	2.6171	
4kV Bkr 71-10404	To 4kV Emerg Bus 10600 (Trip)	1HONDNC013	NFF-24	312	1	5	1.04	1.8194	1.1807	SE-8AE
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	14	2	1	1.00	2.8878	0.0809	
								*	1.2731	
	To 4kV Emerg Bus 10600 (Close)	1HONDNC012	NFF-27	480	1	12	1.04	1.8194	1.8165	
		1HONDNC013	NFF-24	312	1	5	1.04	1.8194	1.1807	
		Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	
		Unscheduled	SIS-14	20	2	1	1.00	2.8878	0.1155	
		Unscheduled	SIS-14	13	2	1	1.00	2.8878	0.0751	
								*	3.1965	
	71-10404 Brk Charging Motor	Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0404	
4kV Bkr 71-10410	Condensate Pmp 33P-8B (Trip)	Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	SE-8T
		Unscheduled	SIS-14	15	2	1	1.00	2.8878	0.0866	
								*	0.1010	
	86U-1CNDB02 UV Aux Relay	1CNDBNC002	NFF-27	480	1	12	1.04	1.8194	1.8165	
		Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	1.8886	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H04(cont'd)

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10412	Res. Supply from 4kV Transf 71T (Trip)	1HONDNC022	NFF-27	490	1	12	1.04	1.8194	1.8544	SE-8R
		1HONDNC023	NFF-24	120	1	5	1.04	1.8194	0.4541	
		1HONDNC037	NFF-21	75	1	2	1.00	1.8194	0.2729	
	Jumper cables from RL3- to RL-5	Unscheduled	SIS-12	25	1	12	1.04	1.8194	0.0946	
		Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	2.7828	
	Res. Supply from 4kV Transf 71T (Close)	1HONDNC022	NFF-27	490	1	12	1.04	1.8194	1.8544	
		1HONDNC023	NFF-24	120	1	5	1.04	1.8194	0.4541	
		1HONDNC039	NFF-24	150	1	5	1.04	1.8194	0.5677	
		Unscheduled	SIS-12	10	4	1	1.04	1.8194	0.0378	
		1HONDNC038	NFF-21	425	1	2	1.00	1.8194	1.5465	
		Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	35	2	1	1.00	2.8878	0.2021	
								*	4.6770	
	71-10412 Brk Charging Motor	Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0432	
4kV Bkr 71-10420	Service Water Pmp 46P-1B (Trip)	Unscheduled	SIS-8	13	2	1	1.00	0.7182	0.0187	SE-8V
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0476	
	86U-1SWSB01 UV Aux Relay	1SWSBNC002	NFF-27	480	1	12	1.04	1.8194	1.8165	
		Unscheduled	SIS-8	13	2	1	1.00	0.7182	0.0187	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	1.9276	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H04(cont'd)

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10430	Circ Water Pmp 36P-1B (Trip)	Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	SE-8S
		Unscheduled	SIS-14	18	2	1	1.00	2.8878	0.1040	
								*	0.1126	
4kV Bkr 71-10440	Aux Feed to 600V Buses (Trip)	Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	SE-8X
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	0.0635	
4kV Bkr 71-10450	Cond Booster Pmp 33P-9B (Trip)	Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	SE-8X
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	0.1010	
	86U-1CNDB01 UV Aux Relay	1CNDBNC012	NFF-27	490	1	12	1.04	1.8194	1.8544	
		Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	1.9554	
4kV Bkr 71-10460	TB Clsd Loop Clg Wtr Pmp 37P-2 (Trip)	Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	SE-8W
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0404	
	86U-1TBCB01 UV Aux Relay	1TBCBNC002	NFF-27	485	1	12	1.04	1.8194	1.8354	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	14	2	1	1.00	2.8878	0.0809	
								*	1.9278	
Ckt. 1HONDO3	4 kV Bus 10400 UV	1HONDNC008	NFF-24	480	1	5	1.04	1.8194	1.8165	SE-8AE
		Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	1.9262	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H06

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10602	Ctrl Supply EDG-B Close	1EDGBBC180	NGG-51	175	1	9	1.04	1.8194	0.6623	SE-8AR
		1EDGBBC181	NGG-51	105	1	9	1.04	1.8194	0.3974	
		1EDGBBC011	NFF-27	745	1	12	1.04	1.8194	2.8194	
		1EDGBBC165	NFE-63	150	1	9	1.04	1.8194	0.5677	
		Unscheduled	SIS-8	16	2	1	1.00	0.7182	0.0230	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
									* 4.5332	
	71-10602 Brk Charging Motor	Unscheduled	SIS-8	16	2	1	1.00	0.7182	0.0230	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
									* 0.0519	
	K10-1EDGB001 EDG B Failure Trip Relay	1EDGBBC012	NFF-27	110	1	12	1.04	1.8194	0.4163	
		1EDGBBC030	NFF-24	137	1	5	1.04	1.8194	0.5185	
		Unscheduled	SIS-8	16	2	1	1.00	0.7182	0.0230	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
									* 0.9866	
	Ctrl Supply EDG-B Trip	1EDGBBC012	NFF-27	110	1	12	1.04	1.8194	0.2081	
		1EDGBBC030	NFF-24	137	1	5	1.04	1.8194	0.2592	
		1EDGBBC165	NFE-63	150	1	9	1.04	1.8194	0.2838	
		Unscheduled	SIS-8	16	2	1	1.00	0.7182	0.0230	
		Unscheduled	SIS-14	8	2	1	1.00	2.8878	0.0462	
									* 0.8204	
4kV Bkr 71-10604	K8-1EDGB02 EDG B & D Tie Brk Closing Relay	1EDGBBC039	NFF-26	68	1	9	1.04	1.8194	0.2573	SE-8AT
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
									* 0.3063	
	93EDG Tie B & D Brk Close	1EDGBBC184	NGG-50	116	1	7	1.04	1.8194	0.4390	
		1EDGBBC036	NFF-26	800	1	9	1.04	1.8194	3.0275	
		1EDGBBC183	NGG-50	116	1	7	1.04	1.8194	0.4390	
		1EDGBBC039	NFF-26	68	1	9	1.04	1.8194	0.2573	
		1EDGBBC037	NFF-24	156	1	5	1.04	1.8194	0.5904	
		1EDGBBC038	NFF-24	104	1	5	1.04	1.8194	0.3936	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
									* 5.1958	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H06(Cont'd)

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10604 (cont'd)	71-10604 Brk Charging Motor	Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	SE-8AT
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0490	
	62 & 62X-1EDGBO2 EDG B & D Output Brk Closing Interlock Relays	1EDGBBC202	NGG-50	380	1	7	1.04	1.8194	1.4381	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	19	2	1	1.00	2.8878	0.1097	
								*	1.5679	
	K9-1EDGB02 EDG B & D Tie Brk Trip Relay	1EDGBBC037	NFF-24	156	1	5	1.04	1.8194	0.5904	
		1EDGBBC039	NFF-26	68	1	9	1.04	1.8194	0.2573	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.8967	
	93EDG Tie B & D Bkr Trip	1EDGBBC039	NFF-26	68	1	9	1.04	1.8194	0.2573	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.3063	
4kV Bkr 71-10610	RHR SWP 10P-1D Close	1RHRDBC002	NFF-26	800	1	9	1.04	1.8194	3.0275	SE-8AX
		Unscheduled	SIS-8	22	2	1	1.00	0.7182	0.0316	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	3.1227	
	71-10610 Brk Charging Motor	Unscheduled	SIS-8	22	2	1	1.00	0.7182	0.0316	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0605	
	RHR SWP 10P-1D SOV 10SOV-101D	1RHRDBC217	NFF-21	275	1	2	1.00	1.8194	1.0007	
		Unscheduled	SIS-8	22	2	1	1.00	0.7182	0.0316	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	1.0958	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H06(Cont'd)

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10612	Control Supply 93EDG-D Close	1EDGDBC180	NGG-51	117	1	9	1.04	1.8194	0.4428	SE-8AS
		1EDGDBC181	NGG-51	105	1	9	1.04	1.8194	0.3974	
		1EDGDBC011	NFF-27	735	1	12	1.04	1.8194	2.7815	
		1EDGDBC012	NFF-27	60	1	12	1.04	1.8194	0.2271	
		1EDGDBC168	NFE-63	122	1	5	1.04	1.8194	0.4617	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	4.3594	
	71-10612 Brk Charging Motor	Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0490	
	K10-1EDGD001 EDG D Failure Trip Relay	1EDGDBC012	NFF-27	60	1	12	1.04	1.8194	0.2271	SE-8AS
		1EDGDBC030	NFF-24	120	1	5	1.04	1.8194	0.4541	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.7302	
	Control Supply 93EDG-D Trip	1EDGDBC012	NFF-27	110	1	12	1.04	1.8194	0.2081	
		1EDGDBC030	NFF-24	137	1	5	1.04	1.8194	0.2592	
		1EDGDBC168	NFE-63	122	1	9	1.04	1.8194	0.2308	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	8	2	1	1.00	2.8878	0.0462	
								*	0.7645	
4kV Bkr 71-10614	Tie to Bus 10400 Trip	Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	SE-8AQ
		Unscheduled	SIS-14	8	2	1	1.00	2.8878	0.0462	
								*	0.0606	
	Tie to Bus 10400 Close	1HOEBBC002	NFF-27	742	1	12	1.04	1.8194	2.8080	
		1HOEBBC020	NGG-50	116	1	7	1.04	1.8194	0.4390	
		1HOEBBC022	NGG-50	116	1	7	1.04	1.8194	0.4390	
		1HOEBBC003	NFF-21	344	1	2	1.00	1.8194	1.2518	
		Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
									5.0445	
	71-10614 Brk Charging Motor	Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0432	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H06(Cont'd)

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10620	RHR SWP 10P-1B Close	1RHRBBC002	NFF-26	800	1	9	1.04	1.8194	3.0275	SE-8AP
		1RHRBBC279	NGG-50	116	1	7	1.04	1.8194	0.4390	
		Unscheduled	SIS-8	20	2	1	1.00	0.7182	0.0287	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	3.5588	
	71-10620 Brk Charging Motor	Unscheduled	SIS-8	20	2	1	1.00	0.7182	0.0287	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0576	
	RHR SWP 10P-1B SOV 10SOV-101B	1RHRBBC217	NFF-21	275	1	2	1.00	1.8194	1.0007	
		Unscheduled	SIS-8	20	2	1	1.00	0.7182	0.0287	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	1.0929	
4kV Bkr 71-10630	Core Spray Pump 14P-1B Close	1CSPBBC145	NFE-63	155	1	5	1.04	1.8194	0.5866	SE-8AV
		1CSPBBC002	NFF-27	750	1	12	1.04	1.8194	2.8383	
		Unscheduled	SIS-8	18	2	1	1.00	0.7182	0.0259	
		Unscheduled	SIS-14	13	2	1	1.00	2.8878	0.0751	
								*	3.5258	
	71-10630 Brk Charging Motor	Unscheduled	SIS-8	18	2	1	1.00	0.7182	0.0259	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0547	
4kV Bkr 71-10640	RHR Pump 10P-3D Close	1RHRDBC354	NGG-51	124	1	9	1.04	1.8194	0.4693	SE-8BB
		1RHRDBC355	NGG-51	124	1	9	1.04	1.8194	0.4693	
		1RHRDBC012	NFF-27	750	1	12	1.04	1.8194	2.8383	
		1RHRDBC014	NFF-24	145	1	5	1.04	1.8194	0.5487	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	15	2	1	1.00	2.8878	0.0866	
								*	4.3256	
	71-10640 Brk Charging Motor	Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0404	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H06(Cont'd)

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
4kV Bkr 71-10650	RHR Pump 10P-3C Close	1RHRBBC012	NFF-27	810	1	12	1.04	1.8194	3.0654	SE-8AZ
		1RHRBBC014	NFF-24	155	1	5	1.04	1.8194	0.5866	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	15	2	1	1.00	2.8878	0.0866	
								*	3.7501	
	71-10650 Brk Charging Motor	Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0404	
	RHR Pump 10P-3C Trip	Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	17	2	1	1.00	2.8878	0.0982	
								*	0.1097	
Ckt. 1HOEB03	Emergency Bus 10600 Undervoltage, Load Shedding and Sequencing	1EDGBBC201	NGG-50	115	1	7	1.04	1.8194	0.4352	SE-8AT
		1EDGBBC199	NGG-47	830	1	2	1.00	1.8194	3.0202	
		1EDGBBC198	NGG-47	50	1	2	1.00	1.8194	0.1819	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	20	1	1	1.00	2.8878	0.1155	
		Unscheduled	SIS-14	6	2	1	1.00	2.8878	0.0347	
								*	3.8077	

* Total resistance of the circuit path for this load

125V DC Power Panel 71L14

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
600V Bkr 71-11416	RB Clg PP 15P-2B	1RBCBNC105	NFF-26	510	1	9	1.04	1.8857	2.0004	SE-9H
(@Reactor Building)	Relay 52X Energize	1RBCBNC108	NFF-21	405	1	2	1.00	1.8857	1.5274	
		Unscheduled	SIS-8	5	2	1	1.00	0.7444	0.0074	1.42-164
		Unscheduled	SIS-14	10	2	1	1.00	2.9930	0.0599	
								*	3.5951	
	Bkr 71-11416 Closing	Unscheduled	SIS-8	5	2	1	1.00	0.7444	0.0074	1.42-164
	Coil 52CC	Unscheduled	SIS-14	10	2	1	1.00	2.9930	0.0599	
								*	0.0673	
	RB Clg PP 15P-2B Close							*	0.0661	
600V Bkr 71-11418	RB Vent Supply Fan 66FN-5B	1RNVBNC105	NFE-64	150	1	7	1.04	1.8857	0.5883	SE-9J
(@Reactor Building)	Trip	Unscheduled	SIS-8	5	2	1	1.00	0.7444	0.0074	
		Unscheduled	SIS-14	10	2	1	1.00	2.9930	0.0599	
								*	0.6556	
600V Bkr 71-11420	RB Vent Return Fan 66FN-12B	1RNVBNC194	NFE-64	150	1	7	1.04	1.8857	0.5883	SE-9K
(@Reactor Building)	Trip	Unscheduled	SIS-8	5	2	1	1.00	0.7444	0.0074	
		Unscheduled	SIS-14	10	2	1	1.00	2.9930	0.0599	
								*	0.6556	

* Total resistance of the circuit path for this load

125V DC Power Panel 71L24

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
600V Bkr 71-12418 (@Turbine Building)	Wtr Heating Pmp 87P-23B Trip	1ANVNNC169	NFE-65	440	1	9	1.04	1.8194	1.6651	SE-9X
		Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	1.42-5
		Unscheduled	SIS-14	10	2	1	1.00	1.8194	0.0364	1.42-5
								*	1.7101	

* Total resistance of the circuit path for this load

125V DC Power Panel 71L44

LOAD I.D	LOAD Description	CABLE NUMBER	CABLE MARK NO.	CIRCUIT LENGTH (feet)	NO. OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
600V Bkr 71-14426	TB Vent Fan 67FN-5B	1TBVBNC104	NFF-27	850	1	12	1.04	1.8194	3.2167	SE-9AQ
(@Turbine Building)	Trip	Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	1.42-10
		Unscheduled	SIS-14	10	2	1	1.00	1.8194	0.0364	1.42-10
								*	3.2617	

* Total resistance of the circuit path for this load

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 2
Load Summary Sheets

General Notes

1) For LOCA and SBO scenario see Appendix 11 and 12. For HPCI MOV and Pump sequencing see Appendix 15.

2) For LOCA w/LOOP: At 0 Seconds the LOCA signals High Drywell Pressure and Reactor Low Level loads start. If a component is energized from High Drywell Pressure or Lo-Lo-Lo Reactor Level, relay starting time is equal to 0.1 sec. For SBO: @ 0 Sec loads all continuous control loads are energized before SBO event. If component energized from SBO circuits time is equal to 0.1 sec.

Per FSAR Sections 14.6.1.3.1 all normal and reserve power is lost (including 115Kv and in house power) concurrent with the LOCA. With a simultaneous loss of house power there will be an immediate loss of power to the EHC pumps, Circulating water pumps, Stator water cooling pumps. Therefore, there will be a turbine trip on either loss of EHC pressure, loss of condenser vacuum, loss of stator water cooling or a customer trip due to generator reverse power (71-32-1UPRN05). If the reverse power relay didn't pickup, the anti motoring circuit would pickup (71-86-1UPRN06) due to the turbine trip. In either case, this would cause the 345KV breakers to trip. The fuse (which is fed from 71DC-A3 ckt #9) that feeds the turbine trip bus is 3 Amps. Since it is unknown when this would occur, this load will conservatively start at 0.1 seconds and remain for the entire duration. The generator reverse power circuit 1UPRN07 includes 2 HEA (23ohms each) relays in parallel with 2 HLA relays (3650ohms each) and 125ohm resistor in series (see drawing ESK-8CA and ESK-8CB). The equivalent resistance is 11.5 ohms (10.9Amps at 125vdc). This load is momentary. However, since it is unknown exactly when it will occur except that it will happen within 1 minute, this load will start at 0 seconds and continue for 1 minute. Additionally, this will cause the exciter field breaker, 71-10202, 71-10402, 71PCB-10042, 71PCB-10052 and 71-10031 to trip. Again since it is unknown when this will occur except that it will occur within the first minute, the trips will start at 0.1 second and continue for 1 minute. However, 71-10202 and 71-10402 will trip by undervoltage at 3 seconds (should the other trips not occur first) and 71MOD-10031 will open after 71PCB-10042 and 71PCB-0052 are opened.

3) For LOCA scenario the 125vdc emergency lighting will be powered by the EDG once the EDGs are loaded on the bus. This is consistent with FSAR Section 8.7. For SBO Circuit breakers at Battery Control Board B will be placed in OFF commencing within 30 minutes of the station blackout per AOP-49 "Station Blackout". 71LPEEBDC1 and 71LPEABDC2 will be ON for the 4 hour of SBO event.

4) SRVs will be used during SBO for pressure control.

5) All 4kV breakers supplying power to a non-safety related buses remain open until off-site power is restored. In accordance with JAF licensing basis, the charger capability will be lost for two hours for the LOCA. Offsite and onsite power will be lost for four hours during the SBO event.

6) All non safety related 4kV breakers, except modified by notes on table, trip on bus undervoltage after about 3 seconds time delay. The time delay is built into the undervoltage control circuitry

7) The trip current for the 4kV breakers has been obtained from GE specification for Metal Clad Switchgear Contract AP-1 Section XVI Item 6.

8) Appendix 8 has the 4.16kv breaker spring charging motor current ratings. The old model spring charging motor has an inrush of approximately 68 amps and running current of 13amps. The new model spring charging motor has an inrush of approximately 60 amps and running current of 14 amps. Therefore, use 68 amps for inrush and 14 amps for running to envelop both models. It should be noted that informational testing on an old model spring charging motor showed the actual inrush to be less than 68 amps (~50amps). The duration of closing the 4 KV Breakers is shown as maximum 4 seconds in Appendix 8 (informational testing showed approximately 3.25 seconds). During an actual event the voltage to the spring charging motor is reduced, therefore, an additional 25% duration will be added to yield a 5 second duration for closing (including spring charging).

9) The load for various panels and relay logics is obtained from the referenced drawings by adding all component loads (except when it was known exactly which relays would actuate).

10) A series of 125V DC Station Battery and Charger weekly surveillance tests from 6/20/96 through 6/15/00 (see Appendix 13) indicate that the continuous control load is not greater than 30A. Conservatively, to bound the actual operating conditions and to account for meter reading inaccuracies, a continuous control load of 40 Amps will be used in this calculation. A separate line item has been added to 71BCB-2B to show the continuous control load. Where continuous control data for individual circuits is shown, this value is subtracted from the line item on 71BCB-2B within the calculation. The value of continuous control load, where it was separated from the load listed on 71BCB-2B, was obtained from associated ESK's and vendor manuals.

PANEL 71BCB-2B

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
A02	71LPEEBDC1	Emerg Lighting Panel	0.1 sec	7.2 sec.	0.1 sec	240 min	N/A	26.33	120	3159	Resistance	II/III	FE-1AH	1
A03	71LPEHB1	Emerg Lighting Panel	0.1 sec	7.2 sec.	0.1 sec	30 min	N/A	9.45	120	1134	Resistance	II/III	FE-1AH	2
A04	Panel 71DC-B4	Emer Diesel Gen Dist Cabinet	(See details on Sheet 71DC-B4)									I	FE-1AH	
A05	71LPEADC2	Emerg Lighting Panel	0.1 sec	7.2 sec.	0.1 sec	240 min	N/A	36.41	120	4369	Resistance	II/III	FE-1AH	3
A06	Panel 71DC-B5	Relay Room Dist Cabinet	(See details on Sheet 71DC-B5)									II/III	FE-1AX	
A07	71LPERDC3	Emerg Lighting Panel	0.1 sec	7.2 sec.	0.1 sec	30 min	N/A	8.24	120	989	Resistance	II/III	FE-1AH	4
A08	71LPERW1/25ASP-4	Emerg Lighting Panel/AS Pnl	0.1 sec	7.2 sec.	0.1 sec	30 min	N/A	11.22	120	1347	Resistance	II/III &	FE-1AH	5
B02	Panel 71DC-B3	Relay Room Dist Cabinet	(See details on Sheet 71DC-B3)									I	FE-1AN	
B03	Panel 71DC-B2	Relay Room Dist Cabinet	(See details on Sheet 71DC-B2)									I	FE-1AL	
B04	Panel 71DC-B1	Relay Room Dist Cabinet	(See details on Sheet 71DC-B1)									II/III	FE-1AK	
B05	71BMCC-4	RB Motor Control Center	(See details on Sheet 71BMCC-4)									I	FE-1AJ	
B06	71L16	600V SWGR Emer Bus 11600	(See details on Sheet 71L16)									I	FE-1AJ	
C01	71BMCC-2	RB Motor Control Center	(See details on Sheet 71BMCC-2)									I	FE-1AJ	
C02	31P-7B(M)	RFPT Emerg Oil Pump Inrush	15 sec	17 sec	17 sec	19 sec	146.38	N/A	125	N/A	Resistance	II/III	ESK-11B	6
		RFPT Emerg Oil Pump F.L.	17 sec	120 min	19 sec	30 min	N/A	59.38	125	7423	VA			
		RFPT Emerg Oil Pump Cntl	15 sec	120 min	17 sec	30 min	N/A	1.29	125	161	Resistance	II/III		
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.21	125		Resistance	N/A		
D01	71BMCC-6	RB Motor Control Center	(See details on Sheet 71BMCC-6)									I	FE-1AJ	
D02	94P-2(M)	Emerg Bearing Oil Pump Inrush	N/A	N/A	2 min & 30 sec	2 min & 33.5 sec	592.18	N/A	125	N/A	Resistance	II/III	ESK-11A	7
		Emerg Bearing Oil Pump F.L.	N/A	N/A	2 min & 33.5 sec	30 min	N/A	172.1	125	21514	VA			
		Emerg Bearing Oil Pump Cntl	N/A	N/A	2 min & 30 sec	30 min	N/A	1.5	125	192	Resistance	II/III		
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.17	125		Resistance	N/A		
N/A	Continuous Control	Continuous Control Loads	0 sec	120 min	0 sec	240 min	N/A	40	132	5280	Resistance	N/A		

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 3

PANEL 71BCB-2B (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Loading data for this panel was obtained from WR-02-00135-00. Additional load of 200 watts for lights that were potentially not on during the current readings. These lights were identified in performance of ST-16J6 dated 11/01/02. Wattage for lights which were either off or inaccessible was obtained from the FE series lighting drawings.
The total load is 120VDC x 26.2 Amps / 127.5 VDC + 200 Watts / 120VDC = 26.33 Amps total.

2) Loading data for this panel was obtained from WR-02-00136-00. All lights were verified to be on.
The total load is 120VDC x 10.3 Amps / 130.8 VDC = 9.45 Amps total.

3) Loading data for this panel was obtained from WR-02-00134-00. Additional load of 2850 watts for lights that were potentially not on during the current readings. These lights were identified in performance of ST-16J6 dated 11/01/02. Wattage for lights which were either off or inaccessible was obtained from the FE series lighting drawings.
The total load is 120VDC x 13.8 Amps / 130.8 VDC+ 2850 Watts /120VDC = 36.41 Amps total.

4) Loading data for this panel was obtained from WR-02-00139-00. Additional load of 100 watts for lights that were potentially not on during the current readings. These lights were identified in performance of ST-16J6 dated 11/01/02. Wattage for lights which were either off or inaccessible was obtained from the FE series lighting drawings.
The total load is 120VDC x 8.0 Amps / 129.6 VDC + 100 Watts /120VDC = 8.2 Amps total.

5) Loading data for this panel was obtained from WR-02-00140-00. All lights were verified to be on.
The total load is 120VDC x 12.1 Amps / 129.4 VDC = 11.22 Amps total.

6) The full load current for this motor was obtained from the motor nameplate (see Appendix 8). The starter for this motor is a RVNR type and the starting current of this motor is calculated in Appendix 14. Appendix 14 provides technical justification inrush duration (2 seconds).
Pump No. 31P-7B Timing Sequence Justification: The pump starts on low lube oil pressure (31PS-6B closes on lube oil pressure to bearings < 36psig), following turbine trip. For LOCA, based on engineering judgement and discussions with turbine engineers, the pump will start after 15 seconds due to turbine coast down time. With a LOCA, steam is lost to the turbine rapidly and the pump will load the turbine down. During this time the shaft driven pump will maintain pressure which is considered to be 15 seconds. During an SBO this pump is not considered to start until after at least 17 seconds (because MSIVs stay open longer).
The additional 2 seconds is due to the MSIVs staying open for at least 2 seconds because the MSIVs don't get a closure signal until after power is lost from RPS.
Circuit breakers at Battery Control Board B will be placed in OFF within 30 minutes of the station blackout per AOP-49 "Station Blackout".
During LOCA/LOBC this load is considered energized for the entire duration of LOCA.

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 4

PANEL 71BCB-2B (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

7) The full load current for this motor was obtained from the motor nameplate (see Appendix 8).
The starter for this motor is a RVNR type and the starting current of this motor is obtained from TIL-914 see Apendix 14.
Appendix 14 provides technical justification inrush duration (3.5 seconds).
Pump No. 94P-2 Timing Sequence Justification:
94P-2(M) will not operate during a LOCA/LOOP scenario. By design, the Main Turbine Turning Gear Lube Oil Pump 94P-1 will provide sufficient turning gear oil pressure to the turning gear and header oil to prevent the Emergency Bearing Oil Pump from automatically starting.
See ESK-11A and ESK-6BA for schematics for 94P-2(M) and 94P-1(M).
The setpoint for 94PS-2A is 197PSIG (auto start for 94P-1), for 94PS-3 is 187PSIG, for 94PS-201 is 17PSIG (reset of 22PSIG), and for 94PS-4 is 17PSIG (reset of 22PSIG).
94PS-3, 94PS-4 and 94PS-201 are in the auto start circuit for 94P-2(M). 94P-1(M) starts when turbine header pressure is approximately 197PSIG during coastdown of the main turbine after a turbine trip.
Upon starting the turning gear oil pump 94P-1, sufficient turning gear oil discharge pressure will be available to reset 94PS-4 prior to 94PS-3 reaching the trip setpoint of 187PSIG (which would auto start the EBOP). (maximum 11 seconds).
The time for header pressure to drop from 197PSIG to 187PSIG would exceed the time it takes for turning gear oil pressure to reset 94PS-4. It takes 1 to 1-1/2 hours to coast down from 1800RPM to 0RPM during a normal shutdown.
Normal operating header pressure is between 240 and 255PSIG. Assuming a 1 hour coast down and a 240PSIG operating pressure, pressure would reduce approximately 4PSIG per minute. Therefore, during a normal shutdown it would take approximately 2.5 minutes to drop from 197PSIG to 187PSIG.
During a LOCA w/LOOP this would be considerably faster because of loss of Circulating Water Pumps. However, even if this were reduced in half, there would still be considerable time to reset 94PS-4 prior to tripping 94PS-3 (@187PSIG). Additionally, during coastdown, once the pressure in the main header reduced to approximately turning gear oil pump discharge pressure (~30PSIG at turbine centerline), the turning gear oil pump will provide sufficient pressure to prevent 94PS-201 from initiating an EBOP autostart.
It should also be noted that the turning gear oil pump is fed from MCC-262 (10600 Bus) and would only be lost momentarily during EDG starting

During SBO, starting of 94P-2 would occur due to loss of 10600 bus (i.e. no power to the turning gear oil pump 94P-1). However, since the vacuum breakers are opened during AOP-49, the main turbine will come to a rapid stop shortly after the condenser vacuum is lost. The simulator shows that the pump will start between approximately 2.5 and 3 minutes. This is considered reasonable based on engineering judgement. The duty cycles uses 2.5 minutes because it removes more amphours from the battery.
Circuit breakers at Battery Control Board B will be placed in OFF within 30 minutes of the station blackout per AOP-49 "Station Blackout".

PANEL 71DC-B1

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
1	71T-2	RSS Transf BU Prot	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8CE	1
2	71T-3	RSS Transf BU Prot	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8CF	1
3	1UPRN06	Gen. & Transf. Prim. Protect.	0.1 sec	1 min	0.1 sec	0.2 sec	N/A	5.15	125	N/A	Resistance	II/III	ESK-8CC	2
4	Panel 71RU-2	Exciter Prot. Diff IEXCN06	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8DD	1
5	FITZ #3 Line	115kV Prot Relaying	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FC	1
6	71RU-3	System BU Prot.	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8CD	1
7	1ZLCN04	115kV Bus Diff & Bkr Failure	3 sec	3.1 sec	3 sec	3.1 sec	N/A	5.5	125	691	Resistance	II/III	ESK-8FM	3
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.10	125		Resistance	N/A		
8	71BRK-10022	115kV Swyd Bkr Trip Ckt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FN	1
9	71BRK-10012	115kV Swyd Bkr Trip Coil #2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FH	1
10	71EDSC-10017 (M)	115kV Bus Tie Disconnect	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FK	1
11	1YL2N07	345kV Bkr 10042 Backup Trip	0.1 sec	1 min	N/A	N/A	N/A	0.34	125	N/A	Resistance	II/III	ESK-8EF	4
		Continuous Control	1 min	120 min	0 sec	240 min	N/A	0.16	125		Resistance	N/A		
12	FITZ #4	115kV Prot Relaying	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FF	1
13	71EDSC-10025	71T-2 High Side Disconnect	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FL	1
14	71MOD-10051	345kV Bkr Disconnect	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8EP	1
15	71PCB-10042	345kV Bkr Trip Coil #2	0.1 sec	1 min	N/A	N/A	15	N/A	125	N/A	Resistance	II/III	ESK-8EC	4
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.03	125		Resistance	N/A		
16	71MOD-10053	345kV Bkr Disconnect	0.1 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8EP	1
17	71PCB-10052	345kV Bkr Trip Coil #2	0.1 sec	1 min	N/A	N/A	15	N/A	125	N/A	Resistance	II/III	ESK-8EK	4
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.03	125	N/A	Resistance	N/A		
18	1YL1N07	345kV Bkr 10052 Backup Trip	0.1 sec	1 min	N/A	N/A	N/A	0.22	125	N/A	Resistance	II/III	ESK-8EN	4
		Continuous Control	1 min	120 min	0 sec	240 min	N/A	0.16	125		Resistance	N/A		
19	71MOD-10031	345kV Disc. Switch Open Coil	0.2 sec	1 min	0.3 sec	1 min	1.71	N/A	125	N/A	Resistance	II/III	ESK-8EW	5
		345kV Disc. Switch Motor Inrush	0.21 sec	1.21 sec	0.31sec	1.31 sec	12	N/A	125	N/A	Resistance			
		345kV Disc. Switch Motor F.L.	1.21 sec	1 min	1.31 sec	1 min	N/A	3.5	125	438	VA			
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.08	125	N/A	Resistance			
20	71MOD-10001	71T-4 & NSS Disconnect	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8CM	1
21	Panel 71RL-2	Lighthouse Hill #3 SEC Relaying	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FD	1
22	Panel 71RH-9	Direct Comparison	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8EL	1
23	Panel 71RL-5	Receptacle	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	N/A	1
24	Panel 71RL-4	DC Test Pole	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	N/A	1

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 6

PANEL 71DC-B1 (Cont'd)

NOTES : (Timing Sequence and Individual Load Current Justifications)

1) This load is not operating during LOCA and/or SBO and considered as part of the continuous control load. For constant load requirements see Panel 71BCB-2B

2) It is anticipated that the anti motoring circuit will be initiated as soon as all turbine stop valves and all intercept control valves or all intermediate stop valves are closed. (see also Appendix 11). This is considered a random load for LOCA which will initiate between 0.1 seconds and 1 minute of the event.
For SBO the anti-motoring logic will pickup immediately due the turbine trip (which causes all Stop & Intercept valves to close). Therefore, this load will occur at 0.1 seconds for SBO.
This circuit includes (1) 2-1UPRN05 (RPM) relay and (2) 86-1UPRNO6, 86X –1UPRN06 (2 HEA ,23ohms each) relays in parallel and (2) 94-1UPRNO6 and 94A-1UPRNO6 (HLA relay, 3650ohms each) and 75 ohm resistor in series.

3) After 3 seconds of sustained undervoltage on the 115 KV bus, an 86LB1-1ZLCN04 lockout relay is energized to trip selected loads.
Continuous Control includes both 27-1ZLCN04 & 2LB-1ZLCN04

4) The primary protection on this breaker will trip the breaker in the first minute of the event.
Breaker primary protection control circuits for 52-10042 and 52-10052 are powerd from Battery A. Therefore, breaker failure circuits are assumed not energized if Battery A power is available. During SBO event we do not assume this failure. Therefore alternate trip circuits need not be energized.
However, for LOCA/LOOP scenarios applying single failure criteria the Battery A as assumed failed. Then, Battery B will provide the control power to alternate trip circuit (trip coil # 2) via solid state breaker failure logic circuits.

5) 71MOD-10031 will open when both breakers 51-10042 and 52-10052 are tripped. Open the Disconnect switch time for the Battery degraded voltage would be anticipated for less than 1 minute.
This is based on actual field experience in viewing opening and closing.

PANEL 71DC-B2

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat	Drawing	Notes
1	1CICB04	RCIC Relay Logic	0 sec	120 min	0 sec	240 min	N/A	0.30	125	37.5	Resistance	I	1.61-153	1
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.07	125	N/A	Resistance	N/A		
	1ADSB01	ADS System Pwr Logic	0.1 sec	120 min	N/A	N/A	N/A	0.51	125	63.2	Resistance	I	1.83-38	2, 3, 5
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.05	125	N/A	Resistance	N/A		
		6 ADS SOV Load	2 min	60 min.	N/A	N/A	N/A	7.68	125	960	Resistance	I		3, 6
	02SOV-71E1	ADS Auto Pilot SOV	2 min	60 min.	N/A	N/A	N/A	1.17	125	145.7	Resistance	I		3, 6
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	2.53	125	N/A	Resistance	N/A		
	1RHRB33	RHR Channel B Logic	0 sec	120 min	N/A	N/A	N/A	3.05	125	381	Resistance	I	1.65-121	2, 3
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.13	125	N/A	Resistance	N/A		
	1ADSB02	ADS Low Water Level Logic	0.1 sec	120 min	N/A	N/A	N/A	0.14	125	17	Resistance	I	1.83-38	2, 5
			N/A	N/A	0.1 sec	240 min	N/A	0.07	125	9	Resistance			
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.03	125	N/A	Resistance	N/A		
2	03SOV-140B	Syst & Back-Up Scram Intlk	0.1 sec	120 min	0.1 sec	240 min	N/A	0.22	125	N/A	Resistance	I	1.67-91	2
3	LOTC4	600V SWGR Test Cabinet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	N/A	8
4	Panel 09-42	Main Steam Isol Valves	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	I	1.70-108	7
5	1CSPB10	Core Spray Chnl B Logic	0 sec	120 min	N/A	N/A	N/A	1.24	125	N/A	Resistance	I	1.64-30	2, 3
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.03	132	N/A	Resistance	N/A		
6	1HPIB24	HPCI Relay Logic (Panel 09-39)	0 sec	120 min	0 sec	240 min	N/A	1.54	125	193	Resistance	I	1.61-141	1
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.37	132	N/A	Resistance	N/A		
	23SOV-102	HPCI Remote Trip Sol Va.	0.1 sec	120 min	0.1 sec	240 min	N/A	0.08	120	10	Resistance	I	1.61-143	
7	RFPT 31FPD-5B	Mtr Speed Chgr & Gear Unit	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-9AE	4
8	RFPT 31FPD-5B	Test and Low Vac Reset	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-9AB	4
9	RFPT 31FPD-5B	Turbine Trip and Reset	0.1 sec	120 min	0.1 sec	240 min	N/A	0.97	125	N/A	Resistance	II/III	ESK-9AA	9
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.17	132	N/A	Resistance	N/A		
10	Panel 09-3	Position Indicators	0 sec	120 min	0 sec	240 min	N/A	0.21	125	27	Resistance	II/III	1.61-141	
		Continuous Control	N/A	N/A	N/A	N/A	N/A	0.21	125	27	Resistance			
	23INV-79	HPCI Inst Pwr Inverter Pnl 09-3	0 sec	120 min	0 sec	240 min	N/A	1.26	125	157	VA	I		1, 14
		Continuous Control	N/A	N/A	N/A	N/A	N/A	1.12	125	140	VA			
	23TU-3-12	HPCI Turbine Speed Pwr Supply	0 sec	120 min	0 sec	240 min	N/A	0.32	125	40	VA	I		1, 14
		Continuous Control	N/A	N/A	N/A	N/A	N/A	0.29	125	37	VA			
	23S0V-53, -54	HPCI Steam Supply Trap & Exh VA's	0.1 sec	120 min	0.1 sec	240 min	N/A	0.28	125	34.8	Resistance	II/III		19

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 9

PANEL 71DC-B2 (Cont'd)

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat	Drawing	Notes
11	02-184P-3B(M)	RWR MG Set B Emerg.Oil Pmp Inrush	6 sec	7 sec	6 sec	7 sec	28.1		125		Resistance	II/III	ESK-11CA	10
		RWR MG Set B Emerg.Oil Pmp F.L.	7 sec	120 min	7 sec	30 min		8.02	125	1003	VA			
		RWR MG Set B Emerg.Oil Pmp Cntl	6 sec	120 min	6 sec	30 min	2.1	0.43	125	54	Resistance			
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.09	132	N/A	Resistance			
12	02-184-1B(BKR)	Reac Recir M/G Set B Trip	17 sec	18 sec	17 sec	18 sec	2.02	N/A	125	N/A	Resistance	II/III	1.62-150	12
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.09	125					
13	02-184-1A(BKR)	Reac Recir M/G Set A Alt Trip	17 sec	18 sec	N/A	N/A	2.02	N/A	125	N/A	Resistance	II/III	1.62-150	13
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.09	125					
14	Panel 09-21	13INV-801B Steam Leak Det Sys	0 sec	120 min	N/A	N/A	N/A	0.58	125	72.4	VA	I	1.85-12	15
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.53	125	65.8	VA			
15	Fire Prot Pnl	Fire Prot Pnl CO2 Sys Ann	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	M	ESK-11DF	4
16	02-3V/V-613D	ATTS Cabinet Pwr Supply Converter	0 sec	7.2 sec	N/A	N/A	N/A	4.21	125	527	VA	I	1.60-16	16
			N/A	N/A	0 sec	240 min	N/A	3.83	125	479	VA			
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.34	125	42	VA	N/A		
17	71T-1B	Main Transf 1B Ann Ckt	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	1.21-20	4
18	76DS-4	Fire Prot. CO2 System	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	M	1.81-108	4
19	Spare													
20	Spare													
21	17EMRP	Start-Up Transient Test Sys	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	SKE-441sh.3	8
22	Panel 09-75	RB CCW Cont Isol Valves loads	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	I	ESK-6KT	11
23	23E/S-200B	Foxboro Inst Pwr Supply	0 sec	7.2 sec	0 sec	240 min	N/A	3.52	125	440	VA	I	FE-3SB	17
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.002	125	0.25	VA	N/A		
24	71INV-1B	27 MAP Pnl - Inst INV Loads.	0 sec	7.2 sec	0 sec	240 min	N/A	5.97	125	746	VA	I	1.49-164	18
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0	125	N/A	VA	N/A		

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 9

PANEL 71DC-B2 (Cont'd)

NOTES : (Timing Sequence and Individual Load Current Justifications)

1) For conservatism all relays are considered energized for the entire duration of LOCA and SBO. For RCIC logic all relays and indicating lights were included in the loading.

2) This load is considered energized for the entire duration of LOCA. RHR and Core Spray channel "B" logic circuit loading conservatively included all relays and indicating lights whether logically energized during the event or not.

3) This load is considered de-energized for the entire duration of SBO

4) This load is not operating during LOCA and/or SBO and considered as part of the continuous control load. For continuous load requirements see Panel 71BCB-2B

5) Some of the ADS logic relays energize at the start of LOCA. Others energize after either on ECCS pump is running or after 120 seconds.
For conservatism this calculations includes all ADS logic relays from on-set of LOCA (at 0.1 seconds).
The load for ADS relay logics is obtained from the referenced drawings by adding all component loads. For circuit 1ADSB02 4 HGA relays are energized for the entire duration of LOCA. For circuit 1ADSB02 2 HGA relays are energized during SBO. Although one of the 2 relays is only energized when reactor level is below "Lo" (confirmatory level for ADS), for simplicity this relay will remain energized for the entire SBO event.

6) This load is energized for the first 60 minutes of LOCA per Safety Evaluation JAF-SE-96-016 Rev.2
All seven ADS valves open on lo-lo-lo Rx level. The load for SRV's is obtained from the referenced drawings by adding all component loads.

7) The circuitry for the MSIV's is normally energized. Isolation is achieved by deenergizing the solenoid valves.
The total load is (2 x 7.8W/125VDC + 9 x 42/1000 Amp + 4 x 8.7W/125VDC = 0.76 Amps total. Although this load is expected to deenergize after about 0.5 seconds per FSAR section 14.6.1.3.3.c due to reaching lo-lo-lo rx level, (for SBO MSIVs will stay energized until the RPS mg set undervoltage is reached, >2 seconds), conservatively this load is included for the duration of LOCA and SBO as continuous control.

8) "Testing Related" loads are not operating during accident scenarios including SBO.

9) This circuit includes 74-1RFPB05 relay (0.125 Amps holding), Green Ind. Light (42 mA) and Reactor Feed Pump Tirbine Trip SOV (125 V DC, 100 Watt).
The total load is (0.125 A + 42/1000 Amp + 100W/125VDC = 0.965 Amps total.

10) The full load current for this motor was obtained from the JAF Electric Motor Data Sheets and/or further confirmed via a telecon with the motor manufacturer (See Appendix 8). The starting current of these motors was assumed conservatively to be with duration of 1 sec.
The starter for this motor is a RVNR type and the starting current of this motor is obtained from Appendix 14.
02-184P-3B starts on low pressure after a six second time delay (see ESK-11CA). This pump is not a shaft oil driven pump (M-G set). See ESK-11CA and GE instruction Manual GEK-16631 pgs. 2-23 & 24 (this is the original GE Operation and Maintenance Instruction Manual supplied with the plant from GE). Procedure No. AOP-49 "Station Blackout" requires commencing to shed this load at 30 minutes after SBO initiation.

11) These valves are manually operated, and considered not operating for entire duration of a LOCA and SBO.

12) Reactor Recirculation M/G Set A Breaker Generator Field trips approximately 17 seconds after loss of AC power (see OP-27).
This circuit includes 1 HGA relay (4.8 Watts), 2 Red Ind. Light (2x 42 mA) and Reactor Recirc M/G Set AKF-2-25 Breaker (1.9 Amps triping).
The total load is (4.8 Watts/125 VDC + 2 x 42/1000 Amp + 1.9 Amps = 2.02 Amps total.

13) Assume battery A failed for LOCA. Battery B will provide the breaker control power
This circuit includes 1 HGA relay (4.8 Watts), 2 Red Ind. Light (2x 42 mA) and Reactor Recirc M/G Set AKF-2-25 Breaker (1.9 Amps triping).
The total load is (4.8 Watts/125 VDC + 2 x 42/1000 Amp + 1.9 Amps = 2.02 Amps total.

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 10

PANEL 71DC-B2 (Cont'd)

NOTES (Timing Sequence and Individual Load Current Justifications)

14) Loading and Continuous Control data for the 23TU-3-12 Lambda Model JWS-150-48/A was obtained from WR-99-06438-00. For conservatism the measured load was increased by 10%. Loading for 23INV-79 was obtained from WR-01-10999-00 which included both standby and running measurements. The maximum load was during running. For conservatism the running load of 143watts was increased by 10% to 157watts.

15) Loading and Continuous Control data for the 13INV-801B Topaz Model 125-GW-125-60 was obtained from WR-02-00664- 00. Data was increased by 10%

16) This load will be energized by the battery until AC power is restored. That is in 7.2 sec in LOCA and 240 min in SBO
Loading for LOCA is based on 27 MTU's (@260mA each), 9 STU's (@75mA each) and 24 Agastat EGP trip relays (@ 250mA each). The basis for 24 trip relays conservatively assumed all Division 2 ATTS trip relays energize except the high temperature trip relays (i.e. those with RTD inputs). Since we are already assuming a station battery as the single failure, one of these circuits energized would require an additional single failure. The loading for the MTU's and STU's is from G080-0207. The loading (6watts @24VDC) for the Agastat EGP relays from A348-C008. Based on telephone memorandum in Appendix 8, this power supply conservatively assumes a 65% efficiency. Therefore, the load is 527 watts (25x13.695/0.65).
The efficiency is based on sound engineering judgement and the telephone memorandum with Datametrics in Appendix 8 .
For SBO only 19 Agastat relays were considered tripped (or potentially tripped). The 5 eliminated were for Rx Lo-Lo-lo, Hi drewell pressure and RCIC steam line break.
Therefore, the load is 479 watts (25x12.445/0.65).
Continuous Control data for the 02-3V/V-0613D ATTS Power Supply Volt Converter obtained from WR-02-00166-00

17) The Monitoring and Analyzing panel (27MAP) contains both AC and DC instrument loads. The normal supply via MCC-262 & MCC-263.
The DC loads are provided with battery backup power from circuit 23.
The AC loads are provided with battery back-up via DC to AC Inverter Panel 71INV-1B, which is fed from circuit 24.
Upon loss of offsite power, the supply for these loads will be provided by the Station Battery until the emergency diesel generator start sequence is completed and power is restored to the 600 V emergency buses. As per Table 8.6-1of JAFNPP FSAR.
This will take approximately 7.2 seconds. However, it should be noted that for SBO scenario, these loads will be considered for the entire 4 hour duty cycle.
Maximum power consumption for 23E/S-200B is 510 watts per F180-1569. Our Foxboro rack for Torus Bulk Water Temperature monitoring contains 2 nest with 11 slots each. 2 of the slots have dummy modules and 2 slots contain modules which are spare. The spare modules require a trickle current for the internal logic circuits. The 2 spare modules is (at most) equivilent to one slot being loaded. Therefore, there are a total of 3 dummy modules out of 22. The calculated power consumption will be (19/22)x510watts = 441watts. Conversation with Bob Davis of Foxboro (866-746-6477) concurred that this is a conservative approach to determining the load on the 2AX-BB4 battery backup module. Bob also indicated that the power supply is capable of "riding thru" momentary dips in supply voltage during motor starting (primarily due to the capacitors on the output xfmr - 100microfarad).
Continuous Control data for the 23E/S-200B Foxboro Model N-2ARPS05-A6+BB4 was obtained from WR-01-13842-00.

18) The load during an SBO or LOCA (when AC power is unavailable) is 187VA. The load consists of 21 ET-16 lights and 75VA for chart recorder (16-1TR-131B) drive motor power. The solenoid valves are isolated on reactor lo level (scram setpoint). Based on tech manual H999-0089 the unit is least efficient at full voltage (140VDC input) which is 82.4% (3.00KW output/3.64KW input). The no load demand is 0.532kw. The efficiency excluding no load is (3.00KW/(3.64KW-0.532KW))x100% = 96.5%. Excluding no load demand, the required input to yield 0.187KW is 0.187KW/0.965 = 0.194KW. The total efficiency at 0.187KW output is: (0.187KW/(0.194KW + 0.532KW))x100% = 26%.
Therefore, the load on this circuit is 726W.
There is no current value for Continuous Control for the 71INV-1B Inverter. See WR-01-13843-00

19) It is unknown if or when the condesate drain pot valves (23AOV-53 & 54) will open. Therefore, conservatively, they will be considered a load for the entire LOCA & SBO duty cycles. The remaining AOVs do not cycle because 23MOV-14 remains open.

PANEL 71DC-B3

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
1	1ESWB04	ESW Lockout Matrix Inrush	2 sec	4.4 sec	2 sec	4.4 sec	2.9	N/A	120		Resistance	I	ESK-11AC	1
		ESW Lockout Matrix	4.4 sec	120 min	4.4 sec	240 min	N/A	0.46	120	56	Resistance			
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.13	125		Resistance	N/A		
2	38SOV-113B	Off-Gas SJAE Suct. Isol Valve	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-11AA	2
3	94HSC	H_2 Stator Cooling Panel	0.1 sec	120 min	N/A	N/A	N/A	0.33	125	N/A	Resistance	II/III	1.11-261	3
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.30	125		Resistance	N/A		
4	25RK-8-03	Extract Stm Non-Return Valves	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-11AAE	4
5	09-ECCS2-EP	SRV Electric Lift Cabinet	0 sec	7.2 sec	N/A	N/A	N/A	0.66	125	41.1	VA	I	ESK-11AAQ	5
		Power Supply	N/A	N/A	0 sec	240 min	N/A	1.06	125	90	VA			6
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.34	125	42	VA			
6	Panel 09AR-6B	Standby Gas Treat Cont B	0.1 sec	120 min	0.1st sec	240 min	6.58	1.64	125	205	Resistance	I	ESK-11AAK	7
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.33	125		Resistance	N/A		
7	Panel 25-17-1	Radwaste Sys Annun Pnl	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	FE-3BY	2
8	Panel 09AR-4	Vibration Detect Alarm	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-11V	2
9	HWC	H2 Water Cooling Panel	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	1.11-260	2
10	71RH-7	345kV Tone Cabinet	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8ES	2
11	76FPRC	Fire Prot Relay Cabinet	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	M	ESK-11DV	2
12	71RH-8	345kV Transf Trip Cab	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8ES	2
13	38MOV-VB2	Condenser Bkr Vac Valve Inrush	N/A	N/A	4 min	4 min & 1 sec	29	N/A	125		Resistance	II/III	ESK-11AB	8
		Condenser Bkr Vac Valve F.L.	N/A	N/A	4 min & 1 sec	5 min & 27.5 sec	N/A	6	125	750	VA			
		Condenser Bkr Vac Valve Cntl	N/A	N/A	4 min	5 min & 27.5 sec	0.66	0.66	125	83	Resistance			
		Continuous Control & Htr	0 sec	120 min	0 sec	240 min	N/A	0.54	125		Resistance			
14	71LOTC-6	600V SWGR Test Cab	N/A	N/A	N/A	N/A				N/A	Resistance	II/III	FE-1AN	9
15	Spare													
16	71RH-8	345kV Transf Trip Cab	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8ER	2
17	Panel 71H02	4160V SWGR Bus 10200	(See details on Sheet 71H02)									II/III	FE-1AM	
18	Panel 71H04	4160V SWGR Bus 10400	(See details on Sheet 71H04)									II/III	FE-1AM	
19	71L34	600V SWGR Bus 13400	(See details on Sheet 71L34)									II/III	FE-1AK	
20	Panel 42WTP-1	Pretreatment & Make-up Ann	0 sec	120 min	0 sec	240 min	N/A		125	N/A	Resistance	II/III	1.55-74	2
21	71HOTC-2	4160V Bkr Test Cubicles	N/A	N/A	N/A	N/A				N/A	Resistance	II/III		9
22	Panel 09-43	Annunciator Panel	0 sec	120 min	0 sec	240 min	N/A	18.2	125	2275	VA	II/III	1.51-259	10
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.32	125	40	VA	N/A		11
23	Spare													
24	71UPS-7	Interposing Relay Cab 09IR-1	0 sec	120 min	0 sec	240 min	N/A	7.0	125	875	VA	II/III	ESK-10GA	12
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.22	125	27	VA	N/A		13

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 12

PANEL 71DC-B3 (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) The ESW lockout matrix picks up on loss pressure (i.e. < 40PSIG) upon loss of AC power to the RBCLC pumps. Based on PTE-96-002 RBC pressure reached 75PSIG between 2 and 3.25 seconds (from normal operating pressure of approximately 120PSIG). The reason for the 1.25 second difference is because there is a 1.25 second difference between the initiation signal of the event from the SOE log and the Alarm Typer. Therefore, 75PSIG was reached by at least 3.25 seconds into the event. Since the initiation signal for the ESW lockout matrix is 40PSIG, for simplicity the calculation will use 2 to 4.4 (i.e.an addition 1 seconds to reach 40PSIG) seconds as the pickup time for the ESW lockout matrix.

2) These loads are part of the continuous control load.

3) LOOP/LOCA and SBO event sequence:
Battery "B" is a alternate feed. For LOCA assume Battery "A" is failed
Loss of AC Stator Water Cooling pump due to loss of AC power creates low pump discharge pressure (94PS-63-P60A) and low cooing water flow (YFL-1, 63-P82, 63-P79).
These switches actuate the relays;
T=0 seconds 63-X82, 62-C5, 62-C1, 63-C57, 74-X15 and 74-C60
T=10 seconds 63-X13
Ref. 1.11-261, GE Generator instruction manual drawing 234R547, Fig 33-1

4) This load is normaly energized during the normal plant operation.

5) The loading for LOCA includes 2 MTU's (@260mA each), 4 STUs (@75mA each), 1 6watt Agastat EGP relay, and 1 ET-16 indicating light (@42.5mA). This yields 1112.5mA @24VDC (26.7watts).Since the power supply is lightly loaded, use 65% efficiency (verses the puplished 80%). Published Lamda literature indicates 65% is typical for a lightly loaded JWS-150 power supply (similar to JWS-300). Therefore the load on the station battery will be 41.1 watts @ 125VDC during LOCA. No SRVs are actuated by the electric lift circuit during a LOCA. Continuous control data was obtained from WR-02-00166-00

6) This calculation only requires 2 SRVs electrically lifting for SBO (see Appendix 12).The loading for SBO includes 2 MTU's (@260mA each),4 STUs (@75mA each), 1 ET-16 indicating light (@42.5mA), 5 6Watt/24vdc Agastat EGP relays (@ 250mA each) and 2 6watt/125vdc Agastat EGP relays. This yields 2112.5mA @24VDC (50.7watts).
Since the power supply is lightly loaded, use 65% efficiency (verses the puplished 80%). Published Lamda literature indicates 65% is typical for a lightly loaded JWS-150 power supply (similar to JWS-300). Therefore, the load on the station battery will be 90watts @ 125VDC during SBO. Continuous control data was obtained from WR-02-00166-00

7) All loads on this circuit are conservatively considered energized for the duration of LOCA and SBO. This breaker feeds 11 CR2810 relays (Inrush 0.641 Amps & holding 0.125 Amps ohms) , one Agastat E7014PF (8 watts), 9 Struthers Dunn relays (2.5 watts each).

8) Both the FLA. and LRC for these motor was obtained from Appendix 8.
Open stroke time for the Battery degraded voltage (79.52 sec + 10% = 87.5 sec) was obtaited from BWR Owners Group DC Motor Performance methodology NEDC-32958 Rev. 0
Values of loading are based on comparable/typical loading for a size 1 DC starter (IC28001607). Per appendix 8 this contactor has a 1050 ohm coil. Additionally, during opening, for conservatism, all 6 indicating lights are included in the loading to simulate valve in mid stroke. 1 CR2800 contactor, 3 Red Indicating light (3 x 42 mA) and 50 Watt 120 V heater. This loading typical for a size 1 starter.

38 MOV-VB2 is opened after the 2 minute of SBO. This is considered a "random" load between 2 -5 minutes. Opening of this valve is placed at the most critical time during that period. This occurs at 4 minutes when HPCI tripping on rx high level.
This is a "prompt" operator action in AOP-49 "Station Blackout". Per conversation with Operations it is not reasonable to expect an operator to commence opening this valve prior to 2 minute into on SBO.

9) These "Testing Related" loads are not operating during accident scenarios.

10) The load current was obtained from Atometrics Report 15904-1 "Control Room Annunciator Study". A review of the annunciator response shows that at 1 minute into a LOCA/LOOP scenario there are 156 NSSS windows (out of 360) and 147 BOP windows (out of 496) lit. This yields 1820watts (.2 amps per window, 5 speakers and 36 interposing relays all @28VDC). Assuming an efficiency of 80% for the 125vdc to 28vdc converter, this yields 18.2 amps @ 125VDC. 80% is based on engineering judgement and is considered conservative for this type of power supply. This assumption needs no further verification. Additionally, this load will be used for SBO even though there are fewer expected alarms.

11) Continuous Control data for the 09-43 Annunciator Termination Cabinet obtained from WR-01-11888-00

12)This loading conservatively includes 284 interposing relays and 9 et-16 lamps (which consists of almost all loads on this circuit)

13) Continuous Control data for the 09IR-1 Interposing Relay Cabinet obtained from WR-00-04690-04

PANEL 71DC-B4

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
1	LOTC2	600V SWGR Test Cab	N/A	N/A	N/A	N/A	N/A	N/A	N/A	II/III	FE-1AH	1
2	93FPBD	Force Paralleling Cntl Pnl										
	TBRX1-1EDGB13	Start Tie Brk Control	1.85 sec	120 min	N/A	0.02	130	3	Resistance	I	ESK-11BP	
	TBRX2-1EDGB13	Start Tie Brk Permissive	1.85 sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD8M-1EDGB13	EDG B & D Force Parallel	1.90 sec	120 min	N/A	0.06	125	8	Resistance	I		
	VSRX1-1EDGB13	EDG B Start Field Flashing	3.52 sec	120 min	N/A	0.02	130	3	Resistance	I		
	VSRX2-1EDGB13	EDG D Start Field Flashing	3.52 sec	120 min	N/A	0.02	130	3	Resistance	I		
	GFR-1EDGB13	EDG B & D Field Flashing	3.54 sec	6.54 sec	N/A	0.02	130	3	Resistance	I		
	TD9M-1EDGB13	EDG B & D Force Parallel	3.54 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD9X-1EDGB13	EDG B & D Force Parallel	6.54 sec	120 min	2.26	0.14	120	17	Resistance	I		
		Continuous Control	0 sec	120 min	N/A	0.151	125	19	Resistance			
7	71L26	Emer SWGR Bus 12600	(See details on Sheet 71L26)							I	FE-1AK	
8	71H06	Emer SWGR Bus 10600	(See details on Sheet 71H06)							I	FE-1AM	
11	93ECP-B	EDG "B" Ctrl & Ann										
	K1-1EDGB12	Auto Start	0.1 sec	120 min	2.26	0.14	120	N/A	Resistance	I	ESK-11BK	
	TBR-1EDGB12	Remote Start	1.8 sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD6-1EDGB12	Engine Start Interlock	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD7-1EDGB12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	K4-1EDGB12	Loss of Gen Field	3.5 sec	120 min	N/A	0.02	130	3	Resistance	I		
	FFR-1EDGB12	Field Flash	3.56 sec	120 min	1.47	0.090	125	N/A	Resistance	I		
	VSR-1EDGB12	Volt Speed	3.5 sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD5-1EDGB12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.06	125	8	Resistance	I	ESK-11BL	
	SOV-1B	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	SOV-2B	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	K2-1EDGB12	Gov. Booster Pump	0.2 sec	1.75 sec	2.08	0.154	125	N/A	Resistance	I		
	ESR40-1EDGB12	40 RPM Speed Relay	0.32 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	ESR200-1EDGB12	200 RPM Speed Relay	1.75 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	ESR400-1EDGB12	400 RPM Speed Relay	3.4 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	C2-1EDGB12	Fuel Oil Prime Pump	0.2 sec	120 min	2.08	0.154	125	N/A	Resistance	I	ESK-11BM	
	TD10-1EDGB12	Loss of Field	3.52 sec	3.58 sec	N/A	0.06	125	8	Resistance	I		

PANEL 71DC-B4(cont'd)

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
11	**93ECP-B**	EDG "B" Ctrl & Ann (Cont'd)										
(Cont'd)	TD1-1EDGB12	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.06	125	8	Resistance	I	ESK-11BM	
	ETM-1EDGB12	Run Time Indicator	0.1 sec	120 min	0.50	N/A	120	N/A	VA	I		5
	93GS-5B	EDG "B" Booster Pmp Inrush	0.3 sec	1.3 sec	40	N/A	115		Resistance	I	ESK-11BM	2,3
		EDG "B" Booster Pmp F.L.	1.3 sec	1.75 sec	N/A	9	115	1035	VA	I		
	93P-4B	EDG "B" Fuel Oil Pmp Inrush	0.3 sec	1.3 sec	6.64	N/A	120		Resistance	I	ESK-11BM	2,3
		EDG "B" Fuel Oil Pmp F.L.	1.3 sec	120 min	N/A	4.44	120	533	VA			
	ESS-1EDGB12	Speed Switch	0.32 sec	120 min	N/A	0.04	125		Resistance	I		4
	62-1EDGB12	High Circulating Current	3.58 sec	120 min	N/A	0.06	125	8	Resistance	I		
		Continuous Control	0 sec	120 min	N/A	0.15	125	19	Resistance			
	93EGP-B	Gen "B" Cont Panel										
	EDG "B" FF	EDG "B" Field Flash	3.6 sec	6.6 sec	N/A	41.14	125	5142	Resistance	I	ESK-8HE	9
	K2/VR-1EDGB25	Auto Field Flash	3.58 sec	6.6 sec	N/A	0.14	115	16	Resistance	I	1.12-41	
	TDVR-1EDGB25	Field Shutdown	3.58 sec	6.6 sec	N/A	0.06	125	8	Resistance	I	1.12-41	
	93P/S-B	P/S for EG-M Control	0 sec	120 min	N/A	0.36	125	44.6	VA	I	ESK-8HG	7
		Continuous Control	N/A	N/A	N/A	0.32	125	41	VA			8
12	**93ECP-D**	EDG "D" Ctrl & Ann										
	K1-1EDGD12	Auto Start	0.1 sec	120 min	2.26	0.14	120	N/A	Resistance	I	ESK-11BQ	
	TBR-1EDGD12	Remote Start	1.8 sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD6-1EDGD12	Engine Start Interlock	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD7-1EDGD12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	K4-1EDGD12	Loss of Gen Field	3.5 sec	120 min	N/A	0.02	130	3	Resistance	I		
	FFR-1EDGD12	Field Flash	3.56 sec	120 min	1.41	0.14	125	N/A	Resistance	I		
	VSR-1EDGD12	Volt Speed	3.5 sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD5-1EDGD12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.06	125	8	Resistance	I	ESK-11BR	
	SOV-1C	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	SOV-2C	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	K2-1EDGD12	Gov. Booster Pump	0.2 sec	1.75 sec	2.08	0.15	125	N/A	Resistance	I		
	ESR40-1EDGD12	40 RPM Speed Relay	0.32 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	ESR200-1EDGD12	200 RPM Speed Relay	1.75 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	ESR400-1EDGD12	400 RPM Speed Relay	3.4 sec	120 min	2.36	0.15	125	N/A	Resistance	I		

PANEL 71DC-B4 (Cont'd)

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
12 (Cont'd)	**93ECP-D**	EDG "D" Ctrl & Ann (Cont'd)										
	C2-1EDGD12	Fuel Oil Prime Pump	0.2 sec	120 min	2.08	0.15	125	N/A	Resistance	I	ESK-11BS	
	TD10-1EDGD12	Loss of Field	3.52 sec	3.58 sec	N/A	0.06	125	8	Resistance	I		
	TD1-1EDGD12	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.06	125	8	Resistance	I		
	ETM-1EDGD12	Run Time Indicator	0.1 sec	120 min	0.5	N/A	120	N/A	VA	I		5
	93GS-5D	EDG "D" Booster Pump Inrush	0.3 sec	1.3 sec	40	N/A	115		Resistance	I	ESK-11BS	2,3
		EDG "D" Booster Pump F.L.	1.3 sec	1.75 sec	N/A	9	115	1035	VA			
	93P-4D	EDG "D" Fuel Oil Pmp Inrush	0.3 sec	1.3 sec	6.64	N/A	120		Resistance	I	ESK-11BS	2,3
		EDG "D" Fuel Oil Pmp F.L.	1.3 sec	120min	N/A	4.44	120	533	VA			
	ESS-1EDGD12	Speed Switch	0.32 sec	120 min	N/A	0.04	125		Resistance	I		4
	62-1EDGD12	High Circulating Current	3.58 sec	120 min	N/A	0.06	125	8	Resistance	I		
		Continuous Control	0 sec	0.1 sec	N/A	0.15	125	19	Resistance	N/A		
	93EGP-D	Gen "D" Cont Panel										
	EDG "D" FF	EDG "D" Field Flash	3.6 sec	6.6 sec	N/A	41.3	125	5160	Resistance	I	ESK-8HE	
	K2/VR-1EDGD25	Auto Field Flash	3.58 sec	6.6 sec	N/A	0.14	115	16	Resistance	I	1.12-41	
	TDVR-1EDGD25	Field Shutdown	3.58 sec	6.6 sec	N/A	0.06	125	8	Resistance	I	1.12-41	
	93P/S-D	P/S for EG-M Control	0.1 sec	120 min	N/A	0.36	125	45.5	VA	I	ESK-8HG	7
		Continuous Control	N/A	N/A	N/A	0.32	125	40.3	VA	N/A		8

PANEL 71DC-B4 (Cont'd)

Compt No.	Load I.D.	Load Description	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Cufrent (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
1	LOTC2	600V SWGR Test Cab	N/A	N/A	N/A	N/A	N/A	N/A	N/A	II/III	FE-1AH	1
2	93FPBD	EDG B&D Para Cont Pnl	4.35 sec	240 min	N/A	2.66	120	319.1	Resistance	I	ESK-11BP	
		Continuous Control	0 sec	240 min	N/A	0.15	125	19	Resistance	N/A		
7	71L26	Emer SWGR Bus 12600	(See details on Sheet 71L26)							I	FE-1AK	
8	71H06	Emer SWGR Bus 10600	(See details on Sheet 71H06)							I	FE-1AM	
11	93ECP-B	EDG "B" Ctrl & Ann	2.5 sec	240 min	N/A	4.61	120	553	Resistance	I	ESK-11BK	6
		Continuous Control	0 sec	240 min	N/A	0.15	125	19	Resistance	N/A		7
	93GS-5B	EDG "B" Booster Pmp Inrush	2.8 sec	3.8 sec	40	N/A	115		Resistance	I	ESK-11BM	2,3
		EDG "B" Booster Pmp F.L.	3.8 sec	4.2 sec	N/A	9	115	1035	VA			
		EDG "B" Booster Pmp Inrush	239 min & 0.3 sec	239 min & 1.3 sec	40	N/A	115		Resistance			
		EDG "B" Booster Pmp F.L.	239 min & 1.3 sec	239 min & 1.75 sec	N/A	9	115	1035	VA			
	93P-4B	EDG "B" Fuel Oil Pump	2.8 sec	240 min	6.64	4.44	120	533	VA	I	ESK-11BM	2,3
	93EGP-B	EDG "B" Field Flash	6.1 sec	9.1 sec	N/A	40.5	125	5063	Resistance	I	ESK-8HE	6, 9
			239 min & 3.6 sec	239 min & 6.6 sec								
	93P/S-B	P/S for EG-M Control	0 sec	240 min	N/A	0.36	125	44.6	VA	I	ESK-8HF	8
		Continuous Control	0.1 sec	120 min	N/A	0.32	125	41	Resistance	N/A		
12	93ECP-D	EDG "D" Ctrl & Ann	2.5 sec	240 min	N/A	4.61	120	553	Resistance	I	ESK-11BQ	6
		Continuous Control	0 sec	240 min	N/A	0.15	125	19	Resistance	N/A		
	93GS-5D	EDG "D" Booster Pmp Inrush	2.8 sec	3.8 sec	40	N/A	115		Resistance	I	ESK-11BS	2,3
		EDG "D" Booster Pmp F.L.	3.8 sec	4.2 sec	N/A	9	115	1035	VA			
	93P-4D	EDG "D" Fuel Oil Pmp Inrush	2.8 sec	3.8 sec	6.64	N/A	120		Resistance	I	ESK-11BS	2,3
		EDG "D" Fuel Oil Pmp F.L.	3.8 sec	240 min	N/A	4.44	120	533	VA			
	93EGP-D	EDG "D" Field Flash	6.1 sec	9.1 sec	N/A	40.5	125	5063	Resistance	I	ESK-8HE	6, 9
			N/A	N/A								
	93P/S-D	P/S for EG-M Control	0 sec	240 min	N/A	0.36	125	45.5	VA	I	ESK-8HF	8
		Continuous Control	0.1 sec	240 min	N/A	0.32	125	40	VA	N/A		

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 17

PANEL 71DC-B4 (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) These loads are not operating during LOCA and SBO.

2) For the LOCA scenario, High Drywell Pressure or Low Low Reactor Water Level signals will start the EDGs without time delay. For the SBO scenario, sustained undervoltage for more than 2.5 seconds will start the EDGs. EDGs start signals will start the Fuel Oil pumps, the Governor Booster pumps and and the engine start sequence (Ref. ESK-11BK & ESK-11BQ).

3) Both the FLA and LRC for these motors were obtained from Appendix 8.
Pump Nos. 93P-4B & D automatically start on loss of AC power or
low reactor water level and high drywell pressure and continue throughout EDG operation.
Pump Nos. 93GS-5B/D start with EDG's and stop when EDG's start reach 200 rpm

4) For test data on ESS current consumption at 125V DC refer to Appendix 8. Load with EDG in standby is 39.6mA. At 40RPM the load is 51mA. At 200RPM the load is 63mA. At 400RPM the load is 74.4mA.

5) The loading basis is in Appendix 8. For conservatism, this load was included for the entire duration for LOCA

6) For the SBO scenario this load is assumed to be energized between 2.5 and 9.7 seconds in the duty cycle as shown on the table. The diesels fail to load on the Bus. For SBO it is assumed that a single EDG loads on the Bus at minute 239. The load for this circuit represents the maximum load on this circuit during EDG starting (4.61 amps normally occurs at 200RPM). Since it is unknown during an SBO w/failed EDG when this will occur we placed 4.61 amps on the circuit for the entire SBO conservatively.

7) Continuous Control data for the 93P/S-B Lambda Model JWS-150-48/A was obtained from WR-01-10535-00. Loading data was increased by 10% for margin & conservatism

8) Continuous Control data for the 93P/S-D Lambda Model JWS-150-48/A was obtained from WR-99-06448-00. Loading data was increased by 10% for margin & conservatism

9) The generator field resistance is 0.491ohms (see drawing 1.12-23). The field flashing blocking diode 1N3296 has an ohmic value of 5.5 mohms. The current limiting resistor network is 2.5 ohms. See drawing 1.12-41 and vendor tech manual M20 and M21. All resistances are summarized in Appendix 1.

10) These SOV's are rated for 13Watts at 125VDC per Graham White Drawing 712-015 which can be found in Design Change D1-98-020.

PANEL 71DC-B5

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
1	06INV-1B	Feedwater Inverter B	0 sec	120 min	0 sec	240 min	N/A	1.15	125	143.3	VA	M	1.75-70	1
		Continuous Control	N/A	N/A	N/A	N/A	N/A	0.99	132.0	130.3	VA	N/A		
2	71DAP-3	Data Aquisition Panel	0 sec	120 min	0 sec	240 min	N/A	N/A	120	N/A	Resistance	II/III	1.53-91	2
4	09ARI-1B	CRD B Alt. Rod Insertion.	0.1 sec	120 min	10 sec	240 min	N/A	0.29	125	36	Resistance	I	ESK-7FA	3
17	71RH-5	Ckts. 1YL2N24 & 25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8EX	2
20	71L14	600V SWGR Control	(See details on Sheet 71L14)									II/III	FE-1AK	
22	71L24	600V SWGR Control	(See details on Sheet 71L24)									II/III	FE-1AM	
24	71L44	600V SWGR Control	(See details on Sheet 71L44)									II/III	FE-1AJ	

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Actual measurement of load during WR 01-10998-00 was 132.04VDC @ 0.993Amps (130.3.4Watts). For conservatism 10% margin was added to 130.3 watts for a total of 143.3 watts. 143.3 watts was used for the loading table. 130.3 watts was removed from the continuous control load on 71BCB-2A table.

2) These loads were considered to be part of the continuous control load indicated on Sheet 2 of this Appendix for 71BCB-2B. This continuous control load value was obtained from a series of Station Battery and Charger weekly surveillance tests.

3) All ARI relays will operate on a LOCA and SBO on Reactor lo-lo level and remain energized for the duration.

MCC 71BMCC-2

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
OA1	29MOV-77	Main Steam Line Drain Isol Valve	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	I	ESK-11AF	1
OA2	23MOV-14 (Open)	HPCI Turbine Steam Inlet VA Inrush	0.1 sec	1.1 sec	10 sec	11 sec	136	N/A	125	N/A	Resistance	I	ESK-11AK	2
		HPCI Turbine Steam Inlet VA F.L.	1.1'sec	16.8 sec	11 sec	26.7 sec	N/A	36	125	4500	VA			
		HPCI Turbine Steam Inlet Cntl Open	0.1 sec	16.8 sec	10 sec	26.7 sec	N/A	0.58	125	72.8	Resistance	I		
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.19	125	24.2	Resistance			
OB1	23MOV-17	HPCI Cond Storage Tk to PP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	I	ESK-11AL	3
OC2	10MOV-67	RHR To Radwaste Inboard Isol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	II/III	ESK-11AH	1
OD1	23P-140	HPCI Gland Seal Cond Exhstr Inrush	0.1 sec	1.1 sec	10 sec	11 sec	9.41	N/A	120	N/A	Resistance	II/III	ESK-11CB	4
		HPCI Gland Seal Cond Exhstr F.L.	1.1 sec	120 min	11 sec	240 min	N/A	3.5	120	420	VA			
		HPCI Gland Seal Cond Exhstr Control	0.1 sec	120 min	10 sec	240 min	N/A	0.49	125	61.8	Resistance	II/III		
		Continuous control	0	0.1 sec	0 sec	10 sec	N/A	0.19	125	24.2	Resistance			
OE1	23P-141	HPCI Gland Seal Cond Pmp Inrush	19 sec	20 sec	29sec	30 sec	46.36	N/A	125	N/A	Resistance	II/III	ESK-11CB	5
		HPCI Gland Seal Cond Pump F.L.	20 sec	120 min	30 sec	240 min	N/A	10	125	1250	VA	II/III		
		HPCI Gland Seal Cond Pump Control	19 sec	120 min	29sec	240 min	N/A	0.49	125	61.8	Resistance	II/III		
		Continuous control	0 sec	10 sec	0 sec	20 sec	N/A	0.19	125	24.2	Resistance			
OE2	23MOV-60	Bypass HPCI Outboard Iso VV	N/A	N/A	N/A	N/A	N/A	N/A	N/A		VA	I	ESK-11AAG	1

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 20

MCC 71BMCC-2 (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) This MOV is not cycled during LOCA and SBO

2) Both the FLA. and LRC for 23MOV-14 motor was obtained from Appendix 8.
See Appendix 15 for stroke time and sequencing.

3) This valve does not stroke. See Appendix 11

4) The full load current for 23P-140 motor was obtained from the JAF Electric Motor Data Sheets. (see Appendix 8).
The starting current of this motor was calculated (see Appendix 14).
The total value for the motor inrush current includes also the motor starting resistor.
See Appendix 15 for sequencing.

5) The full load current for 23P-141 motor was obtained from the JAF Electric Motor Data Sheets and/or with the Baldor Elec. Co. motor test data (See B0600-0182 (T16)).
The starting current (locked rotor) for this motor was obtained from motor test data (See B0600-0182 (T16)).
The total value for the motor inrush current includes also the motor starting resistor.
See Appendix 15 for sequencing.

MCC 71BMCC-4

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
OA2	23MOV-24	HPCI-RCIC Return Cond Tk	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	II/III	ESK-11AN	1,8
OB1	23MOV-25 (Open)	HPCI Min Flow Bypass Inrush	19 sec	20 sec	29 sec	30 sec	82	N/A	125	N/A	Resistance	I	ESK-11AN	2
		HPCI Min Flow Bypass F.L	20 sec	29 sec	30 sec	39 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Control	19 sec	29 sec	29 sec	39 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Close)	HPCI Min Flow Bypass Inrush	29 sec	30 sec	39 sec	40 sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass F.L.	30 sec	38 sec	40 sec	48 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Seating LR	38 sec	39 sec	48 sec	49 sec	41	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass Control	29 sec	39 sec	39 sec	49 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Open)	HPCI Min Flow Bypass Inrush	N/A	N/A	4 min	4 min & 1sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass F.L.	N/A	N/A	4 min & 1sec	4 min & 10 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Control	N/A	N/A	4 min	4 min & 10 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Close)	HPCI Min Flow Bypass Inrush	N/A	N/A	4 min & 10 sec	4 min & 11sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass-Close	N/A	N/A	4 min & 11sec	4 min & 19 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Seating LR	N/A	N/A	4 min & 19 sec	4 min & 20 sec	41	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass Control	N/A	N/A	4 min & 10 sec	4 min & 20 sec	N/A	0.62	125	78	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.24	125	30	Resistance			
OB2	12MOV-18 (Close)	Reactor Wtr Cleanup Inrush	0.1 sec	1.1 sec	1 sec	2 sec	112.2	N/A	125	N/A	Resistance	I	ESK-11AD	3
		Reactor Wtr Cleanup F.L.	1.1 sec	19.1 sec	2 sec	20 sec	N/A	26	125	3250	VA			
		Reactor Wtr Cleanup Seating LRA	19.1 sec	20.1 sec	20 sec	21 sec	56.1	N/A	125	N/A	Resistance			
		Reactor Wtr Cleanup Control	0.1 sec	20.1 sec	1 sec	21 sec	N/A	0.62	125	78	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.24	125	30	Resistance			
OC1	23MOV-57 (Open)	Suct from Suppr Pool Inrush	0.1 sec	1.1 sec	N/A	N/A	25.2	N/A	125	N/A	Resistance	I	ESK-11AP	4
		Suct from Suppr Pool F.L	1.1 sec	43 sec	N/A	N/A	N/A	5.5	125	688	VA			
		Suct from Supp Pool Control	0.1 sec	43 sec	N/A	N/A	N/A	0.62	125	78.1	Resistance			
	23MOV-57 (Close)	Suct from Suppr Pool Inrush	43 sec	44 sec	N/A	N/A	25.2	N/A	125	N/A	Resistance			
		Suct from Suppr Pool F.L	44 sec	1 min & 25 sec	N/A	N/A	N/A	5.5	125	688	VA			
		Suct from Suppr Pool Seating LRA	1 min & 25 sec	1 min & 26 sec	N/A	N/A	12.6	N/A	125	N/A	Resistance			
		Suct from Suppr Pool Control	43 sec	1 min & 26 sec	N/A	N/A	N/A	0.58	125	72.8	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.19	125	24	Resistance			

MCC 71BMCC-4(Cont'd)

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
OC2	23MOV-58	Suppr Pool Upstream Inrush	0.1 sec	1.1 sec	N/A	N/A	20.96	N/A	125	N/A	Resistance	I	ESK-11AP	5
	(Open)	Suppr Pool Upstream F.L.	1.1 sec	43 sec	N/A	N/A	N/A	5.5	125	688	VA			
		Supp Pool Upstream Control	0.1 sec	43 sec	N/A	N/A	N/A	0.62	125	78.1	Resistance			
	23MOV-58	Suppr Pool Upstream Inrush	43 sec	44 sec	N/A	N/A	20.96	N/A	125	N/A	Resistance			
	(Close)	Suppr Pool Upstream F.L.	44 sec	1 min & 25 sec	N/A	N/A	N/A	5.5	125	688	VA			
		Suppr Pool Upstream Seating LRA	1 min & 25 sec	1 min & 26 sec	N/A	N/A	10.48	N/A	125	N/A	Resistance			
		Suppr Pool Upstream Control	43 sec	1 min & 26 sec	N/A	N/A	N/A	0.58	125	72.8	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.19	125	24	Resistance			
OC3	02ADS-71	ADS Relief Valve Cntrl Pnl	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	M	ESK-11AAM	1
OD2	10MOV-17	Outboard Iso Recirc to RHR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	I	ESK-11AE	1
OE1	27MOV-122	PCP Exhaust Valve Inrush	30 min	30 min & 1 sec	N/A	N/A	115.9	N/A	125	N/A	Resistance	I	ESK-11AAN	6
	(Open)	PCP Exhaust Valve F.L.	30 min & 1 sec	30 min & 8 sec	N/A	N/A	N/A	24	125	3000	VA			
		PCP Exhaust Control	30 min	30 min & 8 sec	N/A	N/A	N/A	0.62	125	78	Resistance			
	27MOV-122	PCP Exhaust Valve Inrush	101 min	101 min & 1 sec	N/A	N/A	115.9	N/A	125	N/A	Resistance			
	(Close)	PCP Exhaust Valve - Close	101 min & 1 sec	101 min & 7 sec	N/A	N/A	N/A	24	125	3000	VA			
		PCP Exhaust Valve Seating LRA	101 min & 7 sec	101 min & 8 sec	N/A	N/A	57.95	N/A	125	N/A	Resistance			
		PCP Exhaust Control	101 min	101 min & 8 sec	N/A	N/A	N/A	0.62	125	78	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.24	125	30	Resistance			
OE2	23P-150	HPCI Aux Oil Pump Inrush	0.1 sec	1.1 sec	10 sec	11 sec	72.18	N/A	120	N/A	Resistance	I	ESK-11CB	7
		HPCI Aux Oil Pump F.L.	1.1 sec	30 sec	11 sec	40 sec		50	120	6000	VA			
		HPCI Aux Oil Pump Control	0.1 sec	30 sec	10 sec	40 sec	N/A	0.49	125	62	Resistance			
		HPCI Aux Oil Pump Inrush	43 sec	44 sec	4 min	4 min & 1 sec	72.18	N/A	120	N/A	Resistance			
		HPCI Aux Oil Pump F.L.	44 sec	120 min	4 min & 1 sec	35 min & 30sec		50	120	6000	VA			
		HPCI Aux Oil Pump Control	43 sec	120 min	4 min	35 min & 30sec	N/A	0.49	125	62	Resistance			
		HPCI Aux Oil Pump Inrush	N/A	N/A	40 min	40 min & 1sec	72.18	N/A	120	N/A	Resistance			
		HPCI Aux Oil Pump F.L.	N/A	N/A	40 min & 1sec	240 min		50	120	6000	VA			
		HPCI Aux Oil Pump Control	N/A	N/A	40 min	240 min	N/A	0.49	125	62	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.19	125	24	Resistance			

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 23

MCC 71BMCC-4(Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) It is assumed that this SOV/MOV is not cycled during LOCA and SBO.

2) Both the FLA and LRC for the valve 23MOV-25 was obtained from AC & DC Valve Electric Motor Data Sheets (see Appendix 8).
Data from Votes testing was not reliable for locked rotor current. Therefore, for 23MOV-25, the motor data sheet in Appendix 8 will be the source of LRA and FLA.
See Appendix 15 for sequencing and stroke time duration. Although the calculated stroke time (Appendix 8) is less than 10 seconds, for simplicity the duty cycle will use 10 seconds for the opening and closing stroke times.

3) Both the FLA and LRC for the valve 12MOV-18 was obtained from AC & DC Valve Electric Motor Data Sheets (see Appendix 8)
12MOV-18 Timing Sequence Justification : This valve closes on low reactor water level and high drywell pressure.
Based on 9/16/96 event, it takes approx. 1 sec to reach reactor water Lo level from the event inception.
The 20 second maximum close stroke time obtained from the Technical Requirement Manual (TRM). The calculated value using BWROG methodology is 19.75 seconds (see Appendix 8). The 19.75 seconds is obtained from the calculated spreadsheet value at 0% position. See Design Input 2.5 for acceptability of BWROG methodology. In this particular case an additional 10% margin was not added (as in the case with other MOVs). The calculated stroke time is slightly less than the PCIS required stroke time of 20 seconds. Since this value assumes the lowest bus voltage for the entire stroke, the calculated value of 19.77 seconds is conservative. For simplicity, this duty cycle will use 20 seconds.

4) FLA for 23MOV-57 was obtained from nameplate (see Appendix 8). The LRA was obtained from VOTES testing and corrected for circuit resistance.
See Appendix 15 for HPCI sequencing. This valve receives an open signal at the onset of the LOCA. However, it stops in mid stroke due to low reactor pressure (75PSIG).
The open stroke lasts for 43 seconds. The close stroke will also be 43 seconds.

5) FLA for 23MOV-58 was obtained from nameplate (see Appendix 8). The LRA was obtained from VOTES testing and corrected for circuit resistance.
See Appendix 15 for HPCI sequencing. This valve receives an open signal at the onset of the LOCA. However, it stops in mid stroke due to low reactor pressure (75PSIG).
The open stroke lasts for 43 seconds. The close stroke will also be 43 seconds.

6) Both the FLA and LRC for the valve 27MOV-122 was obtained from AC & DC Valve Electric Motor Data Sheets (see Appendix 8).
27MOV-122 may be manually cycled for drywell venting during LOCA in accordance with EP-6. EP-6 recommends Torus Venting over Drywell Venting.
However, for conservatism, this MOV is assumed to operate at t=30 minutes manually. During SBO event, this MOV would not be cycled because no accident is postulated during SBO.
8 seconds is the maximum close stroke time obtained from the Technical Requirement Manual (TRM). The calculated value using BWROG methodology is 3.77 seconds for opening and 3.91 seconds for closing (see Appendix 8). See Design Input 2.5 for acceptability of BWROG methodology.
An additional 10% margin was added to yield 4.1 seconds (for opening) and 4.3 seconds (for closing).The calculated stroke time (plus 10% margin) is less than the PCIS required stroke time of 8 seconds. For simplicity, this duty cycle will use 8 seconds.

7) The full load current for this motor was obtained from the JAF Electric Motor Data Sheets. (see Appendix 8). .
The starting current (locked rotor) for this motor was obtained from the Baldor Electric Co. (see Appendix 8 Fax from Baldor Electric Co. Dated 7/7/97).
The total value for the motor inrush current includes also the motor starting resistor. See Appendix 14
See Appendix 15 for sequencing.

8) 23MOV-24 is required to be stroked during SBO should RCIC system be placed in pressure control mode as would be expected per AOP-49.
However, this calculation uses an additional restart of HPCI in lieu of RCIC being in pressure control. With RCIC in pressure control a restart of HPCI would not be necessary. The load imposed by a restart of HPCI significantly exceeds the demand of cycling 23MOV-24.
Therefore, a cycling of 23MOV-24 will not be included in this calculation.

MCC 71BMCC-6

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
OA1	23MOV-16	HPCI St Outboard Iso VA Inrush	0.1 sec	1.1 sec	10 sec	11 sec	129.5	N/A	125	N/A	Resistance	I	ESK-11AK	1
	(Open)	HPCI St Outboard Iso VA F.L.	1.1 sec	12.7 sec	11 sec	22.6 sec	N/A	36	125	4500	VA			
		HPCI St Outboard Iso VA Control	0.1 sec	12.7 sec	10 sec	22.6 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-16	HPCI St Outboard Iso VA Inrush	43 sec	44 sec	N/A	N/A	129.5	N/A	125	N/A	Resistance			
	(Close)	HPCI St Outboard Iso VA F.L.	44 sec	55.5 sec	N/A	N/A	N/A	36	125	4500	VA			
		HPCI St Outboard Iso VA Seating LRA	55.5 sec	56.5 sec	N/A	N/A	64.75	N/A	125	N/A	Resistance			
		HPCI St Outboard Iso VA Control	43 sec	56.5 sec	N/A	N/A	N/A	0.62	125	78.1	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.24	125	30	Resistance			
OA2	23MOV-19	HPCI Discharge Downstream Inrush	0.1 sec	1.1 sec	10 sec	11 sec	477	N/A	125	N/A	Resistance	I	ESK-11AL	2
	(Open)	HPCI Discharge Downstream F.L.	1.1 sec	28.8 sec	11 sec	38.7 sec	N/A	43.4	125	5431	VA			
		HPCI Discharge Downstream Control	0.1 sec	28.8 sec	10 sec	38.7 sec	N/A	0.58	125	72.8	Resistance			
	23MOV-19	HPCI Discharge Downstream Inrush	44 sec	45 sec	4 min	4 min & 1 sec	477	N/A	125	N/A	Resistance			
	(Close)	HPCI Discharge Downstream F.L.	45 sec	1 min & 9.4 sec	4 min & 1 sec	4 min & 25.4 sec	N/A	43.4	125	5431	VA			
		HPCI Discharge Downstream Seating LRA	1 min & 9.4 sec	1 min & 10.4 sec	4 min & 25.4 sec	4 min & 26.4 sec	238.5	N/A	125	N/A	Resistance			
		HPCI Discharge Downstream Control	44 sec	1 min & 10.4 sec	4 min	4 min & 26.4 sec	N/A	0.58	125	72.8	Resistance			
	23MOV-19	HPCI Discharge Downstream Inrush	N/A	N/A	35 min	35 min & 1 sec	477	N/A	125	N/A	Resistance			
	(Open)	HPCI Discharge Downstream F.L.	N/A	N/A	35 min & 1 sec	35 min & 28.7 sec	N/A	43.4	125	5431	VA			
		HPCI Discharge Downstream Control	N/A	N/A	35 min	35 min & 28.7 sec	N/A	0.58	125	72.8	Resistance			
	23MOV-19	HPCI Discharge Downstream Inrush	N/A	N/A	40 min	40 min & 1 sec	477	N/A	125	N/A	Resistance			
	(Close)	HPCI Discharge Downstream F.L	N/A	N/A	40 min & 1 sec	40 min & 25.4 sec	N/A	43.4	125	5431	VA			
		HPCI Discharge Downstream Seating LRA	N/A	N/A	40 min & 25.4 sec	40 min & 26.4 sec	238.5	N/A	125	N/A	Resistance			
		HPCI Discharge Downstream Control	N/A	N/A	40 min	40 min & 26.4 sec	N/A	0.58	125	72.8	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.19	125	24	Resistance			
OB1	23MOV-21	HPCI Test Return Valve - Trottle	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	I	ESK-11AM	3
OB2	23MOV-20	HPCI Disch Upstream Shutoff	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	I	ESK-11AM	4

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 25

MCC 71BMCC-6 (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Both the FLA and LRC for the valve 23MOV-16 was obtained from AC & DC Valve Electric Motor Data Sheets (see Appendix 8)

   23MOV-16 Timing Sequence Justification : This valve opens on HPCI Initiation Signal.
   For stroke time and sequencing see Appendix 15

2) Both the FLA and LRC for the valve23MOV-19 was obtained from DC Valve Test Results Summary. (see Appendix 8).

   The FLA selected was from the 9/1/92 VOTES Test which was measured during dynamic testing (under load).
   For this valve the test data was used to determine the inrush current (477 Amps determined by test versus name plate of 810 Amps). See Appendix 8
   For all other MOVs the name plate data was used for conservatism, however for 23MOV-19 there is very big difference between the name plate and test values.
   For sequencing and stroke time see Appendix 15.

3) This valve is normally closed, and stays closed on HPCI initiation signal.

4) It is assumed that this MOV is not cycled during LOCA and SBO.

4 kV SWGR 71HO2

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71H02	71-10202	Norm.Supply from 4kV Transf 71T-4X (Trip	0.1 sec	3 sec	0.1 sec	0.2 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5D	1
71H02	71-10210	Reac Recirc PP 02-2P-1B (Trip)	0.1 sec	0.2 sec	3 sec	3.1 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5F	2
71H02	71-10212	Res.Supply from 4kV Transf 71T-2X	N/A	N/A	N/A	N/A	6	N/A	125	N/A	Resistance	II/III	ESK-5E	3
71H02	1HONBO3	Bus 10200 Undervoltage Oper.	0.1 sec	120 min.	0.1 sec	240 min	N/A	0.22	125	N/A	Resistance	II/III	ESK-5G	4
71H02		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.26	125	N/A	Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Breaker No. 71-10202 will trip when either the undervoltage relays actuate at 3 seconds or when anti-motoring circuit logic is made (ESK-8CC). However, since it is unknown exactly when the anti-motoring circuit logic is made, the duty cycle will conservatively show this breaker trip from 0.1 seconds to 3 second for L Breaker tripping is momentary at SBO thru anti-motoring circuit logic is made (ESK-8CC). .

2) Breaker No.71-10210 trips on initiation of event for LOCA and 3 seconds for SBO.

3) Breaker No. 71-10212 is assumed not to be reclosed until 2 hours for the LOCA w/LOBC event and 4 hours after the SBO event.

4) The load is 1 SAM17A relay (0.12amps + 0.069amps) and 1HLA relay (4.3 watts). See G080-0576 and G080-C019.

4 kV SWGR 71HO4

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71H04	71-10402	Norm Supply from 4kV Transf 71T-4Y (Trip)	0.1 sec	3 sec	0.1 sec	0.2 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AJ	1
71H04	71-10404	Feed to 4kV Emerg Bus 10600(Trip)	6.2 sec	6.3 sec	8.7 sec	8.8 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AY	2
		Feed to 4kV Emerg Bus 10600 (Close)	119 min 20 sec	119 min 21 sec	N/A	N/A	6	N/A	125	N/A	Resistance			3
		Breaker Charging Motor Inrush	119 min 21 sec	119 min 22 sec	N/A	N/A	68	N/A	125	N/A	Resistance			
		Breaker Charging Motor F.L.	119 min 22 sec	119 min 25 sec	N/A	N/A	N/A	14	125	1750	VA	II/III		
71H04	71-10410	Condensate Pmp 33P-8B (Trip)	3 sec	3.1 sec	3 sec	3.1 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AM	
	86U-1CNDB02	37P-8B Undervoltage Trip Aux Relay	3 sec	120 min.	3 sec	240 min	N/A	0.06	125	7.8	Resistance	II/III		
71H04	71-10412	Res. Supply from 4kV Transf 71T-2Y (Close)	119 min 0 sec	119 min 1 sec	N/A	N/A	6	N/A	125	N/A	Resistance	II/III	ESK-5AK	3 ,4
		Breaker Charging Motor Inrush	119 min 1 sec	119 min 2 sec	N/A	N/A	68	N/A	125	N/A	Resistance			
		Breaker Charging Motor F.L.	119 min 2 sec	119 min 5 sec	N/A	N/A	N/A	14	125	1750	VA			
71H04	71-10420	Service Water Pmp 46P-1B (Trip)	3 sec	3.1 sec	3 sec	3.1 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AP	
	86U-1SWSB01	46P-1B Undervoltage Trip Aux Relay	3 sec	120 min.	3 sec	240 min	N/A	0.06	125	7.8	Resistance	II/III		
71H04	71-10430	Circ Water Pmp 36P-1B (Trip)	3 sec	3.1 sec	3 sec	3.1 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AL	
71H04	71-10440	Aux Feed to 600V Buses (Trip)	3 sec	3.1 sec	3 sec	3.1 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AR	
71H04	71-10450	Cond Booster Pmp 33P-9B (Trip)	3 sec	3.1 sec	3 sec	3.1 sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AN	
	86U-1CNDB01	33P-9B Undervoltage Trip Aux Relay	3 sec	120 min.	3 sec	240 min	N/A	0.06	125	7.8	Resistance	II/III		
71H04	71-10460	TB Clsd Loop Clg Wtr Pmp 37P-2B (Trip)	3 sec	3.1 sec	3 sec	3.1 sec	6	N/A	125		Resistance	II/III	ESK-5AQ	
	86U-1TBCB01	37P-2B Undervoltage Trip Aux Relay	3 sec	120 min.	3 sec	240 min	N/A	0.06	125	7.8	Resistance	II/III		
71H04	71-10470	Breaker Control (Spare)	N/A	N/A	N/A	N/A	N/A	N/A	N/A			II/III		
71H04	1HONDO3	Bus 10400 Undervoltage Oper.	0.1 sec	120 min.	0.1 sec	240 min	N/A	0.24	125		Resistance	II/III	ESK-5H	5
71H04		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.78	125	97	Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Breaker No. 71-10402 will trip when either the undervoltage relays actuate at 3 seconds or when anti-motoring circuit logic is made (ESK-8CC). However, since it is unknown exactly when the anti-motoring circuit logic is made, the duty cycle will conservatively show this breaker trip from 0.1 seconds to 3 second for LOCA. Breaker tripping is momentary at SBO thru anti-motoring circuit logic is made (ESK-8CC). .

2) Breaker trips when one of the EDG's reaches 75% of rated voltage and one of the double ended tie breakers is opened with both of EDG output breakers open.

3) For the purpose of this calculation, these breakers are considered to close during the last minute of battery duty cycle as a random load for LOCA.

4) This breaker is normally open, therefore the trip signal at 3 seconds does not trip breaker from the 115 kV bus undervoltage lockout relay 86LB1-1ZLCN04.

5) The load is 1 SAM17A relay (0.12amps + 0.069amps) and 2 HLA relays in series with 300ohm reststor and 1 HLA (4.3 watts). See G080-0576 and G080-C019.

4 kV SWGR 71HO6

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71H06	71-10602	EDG-B feed to Bus 10600 (Close)	7.2 sec	7.3 sec	9.7 sec	9.8 sec	6	N/A	125	N/A	Resistance	I	ESK-5BK	1
		Breaker Charging Motor Inrush	7.3 sec	8.3 sec	9.8 sec	10.8 sec	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	8.3 sec	12.2 sec	10.8 sec	14.7 sec	N/A	14	125	N/A	VA			
	K10-1EDGB01	EDG B Egn Failure	N/A	N/A	9.7 sec	240 min	1.41	0.086	120	10	Resistance	I		
		EDG-B feed to bus 10600 (Trip)	N/A	N/A	9.8 sec	9.9 sec	6	N/A	125	N/A	Resistance	I		
		EDG-B feed to bus 10600 (Close)	N/A	N/A	239 min 7.2 sec	239 min 7.3 sec	6	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor Inrush	N/A	N/A	239 min 7.3 sec	239 min 8.3 sec	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	N/A	N/A	239 min 8.3 sec	239 min 12.2 sec	N/A	14	125	N/A	VA			
71H06	K8-1EDGB02	EDG-B&D Tie Brk Closing Rel	1.9 sec	120 min	4.4 sec	10.7 sec	1.41	0.086	120	10	Resistance	I	ESK-5BM	1, 2
	71-10604	Gen. Tie to 93EDG-B & D (Close)	2 sec	2.1 sec	4.5 sec	4.6 sec	6	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor Inrush	2.1 sec	3.1 sec	4.6 sec	5.6 sec	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	3.1 sec	7 sec	5.6 sec	9.5 sec	N/A	14	125	N/A	VA			
	62-1EDGB02	EDG-B&D Output Brk Closing Rel	7 sec	8.2 sec	9.5 sec	10.7 sec	N/A	0.06	125	8	Resistance	I		
	62X-1EDGB02	EDG-B&D Output Brk Closing Rel	7 sec	8.2 sec	9.5 sec	10.7 sec	N/A	0.03	125	4.3	Resistance	I		
	K9-1EDGB02	Gen. Tie to 93EDG-B & D (Trip)	7.3 sec	120 min	9.7 sec	240 min	1.41	0.086	120	10	Resistance	I		
		Gen. Tie to 93EDG-B & D (Trip)	7.4 sec	7.5 sec	9.8 sec	9.9 sec	6	N/A	125	N/A	Resistance	I		
71H06	71-10610	RHR Serv Wtr Pmp 10P-1D (Close)	10 min	10 min 1 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BR	3
		Breaker Charging Motor Inrush	10 min 1 sec	10 min 2 sec	N/A	N/A	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	10 min 2 sec	10 min 5 sec	N/A	N/A	N/A	14	125	N/A	VA			
	10SOV-101D	RHR Pmp Mtr Cooling SOV	0 sec	10 min	N/A	N/A	N/A	0.21	125	26.6	Resistance	I		
71H06	71-10612	EDG-D feed to Bus 10600 (Close)	7.2 sec	7.3 sec	9.7 sec	9.8 sec	6	N/A	125	N/A	Resistance	I	ESK-5BL	
		Breaker Charging Motor Inrush	7.3 sec	8.3 sec	9.8 sec	10.8 sec	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	8.3 sec	12.2 sec	10.8 sec	14.7 sec	N/A	14	125	N/A	VA			
	K10-1EDGD01	EDG D Egn Failure	N/A	N/A	9.7 sec	240 min	1.41	0.086	120	10	Resistance	I		
		EDG-D feed to Bus 10600 (Trip)	N/A	N/A	9.8 sec	9.9 sec	6	N/A	125	N/A	Resistance	I		
71H06	71-10614	Bus 10400 feed to bus 10600 (Trip)	6.2 sec	6.3 sec	8.7 sec	8.8 sec	6	N/A	125	N/A	Resistance	I	ESK-5BJ	4
		Bus 10400 feed to bus 10600 (Close)	119 min 40 sec	119 min 41 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		5
		Breaker Charging Motor Inrush	119 min 41 sec	119 min 42 sec	N/A	N/A	68	N/A	125	N/A	VA	I		
		Breaker Charging Motor F.L.	119 min 42 sec	119 min 45 sec	N/A	N/A	N/A	14	125	N/A	VA			
71H06	71-10620	RHR Service Wtr Pmp 10P-1B (Close	10 min 5 sec	10 min 6 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BH	3
		Breaker Charging Motor Inrush	10 min 6 sec	10 min 7 sec	N/A	N/A	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	10 min 7 sec	10 min 10 sec	N/A	N/A	N/A	14	125	N/A	VA			
	10SOV-101B	RHR Pmp Mtr 10P-1B Cooling SOV	0 sec	10 min 5 sec	N/A	N/A	N/A	0.21	125	26.6	Resistance	I		
71H06	71-10630	Core Spray PP 14P-1B (Close)	18.2 sec	18.3 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BP	1
		Breaker Charging Motor Inrush	18.3 sec	19.3 sec	N/A	N/A	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	19.3 sec	23.2 sec	N/A	N/A	N/A	14	125	N/A	VA	I		

4 kV SWGR 71HO6 (Cont'd)

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71H06	71-10640	RHR Pump 10P-3D (Close)	13.2 sec	13.3 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BX	1
		Breaker Charging Motor Inrush	13.3 sec	14.3 sec	N/A	N/A	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	14.3 sec	18.2 sec	N/A	N/A	N/A	14	125	N/A	VA			
71H06	71-10650	RHR Pump 10P-3C (Close)	1 sec	1.1 sec	3.5 sec	3.6 sec	6	N/A	125	N/A	Resistance	I	ESK-5BW	1
		Breaker Charging Motor Inrush	1.1 sec	2.1 sec	3.6 sec	8.5 sec	68	N/A	125	N/A	VA	I		
		Breaker Charging Motor F.L.	2.1 sec	6 sec	3.6 sec	8.5 sec	N/A	14	125	N/A	VA	I		
		RHR Pump 10P-3C (Trip)	6.2 sec	6.3 sec	8.7 sec	8.8 sec	6	N/A	125	N/A	Resistance	I		4
		RHR Pump 10P-3C (Close)	8.2 sec	8.3 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		1
		Breaker Charging Motor Inrush	8.3 sec	9.3 sec	N/A	N/A	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	9.3 sec	13.2 sec	N/A	N/A	N/A	14	125	N/A	VA	I		
71H06	71-10660	Feed to Buses 11600 & 12600 (Close)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-5BN	6
71H06	1HOEB03	Emer Bus 10600 Undervoltage, Load Shedding and Sequencing	0.1 sec	7.2 sec	0.1 sec	239 min & 7.2 sec	N/A	1.11	125	139	Resistance	I	ESK-5BT	
71H06		Continuous control	0 sec	120 min	0 sec	240 min	N/A	1.22	125	152	Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) For the LOCA + LOBC scenario timing is based on the load sequence included in UFSAR table 8.6-1

2) EDG B & D Tie breaker is closed when both engines reach 200 rpm.

3) RHR SW are manually started by operators after RHR Pump Start. RHR SW pumps 10P-1B & 10P-1D start at 10 min to initiate RHRSW cooling.
RHRSW pump will be started manually by the control room operator one by one, not simultaneously.
OP-13C directs to start one pump first, and then start next pump if required. According to Control Room SM, Chris Adner,
operation would not start pumps simultaneously because operator knows that 4KV motors can draw high inrush currents resulting in a high voltage drop on emergency buss.
At least 5 to 10 seconds' duration is expected between the pumps'' start.
T=10 minutes is selected for the first manual start of RHRSW pump. This is the time reasonably early because no earlier time is credible for manual action.
Startup of RHRSW pumps which are to provide cooling to the RHR Heat Exchangers would not be delayed until the end time of the 2 hours' battery duty cycle period.

4) Breaker trips when one of the EDG's reach 75% of rated voltage and one of the double ended tie breakers is open with both of EDG output breakers open.

5) For the purpose of this calculation, these breakers are considered to close during the last minute of battery duty cycle as a random load for LOCA.

6) This breaker is not automatically actuated as result of the postulated scenarios

600 V SWGR 71L14

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71L14	71-11402	Breaker Control 71L14 Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6A	1
71L14	71-11416	RB Clg Wtr PP 15P-2B 52X Energize	2 sec	4.4 sec	2 sec	4.4 sec	N/A	1	125	125	Resistance	II/III	ESK-6AD	2
		RB Clg Wtr PP 15P-2B Close	2.1 sec	4.4 sec	2.1 sec	4.4 sec	44	N/A	125	N/A	Resistance	II/III		
71L14	71-11418	RB Vent Supply Fan 66FN-5B Trip	0.1 sec	0.2 sec	0.1 sec	0.2 sec	1.9	N/A	125	N/A	Resistance	II/III	ESK-6AT	3
71L14	71-11420	RB Vent Return Fan 66FN-12B Trip	0.1 sec	0.2 sec	0.1 sec	0.2 sec	1.9	N/A	125	N/A	Resistance	II/III	ESK-6AU	4
71L14		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.17	125		Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) This breaker is manually operating.

2) Based on PTE-96-002 RBC pressure reached 75PSIG between 2 and 4 seconds based on the SOE and Alarm Typer (from normal operating pressure of approximately 120PSIG). 75PSIG is a closure signal for an RBC pump motor breaker. It is assumed that an RBC pump is in standby because the system is normally operated with one pump in standby. Therefore one pump breaker will receive a closure signal. Conservatively, this breaker closure signal will start at 2 seconds and continue until 4.4 seconds. The 4.4 seconds is derived from 4.0 seconds plus 0.4 seconds. The 0.4 seconds is the closure time of the breaker (see DER 00-04175).

3) During the normal plant operation, two out of three supply fans (66FN-5A, 5B and 5C) are running. For conservatism, 66FN-5B fan is assumed to be operating. On loss of AC power (71AC10), the breaker will trip via relay 62CX-1RNVN07 n.c. contact in the trip coil circuit. (Ref. DBD-066, ESK-6AT, ESK-6ED)

4) During the normal plant operation, one out of two return fans (66FN-12A and 12B) is running. For conservatism, 66FN-12B fan is assumed to be operating. On loss of AC power (71RBACB5), the breaker will trip via relay 33Y-1RNVB06 n.c. contact in the trip coil circuit. (Ref. DBD-066, ESK-6AU, ESK-6EA)

600 V SWGR 71L16

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71L16	71-11602	Breaker Control Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-6H	1
71L16	71-11616	Cntrl CRD Water Pump 03P-16B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-6AK	2

NOTES: (Timing Sequence and Individual Load Current Justifications)

1)This breaker is manually operating.

2) This breaker will not trip on low suction pressure due to the head of water from the CST tank

600 V SWGR 71L24

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71L24	71-12402	Breaker Control Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6B	1
71L24	71-12404	Bkr Control Tie to Bus 71L23	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6E	1
71L24	71-12410	Air Compressor 39AC-1B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AH	2
71L24	71-12418	Wtr Heating Pmp 87P-23B Trip	0.1 sec	0.2 sec	0.1 sec	0.2 sec	1.9	N/A	125	N/A	Resistance	II/III	ESK-6AY	3
71L24	71-12416	Air Removal Vac Pump 38P-2B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AB	4
71L24		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.21	125		Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) This breaker is manually operating.

2) Modification M1-99-014 is changing this feeder from electrically operated breaker to manually operated breaker. Therefore, this breaker will not automatically close on loss of AC.

3) During the normal plant operation, one out of two pumps (87P-23A and 23B) is usually running in September thru May. For conservatism, 87P-23B pump is assumed to be operating. On loss of AC power (71AC10), the breaker will trip via relay 71-1AHVN13 n.c. contact in the trip coil circuit.
(Ref. ESK-6AY, ESK-10FT, ESK-6JQ)

4) This vacuum pump is normally off during the normal plant operation. This pump is used for initial condenser vacuum during plant start-up.

600 V SWGR 71L26

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71L26	71-12610	ESW Pmp 46P-2B 52X Energize	2 sec	3.9 sec	2 sec	6.4 sec	N/A	1	125	125	Resistance	I	ESK-6AL	1
		ESW Pmp 46P-2B 52CC (Close)	2.1 sec	3.9 sec	2.1 sec	6.4 sec	44	N/A	125	N/A	Resistance	I		
71L26	71-12602	71L26 Breaker Control Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-6H	2
71L26		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.21	125		Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) The ESW Pump P46-2A will operate upon a LOCA signal. The pump will receive a signal to start when the Emergency Diesel Generator reaches 400 RPM in accordance with the reference drawing. Based on PTE-96-002, RBC pressure reached 75PSIG between 2 and 4 seconds (from normal operating pressure of approximately 120PSIG).
It is unknown how quickly RBC reached 40PSIG. 40PSIG is a closure signal for the ESW pump motor breaker. It is unknown which ESW Pump Motor breaker closure signal will come in first (I.E. 40PSIG or EDG reaching 400RPM).
The breaker will definitely receive a closure signal by 3.5 seconds due to reaching 400 RPM. Conservatively, this breaker closure signal will start at 2 seconds and continue until 3.9 seconds.
The 3.9 seconds is derived from 3.5 seconds plus 0.4 seconds. The 0.4 seconds is the closure time of the breaker (see DER 00-04175).

2) This breaker is manually operating.

600 V SWGR 71L34

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71L34	71-13402	71L34 Breaker Control Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6C	1
71L34	71-13404	Tie to Bus 13300	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6F	1
71L34	71-13420	TB Fan 67FN-6B Trip	0.1 sec	0.2 sec	0.1 sec	0.2 sec	1.9	N/A	125	N/A	Resistance	II/III	ESK-6AW	2
71L34	71-13412	71TBT-4 Admin Complex Trans.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AM	1
71L34		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.17	125		Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) This breaker is manually operating.

2) During the normal plant operation, one out of two exhaust fans (67FN-6A and 6B) is running. For conservatism, 67FN-6B fan is assumed to be operating. On loss of AC power (71TBACB6), the breaker will trip via relay 33Y-1TBVB04 n.c. contact in the trip coil circuit. (Ref. DBD-067, ESK-6AW, ESK-6EM)

600 V SWGR 71L44

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71L44	71-14420	Elec Driven Fire Pmp 76P-2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6XC	1
71L44	71-14426	TB Vent Fan 67FN-5B Trip	0.1 sec	0.2 sec	0.1 sec	0.2 sec	1.9	N/A	125	N/A	Resistance	II/III	ESK-6AV	2
71L44	71-14402	Control Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6D	3
71L44		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.13	125		Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) This fire pump is normally off during the normal plant operation

2) During the normal plant operation, one out of two Supply fans (67FN-5A and 5B) is running. For conservatism, 67FN-5B fan is assumed to be operating. On loss of AC power (71TBACB6), the breaker will trip via relay 33X-1TBVB04 n.c. contact in the trip coil circuit. (Ref. DBD-067, ESK-6AV, ESK-6EM)

3) This breaker is manually operating.

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 3
Battery Duty Cycle Profile
Discharge Data

LOCA DISCHARGE PROFILE DATA

Gould NCN-33							
Time (min.)	Ampere Rate	Amps per pos plate (16 plates)	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
0						2.074	124.46
1	980.96	61.31	1.02	1.02		1.873	112.36
2	444.76	27.80	0.46	1.49		1.937	116.25
3	444.76	27.80	0.46	1.95		1.937	116.25
4	444.76	27.80	0.46	2.41		1.937	116.25
5	444.76	27.80	0.46	2.87		1.937	116.25
6	444.76	27.80	0.46	3.34		1.937	116.25
7	444.76	27.80	0.46	3.80		1.937	116.25
8	444.76	27.80	0.46	4.26		1.937	116.25
9	444.76	27.80	0.46	4.73		1.937	116.25
10	444.76	27.80	0.46	5.19		1.937	116.25
11	444.76	27.80	0.46	5.65		1.937	116.25
12	444.76	27.80	0.46	6.12		1.937	116.25
13	444.76	27.80	0.46	6.58		1.937	116.25
14	444.76	27.80	0.46	7.04		1.937	116.24
15	444.76	27.80	0.46	7.51		1.937	116.24
16	444.76	27.80	0.46	7.97		1.937	116.24
17	444.76	27.80	0.46	8.43		1.937	116.24
18	444.76	27.80	0.46	8.90		1.937	116.24
19	444.76	27.80	0.46	9.36		1.937	116.24
20	444.76	27.80	0.46	9.82		1.937	116.23
21	444.76	27.80	0.46	10.29		1.937	116.23
22	444.76	27.80	0.46	10.75		1.937	116.23
23	444.76	27.80	0.46	11.21		1.937	116.23
24	444.76	27.80	0.46	11.68		1.937	116.23
25	444.76	27.80	0.46	12.14		1.937	116.23
26	444.76	27.80	0.46	12.60		1.937	116.23
27	444.76	27.80	0.46	13.07		1.937	116.23
28	444.76	27.80	0.46	13.53		1.937	116.23
29	444.76	27.80	0.46	13.99		1.937	116.23
30	444.76	27.80	0.46	14.46		1.937	116.23
31	444.76	27.80	0.46	14.92		1.937	116.23
32	444.76	27.80	0.46	15.38		1.937	116.23
33	444.76	27.80	0.46	15.85		1.937	116.23
34	444.76	27.80	0.46	16.31		1.937	116.23
35	444.76	27.80	0.46	16.77		1.937	116.23
36	444.76	27.80	0.46	17.24		1.937	116.23
37	444.76	27.80	0.46	17.70		1.937	116.23
38	444.76	27.80	0.46	18.16		1.937	116.23
39	444.76	27.80	0.46	18.63		1.937	116.23
40	444.76	27.80	0.46	19.09		1.937	116.23

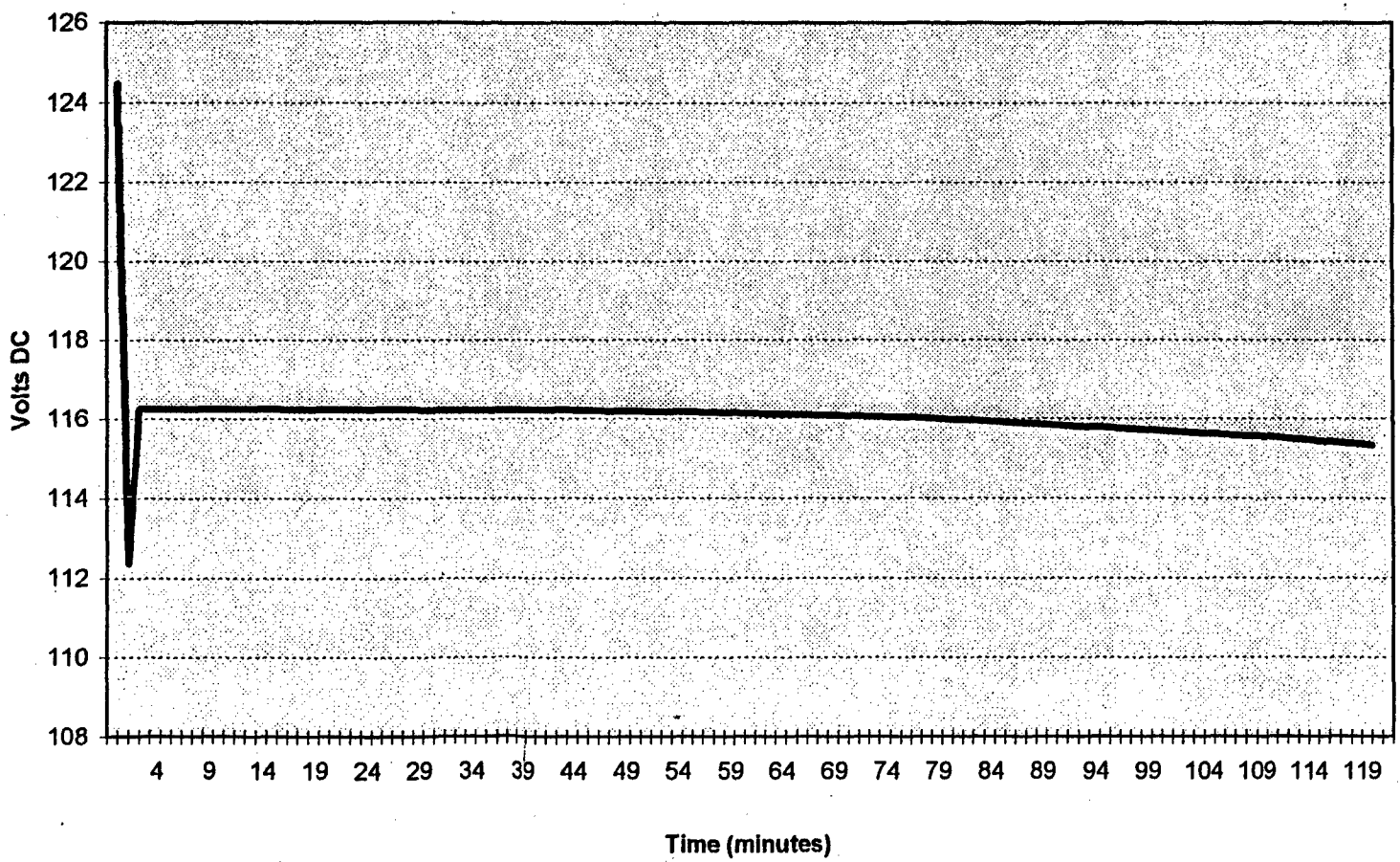
LOCA DISCHARGE PROFILE DATA

Gould NCN-33							
Time (min.)	Ampere Rate	Amps per pos plate (16 plates)	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
41	444.76	27.80	0.46	19.55		1.937	116.23
42	444.76	27.80	0.46	20.02		1.937	116.23
43	444.76	27.80	0.46	20.48		1.937	116.22
44	444.76	27.80	0.46	20.94		1.937	116.21
45	444.76	27.80	0.46	21.41		1.937	116.20
46	444.76	27.80	0.46	21.87		1.937	116.20
47	444.76	27.80	0.46	22.33		1.937	116.19
48	444.76	27.80	0.46	22.80		1.936	116.19
49	444.76	27.80	0.46	23.26		1.936	116.19
50	444.76	27.80	0.46	23.72		1.936	116.18
51	444.76	27.80	0.46	24.19		1.936	116.18
52	444.76	27.80	0.46	24.65		1.936	116.18
53	444.76	27.80	0.46	25.11		1.936	116.17
54	444.76	27.80	0.46	25.58		1.936	116.17
55	444.76	27.80	0.46	26.04		1.936	116.17
56	444.76	27.80	0.46	26.50		1.936	116.16
57	444.76	27.80	0.46	26.97		1.936	116.15
58	444.76	27.80	0.46	27.43		1.936	116.15
59	444.76	27.80	0.46	27.89		1.936	116.14
60	444.76	27.80	0.46	28.36		1.936	116.13
61	444.76	27.80	0.46	28.82		1.935	116.12
62	444.76	27.80	0.46	29.28		1.935	116.12
63	444.76	27.80	0.46	29.75		1.935	116.11
64	444.76	27.80	0.46	30.21		1.935	116.10
65	444.76	27.80	0.46	30.67		1.935	116.10
66	444.76	27.80	0.46	31.14		1.935	116.09
67	444.76	27.80	0.46	31.60		1.935	116.09
68	444.76	27.80	0.46	32.06		1.935	116.08
69	444.76	27.80	0.46	32.53		1.935	116.07
70	444.76	27.80	0.46	32.99		1.934	116.07
71	444.76	27.80	0.46	33.45		1.934	116.06
72	444.76	27.80	0.46	33.92		1.934	116.05
73	444.76	27.80	0.46	34.38		1.934	116.05
74	444.76	27.80	0.46	34.84		1.934	116.04
75	444.76	27.80	0.46	35.31		1.934	116.03
76	444.76	27.80	0.46	35.77		1.934	116.03
77	444.76	27.80	0.46	36.23		1.934	116.02
78	444.76	27.80	0.46	36.70		1.933	116.00
79	444.76	27.80	0.46	37.16		1.933	115.99
80	444.76	27.80	0.46	37.62		1.933	115.98

LOCA DISCHARGE PROFILE DATA

Gould NCN-33							
			Amp				
Time	Ampere	Amps per	Hours	Cumulative		Volts	Actual
(min.)	Rate	pos plate	per pos	A.H./pos.		per	Battery
		(16 plates)	plate	Discharge		cell	Voltage
81	444.76	27.80	0.46	38.08		1.933	115.97
82	444.76	27.80	0.46	38.55		1.933	115.95
83	444.76	27.80	0.46	39.01		1.932	115.94
84	444.76	27.80	0.46	39.47		1.932	115.92
85	444.76	27.80	0.46	39.94		1.932	115.91
86	444.76	27.80	0.46	40.40		1.932	115.89
87	444.76	27.80	0.46	40.86		1.931	115.88
88	444.76	27.80	0.46	41.33		1.931	115.86
89	444.76	27.80	0.46	41.79		1.931	115.85
90	444.76	27.80	0.46	42.25		1.931	115.83
91	444.76	27.80	0.46	42.72		1.930	115.82
92	444.76	27.80	0.46	43.18		1.930	115.80
93	444.76	27.80	0.46	43.64		1.930	115.79
94	444.76	27.80	0.46	44.11		1.930	115.78
95	444.76	27.80	0.46	44.57		1.929	115.76
96	444.76	27.80	0.46	45.03		1.929	115.75
97	444.76	27.80	0.46	45.50		1.929	115.73
98	444.76	27.80	0.46	45.96		1.929	115.72
99	444.76	27.80	0.46	46.42		1.928	115.70
100	444.76	27.80	0.46	46.89		1.928	115.69
101	444.76	27.80	0.46	47.35		1.928	115.67
102	444.76	27.80	0.46	47.81		1.928	115.66
103	444.76	27.80	0.46	48.28		1.927	115.64
104	444.76	27.80	0.46	48.74		1.927	115.63
105	444.76	27.80	0.46	49.20		1.927	115.62
106	444.76	27.80	0.46	49.67		1.927	115.60
107	444.76	27.80	0.46	50.13		1.926	115.59
108	444.76	27.80	0.46	50.59		1.926	115.57
109	444.76	27.80	0.46	51.06		1.926	115.56
110	444.76	27.80	0.46	51.52		1.926	115.54
111	444.76	27.80	0.46	51.98		1.925	115.53
112	444.76	27.80	0.46	52.45		1.925	115.51
113	444.76	27.80	0.46	52.91		1.925	115.49
114	444.76	27.80	0.46	53.37		1.924	115.46
115	444.76	27.80	0.46	53.84		1.924	115.44
116	444.76	27.80	0.46	54.30		1.924	115.42
117	444.76	27.80	0.46	54.76		1.923	115.40
118	444.76	27.80	0.46	55.23		1.923	115.38
119	444.76	27.80	0.46	55.69		1.923	115.36
120	444.76	27.80	0.46	56.15		1.922	115.33

BATTERY "B" LOCA VOLTAGE PROFILE



SBO DISCHARGE PROFILE DATA

Gould NCN-33						
Time (min.)	Ampere Rate	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
0					2.074	124.46
1	907.80	0.95	0.95		1.881	112.83
2	287.21	0.30	1.24		1.953	117.20
3	762.35	0.79	2.04		1.901	114.05
4	486.41	0.51	2.55		1.934	116.02
5	949.71	0.99	3.53		1.876	112.56
6	556.43	0.58	4.11		1.927	115.65
7	556.43	0.58	4.69		1.927	115.65
8	556.43	0.58	5.27		1.927	115.65
9	556.43	0.58	5.85		1.927	115.65
10	556.43	0.58	6.43		1.927	115.64
11	556.43	0.58	7.01		1.927	115.64
12	556.43	0.58	7.59		1.927	115.64
13	556.43	0.58	8.17		1.927	115.63
14	556.43	0.58	8.75		1.927	115.62
15	556.43	0.58	9.33		1.927	115.60
16	556.43	0.58	9.91		1.926	115.59
17	556.43	0.58	10.49		1.926	115.59
18	556.43	0.58	11.07		1.926	115.59
19	556.43	0.58	11.65		1.926	115.59
20	556.43	0.58	12.23		1.926	115.58
21	556.43	0.58	12.81		1.926	115.57
22	556.43	0.58	13.39		1.926	115.57
23	556.43	0.58	13.97		1.926	115.56
24	556.43	0.58	14.55		1.926	115.56
25	556.43	0.58	15.13		1.926	115.56
26	556.43	0.58	15.71		1.926	115.56
27	556.43	0.58	16.29		1.926	115.56
28	556.43	0.58	16.87		1.926	115.56
29	556.43	0.58	17.45		1.926	115.56
30	556.43	0.58	18.03		1.926	115.56
31	236.63	0.25	18.27		1.959	117.52
32	236.63	0.25	18.52		1.959	117.52
33	236.63	0.25	18.76		1.959	117.52
34	236.63	0.25	19.01		1.959	117.52
35	236.63	0.25	19.26		1.959	117.52
36	561.23	0.58	19.84		1.925	115.49
37	561.65	0.59	20.43		1.925	115.48
38	561.65	0.59	21.01		1.924	115.46
39	561.65	0.59	21.60		1.924	115.45
40	561.65	0.59	22.18		1.924	115.44
41	561.65	0.59	22.77		1.924	115.43
42	236.65	0.25	23.01		1.958	117.51
43	236.65	0.25	23.26		1.958	117.51
44	236.65	0.25	23.51		1.958	117.51
45	236.65	0.25	23.75		1.958	117.51
46	236.65	0.25	24.00		1.958	117.51
47	236.65	0.25	24.25		1.958	117.51
48	236.65	0.25	24.49		1.958	117.51

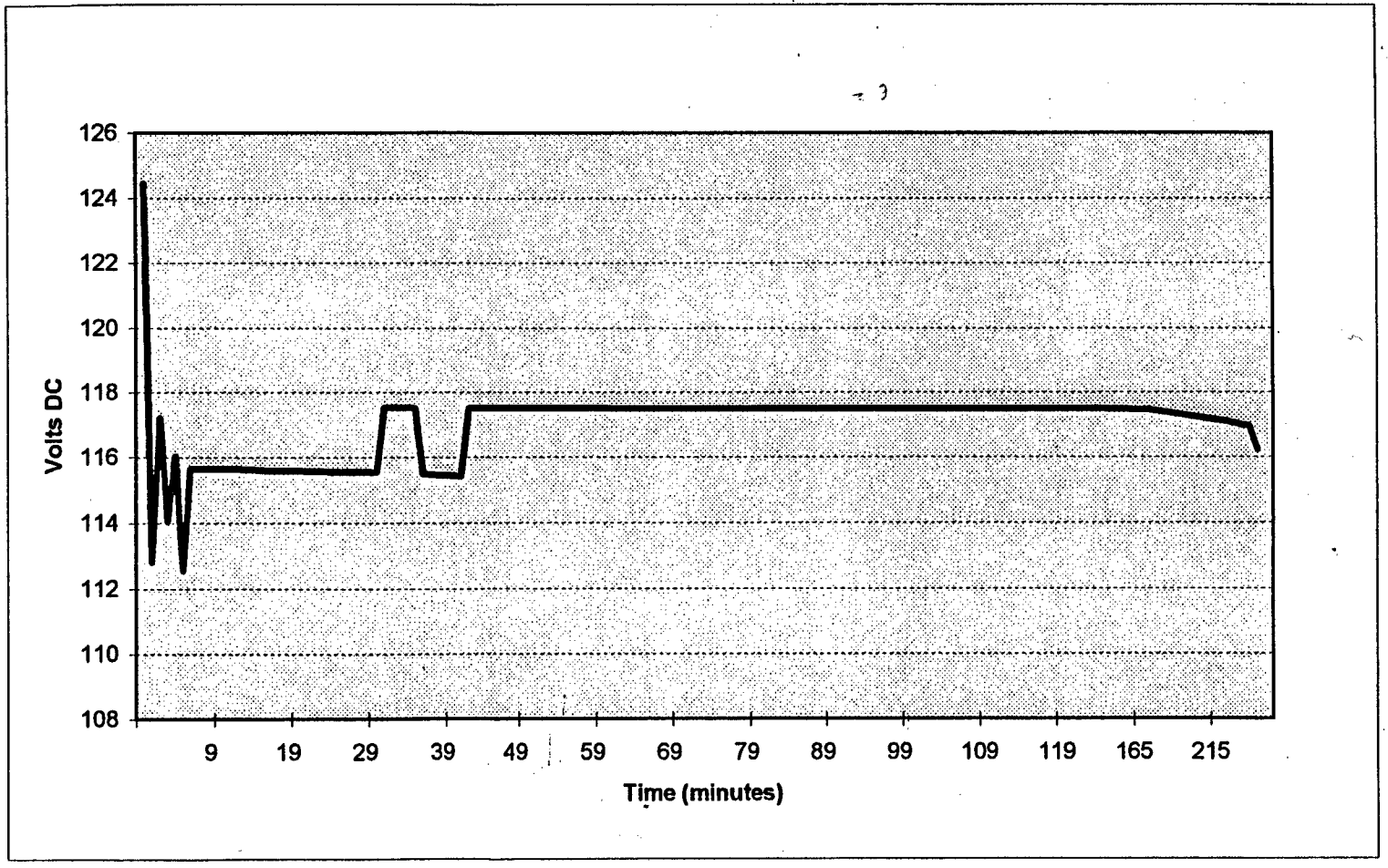
SBO DISCHARGE PROFILE DATA

Gould NCN-33						
Time (min.)	Ampere Rate	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
49	236.65	0.25	24.74		1.958	117.51
50	236.65	0.25	24.99		1.958	117.51
51	236.65	0.25	25.23		1.958	117.51
52	236.65	0.25	25.48		1.958	117.51
53	236.65	0.25	25.73		1.958	117.51
54	236.65	0.25	25.97		1.958	117.51
55	236.65	0.25	26.22		1.958	117.51
56	236.65	0.25	26.47		1.958	117.50
57	236.65	0.25	26.71		1.958	117.50
58	236.65	0.25	26.96		1.958	117.50
59	236.65	0.25	27.20		1.958	117.50
60	236.65	0.25	27.45		1.958	117.50
61	237.75	0.25	27.70		1.958	117.50
62	237.75	0.25	27.95		1.958	117.50
63	237.75	0.25	28.19		1.958	117.50
64	237.75	0.25	28.44		1.958	117.50
65	237.75	0.25	28.69		1.958	117.50
66	237.75	0.25	28.94		1.958	117.50
67	237.75	0.25	29.18		1.958	117.50
68	237.75	0.25	29.43		1.958	117.50
69	237.75	0.25	29.68		1.958	117.49
70	237.75	0.25	29.93		1.958	117.49
71	237.75	0.25	30.18		1.958	117.49
72	237.75	0.25	30.42		1.958	117.49
73	237.75	0.25	30.67		1.958	117.49
74	237.75	0.25	30.92		1.958	117.49
75	237.75	0.25	31.17		1.958	117.49
76	237.75	0.25	31.41		1.958	117.49
77	237.75	0.25	31.66		1.958	117.49
78	237.75	0.25	31.91		1.958	117.49
79	237.75	0.25	32.16		1.958	117.49
80	237.75	0.25	32.40		1.958	117.49
81	237.75	0.25	32.65		1.958	117.49
82	237.75	0.25	32.90		1.958	117.49
83	237.75	0.25	33.15		1.958	117.49
84	237.75	0.25	33.39		1.958	117.49
85	237.75	0.25	33.64		1.958	117.49
86	237.75	0.25	33.89		1.958	117.49
87	237.75	0.25	34.14		1.958	117.49
88	237.75	0.25	34.39		1.958	117.49
89	237.75	0.25	34.63		1.958	117.49
90	237.75	0.25	34.88		1.958	117.49
91	237.75	0.25	35.13		1.958	117.49
92	237.75	0.25	35.38		1.958	117.49
93	237.75	0.25	35.62		1.958	117.49
94	237.75	0.25	35.87		1.958	117.49
95	237.75	0.25	36.12		1.958	117.49
96	237.75	0.25	36.37		1.958	117.49
97	237.75	0.25	36.61		1.958	117.49
98	237.75	0.25	36.86		1.958	117.49

SBO DISCHARGE PROFILE DATA

Gould NCN-33						
Time (min.)	Ampere Rate	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
99	237.75	0.25	37.11		1.958	117.49
100	237.75	0.25	37.36		1.958	117.49
101	237.75	0.25	37.61		1.958	117.49
102	237.75	0.25	37.85		1.958	117.49
103	237.75	0.25	38.10		1.958	117.49
104	237.75	0.25	38.35		1.958	117.49
105	237.75	0.25	38.60		1.958	117.49
106	237.75	0.25	38.84		1.958	117.49
107	237.75	0.25	39.09		1.958	117.49
108	237.75	0.25	39.34		1.958	117.49
109	237.75	0.25	39.59		1.958	117.49
110	237.75	0.25	39.83		1.958	117.49
111	237.75	0.25	40.08		1.958	117.49
112	237.75	0.25	40.33		1.958	117.49
113	237.75	0.25	40.58		1.958	117.49
114	237.75	0.25	40.82		1.958	117.49
115	237.75	0.25	41.07		1.958	117.49
116	237.75	0.25	41.32		1.958	117.49
117	237.75	0.25	41.57		1.958	117.49
118	237.75	0.25	41.82		1.958	117.49
119	237.75	0.25	42.06		1.958	117.49
120	237.75	0.25	42.31		1.958	117.49
125	237.75	1.24	43.55		1.958	117.49
130	237.75	1.24	44.79		1.958	117.49
135	237.75	1.24	46.03		1.958	117.49
140	237.75	1.24	47.26		1.958	117.49
145	237.75	1.24	48.50		1.958	117.48
150	237.75	1.24	49.74		1.958	117.48
155	237.75	1.24	50.98		1.958	117.47
160	237.75	1.24	52.22		1.958	117.46
165	237.75	1.24	53.45		1.958	117.46
170	237.75	1.24	54.69		1.958	117.45
175	237.75	1.24	55.93		1.957	117.45
180	237.75	1.24	57.17		1.957	117.41
185	237.75	1.24	58.41		1.956	117.38
190	237.75	1.24	59.65		1.956	117.35
195	237.75	1.24	60.88		1.955	117.31
200	237.75	1.24	62.12		1.955	117.28
205	237.75	1.24	63.36		1.954	117.24
210	237.75	1.24	64.60		1.953	117.20
215	237.75	1.24	65.84		1.953	117.16
220	237.75	1.24	67.08		1.952	117.12
225	237.75	1.24	68.31		1.951	117.08
230	237.75	1.24	69.55		1.951	117.04
235	237.75	1.24	70.79		1.950	116.99
239	237.75	0.99	71.78		1.949	116.94
240	293.59	0.31	72.09		1.937	116.22

BATTERY "B" SBO VOLTAGE PROFILE



125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 4
Detailed Results

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"125V DC STATION BATTERY "B" SIZING and VOLTAGE DROP, LOCA w/LOOP",

PAGE 1 OF 2

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D-04

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 5
Minimum Voltage for Components/Equipment

PANEL 71BCB-2B for LOCA PICK UP & DROP OUT VOLTAGES

Comp No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Ref.	Component			LOCA Pickup.			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
A02	71LPEEBDC1	Emerg Lighting Panel	II/III	GE	IC28001607	See Design Input 2.18 & 2.19	120	78	18.0	103.29	25.29	YES	102.61	84.61	YES
A03	71LPEHB1	Emerg Lighting Panel	II/III	GE	IC28001607	See Design Input 2.18 & 2.19	120	78	18.0	106.26	28.26	YES	105.57	87.57	YES
A05	71LPEADC2	Emerg Lighting Panel	II/III	GE	IC28001612	See Design Input 2.18 & 2.19	120	78	18.0	102.07	24.07	YES	101.41	83.41	YES
A07	71LPERDC3	Emerg Lighting Panel	II/III	GE	IC28001607	See Design Input 2.18 & 2.19	120	78	18.0	104.37	26.37	YES	103.69	85.69	YES
A08	71LPERW1	Emerg Lighting Panel	II/III	GE	IC28001607	See Design Input 2.18 & 2.19	120	78	18.0	105.09	27.09	YES	104.40	86.40	YES
C02	31P-7B(M)	RFPT B Emerg Oil Pump	II/III	GE	5CD256E1050	IEEE-946 (80% of nominal)	125	100	100.0	97.58	-2.42	NO	100.27	0.27	YES
	31P-7B(M) Control	31P-7B(M) Control	II/III	GE	IC2820A100BB3J	See Design Input 2.21	120	75.6	24.0	109.97	34.37	YES	107.07	83.07	YES
			II/III	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78.0	18.0	109.97	31.97	YES	107.07	89.07	YES
			II/III	GE	IC2800A501AB23C	GE Technical inquiry dated 08/08/97	120	75.6	9.6	109.97	34.37	YES	107.07	97.47	YES
			II/III	GE	IC2820A100BB3J	See Design Input 2.21	120	75.6	24.0	109.97	34.37	YES	107.07	83.07	YES
D02	94P-2(M)	Emerg Bearing Oil Pump	II/III	GE	5CD366E735	IEEE-946 (80% of nominal)	125	100	100.0	N/A	N/A	N/A	N/A	N/A	N/A
	94P-2(M) Control	94P-2(M) Control	II/III	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78.0	18.0	N/A	N/A	N/A	N/A	N/A	N/A
			II/III	GE	IC2820A100BB3K	See Design Input 2.21	120	75.6	24.0	N/A	N/A	N/A	N/A	N/A	N/A
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	N/A	N/A	N/A	N/A	N/A	N/A

PANEL 71BCB-2B for SBO PICK UP & DROP OUT VOLTAGES

Comp No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Ref.	Component			SBO Pickup.			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
A02	71LPEEBDC1	Emerg Lighting Panel	II/III	GE	IC28001607	See Design Input 2.18 & 2.19	120	78.0	18.0	112.13	34.13	YES	102.90	84.90	YES
A03	71LPEHB1	Emerg Lighting Panel	II/III	GE	IC28001607	See Design Input 2.18 & 2.19	120	78.0	18.0	115.36	37.36	YES	105.86	87.86	YES
A05	71LPEADC2	Emerg Lighting Panel	II/III	GE	IC28001612	See Design Input 2.18 & 2.19	120	78.0	18.0	110.81	32.81	YES	101.69	83.69	YES
A07	71LPERDC3	Emerg Lighting Panel	II/III	GE	IC28001607	See Design Input 2.18 & 2.19	120	78.0	18.0	113.31	35.31	YES	103.98	85.98	YES
A08	71LPERW1	Emerg Lighting Panel	II/III	GE	IC28001607	See Design Input 2.18 & 2.19	120	78.0	18.0	114.09	36.09	YES	104.69	86.69	YES
C02	31P-7B(M)	RFPT B Emerg Oil Pump	II/III	GE	5CD256E1050	IEEE-946 (80% of nominal)	125	100.0	100.0	96.32	-3.68	NO	96.14	-3.86	NO
	31P-7B(M)(Control)	31P-7B(M) Control	II/III	GE	IC2820A100BB3J	See Design Input 2.21	120	75.6	24.0	108.55	32.95	YES	103.51	79.51	YES
			II/III	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78.0	18.0	108.55	30.55	YES	103.51	85.51	YES
			II/III	GE	IC2800A501AB23C	GE Technical inquiry dated 08/08/97	120	75.6	9.6	108.55	32.95	YES	103.51	93.91	YES
			II/III	GE	IC2820A100BB3J	See Design Input 2.21	120	75.6	24.0	108.55	32.95	YES	103.51	79.51	YES
D02	94P-2(M)	Emerg Bearing Oil Pump	II/III	GE	5CD366E735	IEEE-946 (80% of nominal)	125	100.0	100.0	99.49	-0.51	NO	102.61	2.61	YES
	94P-2(M)(Control)	94P-2(M) Control	II/III	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78.0	18.0	107.07	29.07	YES	104.70	86.70	YES
			II/III	GE	IC2820A100BB3K	See Design Input 2.21	120	75.6	24.0	107.07	31.47	YES	104.70	80.70	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	107.07	31.47	YES	104.70	95.10	YES

PANEL 71DC-B1 for LOCA PICK UP & DROP OUT VOLTAGES

Comp No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			LOCA Pickup.			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
03	1UPRN06	Gen.& Transf. Prim. Protect.	II/III	GE	N/A	N/A	125	N/A	N/A	106.50	N/A	N/A	105.39	N/A	N/A
07	1ZLCN04	115kV Station UV Trip	II/III	Agastat	7012PBL	A348-C008	125	100	50	108.87	8.87	YES	108.87	58.87	YES
			II/III	GE	12HEA61B235	GE GEZ-7723 (Excerpt), App. 8	125	70	70	108.87	38.87	YES	108.87	38.87	YES
11	1YL2N07	345kV Bkr 71PCB-10042 Alt Failure	II/III	W	N/A	N/A	125	N/A	N/A	104.76	N/A	N/A	103.67	N/A	N/A
15	71PCB-10042	345kV Bkr Trip Coil	II/III	GE	ATB-362-7	GE Summary of CB Equipment 8/28/7	125	70	70	87.98	17.98	YES	87.06	17.06	YES
17	71PCB-10052	345kV Bkr Trip Coil	II/III	GE	ATB-362-7	GE Summary of CB Equipment 8/28/7	125	70	70	88.03	18.03	YES	87.11	17.11	YES
18	1YL1N07	345kV Bkr 71PCB-10052 Alt Failure	II/III	W	N/A	N/A	125	N/A	N/A	105.52	N/A	N/A	104.42	N/A	N/A
19	1YG1NO1	345kV Disc. 71MOD-10031 Open C	II/III	Porter Co.	MK-40A	1.24-33 & P295-0057(P06)	125	90	90	104.93	14.93	YES	103.79	13.79	YES
	71MOD-10031(M	345kV Disc. 71MOD-10031 Motor	II/III	Peerless	SF2R3	1.24-33 & P295-0057(P06)	125	90	90	105.39	15.39	YES	109.56	19.56	YES

PANEL 71DC-B1 for SBO PICK UP & DROP OUT VOLTAGES

Comp No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			SBO Pickup.			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
03	1UPRN06	Gen.& Transf. Prim. Protect.	II/III	GE	N/A	N/A	125	N/A	N/A	116.48	N/A	N/A	116.48	N/A	N/A
07	1ZLCN04	115kV Station UV Trip	II/III	Agastat	7012PBL	A348-C008	125	100	50	113.03	13.03	YES	113.03	63.03	YES
			II/III	GE	12HEA61B235	GE GEZ-7723 (Excerpt), App. 8	125	70.0	70	113.03	43.03	YES	113.03	43.03	YES
15	71PCB-10042	345kV Bkr Trip Coil	II/III	GE	ATB-362-7	GE Summary of CB Equipment 8/28/7	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
17	71PCB-10052	345kV Bkr Trip Coil	II/III	GE	ATB-362-7	GE Summary of CB Equipment 8/28/7	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
19	1YG1NO1	345kV Disc. 71MOD-10031 Open C	II/III	Porter Co.	MK-40A	1.24-33 & P295-0057(P06)	125	90	90	109.47	19.47	YES	100.47	10.47	YES
	71MOD-10031(M	345kV Disc. 71MOD-10031 Motor	II/III	Peerless	SF2R3	1.24-33 & P295-0057(P06)	125	90	90	103.82	13.82	YES	102.39	12.39	YES

PANEL 71DC-B2 for LOCA PICK UP & DROP OUT VOLTAGES

Comp No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			LOCA Pickup.			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
01	1CICB04	RCIC Relay Logic	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	114.17	39.17	YES	103.39	90.89	YES
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	114.17	39.17	YES	103.39	90.89	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	114.17	39.17	YES	103.39	65.89	YES
	1ADSB01	ADS System Power Logic (Logic & SRVs) (PANEL 09-45)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	103.92	28.92	YES	103.23	90.73	YES
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	103.92	28.92	YES	103.23	90.73	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	103.92	28.92	YES	103.23	65.73	YES
			I	Agastat	ETR14D3EC2004	A348-0342	125	100.0	56.25	103.92	3.92	YES	103.23	46.98	YES
	02SOV-71E1	ADS Auto Pilot SOV	I	Target Rock	1/2SMS-S-02-1	QDR No. 35.8	125	92.0	92	107.52	15.52	YES	106.73	14.73	YES
	1RHRB33	RHR Channel B Logic (PANEL 09-33)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	113.09	38.09	YES	102.41	89.91	YES
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	113.09	38.09	YES	102.41	89.91	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	113.09	38.09	YES	102.41	64.91	YES
			I	GE	CR2820B Series A	GE Technical inquiry dated 08/08/97	125	87.5	12.5	113.09	25.59	YES	102.41	89.91	YES
			I	Agastat	ETR	A348-0342	125	100.0	56.25	113.09	13.09	YES	102.41	46.16	YES
			I	Agastat	E7012PH	A348-C008	125	100.0	12.5	113.09	13.09	YES	102.41	89.91	YES
	1ADSB02	ADS Low Water Level Logic	I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	104.15	29.15	YES	103.45	90.95	YES
02	03SOV-140B	RPS Trip Backup Scram SOV (PANEL 09-15)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	105.18	30.18	YES	104.48	91.98	YES
			I	ASCO	NP8316	E-mail from ASCO Dated 11/20/01	125	90.0	90	105.18	15.18	YES	104.48	14.48	YES
05	1CSPB10	Core Spray Channel B Logic (PANEL 09-47)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	114.91	39.91	YES	104.20	91.70	YES
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	114.91	39.91	YES	104.20	91.70	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	114.91	39.91	YES	104.20	66.70	YES
06	1HPIB24	HPCI Relay Logic & Remote Trip (PANEL 09-39)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	115.03	40.03	YES	104.28	91.78	YES
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	115.03	40.03	YES	104.28	91.78	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	115.03	40.03	YES	104.28	66.78	YES
			I	GE	CR2820B Series A	GE Technical inquiry dated 08/08/97	125	87.5	12.5	115.03	27.53	YES	104.28	91.78	YES
	23SOV-102	HPCI Remote Trip SOV	I	Skinner Valve	73212BN52N00N0S2TBC6	JE-01-005	120	96.0	96.0	115.67	19.67	YES	104.44	8.44	YES
09	31SOV-12B	RFPT B Turbine Trip	II/III	ASCO	ASCO Cat No. 106A231	E-mail from ASCO dated 04/26/02	125	90.0	90	101.91	11.91	YES	101.23	11.23	YES
10	23INV-79	HPCI Instrunemt Pwr Inverter	I	Topaz	N250-GWR-125-60-115	WR 97-00648-00 & Cal. Sheet(ICR)	125	101.5	101.5	115.16	13.66	YES	104.28	2.78	YES
	23TU-3-12	HPCI Turbine Speed P/S	I	Lambda	JSW-150-48/A	JE-01-013	125	85.0	85	115.02	30.02	YES	104.13	19.13	YES
	23S0V-53, -54	HPCI Steam Supply Trap & Exh VA's	II/III	ASCO	NP8321A5E	Fax from ASCO dated 10/01/97	125	90	90	103.91	13.91	YES	103.21	13.21	YES
11	02-184P-3B(M)	RWR MG Set B Emerg.Oil Pmp	II/III	GE	5CD14D05A341520	IEEE-946 (80% of nominal)	125	100	100	99.53	-0.47	NO	105.57	5.57	YES
	02-184P-3B(M)(Control)	02-184P-3B(M) Control	II/III	GE	12HFA151A2F	G080-0233	125	75.0	12.5	107.30	32.30	YES	108.16	95.66	YES
			II/III	Agastat	7012PBL	A348-C008	125	100	50	107.30	7.30	YES	108.16	58.16	YES
			II/III	GE	CR105K000BLA	Telecon with GE Dated 04/18/97	125	62.5	37.5	107.30	44.80	YES	108.16	70.66	YES
12	02-184-1B(BKR)	Reac Recir M/G Set B Trip	II/III	GE	12HGA11A52F	G080-0213	125	75.0	12.5	112.39	37.39	YES	112.39	99.89	YES
			II/III	GE	AKF-2-25	GE Material Spec for AK15/25	125	70	70	112.39	42.39	YES	112.39	42.39	YES
13	02-184-1A(BKR)	Reac Recir M/G Set A Alt Trip	II/III	GE	12HGA11A52F	G080-0213	125	75.0	12.5	112.01	37.01	YES	112.01	99.51	YES
			II/III	GE	AKF-2-25	GE Material Spec for AK15/25	125	70	70	112.01	42.01	YES	112.01	42.01	YES
14	13INV-80JB	Steam Leak Det Sys	I	Topaz	125-GW-125-60	T248-0049 & Cal. Sheet(ICR)	125	101.5	101.5	115.38	13.88	YES	104.56	3.06	YES
16	02-3V/V-613D	ATTS Cabinet Pwr Supply Converter	I	Datametric	147D8661P1	G080-0166	125	105	105	115.23	10.23	YES	104.40	-0.60	NO
23	23E/S-200B	Foxboro Inst Pwr Supply	I	Foxboro	N-2ARPS05-A6-BB4	Mod F1-89-158	125	104	104	114.97	10.97	YES	104.11	0.11	YES
24	71INV-1B	27 MAP Pnl-Inst INV Loads	I	HDR Power	STI-03-1	Dwg No. 1.49-160	125	101.5	101.5	114.18	12.68	YES	103.23	1.73	YES

PANEL 71DC-B2 for SBO PICK UP & DROP OUT VOLTAGES

Comp No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			SBO Pickup.			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
01	1CICB04	RCIC Relay Logic	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	115.11	40.11	YES	104.01	91.51	YES
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	115.11	40.11	YES	104.01	91.51	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	115.11	40.11	YES	104.01	66.51	YES
	1ADSB01	ADS System Power Logic (Logic & SRVs) (PANEL 09-45)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	N/A	N/A	N/A	N/A	N/A	N/A
	02SOV-71E1	ADS Auto Pilot SOV	I	Agastat	ETR14D3EC2004	A348-0342	125	100.0	56.3	N/A	N/A	N/A	N/A	N/A	N/A
			I	Target Rock	1/2SMS-S-02-1	QDR No. 35.8	125	92.0	92.0	N/A	N/A	N/A	N/A	N/A	N/A
	1RHRB33	RHR Channel B Logic (PANEL 09-33)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	CR2820B Series A	GE Technical inquiry dated 08/08/97	125	87.5	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	Agastat	ETR	A348-0342	125	100.0	56.3	N/A	N/A	N/A	N/A	N/A	N/A
			I	Agastat	E7012PH	A348-C008	125	100.0	12.5	N/A	N/A	N/A	N/A	N/A	N/A
	1ADSB02	ADS Low Water Level Logic	I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	114.40	39.40	YES	104.10	91.60	YES
02	03SOV-140B	RPS Trip Backup Scram SOV (PANEL 09-15)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	114.70	39.70	YES	104.37	91.87	YES
			I	ASCO	NP8316	E-mail from ASCO Dated 11/20/01	125	90.0	90.0	114.70	24.70	YES	104.37	14.37	YES
05	1CSPB10	Core Spray Channel B Logic (PANEL 09-47)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	N/A	N/A	N/A	N/A	N/A	N/A
06	1HPIB24	HPCI Relay Logic & Remote Trip (PANEL 09-39)	I	GE	12HFA151A2F	G080-0233	125	75.0	12.5	115.31	40.31	YES	104.18	91.68	YES
			I	GE	12HGA11A52F	G080-0213	125	75.0	12.5	115.31	40.31	YES	104.18	91.68	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75.0	37.5	115.31	40.31	YES	104.18	66.68	YES
			I	GE	CR2820B Series A	GE Technical inquiry dated 08/08/97	125	87.5	12.5	115.31	27.81	YES	104.18	91.68	YES
	23SOV-102	HPCI Remote Trip SOV	I	Skinner Valve	73212BN52N00N0S2TBC6	JE-01-005	120	96.0	96.0	114.66	18.66	YES	104.33	8.33	YES
09	31SOV-12B	RFPT B Turbine Trip	II/III	ASCO	ASCO Cat No. 106A231	E-mail from ASCO dated 04/26/02	125	90.0	90.0	111.14	21.14	YES	101.13	11.13	YES
10	23INV-79	HPCI Instrunemt Pwr Inverter	I	Topaz	N250-GWR-125-60-115	WR 97-00648-00	125	101.5	101.5	115.42	13.92	YES	104.15	2.65	YES
	23TU-3-12	HPCI Turbine Speed P/S	I	Lambda	JSW-150-48/A	JE-01-013	125	85.0	85.0	115.29	30.29	YES	104.00	19.00	YES
	23S0V-53, -54	HPCI Steam Supply Trap & Exh VA's	II/III	ASCO	NP8321A5E	Fax from ASCO dated 10/01/97	125	90.0	90	113.29	23.29	YES	103.00	13.00	YES
11	02-184P-3B(M)	RWR MG Set B Emerg.Oil Pmp	II/III	GE	5CD14D05A341520	IEEE-946 (80% of nominal)	125	100.0	100	102.54	2.54	YES	100.92	0.92	YES
	02-184P-3B(M)(Control)	02-184P-3B(M) Control	II/III	GE	12HFA151A2F	G080-0233	125	75.0	13	111.16	36.16	YES	104.52	92.02	YES
			II/III	Agastat	7012PBL	A348-C008	125	100.0	50	111.16	11.16	YES	104.52	54.52	YES
			II/III	GE	CR105K000BLA	Telecon with GE Dated 04/18/97	125	62.5	37.5	111.16	48.66	YES	104.52	67.02	YES
12	02-184-1B(BKR)	Reac Recir M/G Set B Trip	II/III	GE	12HGA11A52F	G080-0213	125	75.0	12.5	109.40	34.40	YES	109.40	96.90	YES
			II/III	GE	AKF-2-25	GE Material Spec for AK15/25	125	70.00	70	109.40	39.40	YES	109.40	39.40	YES
13	02-184-1A(BKR)	Reac Recir M/G Set A Alt Trip	II/III	GE	12HGA11A52F	G080-0213	125	75.00	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			II/III	GE	AKF-2-25	GE Material Spec for AK15/25	125	70.00	70	N/A	N/A	N/A	N/A	N/A	N/A
14	13INV-801B	Steam Leak Det Sys	I	Topaz	125-GW-125-60	T248-0049	125	101.50	101.5	115.66	14.16	YES	104.46	2.96	YES
16	02-3V/V-613D	ATTS Cabinet Pwr Supply Converter	I	Datametric	147D8661P1	G080-0166	125	105.00	105	115.55	10.55	YES	104.34	-0.66	NO
23	23E/S-200B	Foxboro Inst Pwr Supply	I	Foxboro	N-2ARPS05-A6-BB4	Mod F1-89-158	125	104.00	104	115.25	11.25	YES	104.01	0.01	YES
24	71INV-1B	27 MAP Pnl-Inst INV Loads	I	HDR Power	STI-03-1	Dwg No. 1.49-160	125	101.50	101.5	114.46	12.96	YES	103.13	1.63	YES

PANEL 71DC-B3 for LOCA PICK UP & DROP OUT VOLTAGES

Comp No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			LOCA Pickup.			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
01	1ESWB04	ESW Lockout Matrix	I	GE	CR2811A212J	Telecon with GE Dated 06/10/97	125	78.75	43.75	101.97	23.22	YES	108.45	64.70	YES
			I	GE	12HFA154E222H	G080-1269	125	76.25	76.25	101.97	25.72	YES	108.45	32.20	YES
03	94HSC	H_2 Stator Cooling Panel	II/III	GE	12HGA11A52F	G080-0213	125	75.00	12.50	105.26	30.26	YES	104.88	92.38	YES
			II/III	Agastat	7012PH	A348-C008	125	100	50	105.26	5.26	YES	104.88	54.88	YES
05	09-ECCS2-EP	SRV Cab	I	Lambda	JWS300-24	M1-97-070 & WR 03-05397-00	125	96	96	115.95	19.95	YES	104.87	8.87	YES
06	1SGTB01	Standby Gas Treat	I	GE	CR2810 Coil 22D135G22	D1-97-114 and JE-01-093	125	78.75	43.75	99.56	20.81	YES	103.71	59.96	YES
		Control B	I	S & D	219XXF102	S440-C016	125	100	100	99.56	20.81	YES	103.71	3.71	YES
		(PNL 09AR-6B)	I	Agastat	E7014PF	A348-C008	125	100.0	12.50	99.56	-0.44	NO	103.71	91.21	YES
13	38MOV-VB2(M)	Cond Vac Bkr Valve	II/III	Peerless Inc	CZ26755	IEEE-946 (80% of nominal)	125	100	100	N/A	N/A	N/A	N/A	N/A	N/A
	38MOV-VB2(Control)	38MOV-VB2(M) Cntl	II/III	GE	CR105K000BLA	Telecon with GE Dated 04/18/97	125	62.50	37.50	N/A	N/A	N/A	N/A	N/A	N/A
17	71HO2	4kV SWGR Bus 10200	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	116.26	46.26	YES	102.16	32.16	YES
18	71HO4	4kV SWGR Bus 10400	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	116.15	46.15	YES	97.73	27.73	YES
19	71L34	600V SWGR Bus 13400	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	116.25	46.25	YES	104.59	34.59	YES
22	09-43	Annunciator Panel	II/III	RIS	AN-100	RIS AN-100 Installation pg.1	125	105	105	111.48	6.48	YES	99.87	-5.13	NO
24	71UPS-7	Interposing Relay Pnl	II/III	Kepco	26083	JE-02-174	125	100	100	114.46	14.46	YES	103.21	3.21	YES

PANEL 71DC-B3 for SBO PICK UP & DROP OUT VOLTAGES

Comp No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			SBO Pickup.			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
01	1ESWB04	ESW Lockout Matrix	I	GE	CR2811A212J	Telecon with GE Dated 06/10/97	125	78.75	43.75	104.85	26.10	YES	104.15	60.40	YES
			I	GE	12HFA154E222H	G080-1269	125	76.25	76.25	104.85	28.60	YES	104.15	27.90	YES
03	94HSC	H_2 Stator Cooling Panel	II/III	GE	12HGA11A52F	G080-0213	125	75.00	12.50	N/A	N/A	N/A	N/A	N/A	N/A
			II/III	Agastat	7012PH	A348-C008	125	100	50	N/A	N/A	N/A	N/A	N/A	N/A
5	09-ECCS2-EP	SRV Cab	I	Lambda	JWS300-24	M1-97-070 & WR 03-05397-00	125	96	96	115.71	19.71	YES	104.57	8.57	YES
06	1SGTB01	Standby Gas Treat	I	GE	CR2810 Type A14	Telecon indicates 85% or less	125	106.25	43.75	108.40	2.15	YES	103.68	59.93	YES
		Control B	I	S & D	219XXF102	S440-C016	125	100	100	108.40	8.40	YES	103.68	3.68	YES
		(PNL 09AR-6B)	I	Agastat	E7014PF	Amerace Co. Test Report No. ES-1000	125	100	12.5	108.40	8.40	YES	103.68	91.18	YES
13	38MOV-VB2(M)	Cond Vac Bkr Valve	II/III	Peerless Inc	CZ26755	IEEE-946 (80% of nominal)	125	100	100	77.85	-22.15	NO	96.76	-3.24	NO
	38MOV-VB2(Control)	38MOV-VB2(M) Cntl	II/III	GE	CR105K000BLA	Telecon with GE Dated 04/18/97	125	62.50	37.50	115.66	53.16	YES	104.60	67.10	YES
17	71HO2	4kV SWGR Bus 10200	I	GE	MC-4.76	GE Instructions GEI-88771D	125	70	70	116.26	46.26	YES	105.12	35.12	YES
18	71HO4	4kV SWGR Bus 10400	I	GE	MC-4.76	GE Instructions GEI-88771D	125	70	70	116.15	46.15	YES	103.48	33.48	YES
19	71L34	600V SWGR Bus 13400	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	116.24	46.24	YES	105.18	35.18	YES
22	09-43	Annunciator Panel	II/III	RIS	AN-100	AN-100 Installation pg.1	125	105	105	111.47	6.47	YES	99.83	-5.17	NO
24	71UPS-7	Interposing Relay Pnl	II/III	Kepco	26083	JE-02-174	125	100	100	114.45	14.45	YES	103.17	3.17	YES

PANEL 71DC-B4 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
02	93FPBD	Force Paralleling Cntl Pnl													
	TBRX1-1EDGB13	Start Tie Brk Control	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	109.53	12.03	YES	104.83	54.83	YES
	TBRX2-1EDGB13	Start Tie Brk Permissive	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	109.53	12.03	YES	104.83	54.83	YES
	TD8M-1EDGB13	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	109.52	9.52	YES	104.82	92.32	YES
	VSRX1-1EDGB13	EDG A Start Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	108.67	11.17	YES	104.83	54.83	YES
	VSRX2-1EDGB13	EDG C Start Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	108.67	11.17	YES	104.83	54.83	YES
	GFR-1EDGB13	EDG A & C Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	108.65	11.15	YES	104.84	54.84	YES
	TD9M-1EDGB13	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	108.65	8.65	YES	104.84	92.34	YES
	TD9X-1EDGB13	EDG A & C Force Parallel	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.84	28.09	YES	107.89	64.14	YES
07	71L26	Panel 71L26 Close	I	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.16	27.16	YES	93.05	3.05	YES
08	71HO6	Panel 71HO6 Close	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.17	47.17	YES	103.00	33.00	YES
	71HO6	Panel 71HO6 Trip	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.17	47.17	YES	103.00	33.00	YES
11	93ECP-B	EDG "B" Ctrl & Ann													
	K1-1EDGB12	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	96.60	17.85	YES	94.52	50.77	YES
	TBR-1EDGB12	Remote Start	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	107.76	10.26	YES	103.50	53.50	YES
	TD6-1EDGB12	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.76	7.76	YES	103.50	91.00	YES
	TD7-1EDGB12	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.76	7.76	YES	103.50	91.00	YES
	K4-1EDGB12	Loss of Gen Field	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	106.81	9.31	YES	103.50	53.50	YES
	FFR-1EDGB12	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.81	28.06	YES	103.46	59.71	YES
	VSR-1EDGB12	Volt Speed	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	106.81	9.31	YES	103.50	53.50	YES
	TD5-1EDGB12	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	106.04	6.04	YES	95.12	82.62	YES
	SOV-1B	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	106.02	16.02	YES	95.11	5.11	YES
	SOV-2B	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	106.03	16.03	YES	95.11	5.11	YES
	K2-1EDGB12	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	106.04	43.54	YES	95.12	57.62	YES
	ESR40-1EDGB12	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	95.12	16.37	YES	95.39	51.64	YES
	ESR200-1EDGB12	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	105.23	26.48	YES	103.50	59.75	YES
	ESR400-1EDGB12	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.81	28.06	YES	103.50	59.75	YES
	C2-1EDGB12	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	106.04	43.54	YES	95.12	57.62	YES
	TD10-1EDGB12	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.37	7.37	YES	106.98	94.48	YES
	TD1-1EDGB12	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	106.04	6.04	YES	95.12	82.62	YES
	93GS-5B	EDG "A" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	93.35	1.35	YES	104.69	N/A	N/A
	93P-4B	EDG "A" Fuel oil pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	94.93	-1.07	NO	103.31	N/A	N/A
	ESS-1EDGB12	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	95.12	5.12	YES	95.38	5.38	YES
	62-1EDGB12	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	106.98	6.98	YES	103.50	91.00	YES
	93EGP-B	Gen "B" Cont Panel													
	EDG "B" FF	EDG "B" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27/00	125	90	90	103.93	13.93	YES	105.72	15.72	YES
	K2/VR-1EDGB25	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	108.63	16.63	YES	103.93	11.93	YES
	TDVR-1EDGB25	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	108.72	8.72	YES	103.93	91.43	YES
	93P/S-B	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	100-370	85	85	116.92	31.92	YES	94.86	9.86	YES

PANEL 71DC-B4 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
12	93ECP-D	EDG "D" Ctrl & Ann													
	K1-1EDGD12	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	95.74	16.99	YES	96.34	52.59	YES
	TBR-1EDGD12	Remote Start	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	108.13	10.63	YES	103.85	53.85	YES
	TD6-1EDGD12	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	108.13	8.13	YES	103.85	91.35	YES
	TD7-1EDGD12	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	108.13	8.13	YES	103.85	91.35	YES
	K4-1EDGD12	Loss of Gen Field	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	107.25	9.75	YES	103.85	53.85	YES
	FFR-1EDGD12	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	107.25	28.50	YES	103.28	59.53	YES
	VSR-1EDGD12	Volt Speed	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	107.25	9.75	YES	103.85	53.85	YES
	TD5-1EDGD12	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	106.29	6.29	YES	97.03	84.53	YES
	SOV-1D	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	106.27	16.27	YES	97.01	7.01	YES
	SOV-2D	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	106.28	16.28	YES	97.01	7.01	YES
	K2-1EDGD12	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	106.29	43.79	YES	97.03	59.53	YES
	ESR40-1EDGD12	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	97.03	18.28	YES	97.22	53.47	YES
	ESR200-1EDGD12	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.08	27.33	YES	103.85	60.10	YES
	ESR400-1EDGD12	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	107.25.	28.50	YES	103.85	60.10	YES
	C2-1EDGD12	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	106.29	43.79	YES	97.03	59.53	YES
	TD10-1EDGD12	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.72	7.72	YES	107.39	94.89	YES
	TD1-1EDGD12	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	106.29	6.29	YES	97.03	84.53	YES
	93GS-5D	EDG "D" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	95.22	3.22	YES	105.54	N/A	N/A
	93P-4D	EDG "D" Fuel Oil Pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	96.83	0.83	YES	103.66	N/A	N/A
	ESS-1EDGD12	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	97.02	7.02	YES	97.21	7.21	YES
	62-1EDGD12	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.39	7.39	YES	103.85	91.35	YES
	93EGP-D	Gen "D" Cont Panel													
	EDG "D" FF	EDG "D" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27/00	125	90	90	103.20	13.20	YES	105.01	15.01	YES
	K2/VR-1EDGD25	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	107.39	15.39	YES	103.20	11.20	YES
	TDVR-1EDGD25	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	107.39	7.39	YES	103.20	90.70	YES
	93P/S-D	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	100-370	85	85	116.98	31.98	YES	96.82	11.82	YES

PANEL 71DC-B4 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
02	93FPBD	Force Paralleling Cntl Pnl								109.46			101.63		
	TBRX1	Start Tie Brk Control	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	109.46	11.96	YES	101.63	51.63	YES
	TBRX2	Start Tie Brk Permissive	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	109.46	11.96	YES	101.63	51.63	YES
	TD8M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	109.46	9.46	YES	101.63	89.13	YES
	VSRX1	EDG A Start Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	109.46	11.96	YES	101.63	51.63	YES
	VSRX2	EDG C Start Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	109.46	11.96	YES	101.63	51.63	YES
	CRF	EDG A & C Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	109.46	11.96	YES	101.63	51.63	YES
	TD9M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	109.46	9.46	YES	101.63	89.13	YES
	TD9X	EDG A & C Force Parallel	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	109.46	30.71	YES	101.63	57.88	YES
07	71L26	Panel 71L26 Close	I	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.19	90.00	YES	95.34	90.00	YES
08	71HO6	Panel 71HO6 Close	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.22	47.22	YES	98.04	90.00	YES
	71HO6	Panel 71HO6 Trip	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.22	47.22	YES	98.04	90.00	YES
11	93ECP-B	EDG "B" Ctrl & Ann								112.81			98.93		
	K1	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	TBR	Remote Start	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	112.81	15.31	YES	98.93	48.93	YES
	TD6	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	TD7	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	K4	Loss of Gen Field	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	112.81	15.31	YES	98.93	48.93	YES
	FFR	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	VSR	Volt Speed	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	112.81	15.31	YES	98.93	48.93	YES
	TD5	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	SOV-1A	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	112.81	22.81	YES	98.93	8.93	YES
	SOV-2A	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	112.81	22.81	YES	98.93	8.93	YES
	K2	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	112.81	50.31	YES	98.93	61.43	YES
	ESP40	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	ESP200	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	ESP400	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	C2	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	112.81	50.31	YES	98.93	61.43	YES
	TD10	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	TD1	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	93GS-5B	EDG "A" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	97.08	5.08	YES	105.07	13.07	YES
	93P-4B	EDG "A" Fuel oil pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	98.73	2.73	YES	100.38	4.38	YES
	ESS	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	112.81	22.81	YES	98.93	8.93	YES
	62-	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	93EGP-B	Gen "B" Cont Panel													
	Field Flash	EDG "B" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27/00	125	90	90	108.93	18.93	YES	108.93	18.93	YES
	K2/VR	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	108.93	16.93	YES	108.93	16.93	YES
	TDVR	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	108.93	8.93	YES	108.93	96.43	YES
	93P/S-B	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	100-370	85	85	109.20	24.20	YES	0.41	-84.59	NO

PANEL 71DC-B5 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup.			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
01	06INV-1B	Feedwater Inverter B	M	Topaz	N250-GWR-125-60-11	T248-0049 & Cal. Sheet(ICR)	125	101.5	101.5	117.11	15.61	YES	106.48	4.98	YES
04	09ARI-1B	CRD B Alt. Rod Insertion	M	Agastat	EGPD003	A348-0342	125	100	56.25	106.64	6.64	YES	106.30	50.05	YES
			II/III	Agastat	GPD	A348-0342	125	100	56.25	106.64	6.64	YES	106.30	50.05	YES
20	71L14	Panel 71L14 Close	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.12	27.12	YES	87.46	-2.54	NO
		Panel 71L14 Trip	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	70	70	117.12	47.12	YES	87.46	17.46	YES
22	71L24	Panel 71L24 Close	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.14	27.14	YES	106.00	16.00	YES
		Panel 71L24 Trip	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	70	70	117.14	47.14	YES	106.00	36.00	YES
24	71L44	Panel 71L44 Close	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.12	27.12	YES	105.21	15.21	YES
		Panel 71L44 Trip	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	70	70	117.12	47.12	YES	105.21	35.21	YES

PANEL 71DC-B5 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup.			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
01	06INV-1B	Feedwater Inverter B	M	Topaz	N250-GWR-125-60-11	T248-0049 & Cal. Sheet(ICR)	125	101.5	101.5	117.12	15.62	YES	106.78	5.28	YES
04	09ARI-1B	CRD B Alt. Rod Insertion	M	Agastat	EGPD003	A348-0342	125	100	56.25	107.04	7.04	YES	106.60	50.35	YES
			II/III	Agastat	GPD	A348-0342	125	100	56.25	117.12	17.12	YES	106.78	50.53	YES
20	71L14	Panel 71L14 Close	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.13	27.13	YES	86.42	-3.58	NO
		Panel 71L14 Trip	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	70	70	117.12	47.12	YES	106.78	36.78	YES
22	71L24	Panel 71L24 Close	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.15	27.15	YES	106.83	16.83	YES
		Panel 71L24 Trip	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	70	70	117.12	47.12	YES	106.78	36.78	YES
24	71L44	Panel 71L44 Close	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.13	27.13	YES	106.82	16.82	YES
		Panel 71L44 Trip	II/III	GE	AK-2A-25-1	GE FAX 5/2/1997	125	70	70	117.12	47.12	YES	106.78	36.78	YES

MCC 71BMCC-2 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet VA (Open)	I	Anchor	W8622455	JAF-CALC-HPCI-01825	125	87.97	87.97	93.07	5.10	YES	105.27	17.30	YES
	23MOV-14(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78.0	18	103.08	25.08	YES	102.40	84.40	YES
			I	GE	IC2800A1617B3H	See Design Input 2.18 & 2.19	120	78.0	18	103.08	25.08	YES	102.40	84.40	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	103.08	27.48	YES	102.40	78.40	YES
OD1	23P-140(M)	HPCI Gland Seal Cond Exhauster Pump	II/III	GE	5BCJ56ED56A	IEEE-946 (80% of nominal)	120	96	96	102.63	6.63	YES	109.22	13.22	YES
	23P-140(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18	103.71	25.71	YES	103.03	85.03	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	103.71	28.11	YES	103.03	93.43	YES
OE1	23P-141(M)	HPCI Gland Seal Cond. Pump	II/III	Baldor	6229D	IEEE-946 (80% of nominal)	125	100	100	104.43	4.43	YES	108.19	8.19	YES
	23P-141(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18	110.48	32.48	YES	109.20	91.20	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	110.48	34.88	YES	109.20	99.60	YES

MCC 71BMCC-2 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet VA (Open)	I	Anchor	W8622455	JAF-CALC-HPCI-01825	125	87.97	87.97	93.72	5.75	YES	106.53	18.56	YES
	23MOV-14(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	103.12	25.12	YES	103.12	85.12	YES
			I	GE	IC2800A1617B3H	See Design Input 2.18 & 2.19	120	78	18	103.12	25.12	YES	106.53	88.53	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	103.12	27.52	YES	106.53	82.53	YES
OD1	23P-140(M)	HPCI Gland Seal Cond Exhauster Pump	II/III	GE	5BCJ56ED56A	IEEE-946 (80% of nominal)	120	96	96	103.35	7.35	YES	105.93	9.93	YES
	23P-140(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	103.75	25.75	YES	103.75	85.75	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	103.75	28.15	YES	103.75	94.15	YES
OE1	23P-141(M)	HPCI Gland Seal Cond. Pump	II/III	Baldor	6229D	IEEE-946 (80% of nominal)	125	100	100	104.84	4.84	YES	104.42	4.42	YES
	23P-141(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	110.91	32.91	YES	105.54	87.54	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	110.91	35.31	YES	105.54	95.94	YES

MCC 71BMCC-4 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OB1	23MOV-25(Open)	HPCI Min Flow Bypass	I	Velan	B12-2A7PS-2TS	JAF-CALC-HPCI-03199	125	93.48	93.48	99.15	5.67	YES	109.06	15.58	YES
	23MOV-25(Control)	(Open)	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	106.21	28.21	YES	106.34	88.34	YES
			I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78	18	106.21	28.21	YES	106.34	88.34	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	106.21	30.61	YES	106.34	82.34	YES
	23MOV-25(Close)	HPCI Min Flow Bypass	I	Velan	B12-2A7PS-2TS	JAF-CALC-HPCI-03199	125	93.48	93.48	101.63	8.15	YES	112.97	19.49	YES
	23MOV-25(Control)	(Close)	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	106.21	28.21	YES	106.34	88.34	YES
			I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	106.21	28.21	YES	106.34	88.34	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	106.21	30.61	YES	106.34	82.34	YES
OB2	12MOV-18(Close)	RWCU Supply Outboard	I	GE	ROV-6"S.S.-900#SP	JAF-CALC-RWCU-01824	125	92.7	92.7	93.05	0.35	YES	103.86	11.16	YES
	12MOV-18(Control)	Isol Va	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	100.46	22.46	YES	99.80	81.80	YES
		(Close)	I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	100.46	22.46	YES	99.80	81.80	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	100.46	24.86	YES	99.80	75.80	YES
OC1	23MOV-57(Open)	Suct from Suppr Pool VA	I	Powell	1523WE	JAF-CALC-HPCI-01994	125	87.38	87.38	87.52	0.14	YES	103.08	15.69	YES
	23MOV-57(Control)	(Open)	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78.0	18.0	102.33	24.33	YES	107.07	89.07	YES
			I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78.0	18.0	102.33	24.33	YES	107.07	89.07	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.33	26.73	YES	107.07	83.07	YES
	23MOV-57(Close)	Suct from Suppr Pool VA	I	Powell	1523WE	JAF-CALC-HPCI-01994	125	87.38	87.38	94.91	7.53	YES	103.31	15.93	YES
	23MOV-57(Control)	(Close)	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	102.33	24.33	YES	107.07	89.07	YES
			I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	102.33	24.33	YES	107.07	89.07	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.33	26.73	YES	107.07	83.07	YES
OC2	23MOV-58(Open)	Suppr Pool Upstream	I	Powell	1523WE	JAF-CALC-HPCI-01925	125	93.41	93.41	93.75	0.34	YES	105.05	11.64	YES
	23MOV-58(Control)	(Open)	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	102.19	24.19	YES	106.93	88.93	YES
			I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78	18	102.19	24.19	YES	106.93	88.93	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.19	26.59	YES	106.93	82.93	YES
	23MOV-58(Close)	Suct from Suppr Pool	I	Powell	1523WE	JAF-CALC-HPCI-01925	125	93.41	93.41	101.67	8.26	YES	105.28	11.87	YES
	23MOV-58(Control)	(Close)	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	102.19	24.19	YES	106.93	88.93	YES
			I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	102.19	24.19	YES	106.93	88.93	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.19	26.59	YES	106.93	82.93	YES
OE1	27MOV-122(Open)	Drywell Exhaust Isol	I	Borg	445HBB3-002	JAF-CALC-CAD-03201	125	67.13	67.13	76.68	9.54	YES	98.64	31.51	YES
	27MOV-122(Control)	Valve	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	110.08	32.08	YES	111.25	93.25	YES
		(Open)	I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78	18	110.08	32.08	YES	111.25	93.25	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	110.08	34.48	YES	111.25	87.25	YES
	27MOV-122(Close)	Drywell Exhaust Isol	I	Borg	445HBB3-002	JAF-CALC-CAD-03201	125	67.13	67.13	76.55	9.41	YES	98.51	31.37	YES
	27MOV-122(Control)	Valve	I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	110.08	32.08	YES	111.25	93.25	YES
		(Close)	I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	110.08	32.08	YES	111.25	93.25	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	110.08	34.48	YES	111.25	87.25	YES

MCC 71BMCC-4 for LOCA PICK UP & DROP OUT VOLTAGES (Cont'd)

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OE2	23P-150(@0.1 sec)	HPCI Aux Oil Lube Pump (@ 0.1 sec)	I	Baldor	310-406-404	IEEE-946 (80% of nominal)	120	96	96	93.83	2.17	NO	98.51	2.51	YES
	23P-150(Control)		I	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78	18	102.36	24.36	YES	101.69	83.69	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.36	26.76	YES	101.69	77.69	YES
			I	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	102.36	26.76	YES	101.69	92.09	YES
	23P-150(@43 sec)	HPCI Aux Oil Lube Pump (@ 41 sec)	I	Baldor	310-406-404	IEEE-946 (80% of nominal)	120	96	96	101.75	5.75	YES	98.82	2.82	YES
	23P-150(Control)		I	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78	18	102.36	24.36	YES	101.69	83.69	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.36	26.76	YES	101.69	77.69	YES
			I	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	102.36	26.76	YES	101.69	92.09	YES

MCC 71BMCC-4 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OB1	23MOV-25(Open)	HPCI Min Flow Bypass (Open) (@29 sec)	I	Velan	B12-2A7PS-2TS	JAF-CALC-HPCI-03199	125	93.48	93.48	100.28	6.79	YES	110.22	16.74	YES
	23MOV-25(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	101.63	23.63	YES	106.29	88.29	YES
			I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78	18	101.63	23.63	YES	106.29	88.29	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	101.63	26.03	YES	106.29	82.29	YES
	23MOV-25(Close)	HPCI Min Flow Bypass (Close) (@29 sec)	I	Velan	B12-2A7PS-2TS	JAF-CALC-HPCI-03199	125	93.48	93.48	101.26	7.78	YES	112.47	18.98	YES
	23MOV-25(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	101.63	23.63	YES	106.29	88.29	YES
			I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	101.63	23.63	YES	106.29	88.29	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	101.63	26.03	YES	106.29	82.29	YES
	23MOV-25(Open)	HPCI Min Flow Bypass (Open) (@ 4 min)	I	Velan	B12-2A7PS-2TS	JAF-CALC-HPCI-03199	125	93.48	93.48	94.89	1.40	YES	107.00	13.52	YES
	23MOV-25(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	101.63	23.63	YES	106.29	88.29	YES
			I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78	18	101.63	23.63	YES	106.29	88.29	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	101.63	26.03	YES	106.29	82.29	YES
	23MOV-25(Close)	HPCI Min Flow Bypass (Close) (@ 4 min & 10 sec)	I	Velan	B12-2A7PS-2TS	JAF-CALC-HPCI-03199	125	93.48	93.48	97.88	4.39	YES	107.00	13.52	YES
	23MOV-25(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	101.63	23.63	YES	106.29	88.29	YES
			I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	101.63	23.63	YES	106.29	88.29	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	101.63	26.03	YES	106.29	82.29	YES

MCC 71BMCC-4 for SBO PICK UP & DROP OUT VOLTAGES (Cont'd)

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OB2	12MOV-18(Close)	RWCU Supply Outboard Isol Va (Close)	I	GE	ROV-6"S.S.-900#SP	JAF-CALC-RWCU-01824	125	92.70	92.70	101.06	8.36	YES	101.85	9.15	YES
	12MOV-18(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	109.63	31.63	YES	101.96	83.96	YES
			I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	109.63	31.63	YES	101.96	83.96	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	109.63	34.03	YES	101.96	77.96	YES
OE2	23P-150 (@10sec)	HPCI Aux Oil Lube Pump (@ 10 sec)	I	Baldor	310-406-404	IEEE-946 (80% of nominal)	120	96	96.00	95.86	-0.14	NO	100.22	4.22	YES
	23P-150(Control)		I	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78	18	102.94	24.94	YES	106.18	88.18	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.94	27.34	YES	106.18	82.18	YES
			I	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	102.94	27.34	YES	106.18	96.58	YES
	23P-150(@4min)	HPCI Aux Oil Lube Pump (@ 4 min)	I	Baldor	310-406-404	IEEE-946 (80% of nominal)	120	96	96.00	94.98	-1.01	NO	97.52	1.52	YES
	23P-150(Control)		I	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78	18	102.94	24.94	YES	106.18	88.18	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.94	27.34	YES	106.18	82.18	YES
			I	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	102.94	27.34	YES	106.18	96.58	YES
	23P-150 (@40min)	HPCI Aux Oil Lube Pump (@ 40 min)	I	Baldor	310-406-404	IEEE-946 (80% of nominal)	120	96	96.00	100.25	4.25	YES	100.42	4.42	YES
	23P-150(Control)		I	GE	IC28001621AM3H	See Design Input 2.18 & 2.19	120	78	18	102.94	24.94	YES	106.18	88.18	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	102.94	27.34	YES	106.18	82.18	YES
			I	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	102.94	27.34	YES	106.18	96.58	YES

MCC 71BMCC-6 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OA1	23MOV-16(Open)	HPCI Steam Supply Outboard Isol. VA (Open)	I	Anchor	W8622455	JAF-CALC-HPCI-01826	125	91.00	91.00	91.33	0.33	YES	105.74	14.74	YES
	23MOV-16(Control)		I	GE	IC28001617AB3H	See Design Input 2.18 & 2.19	120	78.0	18.0	96.84	18.84	YES	96.21	78.21	YES
			I	GE	IC28001617AB3J	See Design Input 2.18 & 2.19	120	78.0	18.0	96.84	18.84	YES	96.21	78.21	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	96.84	21.24	YES	96.21	72.21	YES
	23MOV-16(Close)	HPCI Steam Supply Outboard Isol. VA (Close)	I	Anchor	W8622455	JAF-CALC-HPCI-01826	125	91.00	91.00	103.27	12.27	YES	100.09	9.09	YES
	23MOV-16(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78.0	18.0	96.84	18.84	YES	96.21	78.21	YES
			I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18.0	96.84	18.84	YES	96.21	78.21	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	96.84	21.24	YES	96.21	72.21	YES
OA2	23MOV-19(Open)	HPCI Discharge to Reactor Inboard Isol. VA (Open)	I	Powell	19023WE	JAF -CALC-HPCI-02094	125	79.00	79.00	79.31	0.31	YES	105.90	26.90	YES
	23MOV-19(Control)		I	GE	IC28001617AD3G	See Design Input 2.18 & 2.19	120	78.0	18.0	98.08	20.08	YES	97.43	79.43	YES
			I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78.0	18.0	98.08	20.08	YES	97.43	79.43	YES
			I	GE	IC2820A200A3E	E-Mail from GE 09/05/00	120	75.6	24	98.08	22.48	YES	97.43	73.43	YES
	23MOV-19(Close)	HPCI Discharge to Reactor Inboard Isol. VA (Close)	I	Powell	19023WE	JAF -CALC-HPCI-02094	125	79.00	79.00	83.03	4.03	YES	98.08	19.08	YES
	23MOV-19(Control)		I	GE	IC28001617AD3G	See Design Input 2.18 & 2.19	120	78.0	18.0	98.08	20.08	YES	97.43	79.43	YES
			I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18.0	98.08	20.08	YES	97.43	79.43	YES
			I	GE	IC2820A200A3E	E-Mail from GE 09/05/00	120	75.6	24	98.08	22.48	YES	97.43	73.43	YES

MCC 71BMCC-6 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OA1	23MOV-16(Open)	HPCI Steam Supply	I	Anchor	W8622455	JAF-CALC-HPCI-01826	125	91.00	91.00	91.97	0.97	YES	107.00	16.00	YES
	23MOV-16(Control)	Outboard Isol. VA	I	GE	IC28001617AB3H	See Design Input 2.18 & 2.19	120	78.0	18.0	96.88	18.88	YES	96.88	78.88	YES
		(Open)	I	GE	IC28001617AB3J	See Design Input 2.18 & 2.19	120	78.0	18.0	96.88	18.88	YES	96.88	78.88	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	96.88	21.28	YES	96.88	72.88	YES
OA2	23MOV-19(Open)	HPCI Discharge to Re	I	Powell	19023WE	JAF -CALC-HPCI-02094	125	79.00	79.00	79.86	0.86	YES	107.15	28.15	YES
	23MOV-19(Control)	Inboard Isol. VA	I	GE	IC28001617AD3G	See Design Input 2.18 & 2.19	120	78.0	18.0	98.12	20.12	YES	98.12	80.12	YES
		(Open)	I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78.0	18.0	98.12	20.12	YES	98.12	80.12	YES
		(@ 10 sec)	I	GE	IC2820A200A3E	E-Mail from GE 09/05/00	120	75.6	24	98.12	22.52	YES	98.12	74.12	YES
	23MOV-19(Close)	HPCI Discharge to Re	I	Powell	19023WE	JAF -CALC-HPCI-02094	125	79.00	79.00	80.90	1.90	YES	94.40	15.40	YES
	23MOV-19(Control)	Inboard Isol. VA	I	GE	IC28001617AD3G	See Design Input 2.18 & 2.19	120	78.0	18.0	98.12	20.12	YES	98.12	80.12	YES
		(Close)	I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18.0	98.12	20.12	YES	98.12	80.12	YES
		(@ 4 min)	I	GE	IC2820A200A3E	E-Mail from GE 09/05/00	120	75.6	24	98.12	22.52	YES	98.12	74.12	YES
	23MOV-19(Open)	HPCI Discharge to Re	I	Powell	19023WE	JAF -CALC-HPCI-02094	125	79.00	79.00	84.54	5.54	YES	111.45	32.45	YES
	23MOV-19(Control)	Inboard Isol. VA	I	GE	IC28001617AD3G	See Design Input 2.18 & 2.19	120	78.0	18.0	98.12	20.12	YES	98.12	80.12	YES
		(Open)	I	GE	IC2800A1607F3H	See Design Input 2.18 & 2.19	120	78.0	18.0	98.12	20.12	YES	98.12	80.12	YES
		(@ 35 min)	I	GE	IC2820A200A3E	E-Mail from GE 09/05/00	120	75.6	24	98.12	22.52	YES	98.12	74.12	YES
	23MOV-19(Close)	HPCI Discharge to Re	I	Powell	19023WE	JAF -CALC-HPCI-02094	125	79.00	79.00	84.51	5.51	YES	111.44	32.44	YES
	23MOV-19(Control)	Inboard Isol. VA	I	GE	IC28001617AD3G	See Design Input 2.18 & 2.19	120	78.0	18.0	98.12	20.12	YES	98.12	80.12	YES
		(Close)	I	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18.0	98.12	20.12	YES	98.12	80.12	YES
		(@ 40 min)	I	GE	IC2820A200A3E	E-Mail from GE 09/05/00	120	75.6	24	98.12	22.52	YES	98.12	74.12	YES

4 kV SWGR 71HO2 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
10202	71-10202(Trip)	Norm.Supply from 4kV Transf 71T-4X	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	92.34	22.34	YES	93.50	23.50	YES
10210	71-10210(Trip)	Reac Recirc PP 02-2P-1B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	91.84	21.84	YES	91.84	21.84	YES
10212	71-10212	Res.Supply from 4kV Transf 71T-2X	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10210	1HONBO3	Bus 10200 Undervoltage Oper.	II/III	GE	12HLA11B12A	G080-0657	125	75	75	101.80	26.80	YES	103.08	28.08	YES
			II/III	GE	SAM17A	G080-0576	125	62.5	62.5	101.80	39.30	YES	103.08	40.58	YES

4 kV SWGR 71HO2 for SBO PICK UP & DROP OUT VOLTAGES

Unit No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
10202	71-10202(Trip)	Norm.Supply from 4kV Transf 71T-4X	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	102.17	32.17	YES	102.17	32.17	YES
10210	71-10210(Trip)	Reac Recirc PP 02-2P-1B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.90	28.90	YES	98.90	28.90	YES
10212	71-10212	Res.Supply from 4kV Transf 71T-2X	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10210	1HONBO3	Bus 10200 Undervoltage Oper.	II/III	GE	SAM17A	G080-0576	125	62.5	62.5	112.64	50.14	YES	104.76	42.26	YES
			II/III	GE	12HLA11B12A	G080-0657	125	75	75	112.64	37.64	YES	104.76	29.76	YES

4 kV SWGR 71HO4 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
10402	71-10402(Trip)	Norm Supply from 4kV Transf 71T-4Y	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	92.60	22.60	YES	92.26	22.26	YES
10404	71-10404(Trip)	Feed to 4kV Emerg Bus 10600	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	102.48	32.48	YES	102.48	32.48	YES
	71-10404(Close)	4160V Bus 10600 Close	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	97.99	27.99	YES	97.99	27.99	YES
	71-10404(Motor)	71-10404 Breaker Charging Motor	II/III	GE		G080-0631	125	90	90	95.95	5.95	YES	108.68	18.68	YES
10410	71-10410(Trip)	Cond Pump 33P-8B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	100.16	30.16	YES	100.16	30.16	YES
	86U-1CNDB02	37P-8B UV Trip Aux Relay	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	100.55	25.55	YES	97.64	85.14	YES
10412	71-10412(Close)	Res. Supply from 4kV Transf 71T-2Y	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	92.37	22.37	YES	92.37	22.37	YES
	71-10412(Motor)	71-10412 Breaker Charging Motor	II/III	GE		G080-0631	125	90	90	95.48	5.48	YES	108.63	18.63	YES
10420	71-10420(Trip)	Service Water Pump 46P-1B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	100.41	30.41	YES	100.41	30.41	YES
	86U-1SWSB01	46P-1B Undervoltage Trip Aux Relay	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	100.55	25.55	YES	97.64	85.14	YES
10430	71-10430(Trip)	Circ. Water Pmp 36P-1B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	100.10	30.10	YES	100.10	30.10	YES
10440	71-10440(Trip)	Aux Feed to 600V Buses	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	100.34	30.34	YES	100.34	30.34	YES
10450	71-10450(Trip)	Cond Booster Pmp 33P-9B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	100.16	30.16	YES	100.16	30.16	YES
	86U-1CNDB01	33P-9B Undervoltage Trip Aux Relay	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	100.54	25.54	YES	97.63	85.13	YES
10460	71-10460(Trip)	TB Clsd Loop Clg Wtr Pmp 37P-2B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	100.45	30.45	YES	100.45	30.45	YES
	86U-1TBCB01	37P-2B Undervoltage Trip Aux Relay	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	100.55	25.55	YES	97.64	85.14	YES
10404	1HONDO3	Bus 10400 Undervoltage Oper.	II/III	GE	8AM17A	G080-0576	125	62.5	62.5	103.85	41.35	YES	97.37	34.87	YES
			II/III	GE	12HLA11B12A	G080-0657	125	75	75	103.85	28.85	YES	97.37	22.37	YES

4 kV SWGR 71HO4 for SBO PICK UP & DROP OUT VOLTAGES

Unit No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
10402	71-10402(Trip)	Norm Supply from 4kV Transf 71T-4Y	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	100.82	30.82	YES	100.82	30.82	YES
10404	71-10404(Trip)	Feed to 4kV Emerg Bus 10600	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	105.63	35.63	YES	105.63	35.63	YES
10410	71-10410(Trip)	Cond Pump 33P-8B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	102.98	32.98	YES	102.98	32.98	YES
	86U-1CNDB02	37P-8B UV Trip Aux Relay	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	103.38	28.38	YES	104.88	92.38	YES
10412	71-10412	Res. Supply from 4kV Transf 71T-2Y	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10420	71-10420(Trip)	Service Water Pump 46P-1B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	103.24	33.24	YES	103.24	33.24	YES
	86U-1SWSB01	Pmp 46P-1B UV Trip Aux Relay	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	103.38	28.38	YES	104.88	92.38	YES
10430	71-10430(Trip)	Circ Water Pump 36P-1B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	102.92	32.92	YES	102.92	32.92	YES
10440	71-10440(Trip)	Aux Feed to 600V Buses	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	103.16	33.16	YES	103.16	33.16	YES
10450	71-10450(Trip)	Cond Booster Pmp 33P-9B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	102.98	32.98	YES	102.98	32.98	YES
	86U-1CNDB01	Pmp 33P-9B UV Trip Aux Relay	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	103.38	28.38	YES	104.88	92.38	YES
10460	71-10460(Trip)	TB Clsd Loop Clg Wtr Pmp 37P-2B	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	103.28	33.28	YES	103.28	33.28	YES
	86U-1TBCB01	37P-2B Undervoltage Trip Aux Relay	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	103.38	28.38	YES	104.88	92.38	YES
10404	1HONDO3	Bus 10400 Undervoltage Oper.	II/III	GE	8AM17A	G080-0576	125	62.5	62.5	113.06	50.56	YES	103.10	40.60	YES
			II/III	GE	12HLA11B12A	G080-0657	125	75	75	113.06	38.06	YES	103.10	28.10	YES

4 kV SWGR 71HO6 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			LOCA Pickup.			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
10602	71-10602(Close)	93EDG-B feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	92.97	22.97	YES	92.97	22.97	YES
	71-10602(Motor)	71-10602 Brk Charging Motor	I	GE		G080-0631	125	90	90	100.46	10.46	YES	104.86	14.86	YES
10604	K8-1EDGB02	EDG-B&D Tie Brk Closing Rel	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.74	27.99	YES	103.12	59.37	YES
	71-10604(Close)	Gen. Tie to 93EDG-B & D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	85.44	15.44	YES	85.44	15.44	YES
	71-10604(Motor)	71-10604 Brk Charging Motor	I			G080-0631	125	90	90	100.46	10.46	YES	102.62	12.62	YES
	62-1EDGB02	93EDG-B&D Output Brk Closing Rel	I	Agastat	E7012PB	A348-C008	125	100	12.5	110.98	10.98	YES	103.22	90.72	YES
	62X-1EDGB02	93EDG-B&D Output Brk Closing Rel	I	GE	12HLA11B12A	G080-0657	125	75	75	110.98	35.98	YES	103.25	28.25	YES
	K9-1EDGB02	Gen. Tie to 93EDG-B & D Trip	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	102.55	23.80	YES	103.23	59.48	YES
	71-10604(Trip)	Gen. Tie to 93EDG-B & D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	101.80	31.80	YES	101.80	31.80	YES
10610	71-10610(Close)	RHR Serv Water Pump 10P-1D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	99.98	29.98	YES	99.98	29.98	YES
	71-10610(Motor)	71-10610 Brk Charging Motor	I	GE		G080-0631	125	90	90	106.78	16.78	YES	113.04	23.04	YES
	10SOV-101D	RHR 10P-1D Motor Cooling SOV	I	ACSO Co.	8210C13	E-Mail from ASCO Dated 11/15/01	125	90	90	117.17	27.17	YES	102.81	12.81	YES
10612	71-10612(Close)	93EDG-D feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	93.61	23.61	YES	93.61	23.61	YES
	71-10612(Motor)	71-10612 Brk Charging Motor	I			G080-0631	125	90	90	100.62	10.62	YES	104.91	14.91	YES
10614	71-10614(Trip)	Bus 10400 feed to bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	105.34	35.34	YES	105.61	35.61	YES
	71-10614(Close)	Bus 10400 feed to bus 10600			AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	92.45	22.45	YES	92.45	22.45	YES
	71-10614(Motor)	71-10614 Brk Charging Motor				G080-0631	125	90	90	107.14	17.14	YES	113.11	23.11	YES
10620	71-10620(Close)	RHR Service Water Pump 10P-1B	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	98.22	28.22	YES	98.22	28.22	YES
	71-10620(Motor)	71-10620 Brk Charging Motor				G080-0631	125	90	90	114.97	24.97	YES	0.00	-90.00	NO
	10SOV-101B	RHR Pmp Mtr Cooling SOV	I	ACSO Co.	8210C13	E-Mail from ASCO Dated 11/15/01	125	90	90	117.17	27.17	YES	102.81	12.81	YES
10630	71-10630(Close)	Core Spray Pump 14P-1B	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.26	27.26	YES	97.26	27.26	YES
	71-10630(Motor)	71-10630 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.26	14.26	YES	110.23	20.23	YES
10640	Bkr 71-10640(Close)	RHR Pump 10P-3D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.45	24.45	YES	94.45	24.45	YES
	71-10640(Motor)	71-10640 Brk Charging Motor	I	GE		G080-0631	125	90	90	106.79	16.79	YES	111.10	21.10	YES
10650	71-10650(Close)	RHR Pump 10P-3C	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	87.29	17.29	YES	87.29	17.29	YES
	71-10650(Motor)	71-10650 Brk Charging Motor	I	GE		G080-0631	125	90	90	101.30	11.30	YES	102.45	12.45	YES
10660	71-10660	Feed to Buses 11600 & 12600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10612	1HOEB03	Emer. Bus 10600 Undervoltage Circuits.	I	GE	SAM17A	G080-0576	125	62.5	62.5	103.52	41.02	YES	99.62	37.12	YES
			I	GE	12HLA11B12A	G080-0657	125	75	75	103.52	28.52	YES	99.62	24.62	YES
			I	GE	12HGA11J52	G080-0213	125	75	12.5	103.52	28.52	YES	99.62	87.12	YES
			I	Agastat	E7012PB	A348-C008	125	100	12.5	103.52	3.52	YES	99.62	87.12	YES
			I	Agastat	E7012PC	A348-C008	125	100	12.5	103.52	3.52	YES	99.62	87.12	YES
			I	Agastat	E7012PD	A348-C008	125	100	12.5	103.52	3.52	YES	99.62	87.12	YES
			I	GE	12HFA151A2F	G080-0233	125	75	12.5	103.52	28.52	YES	99.62	87.12	YES
			I	Brown Bover	ITE-27N	B455-0002 & Appendix 6	125	70	70	103.52	33.52	YES	99.62	29.62	YES

4 kV SWGR 71HO6 for SBO PICK UP & DROP OUT VOLTAGES

Unit No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			LOCA Pickup.			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
10602	71-10602(Close)	93EDG-B feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	93.61	23.61	YES	93.61	23.61	YES
	71-10602(Motor)	71-10602 Brk Charging Motor	I	GE		G080-0631	125	90	90	95.35	5.35	YES	103.85	13.85	YES
	K10-1EDGB01	K10-1EDGB01EDG B Egn Failure	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.67	33.92	YES	97.93	54.18	YES
	71-10602(Trip)	4KV Swgr Bkr 71-10602 Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	99.78	29.78	YES	99.78	29.78	YES
	71-10602(Close)	EDG-B feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	91.78	21.78	YES	91.78	21.78	YES
	71-10602(Motor)	71-10602 Brk Charging Motor	I			G080-0631	125	90	90	103.45	13.45	YES	109.70	19.70	YES
10604	K8-1EDGB02	EDG-B&D Tie Brk Closing Rel	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	107.67	28.92	YES	98.00	54.25	YES
	71-10604(Close)	Gen. Tie to 93EDG-B & D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	86.29	16.29	YES	86.29	16.29	YES
	71-10604(Motor)	71-10604 Brk Charging Motor	I			G080-0631	125	90	90	103.99	13.99	YES	105.90	15.90	YES
	62-1EDGB02	93EDG-B&D Output Brk Closing Rel	I	Agastat	E7012PB	A348-C008	125	100	12.5	113.76	13.76	YES	97.91	85.41	YES
	62X-1EDGB02	93EDG-B&D Output Brk Closing Rel	I	GE	12HLA11B12A	G080-0657	125	75	75	113.76	38.76	YES	97.97	22.97	YES
	K9-1EDGB02	Gen. Tie to 93EDG-B & D (Trip)	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.79	34.04	YES	97.94	54.19	YES
	71-10604(Trip)	Gen. Tie to 93EDG-B & D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	102.20	32.20	YES	102.20	32.20	YES
10610	71-10610	RHR Serv Water Pump 10P-1D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10612	71-10612(Close)	93EDG-D feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.25	24.25	YES	94.25	24.25	YES
	71-10612(Motor)	71-10612 Brk Charging Motor	I			G080-0631	125	90	90	95.49	5.49	YES	103.90	13.90	YES
	K10-1EDGD01	93EDG-D Egn Failure	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	113.01	34.26	YES	97.96	54.21	YES
	71-10612(Trip)	93EDG-D feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	100.03	30.03	YES	100.03	30.03	YES
10614	71-10614(Trip)	Bus 10400 feed to bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	108.73	38.73	YES	108.73	38.73	YES
10620	71-10620	RHR Service Water Pump 10P-1B	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10630	71-10630	Core Spray Pump 14P-1B	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10640	71-10640	RHR Pump 10P-3D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10650	71-10650(Close)	RHR Pump 10P-3C	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	92.58	22.58	YES	92.58	22.58	YES
	71-10650(Motor)	71-10650 Brk Charging Motor	I			G080-0631	125	90	90	102.90	12.90	YES	106.04	16.04	YES
	71-10650(Trip)	RHR Pump 10P-3C	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	108.48	38.48	YES	108.48	38.48	YES
10660	71-10660	Feed to Buses 11600 & 12600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10612	1HOEB03	Emer. Bus 10600 Undervoltage Circuits.	I	GE	SAM17A	G080-0576	125	62.5	62.5	112.62	50.12	YES	94.83	32.33	YES
			I	GE	12HLA11B12A	G080-0657	125	75	75	112.62	37.62	YES	94.83	19.83	YES
			I	GE	12HGA11J52	G080-0213	125	75	12.5	112.62	37.62	YES	94.83	82.33	YES
			I	Agastat	E7012PB	A348-C008	125	100	12.5	112.62	12.62	YES	94.83	82.33	YES
			I	Agastat	E7012PC	A348-C008	125	100	12.5	112.62	12.62	YES	94.83	82.33	YES
			I	Agastat	E7012PD	A348-C008	125	100	12.5	112.62	12.62	YES	94.83	82.33	YES
			I	GE	12HFA151A2F	G080-0233	125	75	12.5	112.62	37.62	YES	94.83	82.33	YES
			I	Brown Boveri	ITE-27N	B455-0002 & Appendix 6	125	70	70	112.62	42.62	YES	94.83	24.83	YES

600 V SWGR 71L14 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
5B	71-11416(52X)	RB Clg Wtr PP 15P-2B 52X Energize	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	108.33	18.33	YES	85.01	-4.99	NO
	71-11416(Close)	RB Clg Wtr PP 15P-2B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	71.29	-18.71	NO	71.06	-18.94	NO
5C	71-11418(Trip)	RB Vent Supply Fan 66FN-5B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	103.15	33.15	YES	103.15	33.15	YES
6D	71-11420(Trip)	RB Vent Return Fan 66FN-12B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	103.15	33.15	YES	103.15	33.15	YES

600 V SWGR 71L14 for SBO PICK UP & DROP OUT VOLTAGES

Comp No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
5B	71-11416(52X)	RB Clg Wtr PP 15P-2B 52X Energize	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	112.24	22.24	YES	84.00	-6.00	NO
	71-11416(Close)	RB Clg Wtr PP 15P-2B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	85.53	-4.47	NO	84.46	-5.54	NO
5C	71-11418(Trip)	RB Vent Supply Fan 66FN-5B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	112.02	42.02	YES	112.02	42.02	YES
6D	71-11420(Trip)	RB Vent Return Fan 66FN-12B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	112.02	42.02	YES	112.02	42.02	YES

600 V SWGR 71L24 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
3D	71-12418(Trip)	Wtr Heating Pmp 87P-23B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	103.32	33.32	YES	103.32	33.32	YES

600 V SWGR 71L24 for SBO PICK UP & DROP OUT VOLTAGES

Comp No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
3D	71-12418(Trip)	Wtr Heating Pmp 87P-23B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	112.19	42.19	YES	112.19	42.19	YES

600 V SWGR 71L26 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	Load I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
2B	71-12610(52X)	ESW Pmp 46P-2B 52X Energize	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	107.50	17.50	YES	91.80	1.80	YES
	71-12610(Close)	600V Bkr 71-12610 52CC	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	93.53	3.53	YES	92.13	2.13	YES

600 V SWGR 71L26 for SBO PICK UP & DROP OUT VOLTAGES

Unit No.	Load I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
2B	71-12610(52X)	ESW Pmp 46P-2B 52X Energize	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	114.38	24.38	YES	94.06	4.06	YES
	71-12610(Close)	600V Bkr 71-12610 52CC	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	100.23	10.23	YES	94.40	4.40	YES

600 V SWGR 71L34 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
2D	71-13420(Trip)	TB Fan 67FN-6B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	101.09	31.09	YES	101.09	31.09	YES

600 V SWGR 71L34 for SBO PICK UP & DROP OUT VOLTAGES

Comp No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
2D	71-13420(Trip)	TB Fan 67FN-6B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	110.07	40.07	YES	110.07	40.07	YES

600 V SWGR 71L44 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
6A	71-14426(Trip)	TB Vent Fan 67FN-5B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	100.24	30.24	YES	100.24	30.24	YES

600 V SWGR 71L44 for SBO PICK UP & DROP OUT VOLTAGES

Comp No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
6A	71-14426(Trip)	TB Vent Fan 67FN-5B	II/III	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	70	70	108.86	38.86	YES	108.86	38.86	YES

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 6
Justification of Loads

The following are components that do not meet the minimum voltage criteria in the voltage drop (profile) calculation. Also included, are loads which drop below their minimum acceptable voltage when the battery voltage is allowed to drop to 109.7VDC for LOCA and 109.86 for SBO (see section 1.3.7 of the main text for methodology). 109.7VDC (LOCA) and 109.86 (SBO) are the minimum voltages being used for determining battery sizing and available margin and to establish acceptance criteria for discharge testing to satisfy Technical Specifications. For SBO an additional spreadsheet has been added to Appendix 4 to show the resulting load voltages when the battery is maintained at 109.86VDC.

LOCA/LOOP:

A. The Reactor Recirculation Pump MG set emergency DC lube oil pump 02-184P-3B(M) does not meet the minimum voltage requirements during starting in the voltage profile calculation. This pump is started at 6 seconds into the duty cycle and continues for the duration of the duty cycle. The voltage at starting (inrush) is approximately 99.53VDC. The minimum required is 100VDC. It recovers to greater than 100VDC within 1 second of starting and remains above 100VDC for the remainder of the duty cycle. Based on engineering judgement, this pump will start and operate but at reduced output power and torque. In any case, this pump does not perform any safety related function. Therefore, no further action or justification is required. Even though it is anticipated that this pump will run, failure of this pump to operate properly represents an economic liability only.

B. The "B" RFPT DC lube oil pump 31P-7B(M) does not meet the minimum pickup voltage during starting. This pump is started at 15 seconds into the duty cycle and continues for the duration of the LOCA. The minimum starting voltage is 100VDC. The voltage at starting (inrush) 97.58VDC with a battery voltage of approximately 115VDC. Terminal voltage recovers to greater than 100VDC after starting and remains above 100VDC for the remainder of the duty cycle. Based on engineering judgment, this pump will start and operate but at reduced speed and torque. In any case, this pump does not perform any safety related function. Therefore, no further action or justification is required. Even though it is anticipated that this pump will run, failure of this pump to operate properly represents an economic liability only. Additionally, this pump terminal voltage is further reduced when battery terminal voltage drops to 109.7VDC. In fact if battery voltage is kept at 109.7 for the duration it fails for the entire duty cycle. Based on the voltage profile calculation (voltage drop calculation) this pump only fails at starting. In any case, failure of this pump is an economic liability only.

C. 02-3V/V-613D is the 125VDC power supply for the ATTS ECCS circuits during loss of AC. The minimum required voltage is 105VDC. The input voltage drops to 104.4VDC between 0.3 and 1 second. The voltage at the beginning of the LOCA event is above 105VDC. The input voltage recovers well above 105VDC after 1 second. The attached telephone memorandum (see Appendix 8) from Datametrics indicates that momentary dips below

105VDC do not cause the unit to fail. The power supply "rides" thru a momentary dip of less than 1VDC for less than 1 second. These units do not have any undervoltage or any logic lockout feature. Therefore, This is acceptable and the operability of this unit is unaffected by this momentary dip below 105VDC. Based on a battery voltage of 109.7VDC, duty cycle this load maintain above the minimum required voltage of 105VDC except 104VDC dropping momentarily to approximately 104.4VDC at 0.3 second. Again, the same justification applies.

D. Not Used.

E. The annunciator panel 09-43 minimum voltage is 105VDC. Based on the calculated voltage profile, during the first second of the event the voltage drops to approximately 100VDC. The power supply does not have any undervoltage logic or lock out (see R335-0095). Additionally, the AC supply has large output capacitors (100uF for 125VDC, 4000uF for 28VDC & 2000uF for 15VDC outputs) which will assist in riding thru the swap over from AC to DC. Therefore, it is expected that the annunciator would ride thru the first second of the event. In any case, once the voltage recovered alarms would come in. Based on a fixed battery terminal voltage of 109.7VDC, this load fails for the entire duty cycle (~102VDC). However, the voltage profile calculation has previously shown that this load will only see less than 105VDC during the first second (which is the design response of the system). This is a non-safety related load which is not required to operate to safely shutdown the plant. Therefore, this does not constitute any safety issues.

F. The power supply 23E/S-200B (16-1TR-131B) minimum voltage is 104VDC. The calculated voltage profile for this indicates that its minimum voltage will be met for the entire duty cycle. However, should battery voltage be at 109.7VDC, the input voltage to the power supply would drop to approximately 103.75VDC. This circuit feeds the Torus Bulk Water Temperature monitoring loop. This will only result in a possible momentary perturbation in torus water temperature indication. However, will not trip the loop. Additionally, AC power will be restored once the EDGs are back on line (less than 11 seconds). The DC supply for this circuit was designed for SBO conditions (F1-89-158). This power supply does not have any undervoltage lockout protection.

G. The EDG Fuel Oil Pump 93P-4B(M) has a minimum of 96VDC. During the first few tenths of a second (i.e. inrush), the voltage dips to approximately 95VDC starting (during inrush). The voltage then recovers to above 96VDC and remains above for the duration of the duty cycle. The fuel pumps will start at slightly lower than minimum voltage (DC motors will start at significantly lower than rated voltage). Review of the fuel pump curve (manual V125-0051) shows the normal capacity of the pump at rated motor voltage is 5.4 GPM and the flow at 80% of nominal speed is approximately 4 GPM. The engine consumption at maximum continuous rating is approx. 3.0

GPM. Therefore, these pumps are oversized. Additionally, the electric pumps are paralleled with the mechanical fuel pumps which will assist once the EDGs start to move. Based on the above facts and sound engineering judgment this pump will perform its intended safety function at a terminal voltage of 95VDC during inrush. With battery voltage at 109.7 VDC, the terminal voltage could drop as low as 94.44 VDC during the first second of starting and then recovers to above 100VDC for the duration of the duty cycle. Again, the same reasoning applies as above.

H. 23P-150 minimum voltage is 96VDC. During the first second of LOCA, this pump voltage drops to approximately 94VDC. The voltage then recovers to greater than 96VDC for the remainder of the duty cycle. This pump will start and run. Additionally, this pump has a reduced voltage starter. It has a 1.6ohm resistor in the starting circuit. After 1 to 2 seconds it will be bypassed and full armature voltage will quickly bring the motor up to speed. Should voltage be at 109.7VDC for the duration of the duty cycle the motor terminal voltage fluctuates between 93.9VDC and 96.2VDC. As indicated previously, the calculated voltage profile only drops below the minimum for the first second of the duty cycle. It is not reasonable to assume that the battery voltage would drop to 109.7 and stay there. HPCI design is to reach 4250GPM within 30 seconds. The HOV-1 valve typically takes about 20 to 22 seconds to fully open. It takes an additional 2 to 3 seconds to be at full flow (typically not more than 25 seconds total to reach full flow). With reduced voltage the speed shouldn't change much, however, reduced torque and horsepower output would be seen. There is approximately 5 seconds of design margin to reach full flow. In addition to this pump, once steam is admitted to the turbine, the main oil pump (mechanically driven pump) will provide additional pressure for the HPCI hydraulic control system. Another consideration, is that the scenario for the duty cycle includes LPCI and Core Spray initiation (which wouldn't require HPCI). If there was a small break LOCA there would be less load on the battery because the switchgear breakers for LPCI and Core Spray (10P-3C,10P-3D & 14P-1A) would not be required. In any case, the DC pump will start and run at reduced voltages and based on engineering judgment (including sytem design margin) would successfully operate HPCI even at a battery reduced voltage of 109.7 VDC for the entire event.

I. The closing of the Reactor Building Closed Loop Cooling Pump feeder breaker 71-11416 does not meet the minimum voltage requirements. This breaker receives a demand to close upon loss of RBC pressure (less than 75PSIG) between 2 and 4.4 seconds into the duty cycle (based on PTE-96-002). The minimum pickup is 90VDC. The voltage drops to approximately 71VDC during closing. The closing solenoid is rated for 90VDC. Previous testing of AK breakers has demonstrated that these breakers will close at less than 90VDC (see DER-00-04175). However, if this coil doesn't pickup it will burn itself out quickly as it is not rated for continuous duty at this voltage OR the fuse will trip. The fuse will trip in less than 1 second. The fuse feed is a Bussman NON-10 which will clear in less than 1 second at

25.35amps (71VDC/2.8ohms). This pump breaker has a non safety related function and it is not required to close for LOCA/LOOP. With a battery voltage of 109.7VDC the voltage at the close coil drops to ~70VDC and stays for the entire duty cycle. Again, this is a non-safety related component whose failure does not have any affect on safety related components.

J. The Struthers Dunn relays on 71DC-B3 circuit 6 indicate that they don't have the minimum required voltage at the start of the duty cycle voltage . In this circuit (1SGTB01) the CR2810 relays have economizing contacts. That is a 775ohm resistance is in parallel with the coil after energized. These relays actuate the Struthers Dunn relays. After the CR2810 relays have "economized" the voltage on these relays recovers well above the minimum required voltage of 100VDC. Logically, all the inrush has cleared once the Struthers Dunn relays are asked to pickup. At this point all minimum voltages are met.

K. Not Used.

L. Not Used.

M. The voltage profile for the ESW pump motor breaker is acceptable for the duration of the LOCA event. However, when the battery voltage is at 109.7 VDC for the entire duty cycle, the voltage drops to slightly less than 90VDC at the end of its cycle (3.9 seconds). At the end of the cycle the breaker has already closed and ,therefore , this is a moot point. It only equates to 0.68 volts below (for the close coil 52CC) and 1VDC below (for the 52X relay) the minimum required voltage of 90VDC. Based on DER-00-04175 response this breaker will close at levels less than 90VDC. Again, this is based on a fixed battery voltage of 109.7 VDC which is unrealistic based on the calculated battery voltage profile. Therefore, this is acceptable as is.

N. The degraded voltage relay accuracies in set point calc JAF-CALC-ELEC-01488 assumes a 0.2% accuracy for repeatability. The Tech Manual B455-0002 indicates that the repeatability accuracy is valid from 100 to 140VDC. The voltage profile calculation shows that this voltage is above 100VDC at the onset of the event when power is lost. It does drop momentarily to 99.62 VDC. This does not invalidate JAF-CALC-ELEC-01488. The relay is functional to 70VDC. Reference ACT-99-45397.

Station Blackout (SBO)

A. The Reactor Recirculation Pump MG set emergency DC lube oil pump 02-184P-3B(M) meets the minimum voltage requirements in the battery voltage drop profile calculation. However, when battery voltage is set at 109.86 VDC the minimum voltage at starting drops to approximately 97.21VDC during starting (inrush). This pump is started at 6 seconds into the duty cycle and continues for 30 minutes. The voltage at starting (inrush) is approximately 97.21 VDC. The minimum required voltage is 100VDC. The voltage recovers to greater than 100VDC at 7 seconds and remains above 100VDC for the remainder of the duty cycle (with a corresponding battery voltage of 109.86 VDC). Based on engineering judgement, this pump will start and operate. In any case, this pump does not perform any safety related function. Therefore, no further action or justification is required. Even though it is anticipated that this pump will run, failure of this pump to operate properly represents an economic liability only.

B. Condenser Vacuum Breaker Valve - 38MOV-VB2. The operation of this valve is not required for any safety-related function. This valve is assumed to be opened at 4 minutes into the event which correspond to HPCI tripping (maximum load on the battery – i.e. critical period). The voltage dips to about 65% of rated motor terminal voltage on inrush while the voltages for the other components in the same panel are around 105.27 VDC for the same time period. After inrush, the voltage recovers to approximately 98 VDC at the terminals of the motor. 98 VDC is also lower than the 80% minimum voltage required by IEEE STD- 946 (100 VDC). At reduced voltage this valve will operate but slower and less starting torque. It has been shown with many other safety related MOVs that they will operate at significantly less voltages than 100VDC. Although it may take longer to come up to speed at this reduce starting voltage, speed of opening is not critical. The purpose of opening this valve during the SBO is to break condenser vacuum to stop the main turbine so that the emergency lube oil pumps can be shed from the bus. The SBO duty cycle has it operating at 4 minutes for sizing purposes (critical period). This is considered conservative because AOP-49 informs the Operators not to cycle loads simultaneously (e.g. open 38MOV-VB2 while HPCI is cycling). AOP-49 requires that Operations commence opening this valve within 30 minutes. Since the valve is operated within at least 30 minutes, the stroke time of the actual operation is not considered critical. Analysis using the BWROG DC MOV Methodology (DCM) shows that even with an artificially low source voltage (to produce about 96 volts at the MOV), the valve still strokes against the required differential pressure (1 atmosphere or about 15 psi). See Appendix 8 for stroke calculation. The BWROG DCM analysis shows at low voltage, the motor slows down and the stroke time increases accordingly (stroke time about 80 seconds, nominal is 48 seconds). The low differential pressure and associated low total thrust requirement means that the MOV is not significantly challenged. This is not a safety related function. The purpose of opening this valve is to reduce condenser vacuum so that the emergency

lube oil pumps can be secured. Even if this valve did not open, vacuum would be lost relatively soon into the event due to no condenser cooling (Circ Water Pumps have tripped) which would quickly stop the main turbine so that lube oil would not be needed. Additionally, shedding the EBOP at 30 minutes is not critical because there is considerable margin for each sizing period after 5 minutes (see Appendix 9). Therefore, the reduced voltage at the valve is acceptable.

C. The closing of the Reactor Building Closed Loop Cooling Pump feeder breaker 71-11416 does not meet the minimum voltage requirements. This breaker receives a demand to close upon loss of RBC pressure (less than 75PSIG) between 2 and 4.4 seconds into the duty cycle (based on PTE-96-002). The minimum pickup is 90 VDC. The voltage drops to approximately 85VDC during closing. The closing solenoid is rated for 90VDC. Previous testing of AK breakers has demonstrated that these breakers will close at less than 90 VDC (see DER-00-04175). However, if this coil doesn't pickup it will burn itself out quickly as it is not rated for continuous duty at this voltage OR the fuse will trip. The fuse will trip in less than 1 second. The fuse feed is a Bussman NON-10 which will clear in less than 1 second at 30.4 amps (85VDC/2.8ohms). This pump breaker has a non safety related function and it is not required to close for SBO. With a battery voltage of 109.86 VDC the voltage at the close coil drops to ~80VDC and stays for the entire duty cycle. Again, this is a non-safety related component whose failure does not have any affect on safety related components.

D. Based on the voltage drop profile in appendix 4, the EDG Fuel Oil Pump 93P-4B(M) has at least 2.73 VDC margin (i.e. above the minimum allowed voltage of 96VDC) during starting. However, considering a battery voltage of 109.86 VDC (discharge test acceptance criteria) the voltage during starting (inrush) could drop as low as 93.48 VDC. However, this voltage recovers to greater than 96VDC for the entire duty cycle. Although the EDGs are assumed to fail during an SBO, justification will be provided to demonstrate they won't fail during the first minute because of the event. 93.48 VDC corresponds to 2.52 VDC below the minimum during starting (inrush). The EDG Fuel Oil Pump starts at the beginning of the duty cycle (2.8 seconds). Even with the battery voltage held at 109.86 VDC, the voltage recovers to above minimum voltage 1 second later and remains above minimum for the remainder of the duty cycle. The fuel pumps will start at lower than minimum voltage (DC motors will start at significantly lower than rated voltage). Review of the fuel pump curve (manual V125-0051) shows the normal capacity of the pump at rated motor voltage is 5.4 GPM and the flow at 80% of nominal speed is approximately 4 GPM. The engine consumption at maximum continuous rating is approx. 3.0 GPM. Therefore, these pumps are oversized. Additionally, the electric pumps are paralleled with the mechanical fuel pumps which will assist once the EDGs start to move. This justification has been provided during the first minute when the EDGs are assumed to fail. During the last minute, when the "B" EDG is required to start, there is sufficient margin such that the minimum voltage is met. Based on the above

facts and sound engineering judgment this pump will perform its intended safety function at a battery voltage of 109.86 VDC during an SBO event. For simplicity this same justification applies to 93P-4(D). 93P-4(D) drops significantly less than 93P-4(B) and, therefore, its performance would only be better. As is the case with 93P-4B(M) the voltage remains above the minimum required based on the expected voltage profile (which includes 25% aging margin, 8% temperature and 5% design margin). However, with battery voltage at 109.86 VDC (battery discharge testing acceptance criteria), the terminal voltage for 93P-4(D) during starting would drop to approximately 95.5VDC. However, as previously stated, the same justification applies as in 93P-4(B) above.

E. The Main Turbine Emergency Bearing Oil Pump 94P-2(M) does not meet the minimum pickup voltage of 100 VDC at starting. The voltage drops to 99.49 VDC during starting (inrush) and recovers to above 100VDC for the remainder of the duty cycle. When battery voltage is reduced to 109.86 VDC the voltage during starting (inrush) drops to 97.81 VDC. The voltage recovers to above 100VDC after starting and remains above for the remainder of its duty cycle. This pump is started at approximately 2.5 minutes into the event. Based on engineering judgment, this pump will start and operate, but at reduced speed and torque (DC motors will start at significantly lower than rated voltage). In any case, this pump does not perform any safety related function. Therefore, no further action or justification is required. Even though it is anticipated that this pump will run, failure of this pump to operate properly represents an economic liability only.

F. The "B" RFPT DC lube oil pump 31P-7B(M) does not meet the minimum pickup voltage. This pump is started at 17 seconds into the duty cycle and continues for 30 minutes. The minimum starting voltage is 100VDC. The voltage at starting (inrush) is approximately 96.3VDC with a battery voltage of approximately 113.89VDC. Terminal voltage recovers to greater than 100VDC after starting and remains above 100VDC for the remainder of the duty cycle (except at 2.5 and 4 minutes it drops to 96.1VDC momentarily). Based on engineering judgment, this pump will start and operate. In any case, this pump does not perform any safety related function. Therefore, no further action or justification is required. Even though it is anticipated that this pump will run, failure of this pump to operate properly represents an economic liability only. In fact if battery voltage is kept at 109.86 VDC for the duration it fails for the entire duty cycle. Based on the voltage profile calculation (voltage drop profile calculation) this pump only fails at starting. In any case, failure of this pump is an economic liability.

G. 02-3V/V-613D is the 125VDC power supply for the ATTS ECCS circuits during loss of AC. The minimum required voltage is 105VDC. The input voltage drops to 104.79 VDC at 10 seconds and 104.34 VDC at 4 minutes. The voltage starts the event above 105VDC. Both of these occurrences are momentary. The attached telephone memorandum (see Appendix 8) from Datametrics indicates that momentary dips below 105VDC do not cause the unit to fail. The power supply "rides" thru a momentary dip of less than 1VDC for less than 1 second. These units do not have any undervoltage or any logic lockout feature. Therefore, this is acceptable and the operability of this unit is unaffected by this momentary dip below 105VDC. Based on a battery voltage of 109.86 VDC for the entire duty cycle this load also drops momentarily to approximately 104.48 VDC at 10 seconds and 104.34 VDC at 4 minutes. Again, the same justification applies.

H. 23P-150 minimum voltage is 96 VDC. The HPCI lube oil pump starts at 10 seconds and restarts when HPCI trips on high reactor level at 4 minutes. The starting voltage drops to 94.98VDC. This voltage immediately recovers to greater than 96VDC for the remainder of the duty cycle. This pump will start and run. Additionally, this pump has a reduced voltage starter. It has a 1.6 ohm resistor in the starting circuit. After 1 to 2 seconds it will be bypassed and full armature voltage will quickly bring the motor up to speed. Should voltage be at 109.86 VDC for the duration of the duty cycle the motor terminal voltage fluctuates between 94VDC and 98VDC. As indicated previously, the calculated voltage profile only drops momentarily below the minimum at 10 seconds into duty cycle. It is not reasonable to assume that the battery voltage would drop to 109.86 VDC and stay there. HPCI design is to reach 4250GPM within 30 seconds. The HOV-1 valve typically takes about 20 to 22 seconds to fully open. It takes an additional 2 to 3 seconds to be at full flow (typically not more than 25 seconds total to reach full flow). With reduced voltage the speed shouldn't change much, however, reduced torque and horsepower output would be seen. There is approximately 5 seconds of design margin to reach full flow. In addition to this pump, once steam is admitted to the turbine, the main oil pump (mechanically driven pump) will provide additional pressure for the HPCI hydraulic control system. In any case, the DC pump will start and run at reduced voltages and based on engineering judgment (including sytem design margin) would successfully operate HPCI even at a battery reduced voltage of 109.86 VDC for the entire event.

I. The voltage profile for the ESW pump motor breaker is acceptable for the duration of the SBO event. However, when the battery voltage is at 109.86 VDC for the entire duty cycle, the voltage drops to slightly less than 90 VDC (by about 0.6VDC) at 3.6 seconds. However, the voltage for the remainder of its closing cycle the voltage remains above the 90VDC minimum. Based on DER-00-04175 response this breaker will close at levels less than 90VDC. Again, this is based on a fixed battery voltage of 109.86 VDC which is unrealistic based on the calculated battery voltage profile. Therefore, this is acceptable as is.

J. The annunciator panel 09-43 minimum voltage is 105VDC. Based on the calculated voltage profile, the voltage drops momentarily to less than 105VDC at 10 seconds, 2.5 minutes and 4 minutes into the SBO. The power supply does not have any undervoltage logic or lock out (see R335-0095). Additionally, the DC supply has input and output capacitors (200uF for 125VDCinput, 10uF for 125VDC output, 100uF for 28VDC output & 200uF for +-12VDC outputs) which will assist in riding thru the momentary dips in DC supply. At 4 minutes there is an extended transient for about 20 seconds (5VDC drop for 1 second followed by 0.1 to 1VDC drop for 19 seconds). However, the voltage comes back to well above the minimum required voltage of 105VDC. Additionally, at 4 minutes the reactor vessel has made its initial level recovery and this transient occurs when HPCI is tripping off line. In any case, once the voltage recovered alarms would come in. Based on a fixed battery terminal voltage of 109.86 VDC, this load fails for the entire duty cycle (~102VDC). However, the voltage profile calculation has previously shown that this load will only see less than 105VDC momentarily at 10 seconds, 2.5 minutes and 4 minutes . This is a non safety related load which is not required to operate to safely shutdown the plant. Therefore, this does not constitute any safety issues.

K. The minimum required voltage for Governor Booster Pump 93GS-5B is 92 VDC. The voltage profile for 93GS-5B is acceptable for the entire duration of SBO event. However, when the battery voltage is at 109.86 VDC for the entire duty cycle, the voltage drops to slightly less than 92 VDC (by about 0.07VDC) at 3.7 seconds momentarily. According to SBO scenario, EDG is not available anyway, therefore, this does not provide any concern. When EDG is restored back in accordance with SBO event scenario (ref. Appendix 12) during the end of the 4 hours SBO event, the voltage is maintained above the required voltage of 92VDC.

CONCLUSIONS

Based on the above analysis, the "B" Station Battery will be able to perform its intended safety function with a battery voltage of 109.7 VDC during a LOCA and 109.86 VDC during an SBO.

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 7
GNB Battery Catalog Information and Capacity Analysis

GNB

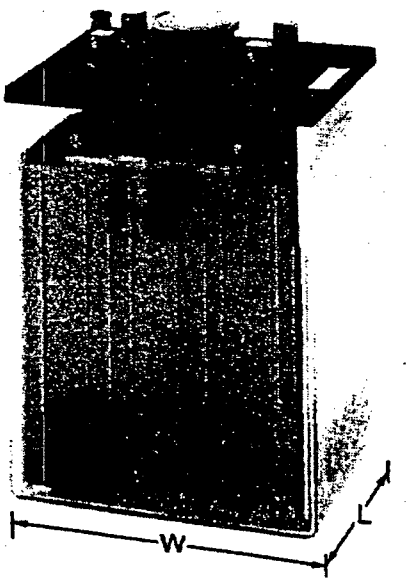
Section 35.40
Nuclear Class 1E
Stationary Batteries

†N*N are the nuclear variant of GNB's commercial N*X line.

TYPE NAN† - LEAD ANTIMONY
TYPE NCN† - LEAD CALCIUM

CAPACITIES-550 A.H. to 2550 A.H.
@ 8 HOUR RATE TO 1.75 V.P.C. AVERAGE

20 YEAR LIFE EXPECTANCY



SPECIFICATIONS

- **Jar** — Styrene-Acrylonitrile (SAN) Plastic
- **Cover** — Butadiene Styrene Rubber

Separators — Microporous Material

Retainers — Fiberglass Mats

Posts — NAN/NCN 7-17 two-1.5" (38.1 mm) square
NAN/NCN 19-27 four-1.0" (25.4 mm) square
NAN/NCN 29-35 four-1.5" (38.1 mm) square

Post Seals — Floating "O" Ring - Seal Nut

Vents — GNB "Pre-Vent" Flame Arrester

Level Lines — High and Low - All Jar Faces

Electrolyte — Height Above Plates - 2.75" (69.9 mm)

Electrolyte Withdrawal Tubes — 2 per cell

Sediment Space — 1.06" (26.9 mm)

Specific Gravity — 1.215 @ 77°F (25°C)

Inter-Cell Connectors — Lead Plated Copper

- **Optional** — Polycarbonate Jar and Cover
28% Limiting Oxygen Index (L.O.I.)
NAN/NCN 19 to 35 Types only

Qualified according to IEEE 535
Tested according to IEEE 450

Plate Dimensions	Height	Width	Thickness
Positive Plate	15.0 in 381.0 mm	12.5 in 317.5 mm	.320 in 8.13 mm
Negative Plate	15.0 in 381.0 mm	12.5 in 317.5 mm	.215 in 5.46 mm

Cell Type	NOM AH CAP	Amperes To 1.75 V.P.C. Average							Overall Dimensions (in/mm)			Approximate Weight (lbs/kg)		Electrolyte Per Cell (gal/liter)
		8 Hr.	5 Hr.	3 Hr.	1 Hr.	30 Min.	15 Min	1 Min.	Length	Width	Height	Net	Packed	
NCN/NAN-7	550	69	96	134	245	300	340	436	7.38 in 187 mm	14.5 in 368 mm	22.13 in 562 mm	160 lbs 72 kg	168 lbs 76 kg	6.4 gal 24.2 liter
NCN/NAN-9	690	86	124	165	300	454	515	582	7.38 in 187 mm	14.5 in 368 mm	22.13 in 562 mm	177 lbs 80 kg	189 lbs 86 kg	6 gal 22.7 liter
NCN/NAN-11	825	103	149	200	375	561	686	727	7.38 in 187mm	14.5 in 368 mm	22.13 in 562 mm	195 lbs 89 kg	207 lbs 94 kg	5.6 gal 21.2 liter
NCN/NAN-13	950	119	171	238	450	666	814	873	7.38 in 187 mm	14.5 in 368 mm	22.13 in 562 mm	213 lbs 97 kg	225 lbs 102 kg	5.1 gal 19.3 liter
NCN/NAN-15	1070	134	194	277	525	768	939	1018	7.38 in 187 mm	14.5 in 368 mm	22.13 in 562 mm	231 lbs 105 kg	243 lbs 110 kg	5.0 gal 18.9 liter
NCN/NAN-17	1200	150	216	312	600	867	1060	1165	7.38 in 187 mm	14.5 in 368 mm	22.13 in 562 mm	269 lbs 112 kg	281 lbs 128 kg	4.9 gal 18.5 liter
NCN/NAN-19	1370	171	246	357	675	953	1165	1260	9.25 in 235 mm	14.5 in 368 mm	22.5 in 572 mm	282 lbs 128 kg	294 lbs 134 kg	6.3 gal 23.8 liter
NCN/NAN-21	1495	187	270	390	750	1033	1263	1400	9.25 in 235 mm	14.5 in 368 mm	22.5 in 572 mm	301 lbs 137 kg	313 lbs 142 kg	6.0 gal 22.7 liter
NCN/NAN-23	1670	209	301	436	825	1136	1389	1540	11.38 in 289 mm	14.5 in 368 mm	22.5 in 572 mm	348 lbs 158 kg	366 lbs 166 kg	8.0 gal 30.3 liter
NCN/NAN-25	1810	226	326	472	900	1232	1506	1680	11.38 in 289 mm	14.5 in 368 mm	22.5 in 572 mm	364 lbs 165 kg	382 lbs 174 kg	7.6 gal 28.2 liter
NCN/NAN-27	1945	243	351	507	975	1327	1622	1840	11.38 in 289 mm	14.5 in 368 mm	22.5 in 572 mm	380 lbs 173 kg	398 lbs 181 kg	7.3 gal 27.6 liter
NCN/NAN-29	2150	269	389	555	1050	1429	1747	1932	14.56 in 370 mm	14.5 in 368 mm	22.5 in 572 mm	446 lbs 203 kg	464 lbs 211 kg	11.5 gal 43.5 liter
NCN/NAN-31	2280	285	411	595	1125	1531	1872	2070	14.56 in 370 mm	14.5 in 368 mm	22.5 in 572 mm	462 lbs 210 kg	480 lbs 218 kg	10.9 gal 41.3 liter
NCN/NAN-33	2415	302	435	629	1200	1633	1966	2220	14.56 in 370 mm	14.5 in 368 mm	22.5 in 562 mm	479 lbs 218 kg	497 lbs 226 kg	10.3 gal 39.0 liter
NCN/NAN-35	2550	319	459	663	1275	1735	2121	2350	14.56 in 370 mm	14.5 in 368 mm	22.5 in 572 mm	496 lbs 225 kg	514 lbs 234 kg	9.7 gal 36.7 liter

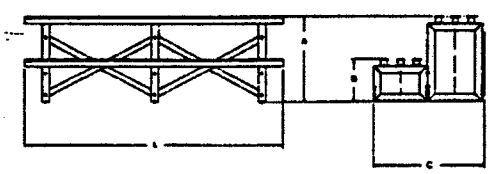
AMP DATA
NAN/NCN CELLS

CELL TYPE	HOURS 8	5	4	3	2	1.5	1	MINUTES 30	15	1
End Voltage 1.84										
NCN/NAN-7	62	87	98	118	139	163	183	210	255	255
NCN/NAN-9	78	110	124	144	167	190	225	280	340	340
NCN/NAN-11	94	132	150	176	207	237	281	350	425	425
NCN/NAN-13	108	152	177	210	239	273	338	420	510	510
NCN/NAN-15	123	172	201	240	287	325	394	490	595	595
NCN/NAN-17	137	192	224	269	332	367	450	560	680	680
NCN/NAN-19	156	219	254	306	377	423	506	630	738	738
NCN/NAN-21	171	240	280	336	422	466	563	700	820	820
NCN/NAN-23	191	268	310	374	459	521	619	770	869	869
NCN/NAN-25	207	290	339	404	504	573	675	840	948	948
NCN/NAN-27	222	312	364	437	549	620	731	910	1027	1027
NCN/NAN-29	246	344	402	480	586	677	787	980	1085	1085
NCN/NAN-31	260	366	423	510	631	730	843	1050	1162	1162
NCN/NAN-33	276	387	452	538	672	786	900	1120	1240	1240
NCN/NAN-35	291	408	476	572	711	832	956	1190	1317	1317
End Voltage 1.86										
NCN/NAN-7	60	83	94	112	129	151	169	186	217	217
NCN/NAN-9	74	104	115	137	155	175	207	248	290	290
NCN/NAN-11	89	124	140	168	192	219	259	310	362	362
NCN/NAN-13	103	144	165	198	222	252	311	372	435	435
NCN/NAN-15	116	162	189	226	266	301	362	434	507	507
NCN/NAN-17	130	180	210	253	308	339	414	496	580	580
NCN/NAN-19	148	205	238	288	350	391	466	558	652	652
NCN/NAN-21	162	226	262	316	391	431	518	620	725	725
NCN/NAN-23	181	250	291	352	426	482	569	682	770	770
NCN/NAN-25	196	273	318	380	467	529	621	744	840	840
NCN/NAN-27	211	293	341	411	509	573	673	806	910	910
NCN/NAN-29	232	324	378	452	543	625	724	868	962	962
NCN/NAN-31	247	342	397	480	585	675	776	930	1031	1031
NCN/NAN-33	262	364	424	506	623	726	828	992	1100	1100
NCN/NAN-35	276	384	446	538	659	768	879	1054	1168	1168

TWO STEP NAN/NCN NUCLEAR CLASS 1E SEISMIC RACKS

Dimensions:

	In	mm
A. — Height (Top Level)	10.62	270
B. — Height (Lower Level)	6.62	168
C. — Width (Depth)	50.00	1270



Cell Type NAN/NCN	Qty Cells	Rack Length ft	Rack Length mm	Qty Racks	Rack P/N S40-400777-	Weight lbs	Weight kg
7-17	60	10	3048	2	120	515	234
	120	10	3048	4	120	515	234
19-21	60	12	3658	2	144	610	277
	120	12	3658	4	144	610	277
23-27	60	15	4572	2	180	735	333
	120	15	4572	4	180	735	333
29-35	60	19	5792	2	228	930	422
	120	19	5792	4	228	930	422

Note: Design and/or specifications subject to change without notice. If questions arise, contact your local GNB sales representative for clarification.

GNB

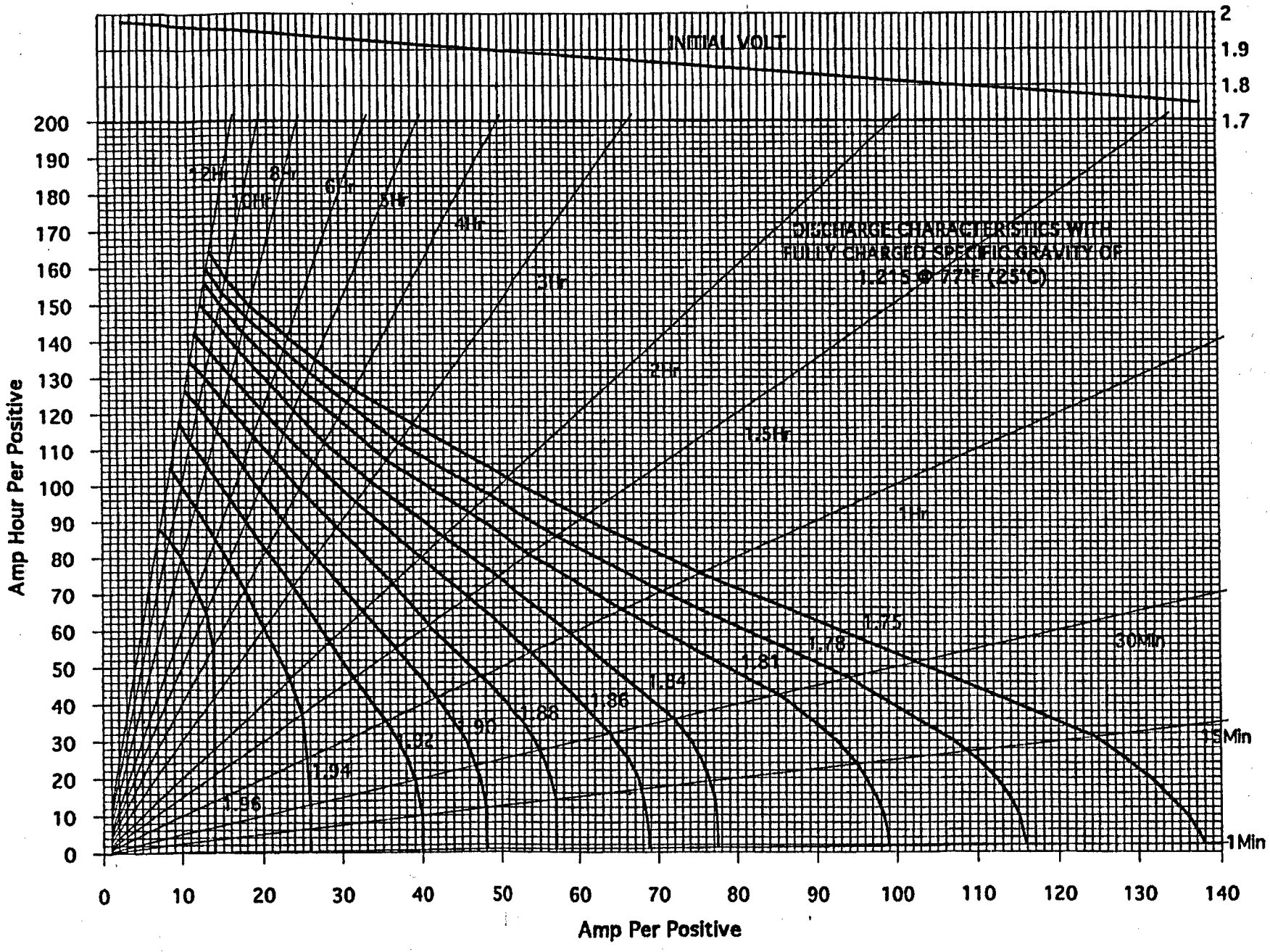
GNB Technologies
Industrial Battery Company
829 Parkview Boulevard
Lombard, IL 60148-3249
U.S.A.
Telephone: 708.629.5200
Facsimile: 708.629.2635
A Pacific Dunlop Company

LEAD RETURN RECYCLE

GNB Technologies
GNB Batteries (Canada) Inc.
4500 Dixie Road, Unit 9B
Mississauga, Ontario L4W-1V7
Canada
Telephone: 905.624.1107
Facsimile: 905.624.1801
A Pacific Dunlop Company

CELL TYPE	HOURS							MINUTES		
	8	5	4	3	2	1.5	1	30	15	1
End Voltage 1.75										
NCN/NAN-7	69	96	112	134	170	207	245	300	340	436
NCN/NAN-9	86	124	138	165	204	240	300	454	515	582
NCN/NAN-11	103	149	167	200	252	300	375	561	686	727
NCN/NAN-13	119	171	198	238	292	345	450	666	814	873
NCN/NAN-15	134	194	227	277	350	412	525	768	939	1018
NCN/NAN-17	150	216	254	312	405	465	600	867	1060	1165
NCN/NAN-19	171	246	290	357	460	535	675	953	1165	1260
NCN/NAN-21	187	270	317	390	515	590	750	1033	1263	1400
NCN/NAN-23	209	301	354	436	560	660	825	1136	1389	1540
NCN/NAN-25	226	326	384	472	615	725	900	1232	1506	1680
NCN/NAN-27	243	351	412	507	670	785	975	1327	1622	1840
NCN/NAN-29	269	389	455	555	715	857	1050	1429	1747	1932
NCN/NAN-31	285	411	483	595	770	925	1125	1531	1872	2072
NCN/NAN-33	302	435	512	629	820	995	1200	1633	1966	2220
NCN/NAN-35	319	459	539	663	868	1053	1275	1735	2121	2350
End Voltage 1.78										
NCN/NAN-7	67	93	108	129	165	197	228	282	324	383
NCN/NAN-9	83	120	132	156	196	228	279	376	432	510
NCN/NAN-11	100	144	162	193	242	285	349	470	540	637
NCN/NAN-13	115	166	190	228	280	328	419	564	648	765
NCN/NAN-15	130	187	220	261	336	391	488	658	756	892
NCN/NAN-17	146	209	244	293	389	442	558	752	864	1020
NCN/NAN-19	165	239	279	333	442	508	628	846	972	1107
NCN/NAN-21	182	262	305	366	494	561	698	940	1080	1230
NCN/NAN-23	202	292	341	407	538	627	767	1034	1188	1287
NCN/NAN-25	219	316	369	440	590	689	837	1128	1296	1404
NCN/NAN-27	237	340	396	476	643	746	907	1222	1404	1521
NCN/NAN-29	260	375	441	522	694	814	977	1316	1512	1624
NCN/NAN-31	275	399	465	555	747	879	1046	1410	1620	1740
NCN/NAN-33	292	422	492	586	795	945	1116	1504	1728	1850
NCN/NAN-35	310	445	518	623	842	1000	1186	1598	1836	1970
End Voltage 1.81										
NCN/NAN-7	65	90	104	124	153	182	208	255	285	330
NCN/NAN-9	81	117	127	152	184	211	255	340	380	440
NCN/NAN-11	97	140	156	185	227	264	319	425	475	550
NCN/NAN-13	112	162	183	218	263	304	383	510	570	660
NCN/NAN-15	127	182	211	252	315	363	446	595	665	770
NCN/NAN-17	141	203	236	285	365	409	510	680	760	880
NCN/NAN-19	161	232	267	324	414	471	574	765	855	954
NCN/NAN-21	176	254	295	357	464	519	638	850	950	1060
NCN/NAN-23	197	284	327	396	505	581	701	935	1045	1100
NCN/NAN-25	213	307	357	428	554	638	765	1020	1140	1200
NCN/NAN-27	229	330	383	464	603	691	829	1105	1235	1306
NCN/NAN-29	254	364	423	509	643	754	893	1190	1330	1386
NCN/NAN-31	268	387	465	540	693	814	956	1275	1425	1485
NCN/NAN-33	284	410	492	571	738	875	1020	1360	1520	1600
NCN/NAN-35	300	432	518	606	781	926	1084	1445	1615	1700

N*N Nuclear Class 1E Stationary Battery Rates



Note: This information represents the average performace of the line.
Refer to the tables for actual discharge data.

Qualified in accordance with IEEE Std 535-1986
Tested in accordance with IEEE Std 450-1987

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Documentation of Telephone Discussion

DATE: 5/6/02 TIME: 4:20PM MODIFICATION NO.: _____

SUBJECT: NCN-33 CELL DISCHARGE CURVES

REFERENCES: JAF-CALC-ELEC-02609 & 02610

	NAME	ORGANIZATION
PARTICIPANTS:	BRIAN MARKS	ENTERGY NUCLEAR NORTHEAST (315) 349-6213
	ROB SCHMIDT (TECHNICAL SERVICES)	GNB (630) 691-7886

SUMMARY OF DISCUSSION: I ASKED ROB IF THE PUBLISHED DISCHARGE CURVES INCLUDE THE AFFECT OF VOLTAGE DROP IN THE INTERCELL CONNECTORS. ROB INDICATED THAT THE RATES HAVE BEEN ADJUSTED TO INCLUDE THE AFFECTS OF THE VOLTAGE DROP IN THE INTERCELL CONNECTORS.

AGREEMENTS/COMMITMENTS: NONE

Prepared By: Brian Marks Date: MAY 6, 2002
Title: Senior Electrical Engineer
Reviewer: Alex Dolle Date: MAY 7, 2002
Title: ELECTRICAL ENGINEER

Distribution:

Marks, Brian

n: Storm Team [Stormteam@Ackerley.com]
.t: Friday, October 12, 2001 8:39 AM
To: Marks, Brian
Subject: Below zero days

Brian,

The two winters with the most below zero days were the winters of 1992-1993 (11) and 1993-1994 (18). I did not include days when the temperature reached 0, the readings were all <= -1. If you took into account any low temperatures of 0, it still ends up the same.

Keep in mind that these readings are for Hancock International Airport. You may tend to be a bit warmer due to your proximity to Lake Ontario. I believe there's a record of temperatures right at your site from meteorological towers on the property. This is mandated by the NRC. A gentleman by the name of Tom Galletta works for the company contracted out to maintain the towers. His office is located adjacent to NM1.

You might want to give him a call. Also, Bill Gregway is the local weather observer for Oswego. He provides information for the Palladium-Times and he may be able to give you readings specifically for Oswego.

If you need anything else, please don't hesitate to write.

Dave Longley
Meteorologist
WIXT NewsChannel 9 Storm Team
5904 Bridge Street
East Syracuse, NY 13057
ne: 315.446.9999 x2213
.x: 315.446.9283
E-mail: stormteam@wixt.com
Web: http://www.wixt.com

Entergy

Interoffice Correspondence

February 14, 2001
JENG-01-0038

MEMO TO: DER 01-00666 FILE

FROM: B. MARKS

VIA: D. RUDDY (ACTING)

SUBJECT: **ACT-00-53590, 'A' STATION BATTERY CAPACITY ANALYSIS**

Attachments 1, 2 & 3 show the trend of actual capacity test results of the "A" & "B" Station Batteries superimposed on the GNB expected full float service life curve for these batteries.

Attachment 1 shows the capacity of "A" Station Battery verses years of service from 1983 to 1995 superimposed on the GNB curve. The final measured capacity (86%) was plotted to fit the GNB curve. The remaining data points were then plotted from that reference point.

Attachment 2 shows the capacity of "A" Station Battery verses years of service from 1995 to present superimposed on the GNB curve. The initial measured capacity (98.9%) was plotted to fit the GNB curve. The remaining data points were then plotted from that reference point.

Attachment 3 shows the capacity of "B" Station Battery verses years of service from 1983 to 1995 superimposed on the GNB curve. The final measured capacity (95%) was plotted to fit the GNB curve. The remaining data points were then plotted from that reference point.

During review of the past discharge test results for each battery, anomalies were identified. Attachments 4 and 5 are summaries of each discharge test for "A" and "B" discharge test respectively. The results in some cases were adjusted accordingly to provide the most accurate trendable data.

The "A" Station Battery was installed in September 1995. Per JAF-CALC-ELEC-02609 Revision 1, the "A" Station Battery has 12% combination temperature and aging margin. Presently, 11% is used for temperature margin (60°F). Therefore, 1% is remaining for aging margin. Attachment 1 shows that the battery, based on its past performance, would reach 100% capacity at 7-1/2 years (3/03). Attachment 3 shows that the battery, based on "B" Station Battery's past performance, would reach 100% at 9-1/2 years

MEMO TO: FILE
FROM: B. MARKS/D. RUDDY
SUBJECT:

January 24, 2001
JENG-01-0038
Page 2 of 3

(3/05). Attachment 2 shows that the battery, based on its current performance plotted on the typical curve, would reach 100% at 12 years (9/07).

The previous duty cycle profiles of both "A" and "B" Station Batteries had a considerable deeper discharge tests ("A" was deepest discharge) than the present duty cycle. Additionally, both batteries were previously pre-aged at manufacturing. That is, both batteries were manufactured to approximately 109% and 104%. The GNB service life curves are based on a 90% formation at the factory. Both the rigorous duty cycle and the pre-aging at manufacturing attributed to accelerated aging of "A" and "B" Station Batteries. "A" Station Battery being more pronounced due to a considerably more rigorous duty cycle than "B" Station Battery and greater pre-aging.

From the above it can be concluded that a conservative scenario is that the battery would remain above 100% until 2003 (after the 2002 refuel outage) and still have a combination of 12% temperature, aging and design margin. More realistically this battery will reach 100% capacity sometime between 3/05 and 9/07.

It should be noted that an attempt was made to correlate the actual discharge test data in the 2000 discharge test to actual capacity. The methodology for calculating battery voltage from IEEE 485 Annex C was used based on (conservatively) the lowest voltage in the first minute (the remainder of the test gave very favorable results). Since two magnitudes of current in the first minute are utilized (i.e. 696 and 609amps), this correlation was made difficult (or at least skewed), however, did provide some usable data. Using 609 amps, the calculation yielded 103.4%. Using 696 amps, the calculation yielded 118%. Note that both tests were adjusted for the voltage drop in the intertier jumpers. The 2000 "B" Station Battery discharge test was analyzed and yielded a 118% capacity utilizing IEEE 485 Annex C methodology. Both the "A" and "B" rough draft IEEE 485 calculations are electronically saved in G/Marks/SB1 discharge test analysis (SB2 discharge test analysis). An engineering judgement can be made that the "A" Station Battery capacity is somewhere between 103.4% and 118%.

A recommended change for minimum battery electrolyte temperature is to revise the acceptance criteria to 65°F (from 60°F). A 3% gain in aging/design margin is realized by not allowing the battery electrolyte temperatures to go below 65°F (see IEEE-485 table 1). PCRs 01-2372 & 01-2373 have been initiated to revise the acceptance criteria for electrolyte temperature from 60°F to 65°F for MST-071.12 and MST-071.13 (these values are to be adjusted upward to account for MTE accuracy. Although not directly associated with battery operability, MOD M1-89-064 specifically changed the low alarm setpoint for battery room ventilation to 65°F (from 60°F). TSI-6 should be revised to reflect MOD M1-89-064. ACTS item 01-56385 has been assigned to licensing to revise TSI-6 to indicate 65°F for the lower temperature limit for operability. This would be consistent with battery electrolyte operability. Attachment 6 is three years of battery room temperature data.

MEMO TO: FILE
FROM: B. MARKS/D. RUDDY
SUBJECT:

January 24, 2001
JENG-01-0038
Page 3 of 3

A Design Change is proposed for the 2002 refuel outage (R15) to alleviate the voltage drop restraints and to bring the aging and design margins more in line with industry standards, IEEE-485 (see PID 93660). Implementation of this modification will also eliminate the need for accelerated battery replacement. DER 01-00666 was initiated to document this condition.

The above actions will ensure continued operability beyond the 2002 refuel outage (R15).

Brian Marks

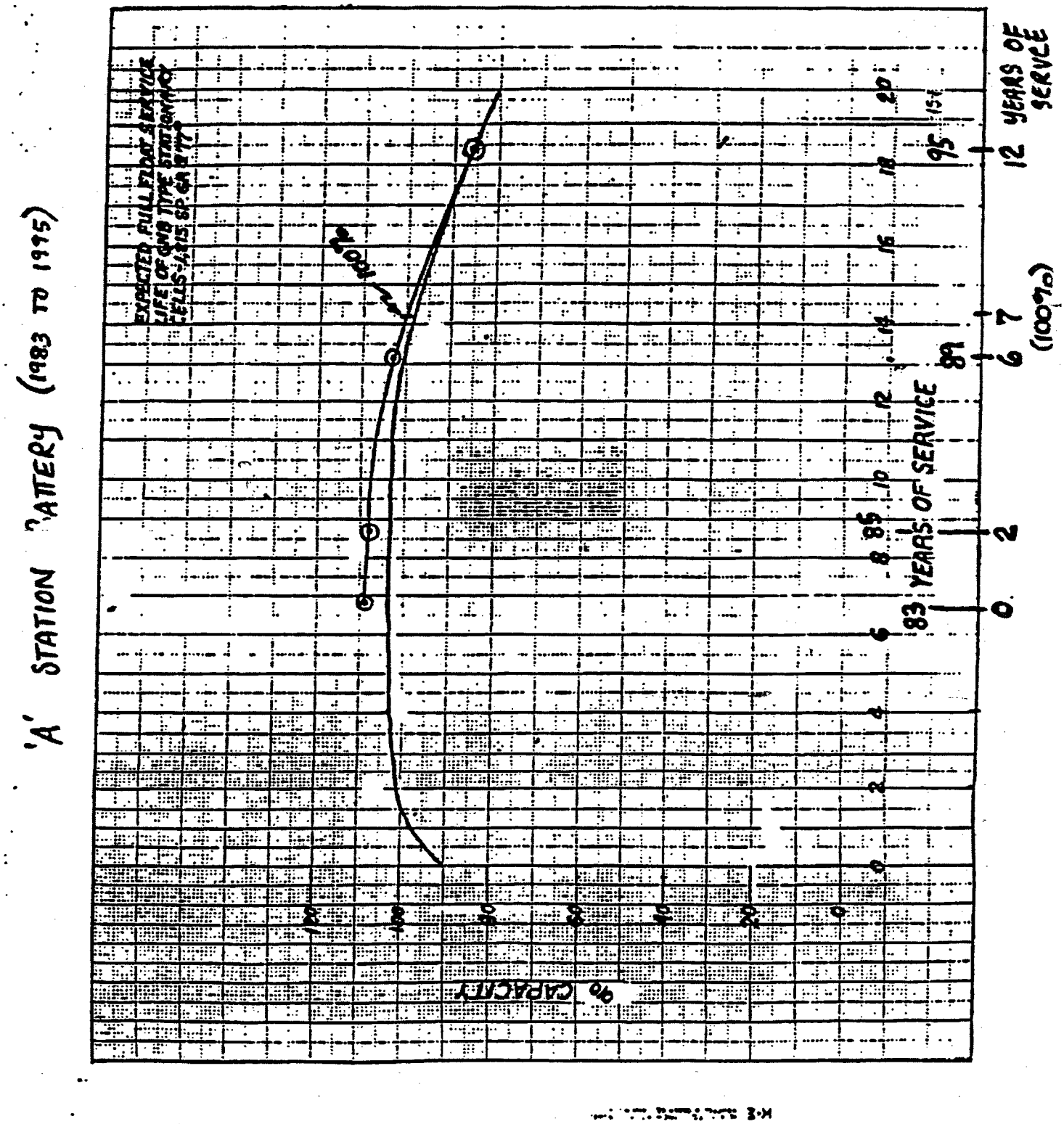
B. MARKS
ELECTRICAL ENGINEER

BM:cf

Attachments

CC: J. Stead
A. Barton
D Starczeski
T. Andersen
B Lonberger
T. Savory
M Abramski
D Parker
RMS
JENG File

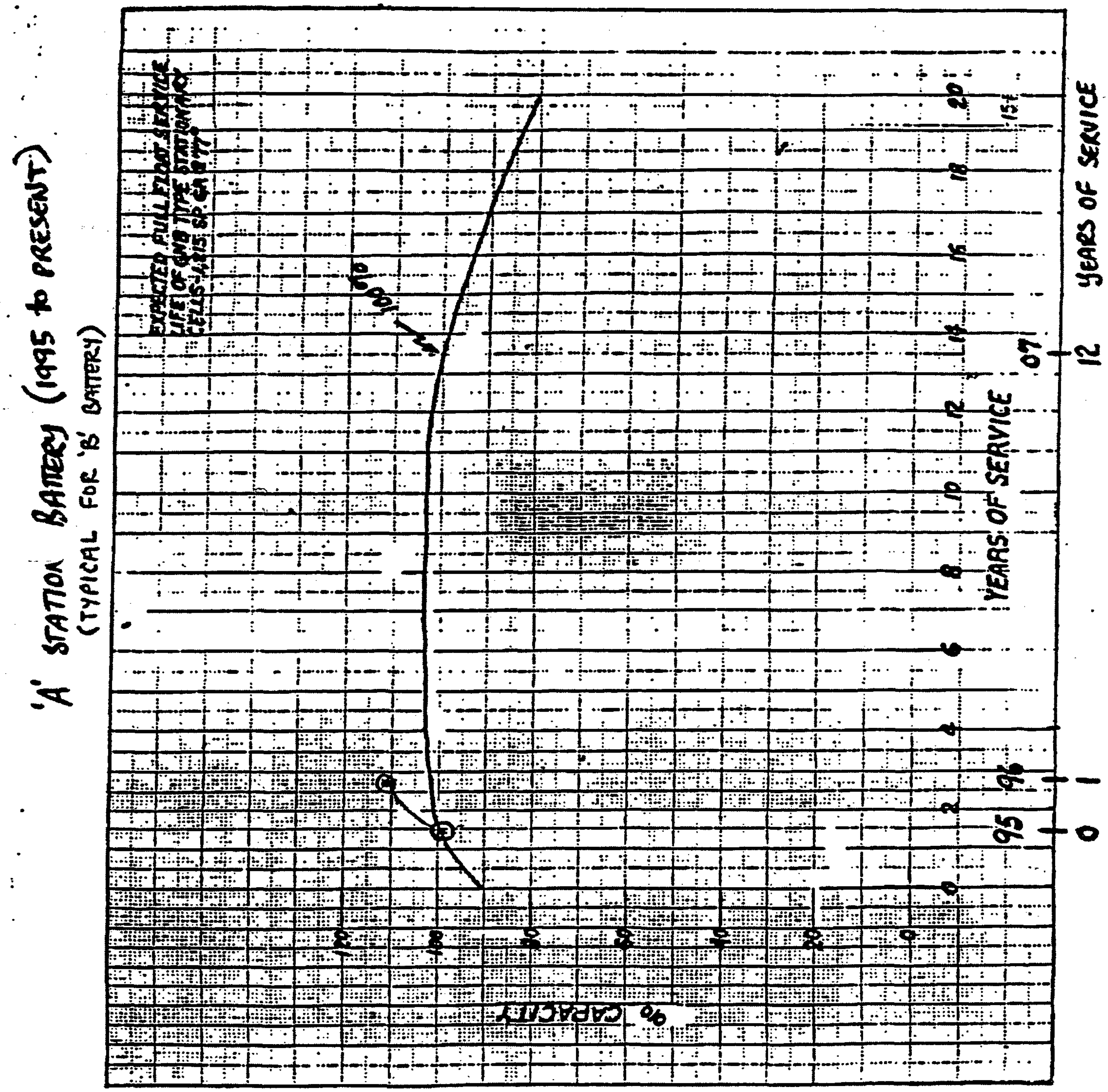
ATTACHMENT 1



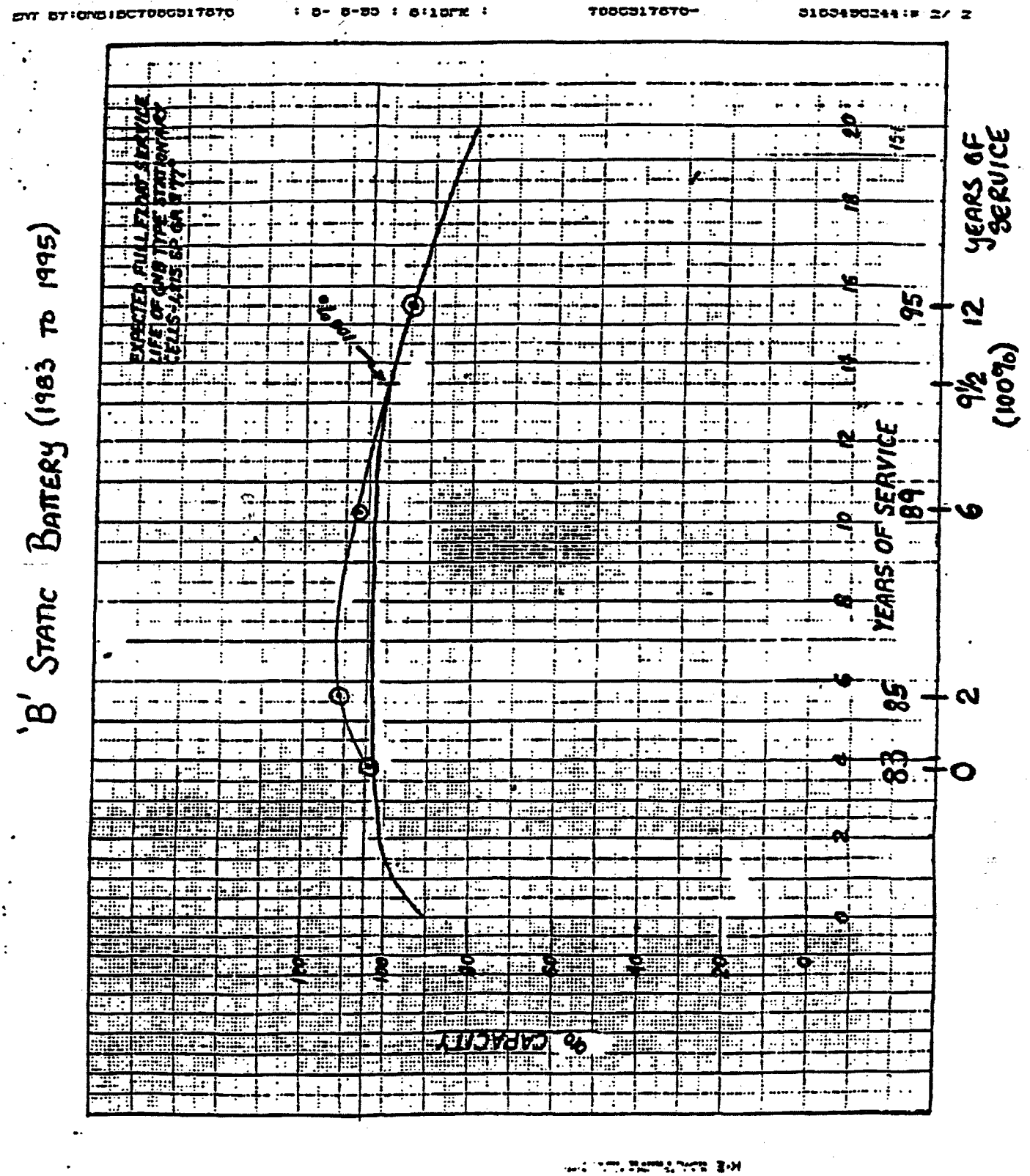
a

ATTACHMENT 2

SENT BY:GNB ISC7080317870 ; 5- 6-93 ; 5:10PM ; 7080317870- 3103490244:# 2/ 2



ATTACHMENT 3



Date	Rate	Duration	End Voltage	# Of Cells	Capacity	Comments
7/17/83	309 Amps	8 Hour	1.75vpc	60	109%	This factory test was stopped at 8 hours (108.41vdc). Capacity estimated to 111% using an excell growth trend (to 105vdc). The rate of 309amps is slightly less than the present temperature corrected discharge rate of 311amps (revised curves). An additional item not accounted for is that the factory test does not consider voltage drop in intertier jumpers (appr 0.13volts). Therefore an additional adjustment (engineering judgement) will make it 109%.
3/4/85	286 Amps	8 Hour	1.75vpc	60	107.5%	Not adjusted for the new discharge rates. The test results are not accurate. The voltage at 8 hours was 107.57vdc. The voltage at the 8 hour mark during the 1983 test was 108.41vdc. The capcity of 101.25% does not appear accurate. The work package does not support this value. Based on the length of time the 1/12/95 test took to get from 107.5 to 105vdc (36 minute), the value of 101.25% can't be accurate. If 36 minutes is added to this test, the value then becomes 107.5%
9/29/89	296 Amps	8 Hour	1.75vpc	58	103.1%	Not adjusted for the new discharge rates. Test was interrupted for 9-1/2 minutes to jumper out low voltage cell. Allowed the battery to "recover". This would tend to show more capacity. The test results will be adjusted down 1.5% from the recorded value of 104.6%. Therefore, the test results then become 103.1%
1/12/95	552 Amps	3 Hour	1.81vpc	58	86%	Modified performance test. No equalize performed prior to test. Also, an additional voltage drop in intertier jumpers of about 0.11 vdc due to higher rate.
New Battery Installed 9/9/95						
8/25/95	595	3 Hour	1.81	58	98.9%	Factory Test. Although the test configuration was slightly different than the installed configuration, the 4/O cables used provided sufficient resistance to simulate our installed configuration. This was a modified performance test.
11/5/96	588	3 Hour	1.783	58	112.40%	Modified performance test. No equalize performed prior to test.

ATTACHMENT 4

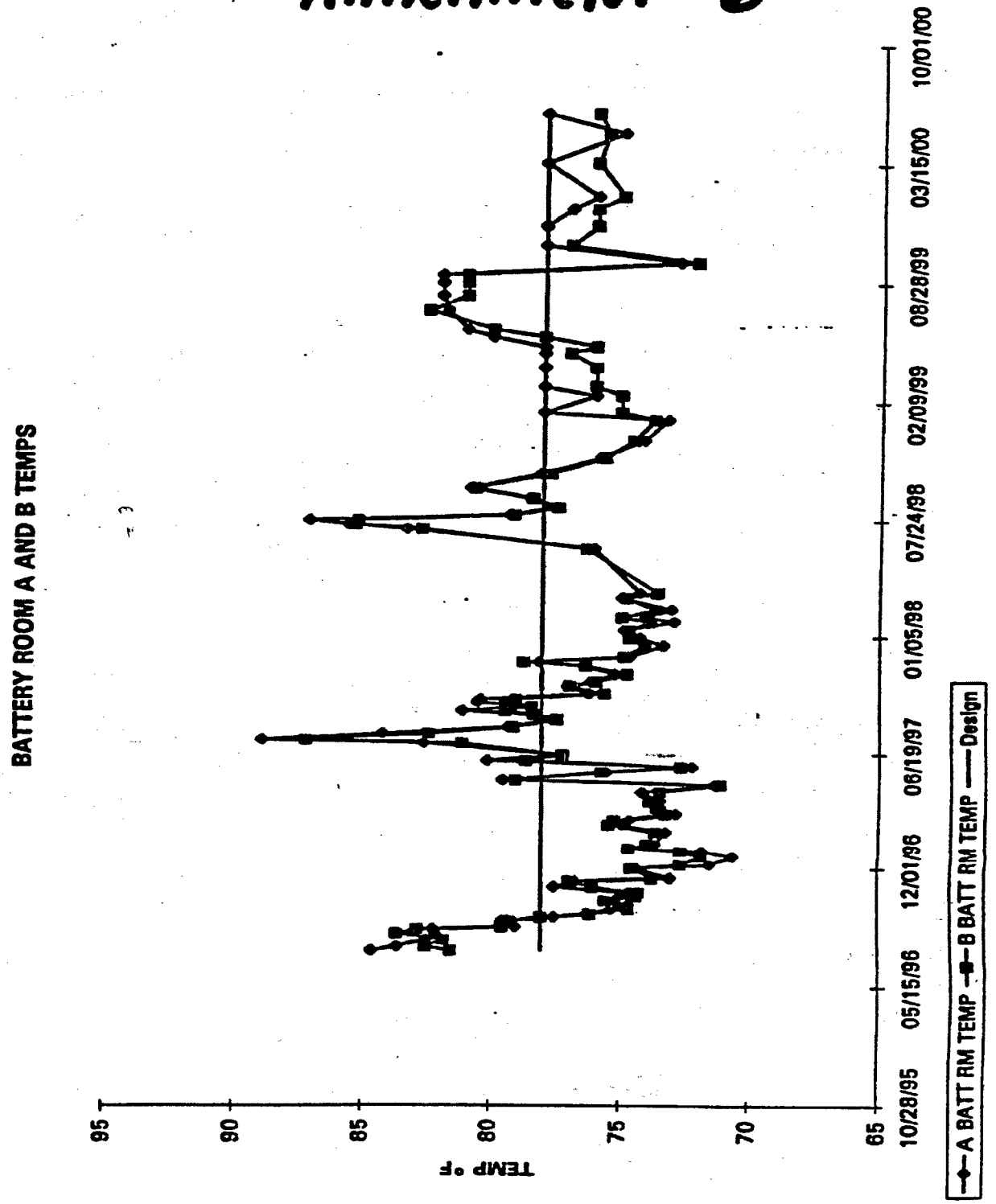
"B" Station Battery

1/8/01

Date	Rate	Duration	End Voltage	# Of Cells	Capacity	Comments
7/16/83	309	8 Hour	1.75vpc	60	104%	This factory test was stopped at 8 hours (107.27vdc). Capacity estimated to 106% using an excell growth trend (to 105vdc). The rate of 300amps is slightly less than the present 8 hour discharge rate of 302amps (revised curves). An additional item not accounted for is that the factory test does not consider voltage drop in intertier jumpers (appr 0.13volts). Therefore an additional adjustment (engineering judgement) will make it 104%.
3/12/85	286	8 Hour	1.75vpc	60	111.7%	Not adjusted for the new discharge rates. The test results are not accurate. The voltage at 8 hours was 108.66vdc. The voltage at the 8 hour mark during the 1983 test was 107.27vdc. The capcity of 101.25% does not appear accurate. The work package does not support this value. Based on the length of time the 1/4/95 test took to get from 108.6 to 105vdc (56 minutes), the value of 101.25% can't be accurate. If 36 minutes is added to this test, the value then becomes 111.7%
9/20/89	300	8 Hour	1.75vpc	58	107%	Test results measured 110% capacity. However this test was adjusted down 3% (see item #3 in JMD-95-018 & JAF-CALC-ELEC-01962) which results in 107% capacity.
1/4/95	558	3 Hour	1.81vpc	58	95%	Modified performance test. No equalize performed prior to test. Also, an additional voltage drop in intertier jumpers of about 0.11 vdc due to higher rate.
New Battery Installed 11/13/96						
7/16/96	607	3 Hour	1.81vpc	58	95%	Factory Test. This was a modified performance test.
11/14/96	575	3 Hour	1.77vpc	60	111%	Modified performance test. No equalize performed prior to test.

ATTACHMENT 5

ATTACHMENT 6



125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 8
Manufacturer's Data and Reference Material

TABLE OF CONTENTS

Okonite Cables
Section 1

General Conductor Information
dc Resistance

Resistance in Ohms per 1000 feet per conductor at 20°C and 25°C of solid wire and class B concentric strands copper and aluminum conductor

Table 1-3

Conductor Size AWG or kcmil	ANNEALED UNCOATED COPPER ANNEALED ALUMINUM								ANNEALED COATED COPPER			
	Solid				Stranded Class B				Solid		Stranded Class B	
	20°C		25°C*		20°C		25°C*		20°C	25°C*	20°C	25°C*
	CU	AL	CU	AL	CU	AL	CU	AL	CU	CU	CU	CU
24	25.7	—	26.2	—	—	—	—	—	26.8	27.3	—	—
22	16.2	—	16.5	—	—	—	—	—	16.9	17.2	—	—
20	10.1	—	10.3	—	10.3	—	10.5	—	10.5	10.7	11.0	11.2
19	8.05	—	8.21	—	—	—	—	—	8.37	8.53	—	—
18	6.39	—	6.51	—	6.51	—	6.64	—	6.64	6.77	6.92	7.05
16	4.02	—	4.10	—	4.10	—	4.18	—	4.18	4.26	4.35	4.44
14	2.52	4.14	2.57	4.22	2.57	—	2.62	—	2.62	2.68	2.68	2.73
12	1.59	2.60	1.62	2.66	1.62	2.65	1.65	2.70	1.62	1.68	1.68	1.72
10	0.999	1.64	1.02	1.67	1.02	1.67	1.04	1.70	1.04	1.06	1.06	1.08
9	0.792	1.30	0.808	1.32	0.808	1.33	0.824	1.35	0.816	0.831	0.840	0.857
8	0.628	1.03	0.641	1.05	0.641	1.05	0.654	1.07	0.646	0.659	0.666	0.679
7	0.498	.817	0.508	.833	0.518	.833	0.518	0.850	0.513	0.523	0.528	0.539
6	0.395	.648	0.403	.661	0.403	.661	0.410	0.674	0.407	0.415	0.419	0.427
5	0.313	.514	0.319	.524	0.320	.524	0.326	0.535	0.323	0.329	0.333	0.339
4	0.248	.407	0.253	.415	0.253	.416	0.259	0.424	0.256	0.261	0.264	0.269
3	0.197	.323	0.201	.330	0.205	.330	0.205	0.336	0.203	0.207	0.209	0.213
2	0.156	.256	0.159	.261	0.159	.262	0.162	0.267	0.161	0.164	0.166	0.169
1	0.124	.203	0.126	.207	0.126	.206	0.129	0.211	0.128	0.130	0.131	0.134
1/0	0.0982	.161	0.100	.164	0.100	.165	0.102	0.168	0.101	0.103	0.104	0.106
2/0	0.0779	.128	0.0795	.130	0.0795	.131	0.0811	0.133	0.0798	0.0814	0.0827	0.0843
3/0	0.0618	.101	0.0630	.103	0.0630	.103	0.0642	0.105	0.0633	0.0645	0.0656	0.0668
4/0	0.0490	.0803	0.0500	.082	0.0500	.0821	0.0509	0.0836	0.0502	0.0512	0.0515	0.0525
250	—	—	—	—	0.0423	.0695	0.0431	0.0708	—	—	0.0440	0.0449
300	—	—	—	—	0.0353	.0579	0.0360	0.0590	—	—	0.0367	0.0374
350	—	—	—	—	0.0302	.0496	0.0308	0.0505	—	—	0.0314	0.0320
400	—	—	—	—	0.0264	.0434	0.0270	0.0442	—	—	0.0272	0.0278
500	—	—	—	—	0.0212	.0348	0.0216	0.0354	—	—	0.0218	0.0222
600	—	—	—	—	0.0176	.0290	0.0180	0.0295	—	—	0.0184	0.0187
750	—	—	—	—	0.0141	.0232	0.0144	0.0236	—	—	0.0145	0.0148
1000	—	—	—	—	0.0106	.0174	0.0108	0.0177	—	—	0.0109	0.0111
1250	—	—	—	—	0.00846	.0139	0.00863	0.0142	—	—	0.00871	0.00888
1500	—	—	—	—	0.00705	.0116	0.00719	0.0116	—	—	0.00726	0.00740
1750	—	—	—	—	0.00604	.00992	0.00616	0.0101	—	—	0.00622	0.00634
2000	—	—	—	—	0.00529	.00869	0.00539	0.00885	—	—	0.00544	0.00555
2500	—	—	—	—	0.00427	.00702	0.00436	0.00715	—	—	0.00440	0.00448

*NOTE: To determine resistance for temperatures other than 25°C use a multiplying factor shown on page 4.

Okonite Cables
Section 1

General Conductor Information
dc Resistance

Based on the resistance-temperature coefficient of copper of 100 percent conductivity and of aluminum 61 percent conductivity (international annealed copper standard) at 25°C and the formulas:

R_1 = Resistance at 25°C
R_2 = Resistance at desired temp. T_2
T_1 = 25°C

Copper

$$R_2 = R_1\left[\frac{234.5 + T_2}{234.5 + T_1}\right]$$

Aluminum

$$R_2 = R_1\left[\frac{228.1 + T_2}{228.1 + T_1}\right]$$

Example:
R dc at 75°C for 4/0 AWG uncoated copper = 0.0509 x 1.193 = .0607 ohms/1000 ft.

Resistance temperature correction factors
Copper Conductors

Table 1-

Temp. C	0	1	2	3	4	5	6	7	8	9
0	.904	.908	.911	.915	.919	.923	.927	.931	.934	.938
10	.942	.946	.950	.954	.958	.961	.965	.969	.973	.977
20	.981	.985	.988	.992	.996	1.000	1.004	1.008	1.012	1.015
30	1.019	1.023	1.027	1.031	1.035	1.039	1.042	1.046	1.050	1.054
40	1.058	1.062	1.066	1.069	1.073	1.077	1.081	1.085	1.089	1.092
50	1.096	1.100	1.104	1.108	1.111	1.115	1.119	1.123	1.127	1.131
60	1.135	1.139	1.143	1.146	1.150	1.154	1.158	1.162	1.166	1.170
70	1.173	1.177	1.181	1.185	1.189	1.193	1.197	1.200	1.204	1.208
80	1.212	1.216	1.220	1.224	1.227	1.231	1.235	1.239	1.243	1.247
90	1.250	1.254	1.258	1.262	1.266	1.270	1.274	1.277	1.281	1.285
100	1.289	1.293	1.297	1.300	1.304	1.308	1.312	1.316	1.320	1.324
110	1.328	1.331	1.335	1.339	1.343	1.347	1.351	1.354	1.358	1.362
120	1.366	1.370	1.374	1.378	1.381	1.385	1.389	1.393	1.397	1.400
130	1.405	1.408	1.412	1.416	1.420	1.424	1.428	1.432	1.435	1.439
140	1.443	1.447	1.451	1.455	1.459	1.462	1.466	1.470	1.474	1.478
150	1.482	1.480	1.489	1.493	1.497	1.500	1.505	1.509	1.513	1.516

Aluminum Conductors

Temp. C	0	1	2	3	4	5	6	7	8	9
0	.901	.905	.909	.913	.917	.921	.925	.928	.932	.936
10	.940	.944	.948	.952	.956	.960	.964	.968	.972	.976
20	.980	.984	.988	.992	.996	1.000	1.004	1.008	1.012	1.016
30	1.020	1.024	1.028	1.032	1.036	1.040	1.044	1.048	1.052	1.056
40	1.060	1.064	1.068	1.072	1.076	1.080	1.084	1.088	1.092	1.096
50	1.100	1.104	1.108	1.112	1.116	1.120	1.124	1.128	1.132	1.136
60	1.140	1.144	1.148	1.152	1.156	1.160	1.164	1.168	1.172	1.176
70	1.180	1.184	1.187	1.191	1.195	1.199	1.203	1.207	1.211	1.215
80	1.219	1.223	1.227	1.231	1.235	1.239	1.243	1.246	1.250	1.254
90	1.258	1.262	1.266	1.270	1.274	1.278	1.281	1.285	1.289	1.293
100	1.297	1.301	1.304	1.308	1.311	1.315	1.319	1.324	1.328	1.332
110	1.336	1.340	1.343	1.347	1.351	1.355	1.359	1.362	1.366	1.370
120	1.374	1.378	1.381	1.385	1.389	1.393	1.397	1.401	1.405	1.409
130	1.413	1.417	1.420	1.424	1.428	1.432	1.436	1.440	1.444	1.448
140	1.452	1.456	1.459	1.463	1.467	1.471	1.475	1.479	1.483	1.487
150	1.491	1.495	1.498	1.502	1.506	1.510	1.514	1.518	1.522	1.526

OCT-25-01 THU 02:38 PM 53 FAX NO. 3152549849764 P.01

ASCO SERVICES, INC.
A Subsidiary of Automatic Switch Co.

FAX

From: Doug Meidling Tel: 973-966-2339
Technical & Training Specialist Fax: 973-966-2431

To: Alex Barton Co.: JAF NPP, Des Eng Dept.

Date: 10/25 /01 Fax : (315)-349-6981 Pages:

Dear Mr. Barton,

Enclosed is all the information I could find on this product. The original serial number specified the coil used, that S/N is no longer available. If you can see the number on the coil I could tell you what the resistance should be. If it is a 10-417-8 the Resistance is 1607 ohms +/- 10 %.
Pick-up was probably set for 75 to 80% of control voltage
Doug

Doug

PS: Note the date on bottom of page (1957)

NORMALLY OPEN D-C CONTACTORS

FOR ALL CLASSES OF LOAD TO 250 VOLTS D-C

Section BULLETIN 1025

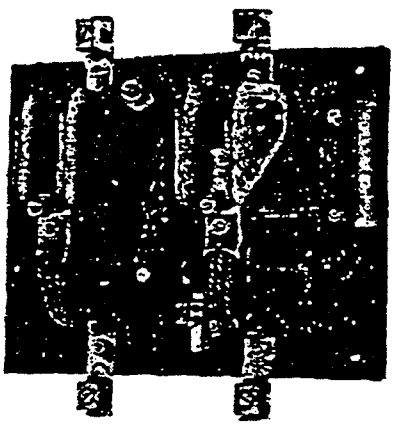


Figure 7. 2 Pole, 200 Ampere, Catalog No. 2514.

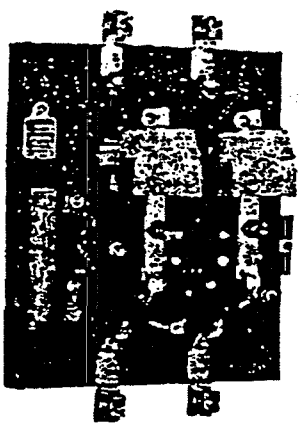


Figure 8. 2 Pole, 60 Ampere, Catalog No. 2508.

Application

Bulletin 1025 Contactors are used for all classes of direct current loads including tungsten lamp and motor loads. These contactors provide a safe and convenient means of repeatedly making and breaking electric circuits either manually by push buttons or automatically by sensitive relays or instruments.

Listed contactors are 2 and 3 pole normally open and are available with or without enclosures and with front or back connections. Multi-pole arrangements are available as required.

Auxiliary contacts, either normally open or normally closed, can be added to any listed contactor.

Construction

Bulletin 1025 Contactors are listed as standard with copper or silver alloy contacts. The contact action in all sizes is adjustable and contacts are readily replaced from the front of the panels.

Each pole is equipped with an unusual design of current coil type magnetic blowout, developed by the Automatic Switch Company, which provides directed control of the arc away from the current carrying contact surfaces.

Panels are ebony asbestos and flush dead construction.

Enclosures are NEMA 1 type, black finish for surface mounting. Weather resistant, dust tight or watertight enclosures are available along with enclosures suitable for flush mounting or hazardous locations; prices will be furnished on request.

Operating Currents

The values tabulated are based on cold coil resistance. Consequently they represent maximum currents. The closing current in many sizes is greater than the holding currents. The momentary higher current value is used, on closing, to insure positive and rapid response. When the contactor is closed additional resistance is automatically connected in series with the contactor coil reducing the current to the values shown.

All D-C contactors will pick up and close at 80% of normal voltage with the coil at its maximum temperature rise. They will withstand 10% overvoltage without damage to the coil windings.

OPERATING CURRENTS AT 115 VOLTS D-C
The Current Values at Other Voltages are Approximately Proportionate

Amperes	Poles	Closing Current	Holding Current	Holding Watts
30	1	0.09	0.09	10.1
	2	0.09	0.09	10.1
60	1	0.60	0.20	22.8
	2	0.50	0.20	22.8
100	1	0.60	0.20	22.8
	2	0.74	0.18	20.3
150	1	0.74	0.18	20.3
	2	1.27	0.20	22.4
200	1	0.74	0.18	20.3
	2	1.27	0.20	22.4
300	1	1.27	0.20	22.4
	2	1.27	0.20	22.4

Ratings

These contactors are listed as standard for 250 volts maximum on all classes of load, noninductive or inductive. Contactors are available for voltages above 250 volts to a maximum of 750 volts.

The 2 pole contactors can be used on 600 volt D-C systems either as single pole double break or as 2 pole contactors. When so used the resistive interrupting capacity reduces to 150% of rated current.

Ratings are in amperes and no derating is required for the enclosed type or for high inrush current loads.

ELECTRICAL SPECIFICATIONS

- RATED IN AMPERES PER POLE FOR ALL CLASSES OF DIRECT CURRENT LOADS.
- STANDARD LISTINGS IN CAPACITIES FROM 30 TO 300 AMPERES TO 250 VOLTS D-C, ONE AND TWO POLE.
- AVAILABLE TO 750 VOLTS D-C.
- INTERRUPTING CAPACITY TO 4 TIMES RATED CURRENT.
- NO DERATING FOR HIGH INRUSH CURRENTS OR ENCLOSED TYPES.

Electrical Connections

Bulletin 1025 Contactors are listed as standard with three possible control forms. Refer to Figures 2, 3, 4, and description of the various methods of control on Page 80.

Since separate control is provided on all contactors, the main line connections can be made to the top or the bottom terminals. When the line connections are made to the top terminals, the poles will be dead when the control circuit is de-energized.

Modified Arrangements

The Automatic Switch Company has manufactured many modified arrangements of Bulletin 1025 Contactors. These modifications were necessitated by conditions of space, or frequency of operation, or control functions, or other reasons.

Users are urged to avail themselves of the ASCO Engineering Service which is part of every negotiation. When a modified arrangement is indicated for any control problem, recommendations will be made on an engineering basis.

Those applications which require continuous operation at a rate of more than 6 per minute should be referred to the Company. Complete information should be submitted so that an accurate analysis and recommendation can be made. In any application where frequent closing and opening is necessary, consultation with an ASCO Engineer will assure dependable control.

Section 3

BULLETIN 1025

NORMALLY OPEN D-C CONTACTORS

FOR ALL CLASSES OF LOAD TO 250 VOLTS D-C

LIST PRICES AND AMPERE RATINGS, OPEN OR ENCLOSED

For 250 Volts D-C, Control Circuit Furnished as Separate Control

Amperes	Poles	FORM 2 2 WIRE CONTROL				FORM 3 3 WIRE "STOP-START" CONTROL				FORM 3M THERMOSTATIC CONTROL WITH RELAY			
		Open Type		Enclosed Type		Open Type		Enclosed Type		Open Type		Enclosed Type	
		Catalog No.	List Price	Catalog No.	List Price	Catalog No.	List Price	Catalog No.	List Price	Catalog No.	List Price	Catalog No.	List Price
30	1	2505	$ 47.00	2515C	$ 61.00	2525	$ 52.00	2535C	$ 67.00	2545	$ 94.00	2555C	$112.00
	2	2506	60.00	2516C	74.00	2526	67.00	2536C	81.00	2546	109.00	2556C	124.00
60	1	2507	78.00	2517C	99.00	2527	86.00	2537C	106.00	2547	131.00	2557C	155.00
	2	2508	106.00	2518C	128.00	2528	113.00	2538C	135.00	2548	160.00	2558C	186.00
100	1	2509	84.00	2519C	105.00	2529	92.00	2539C	113.00	2549	136.00	2559C	161.00
	2	2510	131.00	2520C	168.00	2530	139.00	2540C	167.00	2550	187.00	2560C	221.00
150	1	2511	107.00	2521C	134.00	2531	116.00	2541C	142.00	2551	163.00	2561C	194.00
	2	2512	212.00	2522C	247.00	2532	221.00	2542C	255.00	2552	277.00	2562C	321.00
200	1	2513	110.00	2523C	136.00	2533	119.00	2543C	145.00	2553	165.00	2563C	197.00
	2	2514	221.00	2524C	255.00	2534	229.00	2544C	264.00	2554	286.00	2564C	329.00
300	1*	2565	239.00	2567C	287.00	2569	248.00	2571C	296.00	2573	308.00	2575C	374.00
	2	2566	289.00	2568C	352.00	2570	297.00	2572C	361.00	2574	361.00	2576C	448.00

*Limited to 115 volts, D-C service. Use 2 poles in series for 230 volts D-C.

STANDARD DATA

Standard Control Voltages: 115 or 230 D-C.

Standard Panels: Front connected, flush dead back, ebony asbestos.

Standard Cabinets: NEMA 1, for surface mounting.

Contactors can be furnished with A-C operating coils at prices listed.

Solderless lugs furnished as standard equipment.

Enclosed type ratings are continuous and the same as open type.

ADDITIONAL FEATURES

Special Control Voltages:
To 250 D-C.....Add $7.00 List
To 750 D-C.....Consult Factory

3 or More Poles.....Consult Factory

Back Connected Panels.....Add 10%

2 Contactors mechanically interlocked on a common panel—Add $9.00 list to price of two contactors.

Auxiliary Contacts .....$9.00 List Each (For maximum of two auxiliaries added to Form 2 Contactors. Prices on request for more than two).

Control Stations: Standard duty with steel box for surface mounting.
Type C for Form 2.....$11.00 List
Type D for Form 3.....$11.00 List

Special pole combinations available.

WHEN ORDERING

Specify catalog number, voltage and frequency of line and control circuits, and type of cabinet if other than NEMA 1.

†DIMENSIONS and WEIGHTS for FORM 2 and FORM 3 250 Volts D-C

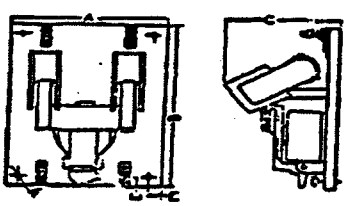


Figure 9. Outline Dimensions.

† For Form 3M Control, the addition of the thermostatic control relay will add approximately 3" to the width.

Amperes	Poles	Lug Overhang		OPEN TYPE							ENCLOSED TYPE			
		Line	Battery	A	B	C	D	E	F	Weight	Width	Height	Depth	Weight
30	1	0	0	4	6	3⅛	½	½	⅛	8	6	10	4½	14
	2	0	0	4	6	3¼	½	½	⅛	9	6	10	4½	15
60	1	5/16	5/16	6	10	5¼	⅛	⅝	5/16	17	8	14	4½	24
	2	⅜	⅜	8	10	5⅛	⅛	⅝	5/16	16	10	14	6½	31
100	1	⅝	1	6	10	5¼	⅛	⅝	½	12	8	16	7	27
	2	1	1⅛	10	10½	6½	1	⅝	½	24	12	17	7½	48
150	1	1⅜	1¼	6½	12	7	⅛	⅝	½	20	8½	21	8	39
	2	1⅛	1½	11	13	6½	1	⅝	½	28	13	21	7½	48
200	1	1⅜	1¼	6¼	12	6	⅛	⅝	½	20	8½	21	8	39
	2	1⅛	1½	11	13	6½	1	⅝	½	28	13	21	7½	48
300	1	1½	1¼	13½	14	6½	1	⅝	½	27	16	27	7½	72
	2	1⅛	1¼	20	14	6½	1	⅝	½	44	23	27	7½	112

All weights are approximate shipping weights in pounds. All dimensions are in inches.

Barton, Alex 71DC-B2 CKT 2

From: ASCOBILL@aol.com
Sent: November 20, 2001 08:23 AM
To: Barton, Alex
Subject: Re: 03SOV-14B (71DC-B2 Ckt.

In a message dated 11/19/01 6:41:43 PM Eastern Standard Time, ABarto1@entergy.com writes:

> Subj: **RE: 03SOV-14B (71DC-B2 Ckt. 2)**
> Date: 11/19/01 6:41:43 PM Eastern Standard Time
> *From: ABarto1@entergy.com (Barton, Alex)*
> *To: ASCOBILL@aol.com ('ASCOBILL@aol.com')*
>
> Bill,
> I need a minimum pick up and drop out voltage, and Wattage for 125 VDC:
>
> HYDRAULIC CONTROL UNITS BACKUP SCRAM PILOT SOLENOID VLV EQ
> AUTOMATIC SWITCH CO (ASCO) SOV MODEL NO. NP8316E36E
>
> Thanks
> Alex Barton
> JAF NPP
> 315-349-6622
> fax 315-349-6981

Hello Alex - the NP8316E36E in 125vdc uses a coil p/n 220339-010-D which is rated at 17.4 watts. Voltage range of 90-140 vdc with 125 as the nominal. Regards, Bill Meyer

71DC-B2 CKT. 9

Barton, Alex

From: Barton, Alex
Sent: Friday, April 26, 2002 9:03 AM
To: 'ASCOBILL@aol.com'
Subject: RE: 31FPD-5A (71DC-A2 Ckt. 8)

Bill,

I need a minimum pick up and drop out voltage for 125 VDC RFPT SOLENOID :

ASCO BULLETIN 1300-106 CAT # 106A231 125 VDC 100 WATT CONTINUOUS DUTY, CLASS H HI TEMP COIL
Ref GE Drawing No. 128C22FC Rev .1

Thanks
Alex Barton
JAF NPP
315-349-6622
fax 315-349-6981

Barton, Alex

From: ASCOBILL@aol.com
Sent: Friday, April 26, 2002 10:48 AM
To: Barton, Alex
Subject: Re: 31FPD-5A (71DC-A2 Ckt. 8)

Hi Alex....all our 125vdc rated coils will operate within a range of 90-140 volts DC.
Best regards, Bill Meyer - Asco Valve sales engineer.

71DC-B2 Ckt #10

AUG-19-97 TUE 10:48 AM ASCO VALVE MKTG FAX NO. 2019667314 P. 01

Automatic Switch Co.

FLORHAM PARK, N.J.

FAX 201-966-7314

TO: *(315) 349-6931*
FAX NUMBER

AT: *NEW YORK POWER AUTHORITY*
COMPANY/LOCATION

FOR: *ALEX BARTON*
NAME OF ADDRESSEE

FROM: *RICH MATYSKIEL, NUCLEAR SALES* DATE: *8 - 19 - 97*
Tel: (201) 966-2258

SPECIAL INSTRUCTIONS:

Alex:

The minimum pickup and dropout voltage for an ASCO nuclear qualified 206-381-6RF, 125 VDC, 35.1 watt valve is 90 VDC.

This is the minimum voltage the valve has been qualified to. Keep in mind that the valve will pickup and drop out at lower voltages depending on additional factors including operating pressure, valve installed life, etc., but ASCO NP-1, 125 VDC valves have only been qualified to a minimum voltage of 90 VDC.

Rich
Nuclear Sales

1 PAGE(S) INCLUDING THIS COVER PAGE

Barton, Alex

From: ASCOBILL@aol.com
Sent: Monday, November 26, 2001 11:29 AM
To: Barton, Alex
Subject: Re: FW: ASCO Solenoid NP8320A186E

In a message dated 11/24/01 12:33:16 PM Eastern Standard Time, ABarto1@entergy.com writes:

> Subj: **FW: ASCO Solenoid NP8320A186E**
> Date: 11/24/01 12:33:16 PM Eastern Standard Time
> *From: ABarto1@entergy.com (Barton, Alex)*
> *To: ASCOBILL@aol.com ('ASCO - Bill Mayer')*
>
> > Bill;
> > I need a minimum pick up and drop out voltage, and Wattage for 125 VDC:
> > ASCO Solenoid NP8320A186E
> >
> > Thanks
> > Alex Barton
> > JAF NPP
> > 315-349-6622
> > fax 315-349-6981

Hello Alex... the NP8320A186E uses a coil p/n 220339-010-D rated at 17.4 watts with a voltage range from 90-140 volts with 125/dc as the nominal. Regards, Bill Meyer

10SOV-101A, -101B, -101C, -101D

Barton, Alex

From: ASCOBILL@aol.com
Sent: November 15, 2001 01:21 PM
To: Barton, Alex
Subject: Your Asco Valve request for information

Hello Alex - Asco valve p/n HC8210C13 - 125vdc uses a coil p/n 222184-016-D rated at 26.6 watts. It is designed to operate within a range of 90-140 volts with 125 as the nominal. Thank you for your inquiry. Best regards, Bill Meyer - Asco Valve sales engineer

10SOV-101A, -101B, -101C, -101D (Cont'd)

ASCO®

FLORHAM PARK, N.J.
FAX 973-966-2273
www.ASCOVALVE.com

QUOTE NO:

TO FAX NO:	315-349-6981	AVD TECHNICAL GROUP (PH - 973-966-2082)
COMPANY:	FITZPATRIC NUCLEAR POWER	__ KARL BINDER/MANAGER
ATTN:	ALEX	__ JEFF BRILL
		__ JAME CHIU
		__ RICH MATYSKIEL
		XX DAN ZARZYCKI

DATE: 11/15/01

REF: HC8210C13 125/DC

ABOVE VALVE TAKES COIL PART NUMBER 222184-016-D
WATTAGE: 26.6
COIL OPERATING RANGE: 90 TO 140 /DC

SEE ATTACHED SUPPORTING DOCUMENTATION.

PLEASE NOTE FAX NO. REFERENCED ABOVE FOR AVD INQUIRIES

Prices quoted are firm for 30 days from date of quote.

SUBJECT TO ASCO TERMS AND CONDITIONS OF SALE

ORDER ENTRY POLICY: If an order is placed for the above valves, please reference assigned Quote No. and send copy of this quote with Purchase Order.

REGARDS,

DAN ZARZYCKI

3 PAGE (S) INCLUDING THIS COVER PAGE

4 kV SWGR 71H6 Units 10610 and 10620 RHR Motor Cooling SOV's

10SOV-101A, -101B, -101C, -101D (Cont'd)

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VI06                  VALVE CROSS REFERENCE - NOTE INQUIRY                PAGE 001

PREFIX1   PFX2 PFX3 CATALOG NO  SUFFIX1 SFX2 SUFFIX3   TPL     CSA
          HC        8210C013
SOLA:VOLTAGE          LL AC/DC    SOLB:VOLTAGE          LL AC/DC
   125/DC             D    D
MSA SYSTEM NUMBER:
 SEQ NO                      NOTE DESCRIPTION
  016     HC8210C13
  018     AIR: 5-250   WATER: 5-200   LT OIL: 5-200
  019     **********************************
  020     **********
  021     WATTS:  26.6 PIPE: 3/4
  610     ERUUU801 -- 07/15/82 RNM ISSUED FOR S.O. 76183K.
  611     ER00103568  A 830216 PWC ADDED REBLD KIT/DEL SPK
  612     ER00109829  B 022184 AEW SOL ASSY WAS 158038-2H
  613     ER110444  C 03/20/84 AEW COIL WAS 96-824-HC.
  614     ER00112358  D 840923 PWC ADDED N/P INFO

                                                    *PF5 TO RETURN TO VI04
* DEPRESS PF12 TO PAGE FORWARD - PF2 FOR FIRST PAGE
* DEPRESS PF1 TO RETURN TO MENU
```

ASCO®

Engineering Information
Solenoid Valves

Coil Operating Voltage Ranges

All coils are designed for industrial operating voltages and can be used on the following voltage ranges:

AC		DC	
Nominal Voltage Rating	Normal Operating Range	Nominal Voltage Rating	Normal Operating Range
24	20-24	6	5.1-6.3
120	102-120	12	10.2-12.6
—	—	24	20-25
240	204-240	120	102-126
480	408-480	240	204-252

Note: Special coils are required for battery charging circuits where wider voltage ranges are typically encountered. For these applications, special continuous duty Class H coils are available that will accommodate a voltage range equivalent to 12% over nominal, 28% under nominal, and a 140°F (60°C) ambient. Standard nominal voltages are 125 and 250 DC, which translate to a voltage range of 90-140 and 180-280, respectively. Add prefix "HC" to the catalog number. "HC" prefix is only applicable to valves with coil classes FT and HT. *Consult factory or other constructions.*

Most ASCO valves, depending on construction, will operate at 15% under nominal voltage and maximum operating pressure differential, and are capable of operating for short periods at 10% over nominal voltage. For coil classes other than FT and HT, over votage is not recommended. *For wider voltage ranges than shown here or for operating voltage ranges for specific catalog numbers, please consult your local ASCO sales office.*

Power Consumption

Power consumption can be determined from the ratings shown on individual Series pages. For AC valves, the watts, volt-ampere "inrush" (the high momentary surge occurring at coil energization), and volt-ampere "holding" (the continuous draw following inrush) are given.

The current rating for inrush and holding may be determined by dividing the voltage into the volt-amp rating:

$$\text{Inrush Amps} = \frac{\text{volt-amp inrush}}{\text{voltage}}$$

$$\text{Holding Amps} = \frac{\text{volt-amp holding}}{\text{voltage}}$$

DC valves have no inrush current. The amp rating can be determined by dividing the voltage into the DC watt rating:

$$\text{Amps} = \frac{\text{watts (DC)}}{\text{voltage}}$$

Notes:

1. When a valve has been energized for a long period, the solenoid becomes hot and can be touched by hand for only an instant. This is a perfectly safe operating temperature. Any excessive heating will be indicated by smoke and the odor of burning coil insulation.

2. Valves for AC service can be converted to other AC voltages simply by changing the coil. Similarly, DC valves can be converted to other DC voltages. *When converting from AC to DC, or vice versa, consult your local ASCO sales office for instructions.*

Solenoid Constructions

Internal parts in contact with fluids are of non-magnetic 300 and magnetic 400 series stainless steel. In AC constructions, the shading coil is normally copper, except that silver is mostly used in valves with stainless steel bodies. Other materials are available, when required. In DC constructions, no shading coil is required. Typically, the core tubes are of 300 series stainless steel and are formed by deep drawings, eliminating the need for silver brazed or welded joints.

NEW YORK POWER AUTHORITY
JAMES A. FITZPATRICK NUCLEAR POWER PLANT
QUALIFICATION DOCUMENTATION REPORT

QDR NO. 35.8

SUBJECT: TARGET ROCK 1/2 SMS-S-02-1 SOLENOID VALVE

This report supersedes the following EQ Reference Files:

EQ REFERENCE #227

Prepared by Roland Ho Kenneth D. Moody Date 3/2/96
For W. Hotchkiss

Reviewed by Michael Durr Date 3/2/96

Approved by George J. Tasick Date 3/2/96

Revision	Pages Affected	Prepared	Reviewed	Approved
1	Sections 2.0,7.0, 3.1.1, 3.2.1.2, 3.2.1.3, 3.2.2, 3.2.3, 3.2.5, 4.7, 4.8, and Fig. 1-1	W. Hotchkiss	Michael Durr 11/7/96	J. Stuart 11/8/96

Actuator assembly shall be a nominal 125 VDC system with a voltage range of 92 VDC to 154 VDC.

3.2.2 Pneumatic Power Supply

The pneumatic power supply available to operate the Electropneumatic Actuator assembly shall supply air or nitrogen at pressures up to 260 PSIG. The system flow capability shall be 50 SCFM at 100 PSIG minimum. The air or nitrogen shall be oil free, filtered to 50 micons maximum and have a dew point of (-) 24°F at atmospheric pressure.

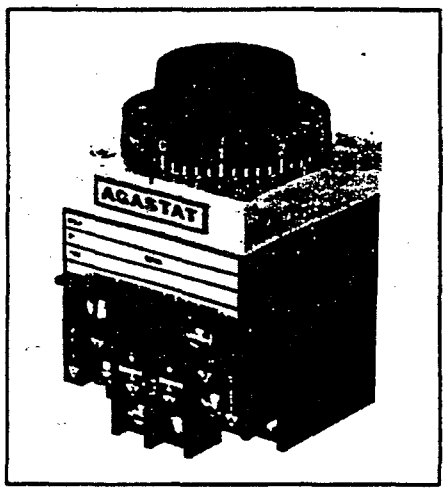
3.2.3 Electrical Enclosure

The electrical connection between the solenoid coil and the electrical system is through the 3/4 inch NPT opening into the electrical enclosure. The power leads are connected to one side of the terminal board and the solenoid coil lead wires are connected to the opposite side. The electrical enclosure seals are Viton O-rings. Since the solenoid coil may be field wired using open raceways, the electrical enclosures of the test valves shall also be open to the ambient environment. After the electrical connection is made, the wires, terminals and terminal boards shall be sprayed with a conformal coating to deposit a protective covering of silicone resin on the electrical connection. The conformal coating application procedure shall be included in the final test report for reference. The external hook up wires connecting the three way solenoid valves to the control circuits during testing are not included in the environmental qualification program.

series E7000 seismic & radiation-tested timing relays

AGASTAT® Series E7000 Timing Relays are suitable for class 1E service in nuclear power generating stations and comply with the requirements of IEEE Standard 323-1974 and IEEE Standard 344-1975. Testing was also referenced to ANSI/IEEE C37.98.

The present Series E7000 design was evolved over 40 years of continual field use in a wide range of industrial applications. On-Delay, Off-Delay and Four-Pole versions are available for use with a choice of 25 coil voltages, as well as time-calibrated delay adjustments to as long as 60 minutes.



Test Procedure

AGASTAT® Timing Relay Models E7012, E7022, E7014 and E7024 were tested in accordance with the requirements of IEEE STD. 323-1974 (Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations), IEEE STD. 344-1975 (Seismic Qualification for Nuclear Power Generating Stations) and referenced to ANSI/IEEE C37.98 (formerly IEEE Standard 501-1978, Standard for Seismic Testing of Relays). The relays were tested according to parameters which, in practice, should encompass the majority of applications. Documented data apply to timing relays which were mounted on rigid test fixtures. The following descriptions of the tests performed are presented in their actual sequence. Qualification tested for VERTICAL OPERATION ONLY.

Radiation Aging

Relays were subjected to a radiation dosage of 2.0×10^6 Rads, which is considered to exceed adverse plant operating requirements for such areas as auxiliary and control buildings.

Cycling With Load Aging

The radiated units were then subjected to 27,500 operations at accelerated rate, with one set of contacts loaded to 120VAC, 60Hz at 10 amps; or 125VDC at 1 amp, and the number of mechanical operations exceeding those experienced in actual service.

Temperature Aging

This test subjected the relays to a temperature of 100°C for 42 days, with performance measured before and after thermal stress.

Seismic Aging

Sufficient interactions were performed at levels less than the fragility levels of the devices in order to satisfy the seismic aging requirements of IEEE STD 323-1974 and IEEE STD 344-1975.

Seismic Qualification

Artificially aged relays were subjected to simulated seismic vibration, which verified the ability of the individual device to perform its required function before, during and/or following design basis earthquakes. Relays were tested in the non-operating, operating and transitional modes.

Hostile Environment

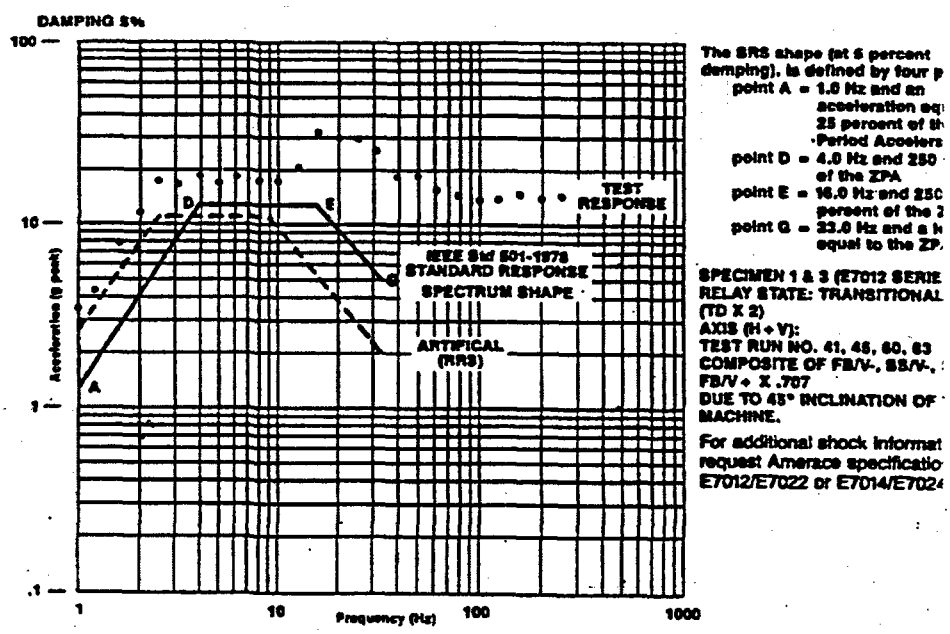
Since the timing relays are intended for use in auxiliary and control buildings, and not in the reactor containment areas, a hostile environment test was performed in place of the Loss of Coolant Accident (LOCA) test. Relays were subjected to combination extreme temperature/humidity plus under/over voltage testing to prove their ability to function under adverse conditions even after having undergone all the previous aging simulation and seismic testing. The devices were operated at minimum and maximum voltage extremes: 85 and 120 percent of rated voltage for AC units, and 80 and 120 percent of rated voltage for DC units, with temperatures ranging from 40°F to 172°F at 95 percent relative humidity.

Baseline Performance

In addition to aging tests, a series of baseline tests were conducted before, and immediately after each aging sequence, in the following areas: Pull-in Voltage; Drop-out Voltage; Dielectric Strength at 1850V 60Hz; Insulation Resistance; Operate Time (milliseconds); Recycle Time (milliseconds); Time Delay (seconds); Repeatability (percent) Contact Bounce (milliseconds at 28VDC, 1 amp.); Contact Resistance (milliohms at 28VDC, 1 amp.)

Data were measured and recorded and used for comparison throughout the qualification test program in order to detect any degradation of performance.

Figure 1.
Response Spectrum, Transitional Mode



series
E7000

seismic and radiation-tested timing relays

SPECIFICATIONS (See also pp. 3 through 7 for basic operational specifications.)*

Environmental Conditions (Qualified Life)

PARAMETER	MIN.	NORMAL	MAX.
Temperature (°F)	40	70-104	156
Humidity (R.H. %)	10	40-60	95
Pressure	—	Atmospheric	—
Radiation (rads)	—	—	2.0×10^8 (Gamma)

Operating Conditions (Normal Environment)

NORMAL OPERATING SPECIFICATIONS	WITH DC COILS	WITH AC COILS
Coil Operating Voltage, Nominal (Rated)	As Spec	As Spec
Pull-in (% of rated value)	80% Min.	85% Min.
Drop-out (% of rated value)	10% Approx.	50% Approx.
Power (Watts at rated value)	8 Approx.	8 Approx.
Relay Operate Time		
Model E7012	N/A	N/A
Model E7022	50 ms. Max.	50 ms Max.
Relay Release (Recycle) Time		
Model E7012	50 ms Max.	50 ms Max.
Model E7022	N/A	N/A
Contact Ratings, Continuous		
(Resistive at 125 vdc)	1.0 amp	1.0 amp
(Resistive at 120 vac, 60 Hz)	10.0 amp	10.0 amp
Insulation Resistance (In megohms at 500 vdc)	500 Min.	500 Min.
Dielectric (vrms, 60 Hz)		
Between Terminals and Ground	1,500	1,500
Between Non-connected Terminals	1,000	1,000
Repeat Accuracy	± 10%	± 10%
Approximate Weight	Model E7012 and E7022 2.25 lbs. Model E7014 and E7024 2.57 lbs. (Weight may vary slightly with particular coil voltage.)	Model E7012 and E7022 2.13 lbs. Model E7014 and E7024 2.43 lbs.

Operating Conditions (Abnormal Environment)

ADVERSE OPERATING SPECIFICATIONS	NORMAL	DBE "A"	DBE "B"	DBE "C"	DBE "D"
Temperature (°F)	70-104	40	120	145	156
Humidity (R.H. %)	40-60	10-95	10-95	10-95	10-95
Coil Operating Voltage* (% of Rated)					
Model E7012 (AC)	85-110	85-110	85-110	85-110	85-110
(DC)	80-110	80-110	80-110	90-110	90-110
Model E7022 (AC)	85-110	85-110	85-110	85-110	85-110
(DC)	80-110	80-110	80-110	80-110	80-110

*All coils may be operated on intermittent duty cycles at voltages 10% above listed maximums (Intermittent Duty = Maximum 50% duty cycle and 30 minutes "ON" time.)

ORDERING INFORMATION

Catalog Number Code

E | 70 | 1 | 2 | A | A | **002

- **E** — Nuclear Safety Related
- **70** — Model Series: AGASTAT® Series 7000 Timing Relay
- **1** — Operation: 1 – On-Delay; 2 – Off-Delay
- **2** — Contact Arrangement: 2 – Double Pole Double Throw; 4 – Four Pole Double Throw
- **A** — Coil Voltage:
  - AC: A – 120V 60Hz, 110V 50Hz; B – 240V 60Hz, 220V 50Hz; C – 480V 60Hz; D – 550V 60Hz; E – 24V 60Hz; F – 127V 50Hz; G – 240V 50Hz; H – 12V 60Hz; I – 6V 60Hz; J – 208V 60Hz
  - DC: M – 28 VDC; N – 48 VDC; O – 24 VDC; P – 125 VDC; Q – 12 VDC; R – 60 VDC; S – 250 VDC; T – 550 VDC; U – 16 VDC; V – 32 VDC; W – 96 VDC; Y – 6 VDC; Z – 220 VDC
- **A** — Time Range E7012, E7022, E7024:
  - A – .1 to 1 sec.
  - B – .5 to 5 sec.
  - C – 1.5 to 15 sec.
  - D – 5 to 50 sec.
  - E – 20 to 200 sec.
  - F – 1 to 10 min.
  - H – 3 to 30 min.
  - I – 6 to 60 min.
  - K – 1 to 300 sec.

  †E7014
  - A – .2 to 2 sec.
  - B – .7 to 7 sec.
  - C – .2 to 20 sec.
  - D – 10 to 100 sec.
  - E – 30 to 300 sec.
  - F – 1.5 to 15 min.
  - H – 3 to 30 min.
- ****002** — Configuration Code

† Model E7014 is available with letter-calibrated dials only. The upper end of the time ranges in this model may be twice the values shown.

CONFIGURATION CODE

The Configuration Code is a suffix to the Model Number which provides a means of identification. When a significant product change is introduced, the Configuration Code and specification sheets will be revised. (001 to 002, etc.).

Replacement Schedule

The qualified life of this unit is 25,000 operations or 10 years from the date of manufacture, whichever occurs first.

The date of manufacture can be found in the first four (4) digits of the serial number on the nameplate: XX XX

First two digits indicate the year.

Second two digits indicate the week.

Example: Date code 8014: 80 indicates 19[illegible] 14 indicates the week of April 2 through 8.

MODEL E7012PC002	
COIL 125VDC	Serial 8014 —
TIME 1.5 TO 15 SEC.	
L1	L2

Mounting Instructions

The Series E7000 relay MUST BE MOUNTED IN THE VERTICAL POSITION; all performance specifications are valid only when they are mounted in this manner.

A mounting bracket and screws and lockwashers required to attach it to the relay are supplied with each unit. Four 8-32 tapped holes are provided in the rear of the relay for attaching the mounting bracket, or for mounting the relay directly to a panel from the rear

WARRANTY

This product is warranted against mechanical and electrical defects for a period of two years from date of shipment from factory if it has been installed and used in accordance with factory recommendations. Any field repairs modifications to the original unit will void this warranty. Amerace Corporation's liability is limited to replacement of parts proved defective in workmanship or materials. (W-AB2)

NOTE: THE BASIC UNIT IS SUBJECTED TO IEEE STD 323-1974 AND IEEE STD. 344-1975 QUALIFICATION TESTS. PERFORMANCE WITH FACTORY INSTALLED AND/OR CUSTOMER SPECIAL OPTIONS HAS NOT BEEN TESTED.

5.2.4 Linear Time Range Adjustment. Basic models are furnished with dials calibrated in linear increments covering the range selected.

5.3 OPERATING CHARACTERISTICS.

5.3.1 Environmental Conditions. (Qualified Life)

PARAMETER	MIN.	NORMAL	MAX.
Temperature (°F)	40	70-104	156
Humidity (R.H. %)	10	40-60	95
Pressure	---	Atmospheric	---
Radiation (rads)	---	-----	2.0×10^5 (Gamma)

5.3.2 Operating Conditions. (Normal Environment)

NORMAL OPERATING SPECIFICATIONS	RELAYS W/ (DC) COILS	RELAYS W/ (AC) COILS
Coil Operating Voltage, Nominal (Rated)	As Spec	As Spec
Pull-in (% of rated value)	80% Min.	85% Min.
Drop-out (% of rated value)	10% Approx.	50% Approx.
Power (Watts at rated value)	8 Approx.	8 Approx.
Relay Operate Time (In ms)		
Model E7012	N/A	N/A
Model E7022	50 ms Max.	50 ms Max.
Relay Release (Recycle) Time (In ms)		
Model E7012	50 ms Max.	50 Ms Max.
Model E7022	N/A	N/A
Contact Ratings, Continuous		
(Resistive at 125 vdc)	1.0 amp	1.0 amp
(Resistive at 120 vac, 60 Hz)	10.0 amp	10.0 amp
Insulation Resistance (In megohms at 500 vdc)	500 Min.	500 Min.
Dielectric (vrms, 60 Hz)		
Between Terminals and Ground	1,500	1,500
Between Non-connected Terminals	1,000	1,000
Repeat Accuracy (See definition in Paragraph 5.3.2.1)	± 10%	± 10%

5.3 OPERATING CHARACTERISTICS.

5.3.1 Environmental Conditions. (Qualified Life)

PARAMETER	MIN.	NORMAL	MAX.
Temperature (°F)	40	70-104	156
Humidity (R.H: %)	10	40-60	95
Pressure	--	Atmospheric	---
Radiation (rads)	--	-----	2.0×10^5 (Gamma)

5.3.2 Operating Conditions. (Normal Environment)

NORMAL OPERATING SPECIFICATIONS	RELAYS W/ (DC) COILS	RELAYS W/ (AC) COILS
Coil Operating Voltage, Nominal (Rated)	As Spec	As Spec
Pull-in (% of rated value)	85% Min.	90% Min.
Drop-out (% of rated value)	10% Approx.	50% Approx.
Power (Watts at rated value)	8 Approx.	8 Approx.
Relay Operate Time (In ms)		
Model E7014	N/A	N/A
Model E7024	75 ms Max.	75 ms Max.
Relay Release (Recycle) Time (In ms)		
Model E7014	75 ms Max.	75 Ms Max.
Model E7024	N/A	N/A
Contact Ratings, Continuous		
(Resistive at 125 vdc)	1.0 amp	1.0 amp
(Resistive at 120 vac, 60 Hz)	10.0 amp	10.0 amp
Insulation Resistance (In megohms at 500 vdc)	500 Min.	500 Min.
Dielectric (vrms, 60 Hz)		
Between Terminals and Ground	1,500	1,500
Between Non-connected Terminals	1,000	1,000
Repeat Accuracy (See definition in Paragraph 5.3.2.1)	± 10%	± 10%

5.3.2.1 Repeat Accuracy. Repeat Accuracy at any fixed temperature is defined as (Ref. Nema Part ICS 2-218.07); "The repeat accuracy deviation (A_R) of a time delay relay is a measure

HOSTILE ENVIRONMENT TEST DATA

SUMMARY SHEET

MODEL NO. E7012PC001 (7012PCE)

TEST ITEM NO. 1

TEMPERATURE	MINIMUM VOLTAGE TEST		MAXIMUM VOLTAGE TEST	
AT 95% R.H. (DEGREES FAHRENHEIT)	AVERAGE TIME DELAY (SECONDS)	REPEAT ACCURACY (PERCENT)	AVERAGE TIME DELAY (SECONDS)	REPEAT ACCURACY (PERCENT)
40°F	1.77 sec	2.5%	1.72 sec	3.4%
50°F	1.89	1.5	1.92	5.0
70°F	1.84	0.2	1.84	0.8
90°F	1.76	1.6	1.75	1.4
110°F	1.71	1.3	1.70	1.3
130°F	1.81	2.0	1.71	1.3
150°F	1.77	2.1	1.67	1.6
165°F	1.80	3.7	1.61	1.5
172°F	1.80	2.0	1.58	3.5

NOTES:

1. TEMPERATURES STATED ARE AT 95% RELATIVE HUMIDITY.
2. AVERAGE TIME DELAY IS AVERAGE OF FIVE (5) CONSECUTIVE READINGS.
3. FOR REPEAT ACCURACY DEFINITION SEE FIGURES 1 AND 2, PAGES 13 AND 14 RESPECTIVELY OF THIS REPORT.

MINIMUM VOLTAGE USED 96 VDC

MAXIMUM VOLTAGE USED 154 VDC

PREPARED BY C.J. Lingyak

DATE 2-25-80

CONTROL PRODUCTS DIVISION

AMERACE CORPORATION
CONTROL PRODUCTS DIVISION
UNION, N.J. 07083

TEST REPORT NO. ES-100

REV. A SHEET 52 OF 105

HOSTILE ENVIRONMENT TEST DATA

SUMMARY SHEET

MODEL NO. E7014PC001 (7014PCE)

TEST ITEM NO. 1

TEMPERATURE	MINIMUM VOLTAGE TEST		MAXIMUM VOLTAGE TEST	
AT 95% R.H. (DEGREES FAHRENHEIT)	AVERAGE TIME DELAY (SECONDS)	REPEAT ACCURACY (PERCENT)	AVERAGE TIME DELAY (SECONDS)	REPEAT ACCURACY (PERCENT)
40°F	3.53 sec.	0.8 %	3.51 sec.	1.3%
50°F	3.58	1.6	3.63	1.8
70°F	3.99	2.4	3.93	2.7
90°F	3.72	1.6	3.72	0.8
110°F	3.72	1.0	3.75	0.8
130°F	3.66	1.0	3.63	0.8
150°F	3.54	1.0	3.61	1.2
165°F	3.53	1.4	3.55	0.9
172°F	3.36	1.1	3.30	0.8

NOTES:

1. TEMPERATURES STATED ARE AT 95% RELATIVE HUMIDITY.
2. AVERAGE TIME DELAY IS AVERAGE OF FIVE (5) CONSECUTIVE READINGS.
3. FOR REPEAT ACCURACY DEFINITION SEE FIGURES 1 AND 2, PAGES 13 AND 14 RESPECTIVELY OF THIS REPORT.

MINIMUM VOLTAGE USED 96 VDC

MAXIMUM VOLTAGE USED 154 VDC

PREPARED BY C.J. Lucas

DATE 2-25-80

HOSTILE ENVIRONMENT TEST DATA

SUMMARY SHEET

MODEL NO. E7022PC001 (7022PCE)

TEST ITEM NO. 1

TEMPERATURE	MINIMUM VOLTAGE TEST		MAXIMUM VOLTAGE TEST	
AT 95% R.H. (DEGREES FAHRENHEIT)	AVERAGE TIME DELAY (SECONDS)	REPEAT ACCURACY (PERCENT)	AVERAGE TIME DELAY (SECONDS)	REPEAT ACCURACY (PERCENT)
40°F	1.66 sec	3.6%	1.75 sec.	0.3%
50°F	1.71	0.2	1.73	0.7
70°F	1.72	0.6	1.72	0.5
90°F	1.60	1.6	1.61	0.2
110°F	1.65	3.6	1.73	1.7
130°F	1.63	2.2	1.67	1.3
150°F	1.54	0.4	1.57	0.6
165°F	1.43	1.0	1.43	0.7
172°F	1.40	0.3	1.37	0.3

NOTES:

1. TEMPERATURES STATED ARE AT 95% RELATIVE HUMIDITY.
2. AVERAGE TIME DELAY IS AVERAGE OF FIVE (5) CONSECUTIVE READINGS.
3. FOR REPEAT ACCURACY DEFINITION SEE FIGURES 1 AND 2, PAGES 13 AND 14 RESPECTIVELY OF THIS REPORT.

MINIMUM VOLTAGE USED 96 VDC

MAXIMUM VOLTAGE USED 154 VDC

PREPARED BY C.J. Lugosi

DATE 2-25-80

operation

OPERATING CHARACTERISTICS

Environmental Conditions (Qualified Life) — Series EGP/EML/ETR

PARAMETER	MIN.	NORMAL	MAX.
Temperature (°F)	40	70-104	156
Humidity (R.H. %)	10	40-60	95
Pressure	—	Atmospheric	—
Radiation (rads)	—	—	2.0×10^4 (Gamma)

Operating Conditions, Normal Environment — Series EGP/EML/ETR

NORMAL OPERATING SPECIFICATIONS	WITH DC COILS			WITH AC COILS	
	EGP	EML	ETR	EGP	ETR
Coil Operating Voltage, Nominal (rated)*	As Spec.	As Spec.	As Spec.	As Spec.	As Spec.
Pull-in (% of rated value)	80% Min.	85% Min.	80% Min.	85% Min.	85% Min.
Drop-out (% of rated value)	5-45%	85% Min.	5-45%	5-45%	5-50%
Continuous (% of rated value)	110% Max.	NA	110% Max.	110% Max.	110% Max.
Power (Watts at rated value)					
Pull-in	6 Approx.	15 Approx.	6 Approx.	6 Approx.	6 Approx.
Drop-out	NA	13 Approx.	NA	NA	NA
Relay Operate Time	30 ms Max.	25 ms Max. With min. latch pulse of 35 ms.	NA	35 ms Max.	NA
Relay Release (Recycle) Time	25 ms Max.	20 ms Max. With min. latch pulse of 30 ms.	75 ms Max.	85 ms Max.	75 ms Max.
Contact Ratings, Continuous					
Resistive at 125 vdc	1.0 amp.	1.0 amp.	1.0 amp.	1.0 amp.	1.0 amp.
Resistive at 120 vac, 60 Hz	10.0 amp.	10.0 amp.	10.0 amp.	10.0 amp.	10.0 amp.
Insulation Resistance (in megohms at 500 vdc)	500 Min.	500 Min.	500 Min.	500 Min.	500 Min.
Dielectric (vrms, 60 Hz)					
Between Terminals and Ground	1,500	1,500	1,500	1,500	1,500
Between Non-connected Terminals	1,500	1,500	1,500	1,500	1,500
Repeat Accuracy	NA	NA	±5%	NA	±5%

Operating Conditions, Abnormal Environment — Series EGP/EML

ADVERSE OPERATING SPECIFICATIONS	NORMAL	OB "A"	OB "B"	OB "C"	OB "D"
Temperature (°F)	70-104	40	120	145	156
Humidity (R.H. %)	40-60	10-95	10-95	10-95	10-95
Coil Operating Voltage (% of rated)*					
AC (Series EGP only)	85-110	85-110	85-110	85-110	85-110
DC (Series EGP only)	80-110	80-110	80-110	80-110	80-110
DC (Series EML only)	85-110	85-110	85-110	85-110	85-110
Relay Operate Time (ms)					
AC (Series EGP only)	35 Max.	35 Max.	35 Max.	35 Max.	35 Max.
DC (Series EGP, Series EML)	30 Max.	25 Max.	37 Max.	40 Max.	40 Max.

Operating Conditions, Abnormal Environment — Series ETR

ADVERSE OPERATING SPECIFICATIONS	WITH DC COILS	WITH AC COILS
Coil Operating Voltage (rated)*	As Spec.	As Spec.
Pull-in (% of rated value)	80% Min.	85% Min.
Continuous (% of rated value)	110% Max.	110% Max.
Drop-out (% of rated value)	5-45%	5-50%
Power (Watts at rated value)	6 Approx.	6 Approx.
Relay Release (Recycle) Time	75 ms Max.	75 ms Max.
Contact Ratings, Continuous		
Resistive at 125 vdc	1.0 amp.	1.0 amp.
Resistive at 120 vac, 60 Hz	10.0 amp.	10.0 amp.
Repeat Accuracy	±10%	±10%

*All coils may be operated on intermittent duty cycles at voltages 10% above rated maximums (Intermittent Duty = Maximum 50% duty cycle and 30 minutes "ON" time.)

5.3 OPERATING CHARACTERISTICS.

5.3.1 Environmental Conditions. (Qualified Life)

PARAMETER	MIN.	NORMAL	MAX.
Temperature (°F)	40	70-104	156
Humidity (R.H. %)	10	40-60	95
Pressure	---	Atmospheric	---
Radiation (rads)	---	-----	2.0×10^5 (Gamma)

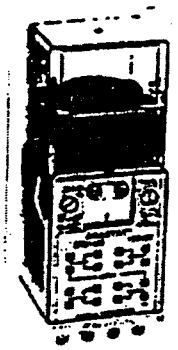
5.3.2 Operating Conditions. (Normal Environment)

NORMAL OPERATING SPECIFICATIONS	RELAYS W/ (DC) COILS	RELAYS W/ (AC) COIL
Coil Operating Voltage, Nominal (Rated)	As Spec	As Spec
Pull-in (% of rated value)	80% Min.	85% Min.
Drop-out (% of rated value)	5 to 45%	5 to 45%
Power (Watts at rated value)	6 Approx.	6 Approx.
Relay Operate Time (In Milliseconds)	30 ms Max.	35 ms Max
Relay Release Time (In Milliseconds)	25 ms Max.	85 ms Max
Contact Ratings, Continuous		
→ (Resistive at 125 vdc)	1.0 amp	1.0 amp
(Resistive at 120 vac, 60 Hz)	10.0 amp	10.0 amp
Insulation Resistance (In megohms at 500 vdc)	500 Min.	500 Min.
Dielectric (vrms, 60 Hz)		
Between Terminal and Ground	1,500	1,500
Between Non-connected Terminals	1,500	1,500

5.3.3 Operating Conditions. (Abnormal Environment)

Agastat®

Control Relays – Series GP Power Relays



DESIGN FEATURES

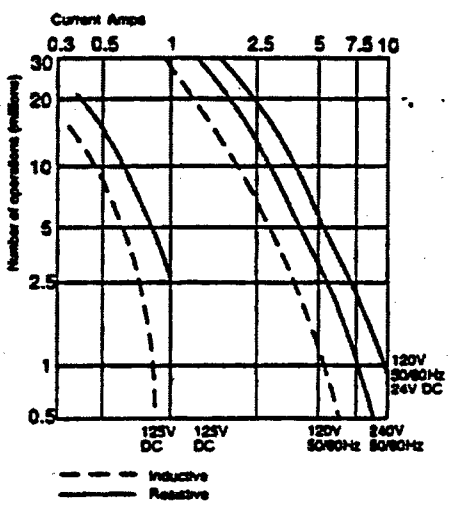
- Occupies a very small panel space
- May be mounted singly, in continuous rows, or in groups.
- Available with a screw terminal molded socket.
- 4 SPDT contacts
- Magnetic blow-out device option increases the DC current carrying capacity approximately ten times for both N.O. & N.C. contacts.
- In both AC and DC operation, the addition of the device will normally double the contact life, due to reduced arcing.

SPECIFICATIONS

Operating Mode: Power Relay
Operating Time: Operate time at 20°C (68°F) and rated voltage:

Between energizing and opening of normally closed contacts/less than 18 milliseconds on AC and less than 15 milliseconds on DC.
Release Time: Between energizing and closing of normally open contacts/less than 35 milliseconds on AC and less than 30 milliseconds on DC.
Between de-energizing and opening of normally open contacts/less than 70 milliseconds on AC and less than 8 milliseconds on DC.

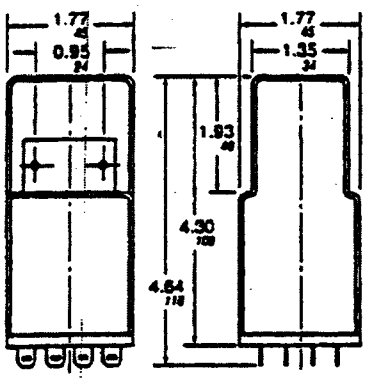
Between de-energizing and closing of normally closed contacts/less than 85 milliseconds on AC and less than 25 milliseconds on DC.
Contacts: Silver plated.
Life: Load Life:

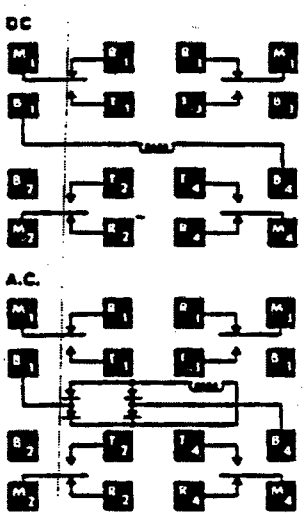


Mechanical Life: 100 million operations

Power Consumption: Typical power consumption at rated voltage is: 6VA for AC coils, 6 Watts for DC coils.
There is no surge current during operation.
Insulation Resistance: Between all non-connected terminals as well as between non-connected terminals and the relay yoke: 1000 megohms at 500 volts DC
Dielectric: 2000 volts RMS 60 Hz between points specified above.
Operating Temperature Range: 0° to 60°C (32°F to 140°F)
Mounting Terminals: 16 flat base pins. Screw terminal sockets are available.
Shock: The relay, when kept energized by means of one of its own contact sets, will withstand 40g shock load when operating on DC, and 150g shock load on AC.
Vibration: Single axis fragility curve data are available on request at frequencies from 5 Hz to 33 Hz.
Wire Connection: The 16 flat pins are arranged in four symmetrical rows of four pins; the pitch in both directions being .394". Connection may be made to the relay by soldering. Sockets are available with screw terminals.

The internal wiring of the relay is also symmetrical as shown in the adjacent figure, allowing the relay to be inserted into the socket in either of two positions. Terminals B2 and B3 are provided as extra connections for special applications.
Approximate Net Weight: 10.9 oz





File No. E15631 File No. LR29186

Thomas&Betts

Agastat®

Control Relays – Series GP Power Relays

SPECIFICATIONS (Cont.)

Coil Operating Voltage

	DC					50/60Hz			
Nominal Coil Voltage	12	24	48	125	250	24	48	120	220
Minimum Pick-up voltage at 40°C	9.5	19	38	100	200	20	41	102	188
Maximum voltage for continuous use	13.5	27	53	143	275	27	53	137	245

For 380 Volts AC – Use 6800 ohms 4 watt resistor in series with 220 volts AC relay

For 440 Volts AC – Use 8200 ohms 6 watt resistor in series with 220 volts AC relay

Coil drop-out voltage is between 10% and 40% of the rated operating voltages for both DC and AC (For example: in a 120 VAC unit, drop-ou will occur between 12 and 48 volts.) DC relays will function with unfiltered DC from a full-wave bridge rectifier.

Contact Ratings

Voltage	Current (Amps)	Power Factor or Time Constant	Number of Electrical Operations	Remarks
540 VAC	3	COS Ø = 0.5	15 000	2 contacts in series
380 VAC	15	Resistive	10 000	2 contacts in parallel
380 VAC	10	Resistive	200 000	
380 VAC	3 x 3.3	COS Ø = 0.8	200 000	3hp motor
220 VAC	20	Resistive	20 000	2 contacts in parallel
220 VAC	15	COS Ø = 0.5	20 000	2 contacts in parallel
220 VAC	10	Resistive	400 000	
220 VAC	3 x 6	COS Ø = 0.8	200 000	3hp motor
220 VAC	5		1 500 000	Filament lamps
220 VAC	5	Resistive	3 000 000	
220 VAC	2.5	COS Ø = 0.25	2 000 000	
220 VAC	2	Resistive	15 000 000	
220 VAC	1.25	Resistive	30 000 000	
120 VDC	1.5	Resistive	20 000 000	with blow-out device
48 VDC	10	Resistive	1 000 000	
48 VDC	1.5	5 ms	18 000 000	

ORDERING INFORMATION

GP
Model Series
GP - Power
ML - Magnetic Latch Relay

A
Coil Voltage
A - 12 VDC
B - 24 VDC
C - 48 VDC
D - 125 VDC
F - 250 VDC*
G - 24 VAC 60Hz
H - 48 VAC 60Hz
I - 120 VAC 60Hz
J - 220 VAC 60Hz

N
Options
N - Magnetic Blow-out Device
Q - Light to indicate coil energization (with 120 VAC, 125 VDC, 220VAC, 250 VDC voltages only) – GP series only
R - Internal diode to suppress coil de-energization transient (When used on DC unit, relay release time increases to the same value as the AC equivalent.) – GP series only

Socket Available See Page 53.

Thomas&Betts

GENERAL ELECTRIC

UTILITY & INDUSTRIAL SALES DIVISION
GENERAL ELECTRIC COMPANY • P.O. BOX 4841 • SYRACUSE, NEW YORK 13221

May 8, 1989

Mr. Roy Thomas
New York Power Authority
J.A. FitzPatrick Nuclear Plant
PO Box 41
Lycoming, New York 13093

Dear Mr. Thomas:

Per your request to Carl Chermak regarding ATB, S/N 0202A9808-101 and 102, we enclose Service Advice No. 236.1 covering suggested maintenance procedures, summary sheet for your breaker plus list of recommended spare parts for this breaker.

If you need anything else, please call.

Very truly yours,

Carole Menzel

Carole Menzel
Sales Assistant

Enc. 5 GE GREASE "RED" MOBILE

SUMMARY OF POWER CIRCUIT BREAKER EQUIPMENT

CUSTOMER INSPECTION	EXCUS. DELAY	PLANT INVEST.	DEFENSE ORDER NO.	
DEFAULT CANCELLATION	NAVY INSP.	RENEGOT. ACT 1951 →	GOVT. CON. NO.	
DELAYS-DAMAGE		PENALTY	STANDARD	PROJECT NO.

PROP- 1-67339 CONTRACT- 76005 REQ.- 309-72033-1

CUST. NO. ACCT- S.O.- H99611

REV.

STAMPING INFORMATION FOR BKR. N. P. 103A3825

S/N 0202A7808-201, 202	REQ. NO. 309-72034-1	TYPE ATB-362-T-37	
DUTY CYCLE OCO-8 SEC-CO-30 SEC-CO		APLTDNY	
NOM. VOLTS 345,000	RATED CONT. AMP. 3000	NOM. MVA. 25000	CY. 60
RATED VOLT RANGE FACTOR (K) 1.1	INTERRUPTING TIME	2 CY.	
RATED MAX. VOLTS 362000	RATED SYM. SHORT CIRCUIT AT RATED MAX. VOLT.	37000	AM
MAX. SYM. INT. AMP. 41,000 AT	330 KV	MAX. ASYM. INT. AMP. 53,300 AT	330 I
CLOSING AND LATCHING ABILITY 65,000 AMP.		IMPULSE WITHSTAND	1500 KV
TRIP COIL 366A0845520	VOLTS 125DC AMP. 15	OPER. RANGE 70-140	VOLTS
CLOS. COIL 366A0845520	VOLTS 125DC AMP. 10	OPER. RANGE 90-130	VOLTS
RESET COIL —	VOLTS AMP.	OPER. RANGE	VOLTS
OPERATING AIR PRESSURE NORMAL	530 P.S.I.G.	MIN. 400	P.S.I.G
NOM SF6 GAS PRESSURE AT 70°F.	75 P.S.I.G.		
WT. OF GAS PER BREAKER 690 LBS.		WIRING DIAG. NO. 0129C4220	
COMPR. GOVERNOR SW. CLOS. PRESS.	1775 P.S.I.G.	OPEN PRESS. 2000	P.S.I.G
LOW PRESS. ALARM SW. CLOS. PRESS.	450 P.S.I.G.	OPEN PRESS. 460	P.S.I.G
LOW PRESS. LOCKOUT SW. CLOS. PRESS.	410 P.S.I.G.	OPEN PRESS. 400	P.S.I.G
⊙ NET WEIGHT OF TRIPLE POLE BREAKER	69,100 LB.	YEAR MFG. 1972	⊙

CAUTION: BEFORE INSTALLING OR OPERATING READ INST. GEK-19388 RENEWAL PARTS GEK-19774

STAMPING INFORMATION FOR COMPRESSOR NP 81719

NO 0202A9508-201, 202 TYPE NAO-12 145 CFM

NET WEIGHT 1600 LBS

OPERATING VOLTAGE 575 VOLTS 3 PHASE 60 CY C

MAX. OPERATING PRESSURE HIGH PRESSURE SYSTEM 2000 LB/SQ
LOW PRESSURE SYSTEM 530

COMPRESSOR DELIVERY AT 2000 LB/SQ. IN. 145 CFM CUBIC FEET FREE AIR

CAUTION BEFORE INSTALLING OR OPERATING READ INST. GEK-7154 R

NP 81719 DIFF. 225 PSI START 100A. RUN 12A.

Nuclear Power Plant
[illegible]
P.O. Box [illegible]
[illegible], New York [illegible]
[illegible]

Memorandum

New York Power Authority

October 4, 2000
JDED-00-0290

MEMO TO: JOE LONA

FROM: SUNG KIM

SUBJECT: **MINIMUM VOLTAGE ACCEPTANCE CRITERIA FOR JAF MAGNE-BLAST 4 KV BREAKERS PREVENTATIVE MAINTENANCE**

Based on discussion with GE representative, Charlie Vickers (Philadelphia GE Service Shop, phone # (215) 289-0400, ext.657) on 10/3/00 for testing of GE Magne-Blast Air Circuit Breaker Type AMH-4.76-250, the following acceptance criteria shall be applied:

Minimum Voltage Test - Verify breaker operation at minimum voltage per GE Manual GEI-88771D (JAF V/M # G080-0631, Binder G47):
Minimum Closing Coil Voltage; 70 VDC,
Minimum Tripping Coil Voltage; 70 VDC

Per GE instruction manual GEI-88771D, the operating ranges for the closing and tripping voltages as given on the breaker nameplate, are as follows:

Nominal Voltage	*Closing Range*	*Tripping Range*
125 v d-c	90 – 130 v d-c	70 – 140 v d-c

However, the part numbers for the closing coil and the tripping coil are identical, i.e. 6174582G1. According to GE, trip is the safe function of the breaker and GE wants the users to ensure the breaker opening operation at a voltage (70 v dc) lower than the breaker closing operation at 90 v dc as stated in the manual. However, the manual does not state which function of the breaker (open or close) is a safe function. At JAF, the safe function of the breakers is both to close and to trip upon demand and therefore, should be tested at a minimum voltage criteria of 70 v dc across both the closing coil and tripping coil. GE also stated that both the trip and close coils are identical in fit, form and function and more force is required in the trip function than the close function. The function of the control power (90 v dc or 70 v dc) is only to release the latch and once the latch is released, then the stored spring energy takes over to complete the breaker closing operation.

If the breaker trip function is verified at a lower voltage (70 v dc) which requires more force, then breaker close function which requires less force is considered verified at 70 v dc. The low voltage test performed on Magne-Blast Circuit Breakers at JAF in the summer of 2000 showed that voltage required to trip breaker is generally more than

MEMO TO: JOE LONA
FROM: SUNG KIM
SUBJECT: **MINIMUM VOLTAGE ACCEPTANCE CRITERIA FOR JAF MAGNE-BLAST 4 KV BREAKERS PREVENTATIVE MAINTENANCE**

October 4, 2000
JDED-00-0290

voltage required to close the breaker. The test data (as-found / as-left) is listed as below:

Breaker Serial #	*Min. Closing Voltage* (as-found/as-left)	*Min. Tripping Voltage* (as-found/as-left)	*Test Date*
0224A8986-020	40 v dc /40 v dc	50 v dc / 70 v dc	6/26/00- 8/17/00
0224A8986-024	40.1 v dc /43 v dc	41.3 v dc / 69.8 v dc	6/26/00, 6/30/00
0224A8985-011	35 v dc /35 v dc	45 v dc / 65 v dc	6/26/00, 7/14/00
0224A8986-001	50 v dc /40v dc	52.6 v dc / 70 v dc	6/26/00, 8/30/00
0224A8985-002	40 v dc /40 v dc	35 v dc / 65 v dc	6/30/00
0224A8986-021	42 v dc /35 v dc	35 v dc / 69v dc	6/26/00, 7/19/00

Electrical Design recommends to revise Acceptance Criteria of Closing Coil Operational Check to pick up at less than or equal to 70 v dc for all applicable procedures.

For example, Maintenance Procedure MP-054.01, Rev.23, Steps 8.34.1, 8.34.3, 8.34.4 and Acceptance Criteria in Section 8.34, and Step 10.18 shall be revised.

Prepared By: _____ Date: 10-4-00
Sung Kim
Sr. Electrical Engineer II

Approved By: _____ Date: 10/4/00
Tom Savory
DE Electrical Supervisor

cc: D. Ruddy
DE Electrical Group
B. Lonberger
J. Vania
D. Vandermark
G. Bregg
JDED File

60787065

J.O.No 11825

July 7, 1969
Revised March 2, 1970

SPECIFICATION

FOR

METAL-CLAD SWITCHGEAR

FOR

EMERGENCY STATION POWER SERVICE

FOR

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

POWER AUTHORITY OF THE STATE OF NEW YORK

REVISIONS	REV. 0	REV 1	REV. 2	REV. 3
Prepared By / Lead Engr Approval	KVR APS	[illegible] APS		
Project Engineer Approval	[illegible]	L.S. [illegible]		
CATEGORY I A Equipment Specialist Review	[illegible] 12-10-69	[illegible] 3-4-70		
Quality Assurance Review	G.B.	HVR.		

-:-

CONTRACTOR - GENERAL ELECTRIC COMPANY
CONTRACT AP-1, SECTION XVI, ITEM 6

Stone & Webster Engineering Corporation, Engineer
225 Franklin Street
Boston, Massachusetts 02107

11911093

60787069

8. Additional cubicles

8.1 Bus transition cubicle, quantity * (Later)

8.2 Potential transformer cubicle, quantity None

8.3 Blank cubicles, quantity None

8.4 Cubicle complete except for future breaker, quantity None

8.5 Switchgear shall be arranged for future extension: Yes X no ____

9. Operating mechanism

9.1 Type: Stored energy X Solenoid _____

9.2 Control voltage: 125 v d-c

9.3 Number of operations without recharging stored energy device * 1

9.4

	1,200 Amp	_____	_____
Tripping current	* 6.0	* _____	* _____
Closing current	* 6.0	* _____	* _____

10. Buses

10.1 Ampere capacity: 1,200 amp Switchgear assemblies Nos. 44 and 45

10.2 Type bus: Copper * _____, Aluminum * X

10.3 Buses and connections shall be insulated

10.4 All bolted connections shall be silver plated

11. Cable connectors and terminators

11.1 Connectors by: Contractor X Authority _____

11.2 Type: Bronze _____, Aluminum (Later), Bolted _____, Compression X (2 Bolts minimum in pad)

11.3 Cable terminators and mounting brackets furnished by: Contractor X Authority _____

11.4 Clamp type ground connectors shall be provided on the ground bus in each cubicle for Authority's ground connection.

Marks, Brian

From: Robles, Primitivo (PS, NE) [Primitivo.Robles@gene.GE.com]
Sent: Monday, February 21, 2000 9:53 PM
To: MARKS, BRIAN (NYPA)
Subject: FW: Fitz. Spring Charging Motor

Importance: High

Brian:
Please see info below on subject matter. This information is "commerical only", i.e., not verified or provided under GE quality program. If you wished to receive this information as verified and under a GE letterhead, please let me know.
P. Robles, Jr.

>----Original Message----
> From: Sanders George W. (PS, NE)
> Sent: Monday, February 21, 2000 4:03 PM
> To: Quinn, Paul
> Cc: Panetta, Thomas
> Subject: Fitz. Spring Charging Motor
> Importance: High
>
> Paul,
>
> The following is the manufacturer's data for the spring charging motor
> originally spuplied with the AMH breakers.
>
> Motor #0105C9393P002
>
> Rated Voltage; 115VAC/125VDC
> Inrush Current; 68A., +/- 10%
> Running Current; 13A., +/- 10%
> Spring charging Time; Four Seconds, Maximum @ rated voltage.
>
> For the current production spring charging motor, supplied as a renewal
> part,
>
> Motor # 0184B7360G002 (also supplied safety related as DJ317A7494P008)
>
> Rated Voltage; 115VAC/125VDC
> Inrush Current; 60A., +/- 10%
> Running Current; 14A., +/- 10%
> Spring charging Time; Four Seconds, Maximum @ rated voltage.
>
>
> This document has not been verified in accordance with GE procedures and
> should be used accordingly. If the customer wishes a verified document it
> will require a charge number.
>
> Regards,
> George Sanders

James A. FitzPatrick
Nuclear Power Plant
P.O. Box 41
Lycoming, New York 13093
315 342.3840

New York Power Authority

DESIGN ENGINEERING DEPARTMENT

DATE: 5-2-97

TO: MIKE AUSTIN **FAX #:** 770-452-4870
PHONE: 770-452-4808

FROM: ALEX BARTON DES ENG **PHONE:** 315-349-6622

Sending No. [315] 349-6981

Confirmation or Problems Call [315] 349-6910 (Patty)

4 **Pages INCLUDING This Cover Sheet**

THE BKR OF INTEREST TO NYPA IS AN AK-2A-25-1.

MESSAGE: ATTACHED IS A COPY OF 2 SHEETS FROM G.E. "DESCRIPTIVE MATERIAL SPECIFICATIONS" WHICH COVER AK/15/25, AK-50/75, AK-100 BKRS THE BOTTOM of the Sheets are marked LRS-50-3&4 and dated 8/3-64 & 5-63, I obtained these sheets from NIAGRA MOHAWK NINE MILE POINT 1. I WOULD LIKE TO KNOW IF THESE ARE APPLICABLE TO THE AK-2A-25-1 BKR. WHICH JA.FITZPATRICK HAS?

GENERAL ELECTRIC COMPANY

DESCRIPTIVE MATERIAL SPECIFICATIONS

OPERATING CURRENTS

	Rated Volts	Range	AK-15/25 Amperes Inrush/Sustained	AK-50/75 Amperes Inrush/Sustained	AK-100 Amperes Inrush/Sustained
Closing A-C	115	(95-125)	153/78	9/4	9/4
	230	(190-250)	68/28	4/2.6	4/3.2
	460	(380-500)	65/24	-----	-----
D-C	125	(90-130)	44/44	30/4	30/5
	250	(180-260)	24/24	15/2	15/2.5
Tripping A-C	115	(85-125)	12.3/10.8	12.3/10.8	12.3/10.8
	230	(190-250)	6.9/5.7	6.9/5.7	6.9/5.7
	460	(380-500)	3.4/3.1	-----	-----
D-C	125	(70-140)	1.9/1.9	1.9/1.9	1.9/1.9
	250	(140-280)	1.0/1.0	1.0/1.0	1.0/1.0

SERIES OVERCURRENT TRIPPING DEVICES

Combination of Series Tripping Devices Available

Dual Magnetic	- Long-time-delay and Instantaneous
Selective Fault	- Short-time-delay and Long-time-delay
	- Short-time-delay, Long-time-delay and Instantaneous
	- Short-time-delay and Instantaneous
Fault	- Short-time-delay
	- Instantaneous

Long-time-delay (overload protection, characteristic curves 1A, 1B, 1C, 1BB and 1CC)

Pick-up adjustable, calibrated settings: 80, 100, 120, 140, 160% of coil rating.
Time delay, (adjustable EC-2 only) factory-set for one of the following characteristics:

AK-15/25/50	Time in seconds at 6 times pickup
1A - Maximum	30
1B - Medium	15
1C - Minimum	5
AK-75/100	
1BB - Maximum	4
1CC - Minimum	2

WITH LETTER
FOR NINE MILE POINT NUCLEAR
ORDER NO.
INDEX

Short-time-delay (Selective fault protection characteristic curves 2A, 2B, 2C, 2AA, 2BB, 2CC)

Pick-up adjustable, calibrated for 3 points, adjustable between limits having a ratio of 2-1/2 to 1, in the range of 200 to 1000% of coil rating, 2 to 5, 3 to 7 and 4 to 10.
Time delay, non-adjustable factory-set for one of the following timing characteristics:

Characteristic Curve	Time Delay @ 2-1/2 times Pick-up Setting (60 Cycle)	Minimum Trip Coil Ratings AK-15	AK-25	AK-50	AK-75	AK-100
2A/2AA	24 cycles Maximum	150	250	500	2000	2000
2B/2BB	16 cycles Intermediate	125	200	400	2000	2000
2C/2CC	8 cycles Minimum	100	175	350	2000	2000

Instantaneous (Fault protection characteristic curve 3).

Pick-up adjustable, in ranges of 4 to 9, 6 to 12 or 9 to 15 times coil rating. Standard range is 6 to 12 times coil rating set at 12 times (adjustable only in EC-2A & EC-1B)

UNDERVOLTAGE TRIPPING DEVICE (instantaneous or time-delay)

Pick-up voltage, 80% or less of rated control voltage, (115, 230 volts)
Drop-out voltage, between 30% and 60% of rated control voltage. (No field adjustment)
Time delay

AUXILIARY SWITCH, 4 or 10 contacts, (2 or 5 "a" and 2 or 5 "b", shunt trip requires one "a" contact and AK-50, 75 & 100 require one "b" in closing circuit).

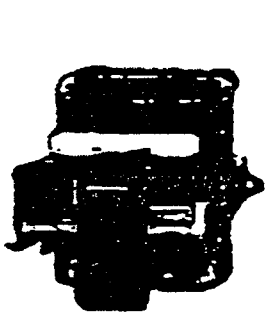
BELL ALARM and/or **LOCKOUT**, overcurrent device, hand/electrical reset, one normally open and one normally closed contact.

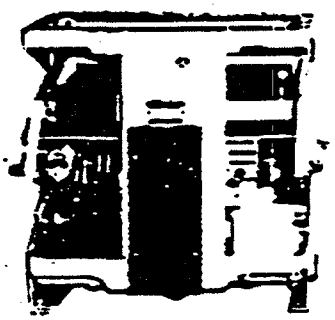
APR-09-97 WED 11:22 AM

GENERAL ELECTRIC COMPANY

DESCRIPTIVE MATERIAL SPECIFICATIONS

LOW VOLTAGE POWER CIRCUIT BREAKER RATED 600 VOLTS A-C (50-60 CYCLES) 250 VOLTS D-C





AK-15/25 AK-50 AK-75 AK-100

REMOVABLE BREAKER ELEMENTS

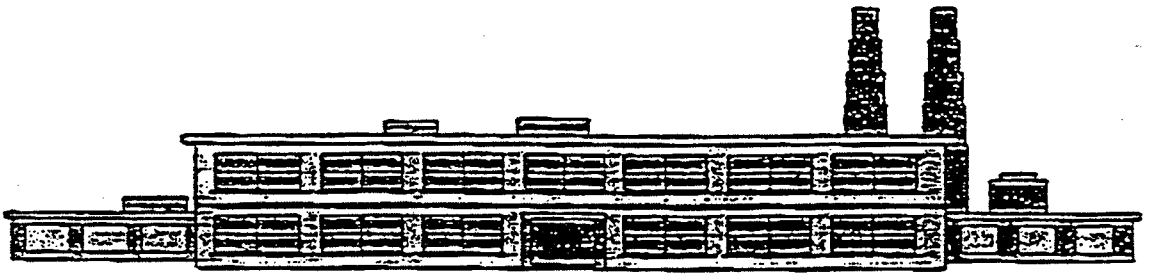
BREAKER RATINGS	AK-15	AK-25	AK-50	AK-75	AK-100
Frame Size (Maximum Coil Rating) Amps A-C	225	600	1,600	3,000	4,000
Amps D-C	225	600	2,000	4,000	6,000
Short Time Amps. A-C (symmetrical)	9,000	22,000	50,000	65,000	85,000
D-C	10,000	15,000	50,000	75,000	100,000
600 V. A-C & 250 V. D-C					
Interrupting Rating Amps A-C (symmetrical)	14,000	22,000	42,000	65,000	85,000
D-C	15,000	25,000	50,000	75,000	100,000
Minimum Series Trip Coil Rating Amps.	15	40	200	2,000	2,000
480 V					
Interrupting Rating Symmetrical Amps.	22,000	30,000	50,000	65,000	85,000
Minimum Series Trip Coil Rating Amps.	20	100	400	2,000	2,000
240 V					
Interrupting Rating Symmetrical Amps.	25,000	42,000	65,000	85,000	130,000
Minimum Series Trip Coil Rating Amps.	30	150	600	2,000	2,000

(Standard Coil Ratings: 15, 20, 30, 40, 50, 70, 90, 100, 125, 150, 175, 200, 225, 250, 300, 350, 400, 500, 600, 800, 1000, 1200, 1600, 2000, 2500, 3000 and 4000.)

INSULATION (60 CYCLE KV)					
Breaker	2.2	2.2	2.2	2.2	2.2
Control Wiring	1.5	1.5	1.5	1.5	1.5
Closing Motor	----	----	.9	.9	.9
OPERATING TIME (Cycles on 60 Cycle Base)					
Closing Electrically					
Time from energizing closing circuit					
until contacts start motion	----	----	90	90	90
until contacts touch	5.0	5.0	95*	95*	95*
			(*5 cycles is available for synchronizing and automatic transfer when required)		
Opening					
With Instantaneous Series Trip	1.5	1.5	3.	3.	3.
With Shunt (Potential) Trip	2.5	2.5	3.5	3.5	3.5
WEIGHTS					
Net manual/electrical	75/90	80/95	290/350	420/480	540/600
Shipping manual/electrical	80/95	85/100	330/390	475/535	615/675

These data subject to change without notice.

GENERAL ELECTRIC COMPANY



Switchgear Department
5134 Peachtree Road, Chamblee, GA 30341

DATE: 5/2/97

TO: Alex Barton

Phone No.: _____ Fax No.: _____

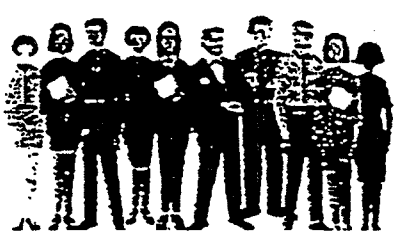
Number of Pages (including Cover): 1

Alex,

The numbers you sent me for the 125 VDC Control Power (operating voltage range of 90-130 VDC, Inrush+Sustained = 44/44, and Shunt Trip Operating range of 70-140, Inrush/Sustaind = 1.9/1.9 are correct except for the closing operating voltage range which should be 90-140 VDC.

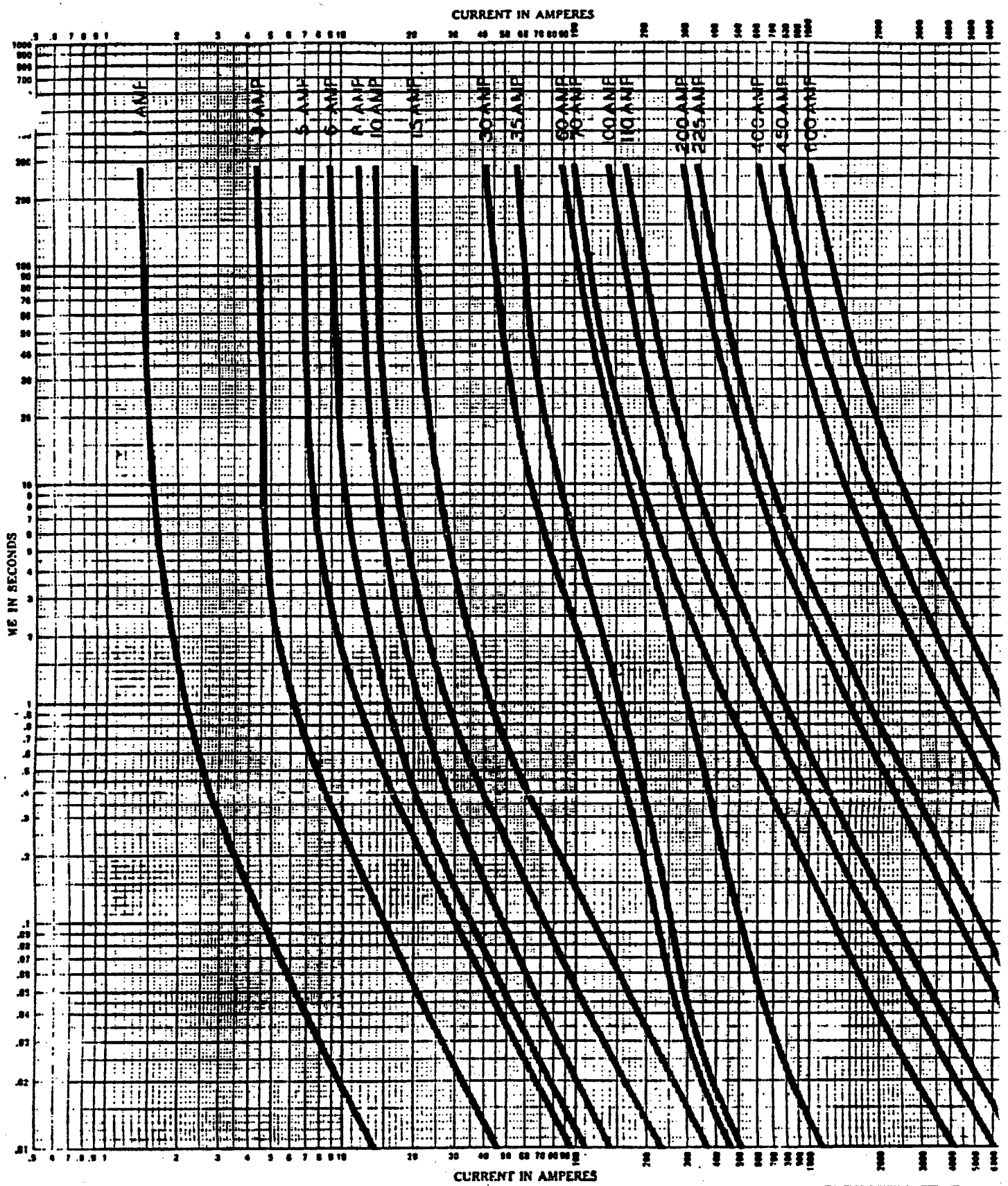
SWITCHGEAR SERVICES
Mike Austin

Phone: (770)452-4870 Dial Comm:8*283-_____
Fax: (770)452-4808 Dial Comm: 8*283-4808



Serving You...

02-97 12:11 FROM:GE SWITCHGEAR ID:7704524808 PAGE 1/1



Total Clearing Time-Current Characteristic Curves
For
NON ONE-TIME Fuses (250V)

BUSSMANN

No. FORM 151
Date 4-27-67

James A. FitzPatrick
Nuclear Power Plant
P.O. Box 41
Lycoming, New York 13093
315 342.3840

Memorandum

New York Power Authority

November 4, 1996
JDED 96-0564

MEMORANDUM TO: FILE

FROM: T. J. ANDERSEN

SUBJECT: TESTING OF PICK-UP AND DROP-OUT VOLTAGES OF RELAYS WHICH ARE TO BE FOUND IN THE EMERGENCY DIESEL GENERATOR CONTROL PANELS

On 10/28/96 the following relays; items 1 through 4 were tested by Mr. Brian Marks of JAF Maintenance Engineering department and Mr. T. J. Andersen of JAF Electrical Design Engineering. On 10/29/96 Mr. R. Baker of JAF Maintenance Engineering department tested item #5.

1. Agastat Model E7014PC002 SN#88370408 Cert. #CT88-5781 Item #2

   Pick-up occurred at 70.36 VDC @ 39mA.
   Drop-out occurred at approx 10VDC

2. Agastat Model E7012PC002 SN#88370398 Cert. #CT88-5781 Item #?

   Pick-up occurred at the following points: 71.77VDC @ 39mA
   70.38VDC @ 39mA
   Drop-out occurred at the following points: 12VDC
   11VDC

3. Agastat Model E7022PK002 SN#88370433 Cert. #C788-2965

   Pick-up occurred at the following points: 76VDC @ 40mA
   78VDC @ 40mA
   77.5VDC @ 40.5mA
   Drop-out occurred at the following range: 35-36VDC

4. Square "D" model KDP13V63 (125VDC) Cert. #CT S9568208

   Pick-up occurred at the following points: 89VDC, 86VDC, 90.5VDC, 91.85VDC all @ 6.4mA (current)

   Drop-out occurred in the following range: 44±2VDC

MEMORANDUM TO: FILE November 4, 1996
FROM: T. J. ANDERSEN JDED-96-0564
SUBJECT: TESTING OF PICK-UP AND DROP-OUT VOLTAGES OF RELAYS WHICH ARE TO BE FOUND IN THE EMERGENCY DIESEL GENERATOR CONTROL PANELS Page 2 of 2

5. General Electric model CR105K000BLA, Coil 15D21G26, 115/125VDC Cert. #Ct-C1.

   Pick-up occurred at: 61VDC @ 0.88 Amps

Items 1-5 were tested with Sorensen Power Supply DCR 150-6B located in the QC Test Lab in receipt inspection in the JAF Warehouse

Items 1-4 were tested at ambient temperature of 72.2°F, (Fluke ID# QE-18, Probe ID# QE-18C

Items 1-5 volt meter used was Fluke, ID# Q-E14, Cal. Due 2/2/97

Items 1-4 Ammeter used was Simpson ID# E-720, Cal. Due 8/26/97

Items 1-3 Fluke meter also used to detect contact change of state

Item 4 change of state was detected by listening to relay click on.

Item 5 ammeter used was Fluke 25, ID# E-260, Cal. Due 3/18/97

Item 5 was tested at ambient temperature of 68°F.

Attached for records are the original data sheets for the tests.

T.J. ANDERSEN
Sr. Electrical Engineer

TJA:bnr

cc: M. Speziali H. Kodali
B. Marks
J. Stead
A. Kahn
JDED File
RMS (JAF)

10/28/96 Temp 72.5°F
Fluke QE-18
51 probe QE-18C

AGASTAT
MODEL
E7014PC002 Pick-up @ 70.36 VDC Pick-up
SN#88370408 39 MA current pu
Cert # CT88-5781 item#2 10 VDC drop out

Sorensen supply DCR150-6B
⊖ ⊕

Volt meter	Ammeter	contact detector
Fluke	Simpson	Fluke
Q-E14	E 720	
Cal due 2/2/97	Cal due 8/26/97	

E7012PC002 Pick up @ 71.77 vdc, 70.38 vdc pick-up
SN# 88370398 39 MA. 39 MA Current P.U.
Cert# CT88-5781 item# 12 VDc ; 11 vdc ≈ drop out

E7022PK00 Pick up @ 76, 78, 77.5 vdc 77.6 Pick-up
SN# 88370433 40 ma 40 40.5 ma
Cert# CT 88-2965 35-36 vdc dropout

Square "D" 89 VDC 86 90.5, 91.85 pick-up
KDP13V63 (125VDC) 6.4 ma current PU
CT# S9568208 44 VDC ≈ drop out

Data
T J Anderson recorded by & B. Marks

NEW YORK POWER AUTHORITY
JAMES A. FITZPATRICK NUCLEAR POWER PLANT

EDP-2

CALCULATION SHEET

Mod/Proj. No.	Calc. No./ECR No.	Set No./Rev.	Page
		1	___ of ___

Subject/Title	QA Class

Preparer/Date	Reviewer/Date	Method	Approval/Date

JC7903G2

CR 105 K000BLA

COIL 15D21G26

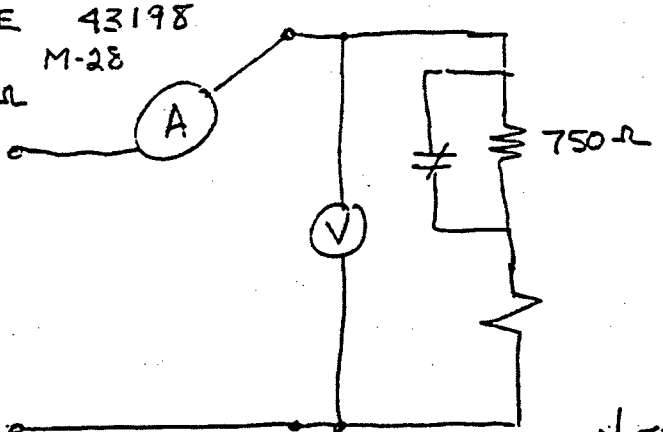
115/125 VDC

CT-C1

CAL DUE 2/2/97
VM FLUKE 8060A
Q-E14

PS SORENSEN
DCR 150-68

SERIES RESISTOR
OHMITE 43198
M-28
750 Ω



AM FLUKE 25
E-260
cal due 3/18/97

TEMP - Rm ≈ 68°F

NOTE:
TYPICAL circuit for
CR105 Relay
only coil was tested for
pick-up without resistor. TJK 11/18/96

RELAY POSITION VERTICAL

61 VDC .88 AMPS ← Pickup by Bob Baker

10/27/96 - 0640 my first day of the outage (SUNDAY)

OL'S TRIPPED ON Rx BLDG CRANE 0330 THIS AM - BIG SAFETY ISSUE ABOUT WALKING THE BEAM. SEE OL HAVE AUTO RESET FEATURE? They do n

AB 705 CONTACTOR - NON AUTO RESET OL -

DER-96-1223 Reviewed draft - made changes.

10AM - helped OPS tag out 10052 & 10042 BKRS.

Look at T4 tag out. - looks OK

help electrician with tag out on exciter

Monday 10/28/96 0700 -

DER 96.1223 TO ANDY FOR REVIEW ; comment

Station Batt - [illegible] with Riley Pii data

Tuesday 10/29/96 0700

DER to B Bruno for act's dates

Tested CR 105 contactor PU ≈ 62 Vac look OK.

The [D] relay KDP appears to be a PU problem.

Decision to replace the 2 cells that were removed about 16 yrs ago. has been made.

COMPANY OR COMPONENT — COMPLETE MAILING ADDRESS

TO: TAD MARKS — NYPA JAF MAINT.

GENERAL ELECTRIC — QUICK LETTER—WHEN REPLY NEEDED

FROM NAME — COMPONENT — COMPLETE MAILING ADDRESS

PAUL QUINN — GE SSM JAF

SUBJECT IC2800-1600 D.C. CONTACTOR P/U & D/O

BRIAN

THE FOLLOWING PICK-UP AND DROP-OUT VOLTAGES WERE PROVIDED BY THE GE PRODUCT DEPT. FOR ALL IC2800-1600 SERIES D.C. CONTACTORS.

	COLD	HOT
PICK-UP	45%-65%	80%
DROP-OUT	5%	15% (MAX.)

USE THE HOT P/U & D/O FOR YOUR TESTING.

SIGNED Paul M. Quinn DATE 9/21/92 PHONE/DIAL COMM. x6211

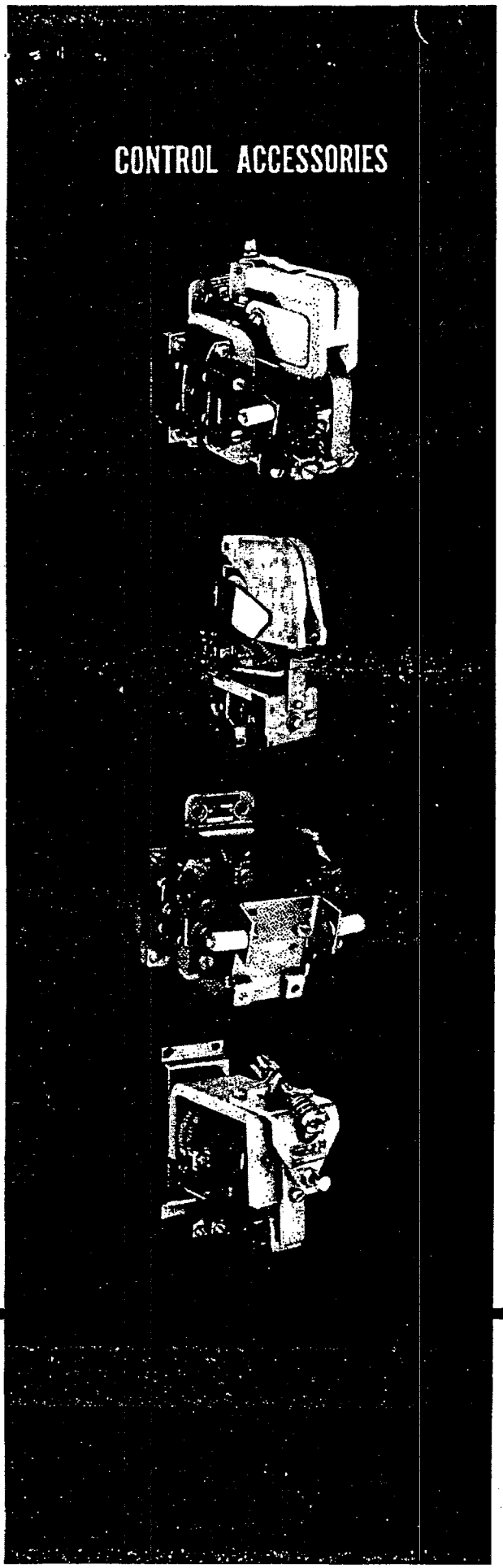
REPLY

SIGNED DATE PHONE/DIAL COMM.

FN-754 (3 SHTS.) (3-75) REV.

DATE SIGNED

GEA-662
Handbook Section 265
April 25, 19



0150063

DC CONTACTORS AND RELAYS

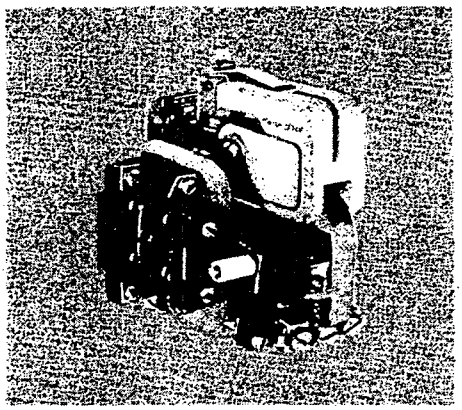
CONTENTS

GENERAL ELECTRIC

0150084

DC CONTACTORS AND RELAYS

GENERAL-PURPOSE CONTACTORS



IC2800-1617

WHERE TO USE

Use for general DC industrial control such as machine-tool control, textile-machinery control and similar applications. Contactors have a steel base insulated from the electrical circuits. They can be mounted on either metal or insulating panels.

Select contactor ratings on the basis of both DC current-carrying capacity and blowout ratings.

For motor and resistive loads choose contactors with the required DC current-carrying capacity as given in the application table on page 4. Specify units with maximum blowout ratings, and design operating overloads for reduced-voltage starters to four times full-load current.

For moderately inductive loads, such as motor fields with discharge resistors, select contactors with blowout ratings two to three times rated full-load DC current.

For highly inductive loads, such as brake coils without discharge resistors, use two poles in series and choose blowout ratings equal to three or four times rated coil current.

Choose contactors with holding coils whenever a positive lock-out of the main pole is desired, as for dynamic braking of a motor or reversing a DC circuit.

Order interlocks either factory-mounted or separately supplied depending upon anticipated use. If applications are known in advance, factory-mounted interlocks can be ordered. If flexibility in application is desired, order interlocks separately and mount as needed. Select voltage range depending on application.

HOW TO ORDER

By catalog number—Order contactors by complete IC number, where given, including form number, coil number, and interlock designation (if required). Order accessories (rectifiers, resistors, auxiliary contactors) for unit-mounted contactors as separate items included in the contactor price.

Example: *For a NEMA Size 1 contactor having one normally open pole with blowout rating of 25 amp, and two normally open interlock circuits, for operation on 550 volts DC—specify contactor IC2800-1607F19F and series resistor 151A3984G1—5700 ohms.*

By description—To order contactors for which a form number is not listed, order by description only.

HOW TO SELECT

Step 1—Select Form

NEMA Size	8-hr Open Rating Amp DC	Poles	Blowout Rating Amp, DC		Holding Coil**	Unit-mounted			Enclosed (NEMA Type 1 Ventilated)			
							List Price, GO-10		DC Coil Operation		AC Coil Operation	
			NO Pole	NC Pole		Form IC2800-	DC Coil Operation	AC Coil Operation	IC2801-	List Price GO-10	IC2801-	List Price GO-10
1	25	1 NO	none	....	....	1607A	$40	$85	8A200B	$40	8A250B	$145
			1	....	....	1607B	43	88	8A200C	43	8A250C	148
			2	....	....	1607C	43	88	8A200D	43	8A250D	148
			5	....	....	1607D✚	43	88	8A200E	43	8A250E	148
			10	....	....	1607E	43	88	8A200F	43	8A250F	148
			25	....	....	1607F✚	43	88	8A200A	43	8A250A	148
		1 NC	....	2	no	1608F	63	108	8B200D	83	8B250D	168
			....	5	no	1608H	63	108	8B200E	83	8B250E	168
			....	10	no	1608K	63	108	8B200F	83	8B250F	168
			....	25	no	1608M	63	108	8B200A	83	8B250A	168
			....	25	yes	1608L	73	118	.....	93	.....	178
			....	none	no	1608B	60	105	8B200B	80	8B250B	165
		2 NO*	25	....	....	.....	....	....	8A201A	116	8A251A	221
		1 NO and 1 NC	2	2	no	1609F	88	133	8C200D	108	8C250D	193
			5	5	no	1609H✚	88	133	8C200E	108	8C250E	193
			10	10	no	1609K	88	133	8C200F	108	8C250F	193
			25	25	no	1609M	88	133	8C200A	108	8C250A	193
			25	25	yes	1609L	98	143	.....	118	.....	203
			25	none	no	1609AA	85	130	.....	105	.....	190
			25	none	yes	1609W✚	95	140	.....	115	.....	200
2	50	1 NO	none	....	....	1617A	83	98	8D200B	78	8D250B	163
			5	....	....	1617F	87	102	8D200C	82	8D250C	167
			10	....	....	1617E	87	102	8D200D	82	8D250D	167
			25	....	....	1617C	87	102	8D200E	82	8D250E	167
			50	....	....	1617B✚	87	102	8D200A	82	8D250A	167
		1 NC	....	none	no	1618B	82	127	8E200B	107	8E250B	192
			....	5	no	1618K	86	131	8E200C	111	8E250C	196
			....	10	no	1618H	86	131	8E200D	111	8E250D	196
			....	25	no	1618D	86	131	8E200E	111	8E250E	196
			....	50	no	1618F	86	131	8E200A	111	8E250A	196
			....	50	yes	1618E	104	149	.....	129	.....	214
		2 NO	none	....	....	16128E	83	128	CE200H	108	CE250H	193
			5	....	....	16128D	91	136	CE200J	116	CE250J	201
			10	....	....	16128C	91	136	CE200K	116	CE250K	201
			25	....	....	16128B	91	136	CE200L	116	CE250L	201
			50	....	....	16128A✚	91	136	CE200G	116	CE250G	201

✚Normal factory stock.
* Two separate contactors in one enclosure.
**Holding coils available on all contactors having a NC pole. Order by description if not listed.

GENERAL-PURPOSE CONTACTO

Step 1—Select Form (Continued)

NEMA Size	8-hr Open Rating Amp DC	Poles	Blowout Rating Amp, DC NO Pole	Blowout Rating Amp, DC NC Pole	Holding Coil**	Unit-mounted Form IC2800-	Unit-mounted List Price, GO-10 DC Coil Operation	Unit-mounted List Price, GO-10 AC Coil Operation	Enclosed (NEMA Type 1 Ventilated) DC Coil Operation IC2801-	Enclosed DC Coil Operation List Price GO-10	Enclosed AC Coil Operation IC2801-	Enclosed AC Coil Operation List P GO-
2	50	1 NO and 1 NC	5	5	no	1619P	$120	$165	BF200C	$145	BF250C	$2
			10	10	no	1619R	120	165	BF200D	145	BF250D	2
			25	25	no	1619D	120	165	BF200E	145	BF250E	2
			50	50	no	1619F	120	165	BF200A	145	BF250A	2
			50	50	yes	1619E	138	183	.....	163	.....	2
			50	none	no	1619M	116	161	.....	141	.....	2
			50	none	yes	1619L✤	134	179	.....	159	.....	2
		2 NO and 1 NC	5	5	no	1613BJ	154	199	.....	169	.....	2
			10	10	no	1613BH	154	199	.....	169	.....	2
			25	25	no	1613BG	154	199	.....	169	.....	2
			50	50	no	1613BF	154	199	.....	169	.....	2
			50	50	yes	1613BA	172	217	.....	197	.....	2
			50	none	no	1613BM	150	195	.....	165	.....	2
			50	none	yes	.....	178	223	.....	193	.....	2
		2 NO and 2 NC	5	5	no	1614BJ	199	244	CR200V	222	CR250C	3
			10	10	no	1614BH	199	244	CR200W	222	CR250D	3
			25	25	no	1614BG	199	244	CR200X	222	CR250E	3
			50	50	no	1614BF	199	244	CR200S	222	CR250A	3
			50	50	yes	1614BA	217	262	CR200L	242	.....	3
			50	none	no	.....	183	228	.....	206	.....	2
			50	none	yes	.....	201	246	.....	224	.....	3
3	100	1 NO	none	....	....	1621AN	77	122	BX200H	107	BX250H	1
			5	....	....	1621AS	82	127	BX200J	112	BX250J	1
			10	....	....	1621AR	82	127	BX200K	112	BX250K	1
			25	....	....	1621AQ	82	127	BX200L	112	BX250L	1
			50	....	....	1621AP	82	127	BX200M	112	BX250M	1
			100	....	....	1621AM✤	82	127	BX200G	112	BX250G	1
		1 NC	....	5	no	.....	118	163	.....	148	.....	2
			....	10	no	.....	118	163	.....	148	.....	2
			....	25	no	.....	118	163	.....	148	.....	2
			....	50	no	1620AV	118	163	.....	148	.....	2
			....	100	no	1620AP	118	163	BR200AR	148	.....	2
			....	100	yes	1620AM	138	183	.....	168	.....	2
			....	none	no	1620AQ	113	168	.....	153	.....	2
		2 NO	none	....	....	1622AN	112	157	BY200H	142	BY250H	2
			5	....	....	1622AS	122	167	BY200J	152	BY250J	2
			10	....	....	1622AR	122	167	BY200K	152	BY250K	2
			25	....	....	1622AQ	122	167	BY200L	152	BY250L	2
			50	....	....	1622AP	122	167	BY200M	152	BY250M	2
			100	....	....	1622AM✤	122	167	BY200G	152	BY250G	2
		1 NO and 1 NC	5	5	no	1625BD	158	203	.....	188	.....	2
			10	10	no	1625BC	158	203	.....	188	.....	2
			25	25	no	1625BB	158	203	.....	188	.....	2
			50	50	no	1625BA	158	203	.....	188	.....	2
			100	100	no	1625AQ	158	203	.....	188	.....	2
			100	100	yes	1625AM	178	223	.....	208	.....	2
			100	none	no	1625AS	153	198	.....	183	.....	2
			100	none	yes	1625AP✤	173	218	.....	203	.....	2
		2 NO and 1 NC	5	5	no	1623BD	198	243	.....	228	.....	3
			10	10	no	1623BE	198	243	.....	228	.....	3
			25	25	no	1623BF	198	243	.....	228	.....	3
			50	50	no	1623BG	198	243	.....	228	.....	3
			100	100	no	1623AQ	198	243	.....	228	.....	3
			100	100	yes	1623AM	218	263	.....	248	.....	3
			100	none	no	1623AS	193	238	.....	223	.....	3
			100	none	yes	1623AP✤	213	258	.....	243	.....	3

Step 2—Add Coil Number

Volts	COIL NUMBER UNIT MOUNTED Without Holding Coil Size 1	Without Holding Coil Size 2 1617, 1618, 1619	Without Holding Coil Size 2 1612, 1613, 1614	Without Holding Coil Size 3	With Holding Coil Size 1	With Holding Coil Size 2 1617, 1618, 1619	With Holding Coil Size 2 1612, 1613, 1614	With Holding Coil Size 3	Enclosed	List Pr GO-1
115/120 V DC	3✤	3✤	3	3	203	203	203	203	¶	
230/240/250 V DC	2✤	2✤	2✤	2✤	202✤	202✤	202✤	202✤	¶	PRIC
500 V DC	37‡	4	4	4	204	204	204	204	¶	INCLUI
550 V DC	38‡	5	5	5	211	205	205	205	¶	IN
110 V AC	9‡	16‡	15‡	15‡	.....	.....	.....	.....	202	ABO\
220 V AC	9‡	16‡	15‡	15‡	.....	.....	.....	.....	203	
440 V AC	3‡	3‡	3‡	3‡	.....	.....	.....	.....	204	

Step 3—Add Interlock Designation

Circuit Arrangement ✤	0-48 v DC Left-hand Mounting	0-48 v DC Right-hand Mounting	49-600 v DC; 0-600 v AC Left-hand Mounting	49-600 v DC; 0-600 v AC Right-hand Mounting	Price Addition, GO-10 0-48 v DC	Price Addition, GO-10 49-600 v DC; 0-600 v AC
1 NO	AB	AC	B	C	$15	$9
1 NC	AD	AE	D	E	15	9
2 NO	AF	AG	F	G	21	12
1 NO, 1 NC	AH	AJ	H	J	21	12
2 NC	AK	AL	K	L	21	12

Selection table continued on page 4.

✤Normal factory stock.

**Holding coils available on all contactors having NC pole. Order by description if not listed.

‡ Accessories required from page 4.

¶ Specify control volts.

✤ Interlock contacts can be changed from normally open to normally closed and vice versa if n sary. To insure proper electrical clearanc NO–NC forms, locate NC contact at botto interlock.

Prices and data subject to change without notice

GENERAL-PURPOSE CONTACTORS

Step 4—Specify Accessories (required for unit-mounted contactors and voltages indicated)

Contactor NEMA Size	Operation	Volts	Series Resistor	Rectifier	Auxiliary Contactor	Price Additic GO-1(
1	DC	500	151A3984G1—4000 ohms	.....	.....	
		550	151A3984G1—4500 ohms	.....	.....	
	AC	115, 60 cycles	151A3984G1—150 ohms	6RS22PB3AHD1	.....	
		220, 60 cycles	151A3984G1—750 ohms	6RS22PB3AHD1	.....	
		440, 60 cycles	151A3984G1—3000 ohms	6RS22PB6AHD1	.....	
2†	AC	115, 60 cycles	151A3984G1—200 ohms	6RS22PB3AHD1	.....	NONE
		220, 60 cycles	151A3984G1—750 ohms	6RS22PB3AHD1	.....	
		440, 60 cycles	151A3984G1—2800 ohms	6RS22PB6AHD1	.....	
2‡	AC	115, 60 cycles	151A3984G2—85 ohms	6RS22PB3AHD1	CR2810-A14AC2	
		220, 60 cycles	151A3984G2—430 ohms	6RS22PB3AHD1	CR2810-A14AC2	
		440, 60 cycles	151A3984G2—1400 ohms	6RS22PB6AHD1	CR2810-A14AC2	
3	AC	115, 60 cycles	151A3984G2—85 ohms	6RS22PB3AHD1	CR2810-A14AC2	
		220, 60 cycles	151A3984G2—430 ohms	6RS22PB3AHD1	CR2810-A14AC2	
		440, 60 cycles	151A3984G2—1400 ohms	6RS22PB6AHD1	CR2810-A14AC2	

Step 5—Specify Mechanical Interlocks (required to interlock two adjacent contactors)

Contactor	Mechanical Interlock	Contactor Spacing (In.) Center Line to Center Line	List Price, GO-10
IC2800-1607	IC2956 Cat. No. 8201808G5	3⅜	$16
IC2800-1617	IC2956 Cat. No. 8201808G4	3½	20
IC2800-1621	IC2956 Cat. No. 6923809G8	5½	25

* Specify two for contactors with holding coils.
† Forms 1617, 1618, and 1619.
‡ Forms 1612, 1613, and 1614.
NOTE: Mechanical interlocks are used as a supplement to electrical interlocks when required for additional protection. When mechanical interlocks are used, the electrical interlocks must be mounted on the outside of each contactor.

Contactor spacing is horizontal distance be center lines of contactors.

HOW TO SELECT INTERLOCKS FOR STOCKING

Step 1—Select Interlock Contact Blocks (One contact block maximum per contactor)

Circuits	0–48 v DC	49–600 v DC; 0–600 v AC	List Price, GO-10	
			0–48 v DC	49–600 v DC; 0–600 v
1 NO	IC2956-A200AD	IC2956-A200G	$12	$6
1 NC	IC2956-A200AE	IC2956-A200H	12	6
2 NO	IC2956-A200AA	IC2956-A200A✚	18	9
2 NC	IC2956-A200AB	IC2956-A200B✚	18	9
1 NO, 1 NC	IC2956-A200AC	IC2956-A200C✚	18	9

Step 2—Select Mounting Kit (one required per contact block)

Contactor		Mounting Kit		List Price, GO-10	
Size	Main Poles	Left-hand Mounting	Right-hand Mounting	Left-hand Mounting	Right-hand Mounting
1	All	IC2956-A202J✚	IC2956-A202K	$1	$1
2*	All	IC2956-A202C✚	IC2956-A202D	1	1
3	NO	IC2956-A202E✚	IC2956-A202F	1	1
3	NC	IC2956-A202E✚	IC2956-A202F	1	1
3	1 NO, 1 NC	IC2956-A202E✚	IC2956-A202F	1	1
3	2 NO	IC2956-A202G✚	IC2956-A202H	1	1
3	2 NO, 1 NC	IC2956-A202G✚	IC2956-A202H	1	1

✚Normal factory stock.

* For Form 1612, order mounting kit listed for Size 3 contactor. For Forms 1613 and 1614 order IC2956-A202G for either side.

CONTACT RATINGS

Contactor Size	Open Carry Rating in Amperes (When maximum blowout is used)				Make Amp 600 v DC	Interrupt		
	8-hr	60-min	30-min	10-min		DC Motor Circuit		Inductive Circ with Discharge Resi
						250 v	600 v	
1	25	25	30	37	100	100 A	40 A	30%–80% blowout rating
2	50	60	70	90	200	200 A	100 A	
3	100	133	150	200	400	400 A	200 A	

Horsepower ratings—Select contactors on the basis of the highest horsepower at which motor is rated (or operated if operated at a service-factor rating).

Intermediate accelerating contactors—Select intermediate accelerating contactors (from Step 1) so that the 8-hour rating will not be less than 0.25 times the accelerating peak.

APPLICATION (MOTOR AND RESISTIVE LOADS)

Contactor Size	Motor Horsepower								Resistive Heating Load: (Except infrared lamp loc Kw	
	Full-voltage Starting		Reduced-voltage Starting Continuous-rated Motors (Line, reversing, or final accelerating contactor)				30-min	60-min		
	115/120 v	230–550 v	115/120 v	230/240/250 v	500 v	550 v	230/240/250 v	230/240/250 v	115/120 v	230/240/2
1	1½	2	3	5	5	5	7½	5	2.5	5.0
2	.....	.....	5	10	15	15	15	15	5.2	10.4
3	.....	.....	10	25	30	30	35	35	10.4	20.8

Discharge resistor—The discharge resistor for an inductive circuit can be permanently connected in parallel with the load or can be connected across the load by a normally closed pole. The resistor should not exceed four times the load resistance for 250 volts or two times the load resistance for 600 volts.

Interlock contact rating—See page 19.

CONTROL POWER REQUIREMENTS

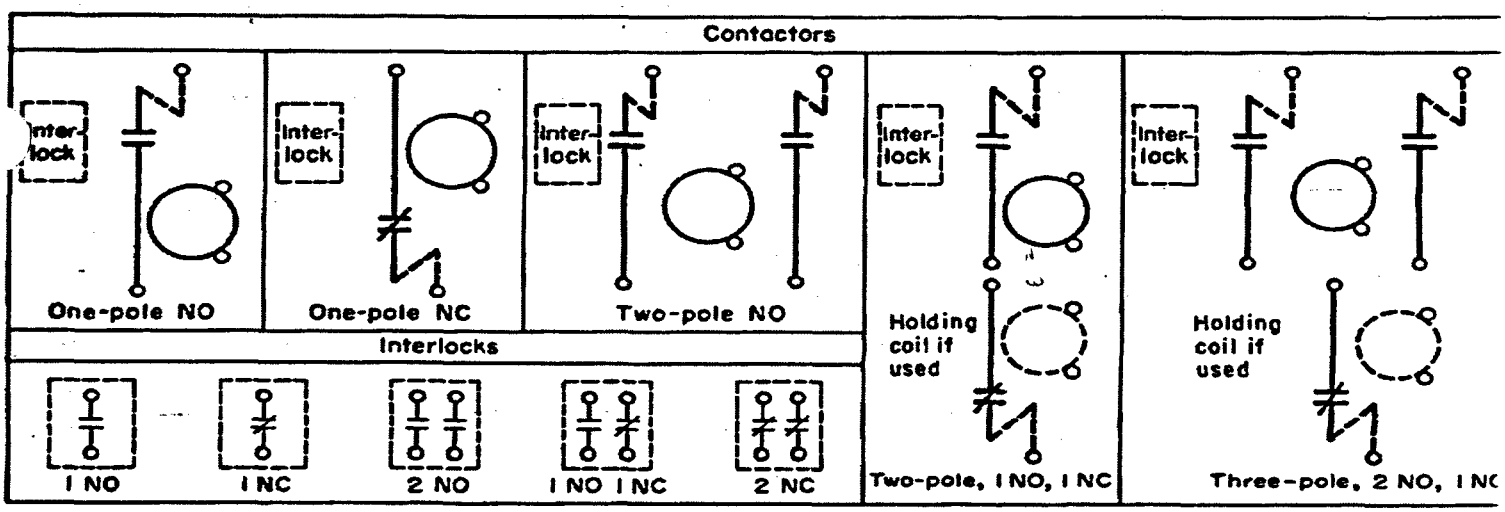
Contactor Size	Poles	Number of Contactors	CURRENT REQUIREMENTS—AMP VOLTS DC 115/120	230/240/250	500	550	BURDEN—VOLT-AMPERES* VOLTS AC 115	220	44
1	1 NO	1	0.133	0.076	0.069	0.071	31	46	4E
	1 NC	1	0.133	0.076	0.069	0.071	31	46	4E
	1 NO–1 NC**	1	0.133	0.076	0.069	0.071	31	46	4E
	2 NO	2	0.263	0.139	0.076	0.066	54	53	57
2	1 NO	1	0.135	0.083	0.038	0.028	27.6	48.5	4E
	1 NC	1	0.135	0.083	0.038	0.028	27.6	48.5	4E
	1 NO–1 NC**	1	0.135	0.083	0.038	0.028	27.6	48.5	4E
	2 NO	1	0.320	0.173	0.087	0.069	47.2	77	105
	2 NO–1 NC†	1	0.320	0.173	0.087	0.069	47.2	77	105
	2 NO–2 NC†	1	0.320	0.173	0.087	0.069	47.2	77	105
3**	1 NO	1	0.320	0.173	0.087	0.069	47.2	77	105
	1 NC†	1	0.320	0.173	0.087	0.069	47.2	77	105
	2 NO	1	0.320	0.173	0.087	0.069	47.2	77	105
	1 NO–1 NC†	1	0.320	0.173	0.087	0.069	47.2	77	105
	2 NO–1 NC†	1	0.320	0.173	0.087	0.069	47.2	77	105

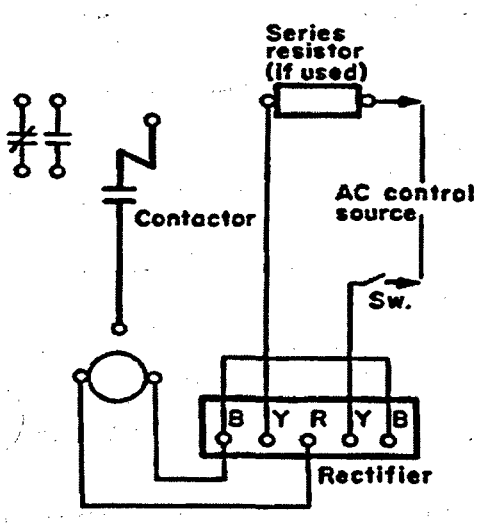
* Volt-ampere Burden includes power requirements of rectifier series resistor and auxiliary contactor.

**Listed power requirements pertain to operating coil only; holding coil if used will have same power requirements as operating coil.

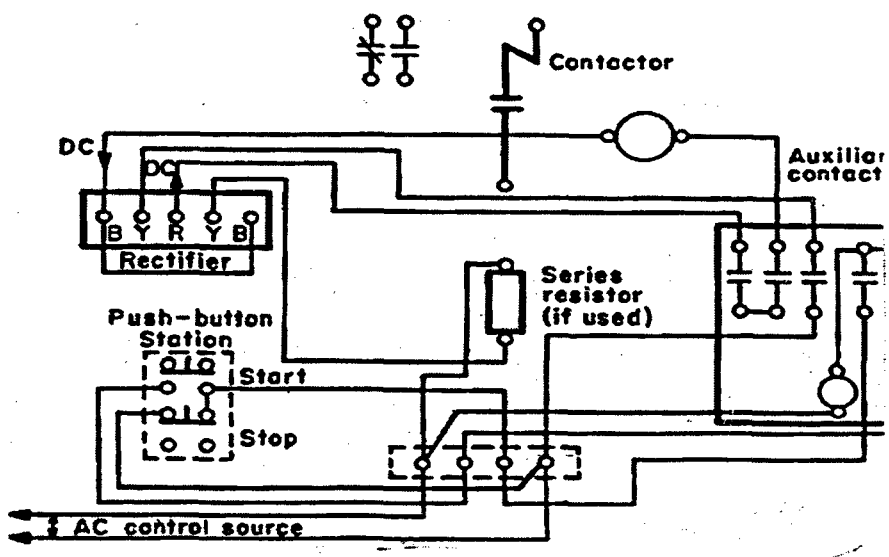
† Listed power requirements pertain to operating coil only; holding coil if used will have same power requirements of operating coil.

WIRING SYMBOLS (FRONT VIEW)





Size 1 and 2 contactor—typical diagram for a-c operation



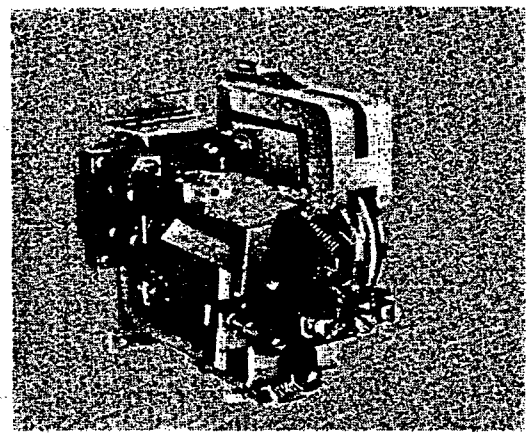
Size 3 contactor—typical diagram for a-c operation

Prices and data subject to change without notice

0150078

TIME-DELAY CONTACTORS

NORMALLY OPEN



IC2800-B310

WHERE TO USE

IC2800-B310 and -B410 contactors are normally open, single-pole contactors constructed with copper jacketed coils which provide time delay on drop-out. The contactors are front-connected and can be mounted on either insulating or noninsulating panels.

HOW TO ORDER

Order by complete IC number including form, time delay, and interlock de nation. Specify accessories, where ca for, as separate items included in the c tactor price.

Example: *To order a 50-amp, 110- AC contactor with two NO interlock. blowout rating of 10 amp and a ti delay of 0.5 seconds, specify conta IC2800-B301CR210D with resistor 15 3984G1—90 ohms. IC- and recti 6RS22PB3AHD1.*

HOW TO SELECT

Step 1—Select Form

8-hr Open Rating (Amp) 600 v Max	Poles	Blowout Rating (Amp)	Form IC2800-	List Price, GO-10 DC Operation	List Price, GO-10 AC Operation
50	1 NO	2	B310F	$79	$164
		5	B310D	79	164
		10	B310C	79	164
		25	B310B	79	164
		50	B310A	79	164
100	1 NO	None	B410H	91	176
		5	B410M	96	181
		10	B410L	96	181
		25	B410K	96	181
		50	B410J	96	181
		100	B410G	96	181

Step 2—Add Time-delay Designation

(Select time delay so that the desired delay falls in the middle of the time-delay range, as nearly as possible)

Time Delay in Seconds		Designation						
Without Interlock	With Two-circuit Interlocks	AC Operation 115/120	AC Operation 230/240/250	AC Operation 500 v	AC Operation 550 v	AC Operation 110 v	AC Operation 220 v	AC Operation 440 v
IC2800-B310								
0.25–0.35	0.2 –0.25	Y203	Y202	Y204	Y216	Y210	Y210	Y203
0.4 –0.6	0.3 –0.45	X203	X202	X204	X216	X210	X210	X203
0.5 –0.8	0.4 –0.6	R203	R202	R204	R216	R210	R210	R203
0.75–1.25	0.6 –0.9	B203	B202	B204	B216	B210	B210	B203
1.0 –1.4	0.75–1.1	F203	F202	F204	F216	F210	F210	F203
1.3 –1.6	1.0 –1.2	E203	E202	E204	E216	E210	E210	E203
IC2800-B410								
0.7–0.9	0.7–0.9	Y32	Y31	Y33	Y34	Y37	Y37	Y31
0.9–1.2	0.9–1.2	X32	X31	X33	X34	X37	X37	X41
1.3–1.8	1.3–1.8	R32	R31	R33	R34	R37	R37	R31
1.8–2.5	1.5–2.5	B32	B31	B33	B34	B37	B37	B31
3.2–5.0	3.2–5.0	F32	F31	F33	F34	F37	F37	F31

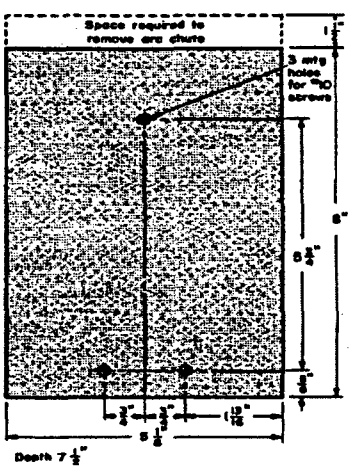
Step 3—Add Interlock Designation

Number of Interlock Circuits	Designation	Price Addition, GO-10
None	.....	.....
2 NO	D	$12
1 NO, 1 NC	C	12
2 NC	B	12

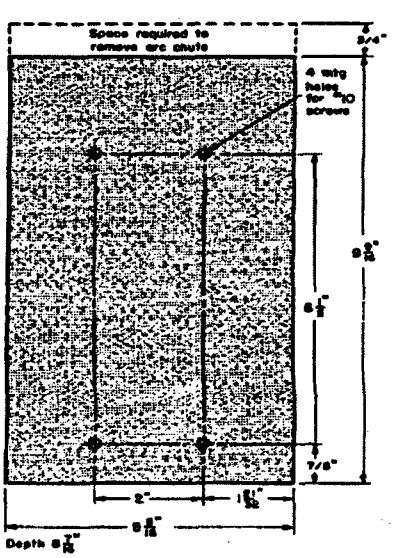
Step 4—Specify Accessories (For listed voltages only. Included in contactor price)

...ol ...s	IC2800-B310 Rectifier	IC2800-B310 Resistor Cat. No.	IC2800-B410 Rectifier	IC2800-B410 Resistor Cat. No.
500 V DC	.....	151A3984G1—3000 ohms	.....	.....
550 V DC	.....	151A3984G1—4000 ohms	.....	.....
110 V AC	6RS22PB3AHD1	151A3984G2— 90 ohms	6RS22PB3AHD1	151A3984G2— 80 ohms
220 V AC	6RS22PB3AHD1	151A3984G2— 450 ohms	6RS22PB3AHD1	151A3984G2— 350 ohms
440 V AC	6RS22PB6AHD1	151A3984G2—1800 ohms	6RS22PB6AHD1	151A3984G2—1400 ohms

Refer to Page 15 for Dimensions of Accessories.



Mounting Dimensions IC2800-B310



Mounting Dimensions IC2800-B410

0150079

NORMALLY CLOSED

WHERE TO USE

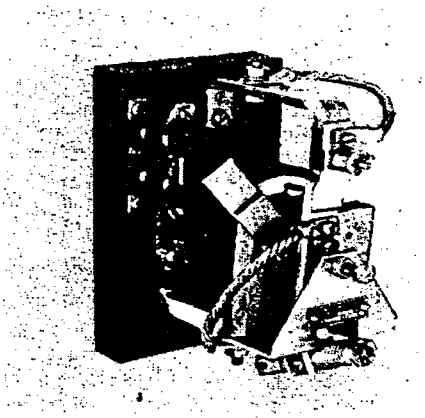
Used to short-out resistance steps in starting DC motors. Contactors are normally closed, without blowouts, and are not designed to interrupt power.

Pick-up is instantaneous; dropout occurs with time delay obtained by use of a nonmagnetic armature shim. Time delay of IC2800-A501 contactors can be adjusted over a narrow range by the armature spring. Time delay of IC2800-Y109 and -Y110 contactors can be adjusted over a wide range by a sliding shim.

Mount contactors on either metal or insulating panels. Make connections from the front.

HOW TO ORDER

Order by complete IC number including form number, suffix designation for time delay and holding resistor, if required. **Example:** *To order 100-amp 115-volt continuously rated contactor with two normally closed interlocks and time delay of 1.0 seconds, specify contactor IC2800-A501AF23B and resistor 151A-3984G1—250 ohms.*



IC2800-A501

HOW TO SELECT

Step 1—Select Form

Contact Rating Amp	Poles	Time Delay (seconds)	Volts	Interlock Arrangement	Form IC2800-	List Price, GO-10
100	1 NC	See Step 2	115/120	2 NO	A501A..23D	$119
				1 NO, 1 NC	A501A..23C	119
				2 NC	A501A..23B	119
			230/240/250	2 NO	A501A..24D	119
				1 NO, 1 NC	A501A..24C	119
				2 NC	A501A..24B	119
			500	2 NO	A501A..27D	119
				1 NO, 1 NC	A501A..27C	119
				2 NC	A501A..27B	119
			550	2 NO	A501A..28D	119
				1 NO, 1 NC	A501A..28C	119
				2 NC	A501A..28B	119
150	1 NC	0.75–3.0	115/120	2 NO	Y109B2	149
				1 NO, 1 NC	Y109A2	149
			230/240/250	2 NO	Y109B3	149
				1 NO, 1 NC	Y109A3	149
			500	2 NO	Y109B4	149
				1 NO, 1 NC	Y109A4	149
			550	2 NO	Y109B4	149
				1 NO, 1 NC	Y109A4	149
300	1 NC	0.75–3.0	115/120	2 NO	Y110B4	180
				1 NO, 1 NC	Y110A4	180
			230/240/250	2 NO	Y110B2	180
				1 NO, 1 NC	Y110A2	180
			500	2 NO	Y110B13	180
				1 NO, 1 NC	Y110A13	180
			550	2 NO	Y110B13	180
				1 NO, 1 NC	Y110A13	180

Step 2—Insert Time-delay Designation

(For Form A501A only)

Timing Range in Seconds		Designation
Intermittent Coil Operation	Continuous Coil Operation (Requires holding resistor, Step 3)	
0.34–0.59	0.17 –0.295	Y
0.48–0.88	0.24 –0.44	X
0.63–1.30	0.315–0.65	R
1.05–2.14	0.53 –1.07	B
1.86–3.24	0.93 –1.62	F
2.60–4.80	1.30 –2.40	C
5.80–7.60	2.90 –3.80	E
6.50–8.50	3.25 –4.25	D

Step 3—Specify Holding Resistor

(For Form A501A continuous duty only)

Volts	Resistor	Price Addition, GO-10
115/120	151A3984G1– 250 ohms	$2.50
230/240/250	151A3984G1–1000 ohms	2.50
500	151A3984G1– 600 ohms	2.50
550	151A3984G1–5000 ohms	2.50

Refer to Page 15 for Dimensions of Accessories.

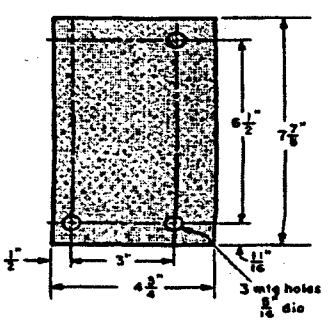
Continuous duty—For continuous duty of IC2800-A501A, one interlock must be used to place holding resistor in circuit after pickup.

Interlock contacts—Interlock contacts can be changed by the purchaser from normally open to normally closed, and vice versa.

IC2800 Form	Dimensions in Inches						Depth
	A	B	C	D	E	F	
Y109	8½	4⅝	3½	½	6	1	6⅛
Y110	10½	6⅛	4¾	¾	7¼	1¼	7⅛

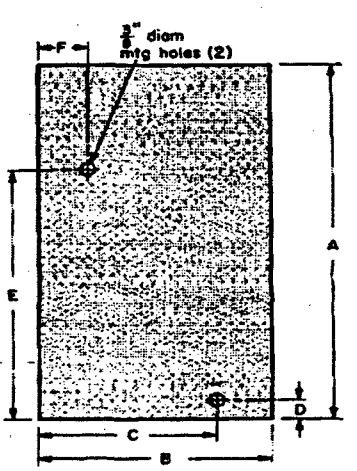
CONTROL POWER REQUIREMENTS

Volts	Amperes			
	IC2800—A501		IC2800-Y109	IC
	Without holding resistor	With holding resistor		
115/120	0.55	0.262	1.05	1
230/240/250	0.31	0.141	0.56	(
500	0.17	0.08	0.35	(
550	0.12	0.06	0.25	(



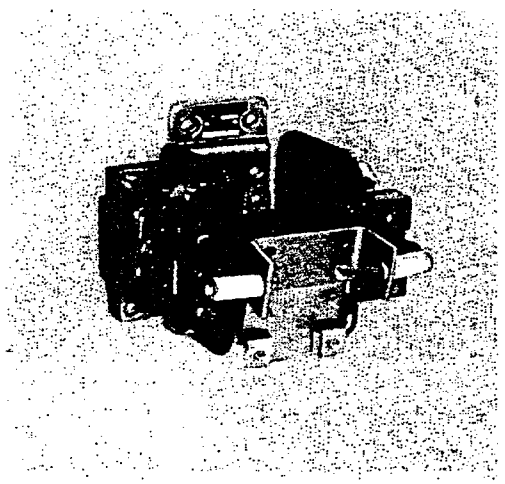
Depth 6 in. Weight 10 lbs.

Mounting Dimensions IC2800-A50

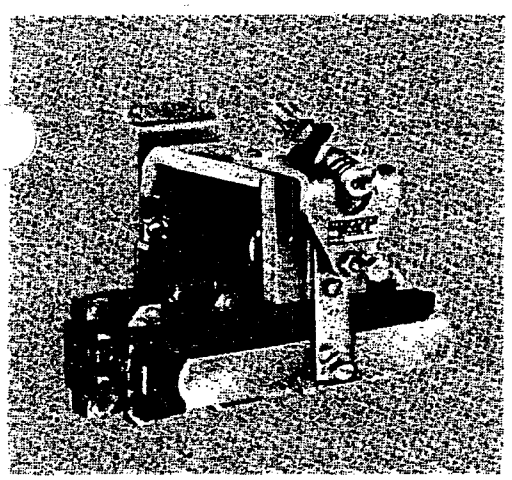


Mounting Dimensions IC2800-Y109 and

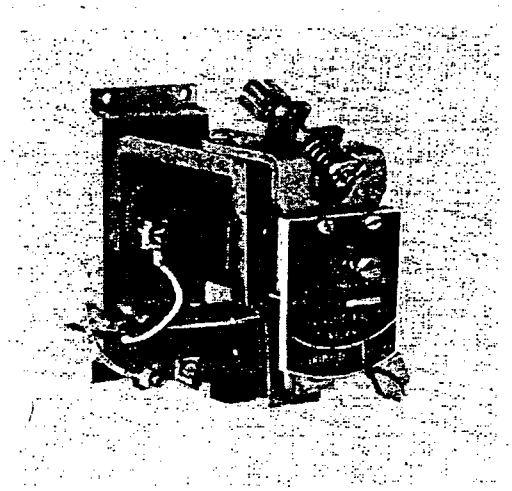
GENERAL-PURPOSE RELAYS



General-duty relay



Heavy-duty relay



Latched-in relay

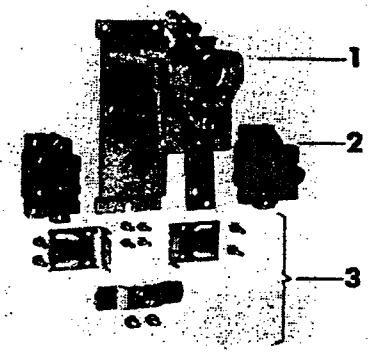
HOW TO SELECT ASSEMBLED RELAYS

Step 1—Select Form

Number of Contacts	Contact Arrangement NO	Contact Arrangement NC	Unit-mounted (Open) Form IC2820-	Unit-mounted (Open) List Price, GO-10	NEMA 1 Enclosed Form IC2821-	NEMA 1 Enclosed List P GO-
General-duty, 0–48 Volts DC						
1	0	1	A200A...AB	$33	BA200A...AB	$48
	1	0	A200A...AC	33	BA200A...AC	48
2	0	2	A200A...AD	39	BA200A...AD	54
	1	1	A200A...AE	39	BA200A...AE	54
	2	0	A200A...AF	39	BA200A...AF	54
4	2	2	A200A...AJ	60	BA200A...AJ	75
	3	1	A200A...AK	60	BA200A...AK	75
	4	0	A200A...AL	60	BA200A...AL	75
General-duty, 49–600 Volts DC						
1	0	1	A200A...B	27	BA200A...B	42
	1	0	A200A...C	27	BA200A...C	42
2	0	2	A200A...D	30	BA200A...D	45
	1	1	A200A...E	30	BA200A...E	45
	2	0	A200A...F	30	BA200A...F	45
4	2	2	A200A...J	42	BA200A...J	57
	3	1	A200A...K	42	BA200A...K	57
	4	0	A200A...L	42	BA200A...L	57
Heavy-duty, 0–48 Volts DC						
1	0	1	A100BB...DB	55	AF201B...DB	75
	1	0	A100BB...DC	55	AF201B...DC	75
2	0	2	A100BB...DD	61	AF201B...DD	81
	1	1	A100BB...DE	61	AF201B...DE	81
	2	0	A100BB...DF	61	AF201B...DF	81
4	0	4	A100BB...DG	82	AF201B...DG	102
	1	3	A100BB...DH	82	AF201B...DH	102
	2	2	A100BB...DJ	82	AF201B...DJ	102
	3	1	A100BB...DK	82	AF201B...DK	102
	4	0	A100BB...DL	82	AF201B...DL	102
Heavy-duty, 49–600 Volts DC						
1	0	1	A100BB...B	49	AF201B...B	69
	1	0	A100BB...C	49	AF201B...C	69
2	0	2	A100BB...D	52	AF201B...D	72
	1	1	A100BB...E	52	AF201B...E	72
	2	0	A100BB...F	52	AF201B...F	72
4	0	4	A100BB...G	64	AF201B...G	84
	1	3	A100BB...H	64	AF201B...H	84
	2	2	A100BB...J	64	AF201B...J	84
	3	1	A100BB...K	64	AF201B...K	84
	4	0	A100BB...L	64	AF201B...L	84
6	0	6	A100BB...AB	76	AF201B...AB	96
	1	5	A100BB...AD	76	AF201B...AD	96
	2	4	A100BB...AE	76	AF201B...AE	96
	3	3	A100BB...AF	76	AF201B...AF	96
	4	2	A100BB...AG	76	AF201B...AG	96
	5	1	A100BB...AH	76	AF201B...AH	96
	6	0	A100BB...AJ	76	AF201B...AJ	96
8	2	6	A100BB...BB	88	AF202B...BB	108
	3	5	A100BB...BC	88	AF202B...BC	108
	4	4	A100BB...BD	88	AF202B...BD	108
	5	3	A100BB...BE	88	AF202B...BE	108
	6	2	A100BB...BF	88	AF202B...BF	108
	7	1	A100BB...BG	88	AF202B...BG	108
	8	0	A100BB...BH	88	AF202B...BH	108
10	4	6	A100BB...CB	100	AF203B...CB	120
	5	5	A100BB...CC	100	AF203B...CC	120
	6	4	A100BB...CD	100	AF203B...CD	120
	7	3	A100BB...CE	100	AF203B...CE	120
	8	2	A100BB...CF	100	AF203B...CF	120
	9	1	A100BB...CG	100	AF203B...CG	120
	10	0	A100BB...CH	100	AF203B...CH	120
12	6	6	A100BB...CJ	112	AF203B...CJ	132
	7	5	A100BB...CK	112	AF203B...CK	132
	8	4	A100BB...CL	112	AF203B...CL	132
	9	3	A100BB...CM	112	AF203B...CM	132
	10	2	A100BB...CN	112	AF203B...CN	132
	11	1	A100BB...CP	112	AF203B...CP	132
	12	0	A100BB...CQ	112	AF203B...CQ	132
Latched-in Relay, Manually Reset						
1	0	1	A101A...B	56	.....	...
	1	0	A101A...C	56	.....	...
2	0	2	A101A...D	59	.....	...
	1	1	A101A...E	59	.....	...
	2	0	A101A...F	59	.....	...
4	2	2	A101D...J	71	.....	...
	3	1	A101D...K	71	.....	...
	4	0	A101D...L	71	.....	...

0150081

GENERAL-PURPOSE RELAYS



Building-block units

WHERE TO USE

Use for general-purpose relaying, undervoltage protection, field protection, plugging, and similar applications. Relays are available with either shunt or series coils. They can be mounted on either steel or insulating panels.

Choose general-duty relays for normal service or where space is limited. Select heavy-duty relays for severe service or when more than four circuits are required. Latched-in relays are used for overvoltage or overcurrent protection. Note that relays for control of circuits 48 volts and below have contacts designed especially for this voltage.

Complete relays are recommended when applications are known in advance. Building-block units are recommended when applications vary in number of circuits and contact arrangements.

Contacts can be changed from normally open to normally closed and vice versa, except that general-duty relays should not exceed two normally closed contacts.

HOW TO ORDER

Relays with shunt coils—Order by complete IC number including coil number. **Example:** ***To order a four-circuit relay with two normally open and two normally closed sets of contacts for operation on 230 volts DC, order IC-2820-A100BB2J.***

Relays with series coils—Order by complete IC number and specify current rating required.

Relays in building-block form—Order by catalog number. Specify ampere rating when ordering series coils.

Step 2—Insert Coil Number

Type of Coil	Coil Rating: DC Volts	Coil Rating: Ohms at 25 C, A100	Coil Rating: Ohms at 25 C, A200	IC2820-A100 or IC2821-AF	IC2820-A200 or IC2821-BA
Shunt	115/120	725	830	3	3
Shunt	230/240/250	2790	3200	2	2
Shunt	500	10650	....	4	...
Shunt	550	17400	....	5	...
Series	0.3 to 100 amperes			*	...

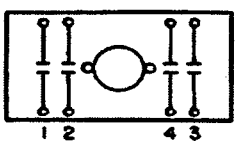
* Specify current rating required.

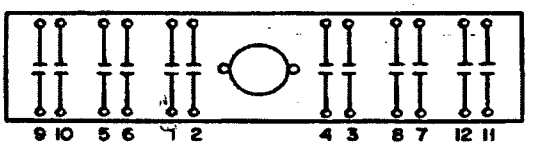
HOW TO SELECT BUILDING-BLOCK UNITS

Building Block Unit	Application	0–48 v DC: Catalog Number	0–48 v DC: List Price GO-10	49–600 v DC: Catalog Number	49–600 v DC: List Price GO-10
General-duty Relay					
1—Frame-and-coil assembly	115/120 v coil	IC2820-A200A3	$18	IC2820-A200A3✚	$18
	230/240/250 v coil	IC2820-A200A2	18	IC2820-A200A2✚	18
2—Contact blocks	2 NO circuits	IC2956-A200AA	18	IC2956-A200A✚	9
	1 NO, 1 NC circuits	IC2956-A200AC	18	IC2956-A200C✚	9
	2 NC circuits	IC2956-A200AB	18	IC2956-A200B✚	9
3—Mounting kits	1 contact block	IC2956-A201J	2	IC2956-A201J✚	2
	2 contact blocks	IC2956-A201K	2	IC2956-A201K✚	2
Heavy-duty Relay					
1—Frame-and-coil assembly	115/120 v coil	IC2820-A100BB3	40	IC2820-A100BB3✚	40
	230/240/250 v coil	IC2820-A100BB2	40	IC2820-A100BB2✚	40
	500 v coil	IC2820-A100BB4	40	IC2820-A100BB4✚	40
	550 v coil	IC2820-A100BB5	40	IC2820-A100BB5✚	40
	0.3–300 amp series coil	IC2820-A100BB*	40	IC2820-A100BB*✚	40
2—Contact blocks	2 NO circuits	IC2956-A200AA	18	IC2956-A200A✚	9
	1 NO, 1 NC circuits	IC2956-A200AC	18	IC2956-A200C✚	9
	2 NC circuits	IC2956-A200AB	18	IC2956-A200B✚	9
3—Mounting kits	1 or 2 contact blocks	IC2956-A201B	2	IC2956-A201B✚	2
	3 contact blocks	IC2956-A201C	5	IC2956-A201C✚	5
	4 contact blocks	IC2956-A201D	7	IC2956-A201D✚	7
	5 or 6 contact blocks	IC2956-A201E	11	IC2956-A201E✚	11

✚Normal factory stock. * Specify coil rating.

WIRING SYMBOLS





General-duty Relay: Number of Contacts	General-duty Relay: Contact Positions
1	1
2	1-2
4	1-2-4-3

Heavy-duty Relay: Number of Contacts	Heavy-duty Relay: Contact Positions
1	1
2	1-2
4	1-2-4-3
6	5-6-1-2-4-3
8	5-6-1-2-4-3-8-7
10	9-10-5-6-1-2-4-3 -12-11
12	9-10-5-6-1-2-4-3-8-7 -12-11

NOTE: Normally closed contacts are assigned positions in the order of one per contact block in odd-numbered positions starting at left, and a second per contact block in even-numbered positions starting at right. Thus a six-circuit relay would have normally closed contacts assigned positions as follows as necessary in the order 5-1-3-4-2-6.

CONTACT RATINGS

Contacts	Volts	Rating in Amperes: Carry	Make	Break Inductive Load*: One Circuit	Break Inductive Load*: Two Circuits in Series	Break Noninductive Load: One Circuit	Break Noninductive Load: Two Circuit in Series
48 v and below	12 v DC & below	10	30	8.0	...	8.0	.....
	24 v DC	10	30	4.0	...	6.0	.....
	48 v DC	10	30	1.3	...	1.95	.....
49–600 volts	115/120 v DC	10	60	1.8	4.0	2.7	6.0
	230/240/250 v DC	10	30	0.5	1.2	0.75	1.8
	500/550 v DC	10	12	0.2	0.35	0.3	0.525
	110 v AC	10	60	6.0	...	6.0	.....
	220 v AC	10	30	3.0	...	3.0	.....
	440 v AC	10	15	1.5†	...	1.5†	.....
	550 v AC	10	12	1.2†	...	1.2†	.....

* Ratings based on contactor coil currents, not brake or field-coil circuits.

† Because of arc flare, allow 1 in. clearance through to ground, or 2 in. clearance to another contact block or interlock when open sides face each other.

PICKUP AND DROPOUT

Relay	Pickup	Dropout
General-duty	Cold: 63% rated volts or below Hot: 80% rated volts or below	20% rated volts or above
Heavy-duty	Cold: 63% rated volts or below Hot: 80% rated volts or below	5% rated volts or above

NEW YORK POWER AUTHORITY

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Documentation of Telephone Discussion

DATE: 8/15/00 TIME: 1000 MODIFICATION NO.: JAF-CALC-ELEC-0416

SUBJECT: INTERPETATION OF DROPOUT VOLTAGE INCREASE DUE TO CONTINUOUS OPERATION (MORE THAN 4 HOURS)

REFERENCES: V/M GO80-0213, PAGE 7, 2nd PARAGRAPH

	NAME	ORGANIZATION
PARTICIPANTS:	BRIAN MARKS	NYPA
	STEVE GOERTZEN (PROTECTIVE RELAY APPLICATIONS ENGINEER)	GE (800) 547-8629

SUMMARY OF DISCUSSION: THE STATEMENT IN GO80-0213 "FOR DC RELAYS, THE PICKUP AND DROPOUT VOLTAGES INCREASE BY 5 TO 10 PERCENT AFTER HAVING BEEN ENERGIZED FOR A FEW HOUR (MINIMUM 4 HOURS)" WAS INTERPRETED (DEFINED) TO INDICATE (BY STEVE GOERTZEN):

THE DROPOUT (OR RESET) OF AN HGA RELAY INCREASES BY 5 TO 10 PERCENT ADDITIONALLY TO ITS COLD RANGE. ITS COLD RANGE IS 2 TO 10 PERCENT (SEE RELAY SELECTION GUIDE). THEREFORE, AFTER 4 HOURS IN SERVICE (ENERGIZED) AN HGA RELAY DROPOUT RANGE IS 7 TO 20 PERCENT.

AGREEMENTS/COMMITMENTS:

Prepared By: BRIAN MARKS Date: 8/15/00
Title: SENIOR ELECTRICAL ENGINEER
Reviewer: [signature] Date: 8/15/00
Title: Senior Elect Engr II

Distribution: Tom Savory
Alex Barton

NEW YORK POWER AUTHORITY
JAMES A. FITZPATRICK NUCLEAR POWER PLANT

DOCUMENTATION OF TELEPHONE DISCUSSION

DATE: 11/23/94 TIME: 11:00 MODIFICATION NO. N/A (If Applicable)

SUBJECT: GE Relay Model No. CR2810A14AT22, Coil # 22D135G22

REFERENCES: CG-92-066, Rev. 0

PARTICIPANTS:	NAME	ORGANIZATION
	Bill Siebenhaar	General Electric (704) 561-5715
	C. E. Fulton	NYPA-Procurement Engineering

SUMMARY OF CONVERSATION: Contacted Bill to acquire the values for referenced coil:

Resistance: 100 +/- 10%
Inrush Current: 0.641 (maximum)
Holding Current: 0.125 +/- 10%
Pick-Up Voltage: 85% or less of coil rating
Drop-Out Voltage: 35% - 60% of coil rating

Bill said that coil drop-out voltage is not tested by GE, because they don't feel this is a critical function. This would hold true for all AC and DC coils.

AGREEMENT/COMMITMENTS: Informed Bill that NYPA will still test all relays for drop-out voltage requirements. If relay(s) being tested doesn't meet specified value, each item will be addressed on a "case-by-case" bases for acceptance or rejuction based on intended application(s).

PREPARED BY: [signature] DATE: 11/23/94
TITLE: Procurement Engineer

REVIEWED BY: [signature] DATE: 11-30-94
TITLE: Procurement Engineer

NEW YORK POWER AUTHORITY
JAMES A. FITZPATRICK NUCLEAR POWER PLANT

DOCUMENTATION OF TELEPHONE DISCUSSION

DATE: 6/10/97 TIME: 10:00 am MODIFICATION NO. (If Applicable) N/A

SUBJECT: Relay, Model CR2811A212J, Coil Model 22D135G441 (marked with 115/125 VDC).

REFERENCES: N/A

PARTICIPANTS:	NAME	ORGANIZATION
	Bill Siebenhaar	GE-Applications Engineer (704) 561-5715
	C.E. Fulton	NYPA-Procurement Engineer

SUMMARY OF CONVERSATION: Called Bill to acquire the Pick-Up and Drop-Out voltages for this referenced coil. Per Bill this is a four (4) pole relay. 3 normally open/1 normally closed. The electrical specifications for this coil is as follows:

Pick-Up Voltage: 63% of normal voltage or ~~less~~ more (LESS)
Drop-Out Voltage: 35% to 23% of normal voltage.
Coil Resistance: 85 ohms, +/- 10%

Bill said that the Pick-Up and Drop-Out voltages for the 441 coil are the same as for the 641 coil.

AGREEMENT/COMMITMENTS: N/A

PREPARED BY: [signature] DATE: 6/10/97
TITLE: Procurement Engineer

REVIEWED BY: [signature] DATE: 6/10/97
TITLE: Procurement Engineer

NEW YORK POWER AUTHORITY
JAMES A. FITZPATRICK NUCLEAR POWER PLANT

DOCUMENTATION OF TELEPHONE DISCUSSION

DATE: 12/28/94 TIME: 8:00 am MODIFICATION NO. N/A (If Applicable)

SUBJECT: Relay Coil Model No. 22D135G641, 115/120 VDC.

REFERENCES: Eng. Review Package CG-92-066, Rev. 0

PARTICIPANTS:	NAME	ORGANIZATION
	Dick Mote	General Electric (Engineer (309) 664-1470
	C. E. Fulton	NYPA-Procurement Engineering

SUMMARY OF CONVERSATION: Spoke with Dick about the coil holding current not being within the specified value of .094 +/- 10% as received from Bill Siebenhaar on 7/13/94. Actual testing of the holding current indicated .1445 amp, above the maximum specified tolerance. Dick said the .094 amp was not correct. For this particular coil the holding current will be calculated by adding the coil resistance of 53 ohms to the 775 ohm Ohmite resister together for a total value of 828 ohms.

Using Ohms Law where I=E/R, the test voltage of 120 VDC is divided by 828 ohms to equal .145 amp +/- 10% to establish an acceptable tolerance of .1305 amp - .1595 amp. With this corrected holding current the initial test result of .1445 amp is acceptable.

AGREEMENT/COMMITMENTS: Dick Mote will contact Bill Siebenhaar to inform him that his coil spec sheet for this coil model is not correct, so that he can change it.

PREPARED BY: [signature] DATE: 12/28/94
TITLE: Procurement Engineer

REVIEWED BY: [signature] DATE: 12/28/94
TITLE: Procurement Engineer

NEW YORK POWER AUTHORITY
JAMES A. FITZPATRICK NUCLEAR POWER PLANT

DOCUMENTATION OF TELEPHONE DISCUSSION

DATE: 4/18/97 TIME: 3:20 pm MODIFICATION NO. N/A (If Applicable)

SUBJECT: PICK-UP AND DROP-OUT VOLTAGES OF A GE RELAY, CONTACTOR, AND CIRCUIT BREAKER MINIMUM CLOSE/TRIP VOLTAGE

REFERENCES: CGI DEDICATION NO. CG-92-066 FOR GE RELAYS

PARTICIPANTS:	NAME	ORGANIZATION
	BILL SIEBENHAAR	GE-APPLICATIONS ENG. (704) 561-5715
	C.E. FULTON	NYPA-PROCUREMENT ENG.

SUMMARY OF CONVERSATION: CALLED BILL TO ACQUIRE THE PICK-UP AND DROP-OUT VOLTAGES OF THE FOLLOWING ITEMS:

RELAY MODEL CR2811A257AA641 (COIL# 22D135G641) HAS A VOLTAGE PICK-UP OF 63% OR LESS OF NORMAL VOLTAGE. DROP-OUT VOLTAGE WILL BE AT OR BETWEEN 35% - 23% OF NORMAL VOLTAGE.

CONTACTOR MODEL CR105K00BLA HAS A PICK-UP VOLTAGE OF 50% OR GREATER OF NORMAL VOLTAGE WHEN THE COIL IS COLD. PICK-UP WILL BE 80% OR GREATER WHEN THE COIL IS HOT. DROP-OUT WILL BE AT OR BETWEEN 30% - 20% OF NORMAL VOLTAGE REGARDLESS OF COIL TEMPERATURE. NOTE: 100 SERIES NOW REPLACED WITH 300 SERIES. SAME COIL DESIGN USED FOR ALL SERIES.

BILL HAS NO INFORMATION AT HIS FACILITY FOR THE GE MODEL ATB-362-7 CIRCUIT BREAKER. A DIFFERENT GE DIVISION WILL NEED TO BE CONTACTED.

AGREEMENT/COMMITMENTS: N/A

PREPARED BY: [signature] DATE: 4/21/97
TITLE: PROCUREMENT ENGINEER

REVIEWED BY: [signature] DATE: 4-21-97
TITLE: Procurement Engineer

FAX

Date 6/14/99

Number of pages including cover sheet 1

TO: Alex Barton

Phone
Fax Phone

FROM: Al Stott
GE Supply
28 Corporate Circle
East Syracuse, NY 13057

Phone 315.431.2260
Fax Phone 315.431.2266

CC:

REMARKS: ☐ Urgent ☐ For your review ☐ Reply ASAP ☐ Please Comment

CR 106 D 0 120 vac Coil info

In Rush : 528 Va

Sealed : 60 Va

CR105D0 would Be the same.

CR 2811 Coil 22D135G641

In Rush : 2.25

Sealed : .094

Regards

Al Stott

JUL-19-2000 10:52 GE SUPPLY SYRACUSE P.01/01

TE 7/13/00 SINGLE LEVEL BILL OF MATERIAL INQUIRY AME7C K
EXTENDED DESCRIPTION

ITEM NUMBER 22D1350441 REV 12
DESC COIL U/M PC

MAN 03-14-85 ENG REV 12 02-24-92 92-1601
1 115/125 VOLTS DC
2 .086 SEALED AMPS/10.2 SEALED W/1.41 INRUSH AMP
3 2057 TURNS(+/-2%)/85 OHMS RES(+/-10%)@ 25 DEG C
4 TEST 120 VOLTS DC
5 POLE FORM 1-6 IN LINE

(ENTER) TO RETURN

125vdc Coil FOR CR2811A211

Tim Romanowski

Regards
Al Stott
GE Supply

TOTAL P.01

[illegible] GE SUPPLY SYRACUSE

EXTENDED DESCRIPTION

ITEM NUMBER 22D135G641 REV 12
DESC COIL SAME AS G541 U/M PC

MAN 09-96-85 ENG REV 12 02-24-92 92-1601
1 115/125 VOLTS DC
2 .094 SEALED AMPS/11.0 SEALED W/2.25 INRUSH AMPS
3 1649 TURNS(+/-2%)/53 OHMS RES(+/-10%)@ 25 DEG C
4 TEST 120 VOLTS DC
5 POLE FORM 9-12 DBL. STK.

ATTN: AL

<ENTER> TO RETURN

Attn: Alex Barton

Regards

TOTAL =.01

JUN-20-2000 11:19 GE SUPPLY SYRACUSE P.01

FAX

Date 6/20/00

Number of pages including cover sheet 2

TO: Alex Barton

Phone
Fax Phone

FROM: Al Stott
GE Supply
28 Corporate Circle
East Syracuse, NY 13057

Phone 315.431.2260
Fax Phone 315.438-3113

CC:

REMARKS: ☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please Comment

Alex

Plus is what's available for WFO on your coil

Regards

Al

JUN-20-2000 11:15 GE SUPPLY SYRACUSE P.02

DATE 06/19/2000 Single level Parts List (REL) BMG408R 02

Asm# : 15D21G026 COIL DATA Rev# 17 Family COIL

Struc# : COIL132601

Desc no		Deecription
000		GEN 06-19-00 ENG REV 17 08-05-98 98-4420 COIL
010	013	100/200/300-LINE SIZE 00, 0 & 1 COIL
021	010	
100	014	5.00 SEALED WATTS/MLT .45 FT/.52 IN TRAVERSE
201	007	.187 SQ IN WINDING SPACE/.360 IN WALL
203	412	1260 TURNS(+/-1/4%)/60.1 RES OHMS(+/-10%)@25 DEG C
215	026	43 TURNS PER LAYER
299	010	
394	010	
395	010	GRP ** VOLTS ** SEALED INRUSH
396	010	NO. 60HZ 50HZ AMPS AMPS
399	010	----------
426	050	026 115-125V DC .154 2.1
899	010	

F3 RETURN TO MENU
Function key not allowed.

Attn: A1

Attn: Bill Hamm

Technical Inquiry

Inquiry #:	VOA439	Caller: Bill Hamm	Opened: 08/08/97 09:27 AM
Customer#:	3393725	Customer Name:	GE Supply
Region:	Northeast	Customer Type:	Gesco
Customer Addr:	6603 Joy Dr Po Box 488 East Syracuse Ny		
Customer Fax#:	8-8*563-3113	Customer Phone#:	800-789-1618
AR Extension:	4071	AR Name & Loca.:	Vonda Adams: Northeast, Group 026
Access:			

Question:

customer is looking for the pickup volt, drop out volt, coil burden, and watts on a CR2820b series a 125 volt dc. Another number he had was 145c3036p003. Do we have? thx

Paste any Images Below:

Product Family:	Control Products
Question Type:	Rating Information

Answer:

From the renewal parts bulletin gef-4244e I identified a 115/125 v coil that was used in a 2820b. Have the customer look on the coil to verify what the coil number is or provide the complete catalog number of the 2820b.

55-150695G041
115/125 VOLTS DC,8 WATTS
97 OHMS RES
2024 TURNS
1200 OHMS 25 WATT RESISTOR (REF)

If the relay contains an DC coil, the pickup voltage for a 2820B is usually 70% of the coil voltage and the drop off voltage is 10 % of the coil voltage.

Note: These are guidelines, not standards which must be strictly met.

[redacted] Factory Involved: No [redacted] No

Answer Found: GEF Pub#:gef-4244e Page#:

New Call Information

Call Information/History:

Routing

Current Owner: Jackie Affayroux/MKT_CSC/Marketing/GE_ED&C At Location: FACTS Team

SEP-30-2000 14:24 GE MULTILIN 905 201 2098 P.01/01

Power Management

FAX: (905) 201-2098
TEL: (905) 294-6222
www.ge.com/indsys/pm

215 ANDERSON AVENUE
MARKHAM, ONTARIO
CANADA, L6E 1B3

FAX MESSAGE

ATTN: Alex Barton	**SUBJECT:** C00-33849: HFA, HGA, & HMA Specs
COMPANY: New York Power Authority	**FROM:** Technical Support Department
FAX No: 315-349-6981	**DATE:** 09/30/00 **SHEET** 1 **OF** 1

Message:

Mr. Alex Barton,

Thank you for your fax asking for information on the pick up and drop out ratings of the HFA, HGA, and HMA relays. Please find the requested information below:

Model Number	Pick up	Drop Out
12HFA151A2F	Hot: 80% Cold: 60%	Hot 7-20 % Cold 2-10 %
12HGA11A52F	Hot 75-90 % Cold 70-80 %	Hot 7-20 % Cold 2-10 %
12HMA124A2	Hot 70-90 % Cold 60 %	Hot 12 –30% Cold 2-10 %

Best Regards,

GE Power Management Technical Support

Technical Support
General Electric Power Management
Markham, ON, L6E 1B3
1-800-547-8629 (North America)
+34-94-485-8854 (Europe & the Middle East)
(905)294-6222 (International)
Fax: (905) 201-2098
E-mail: info.pm@indsys.ge.com
http://www.geindustrial.com/pm

JUL-25-2000 15:35 GE SUPPLY SYRACUSE P.01

To Tom Romanowski	From AL STOTT
Co./Dept.	Co. GE Supply
Phone #	Phone #
Fax # 3496481	Fax #

Table E Lists the voltage and frequencies of the operating and reset coils.

Table F and G (below) show the various contact configurations available.

To obtain a complete catalog number, select the basic number from Table D, insert the form number from Table E; specify the contact code from either Table F or Table G.

nly
Front connected
Surface mounting
Reset coil cutoff contact } Select 12HFA54E-H from Table D

48 VDC operate coil
115V 60 Hz reset coil } Select form number 245 from Table E

3 N.O. and 2 N.C. contacts } Select contact code 42 from Table F

Thus, 12HFA54E245H code 42 is the complete relay number.

SELECTION GUIDE

TABLE D. BASIC NUMBER

Type of Reset	Mounting	Basic Number	Contact	Basic Number	Contact	Approx. Wt. in lbs (kg) Net	Ship
Hand and electric reset	Back-connected surface mounting	12HFA54B-	Table F	12HFA54H-	Table G	5 (2.2)	7 (3.1)
	Back-connected semi-flush mounting	12HFA54B-F		12HFA54H-F			
	Front-connected surface mounting	12HFA54B-H		12HFA54H-H			
	Back-connected drawout case	12HFA74B-A		12HFA74H-A			
Hand and electric reset with mechanical target	Back-connected surface mounting	12HFA54C-		12HFA54J-		12 (5.4)	18 (8.1)
	Back-connected semi-flush mounting	12HFA54C-F		12HFA54J-F		5 (2.2)	7 (3.1)
	Front-connected surface mounting	12HFA54C-H		12HFA54J-H			
Electric reset only	Back-connected surface mounting	12HFA54E-		12HFA54L-			
	Back-connected semi-flush mounting	12HFA54E-F		12HFA54L-F			
	Front-connected surface mounting	12HFA54E-H		12HFA54L-H			
	Back-connected drawout case	12HFA74E-A		12HFA74L-A		12 (5.4)	12 (8.1)

TABLE E. FORM NUMBERS

	Voltage and Frequency	Reset Coil Rating 48 VDC	125 VDC	250 VDC	115 V 60 Hz	230 V 60 Hz
		Form Numbers				
Operating Coil Rating	12 VDC	122	182	212	242	272
	24 VDC	123	183	213	243	273
	48VDC	125	185	215	245	275
	125 VDC	127	187	217	247	277
	250 VDC	128	188	218	248	278
	115 V 60 Hz	129	189	219	249	279
	230 V 60 Hz	130	190	220	250	280

TABLE F	CODE NUMBER 60	51	42	33	24	15
Position No.	Contact Arrangement					
1						
2						
3						
4						
5						
6©						

©This contact is reserved for opening the reset coil circuit to protect the intermittently rated reset coil.

NOTES:
= Normally open contact, open when relay is de-energized
= Normally closed contact, closed when relay is de-energized.

OPERATING CHARACTERISTICS

Model Number	Pickup Voltage in Percent of Rating Hot	Cold	Dropout Voltage in Percent of Rating AC	DC	Operating Time at Rated Voltage to Close a N.O. Contact AC	DC	Operating Time to Open a N.C. Contact When Voltage Reduced from Rated to Zero AC	DC
HFA51A, -B HFA54B, -C, -E, -H, -J, -L HFA71A, -B HFA74B, -E, -H, -L	80 or less, AC or DC	60 or less, DC	30-60	2-10	33 ms or less	84 ms or less	14 ms or less	28 ms or less
HFA53K HFA73K	80 or less, DC only	60 or less, DC only	—	2-10	9 ms or less for tripping duty			9 ms or less
HFA55D	①	35-80 AC 30-60 DC	①	①			Adjustable 250 to 2000 ms factory set at 2000 ms	
HFA55E	①	①	①	①	Adjustable 67-100 ms factory set at 83 ms		250 ms	

① These relays are adjusted to give the proper time delays at rated voltage. Since these adjustments affect the pickup voltage point, it is not possible to accurately predict the pickup voltage.

TABLE G	CODE NUMBER 60	51	42	33	24	15	06
Position No	Contact Arrangement						
1							
2							
3							
4							
5							
6							

NOTES:
= Normally open contact, open when relay is de-energized.
= Normally closed contact, closed when relay is de-energized.

If contact code is not specified on the order, Code 60 will be furnished. Relays stocked in the warehouse are stocked with contact Code 60. Conversion from normally open to normally closed, or vice-versa, can be easily accomplished in the field.

HEA

Multicontact Auxiliary Relays

GEZ-7723

GE Protective Relays

HEA61, HEA62, and HEA63

APPLICATION

The Type HEA high-speed multicontact, auxiliary relays are applicable where it is desired that a number of operations be performed simultaneously from the operation of a single relay.

Typical functions that can be performed by these relays are:

1. Trip the main circuit breaker of a system.
2. Trip station auxiliary breakers.
3. Trip main or auxiliary field breakers.
4. Trip and lock out all breakers on a bus.

Perhaps the most important use of the Type HEA relay is in conjunction with differential relays which protect transformers, rotating apparatus, buses, etc.

CONSTRUCTION

The HEA multicontact, hand-reset auxiliary relays are built with many parts common to the well-known Type SB-1 control and transfer switches.

The mechanical target on the escutcheon plate assembly indicates the position of the relay. The black target indicates the reset position and the orange target, the tripped position. To reset the relay after being tripped, the handle is turned clockwise as indicated by the arrow on the escutcheon plate.

Since basically the HEA relay is similar to the SB-1 switch, it is available with a shaft long enough to allow it to be mounted on panels with a thickness of from ⅛ inch to 2 inches thick, in increments of 1/16 inch.

Like the SB-1 switch, all HEA relays must be ordered for the specific panel thickness, otherwise the relay will be supplied with a shaft long enough to be mounted only on a ⅛ inch panel.

EXAMPLE:

12HEA61A222 for ¾ inch panel relay number would be 12HEA61A222X12 (¾ inch = 12/16 = ... X12).

EXAMPLE:

12HEA63F272 for 1½ inch panel relay number would be 12HEA63F272X24 (1½ inch = 24/16 = ... X24).

OPERATION

The operating shaft is held in the reset position by a positive roller latch which is especially constructed to resist shock and vibration. It is released through the action of the operating coil, in attracting a hinged-armature element.

All HEA relays are made so that they should not normally be tripped manually, although it is possible by removing the rear cover and releasing the hinged-armature element.

SPECIAL MOUNTING

Type HEA61A, 61B, 61C, 62C, 63C and 63G relays can be supplied with a bevel-gear drive which allows the relay to be mounted in locations where normally the depth is not sufficient. The relays can be mounted like the standard but the bevel-gear drive changes the direction by 90 degrees of that portion of the relay that is behind the panel. The bevel-gear drive is available to change the direction up, down, left, or right.

To select the proper model number of the special relay, select the number of the standard relay desired (example—12HEA61C230X2). If a right angle drive upward is desired, add the letters "Right-angle Up" to the standard model number. Hence, the model number would be 12HEA61CRU230X2 (for ¼-in. panel).

CONTACT RATINGS

The current-closing rating of the contacts is 50 amperes for voltages not exceeding 600 volts. The contacts have a current-carrying capacity of 20 amperes continuously or 50 amperes for one minute. The interrupting ability of the contacts varies with the inductance of the circuit. The values (in amperes) given in Table I, for dc inductive circuits, are based on the average trip coil.

BURDENS

The burdens for the Type HEA relays are given in Table II.

TABLE I—CONTACT INTERRUPTING RATINGS

Circuit Volts	Amps Noninductive Circuits Number of Contacts			Amps Inductive Circuit Number of Contacts		
	1	2 in Series	4 in Series	1	2 in Series	4 in Series
24 dc	6.0	30.0	...	4.0	20.00	30.0
48 dc	5.0	25.0	40.0	3.0	15.00	25.0
125 dc	2.5	11.0	25.0	2.0	6.25	9.5
250 dc	0.75	2.0	8.0	0.7	1.75	6.5
600 dc	0.25	0.45	1.35	0.15	0.35	1.25
115 ac	40.00	50.0	...	24.0	50.0	...
230 ac	25.00	50.0	...	12.0	25.0	40.0
460 ac	12.00	25.0	...	5.0	12.0	20.0
550 ac	6.00	12.0	...	4.0	10.0	15.0

TABLE II—BURDEN DATA OF TRIP COIL

Intermittent Rating Volts	Frequency	Coil Resis Ohms at 25 C	Ac Coil Current Amps at (Rated Volts)	Operating Range Volts	Rating of Protective Relay Target Coil Amp	
					Universal Target Seal-in	Separate Target and Seal-in
24	dc	1.2	.....	14-30	2.0	1.0
48	dc	4.5	.....	28-60	2.0	1.0
125	dc	23	.....	70-140	0.2	1.0
250	dc	103	.....	140-280	0.2	0.2
115	50/60 Hz	.....	25	95-125	2.0	.....
230	50/60 Hz	.....	14	190-250	2.0	.....
460	50/60 Hz	.....	7	380-500	2.0	.....

PROTECTIVE RELAYS

Type HFA100 Century Series

Multicontact Auxiliary Relays

ELECTRIC RESET RELAYS

Table A lists the combination of reset and mounting available.

Table B lists the voltage and frequencies of the operating and reset coils.

Table C shows the various contact configurations available.

To obtain a complete catalogue number, select the *basic number* from Table A; insert the *form number* from Table B; specify the *contact code* from Table C.

EXAMPLE:

Electric reset only Front connected Surface mounting	Select 12HFA154E-H from Table A
48V dc operate coil 120V 60 Hz reset coil	Select form number 44 from Table B
3 N.O. and 2 N.C. contacts	Select contact code 42 from Table C

Thus, 12HFA154E44H code 42 is the complete relay numb

Table A
SELECTION OF HFA ELECTRIC RESET MODELS

Type of Reset	Mounting	Contacts	Basic Number*	Weight lb(kg) Net	Ship
Electric and Hand Reset	Back connected semi-flush	Table C	12HFA154B-F	5(2.3)	7(3.2)
	Front connected surface mounted		A1548-H	5(2.3)	7(3.2)
	Back connected drawout case		A1748-A	12(5.4)	18(8.2)
Electric Reset Only	Back connected semi-flush	Table C	12HFA154E-F	5(2.3)	7(3.2)
	Front connected surface mounted		A1545-H	5(2.3)	7(3.2)
	Back connected drawout case		A1745-A	12(5.4)	18(8.2)

* On hand and electric reset Types HFA154B, 174B, 154E and 174E one cr[illegible]t is wired in series with reset coil to provide positive cutoff. Thus f[illegible]tacts are available for external circuits.

Table B
SELECTION GUIDE—FORM NUMBERS

		Reset Coil Rating					
	Voltage and Frequency	110V Dc	125V Dc	220V Dc	250V Dc	120V 60 Hz	120V 50
		Form Numbers					
OPERATE COIL RATING	6V Dc	...	27	...	7	47	...
	12V Dc	...	26	...	6	46	...
	24V Dc	...	25	...	5	45	...
	32V Dc	33	...	13	...	...	53
	48V Dc	...	24	...	4	44	...
	62.5V Dc	...	23	...	3	43	...
	110V Dc	32	...	12	...	...	52
	125V Dc	...	22	...	2	42	...
	220V Dc	31	...	11	...	...	51
	250V Dc	...	21	...	1	41	...
	120V 60 Hz	...	29	...	9	49	...
	240V 60 Hz	...	28	...	8	48	...
	120V 50 Hz	39	...	19	...	...	59
	240V 50 Hz	38	...	18	...	...	58

Table C—Contact Arrangement

	Code Number					
	60	51	42	33	24	15
Position No.	Contact Arrangement					
1	⇌	⇌	⇌	⇌	⇌	⇍
2	⇌	⇌	⇌	⇌	⇍	⇍
3	⇌	⇌	⇍	⇍	⇍	⇍
4	⇌	⇍	⇍	⇍	⇍	⇍
5	⇌	⇌	⇌	⇍	⇍	⇍
6 ③	⇌	⇌	⇌	⇌	⇌	⇌

NOTES:

⇌ = Normally open contact, open when relay is de-energized.

⇍ = Normally closed contact, closed when relay is de-energized.

③This contact is reserved for opening the reset coil circuit to protect the intermittently rated reset coil.

If contact code is not specified on the order, *Code 60 will be furnished.* Relays stocked in the warehouse are stocked with contact Code 60. Conversion from normally open to normally closed or vice-versa, can be easily accomplished in the field.

OPERATING CHARACTERISTICS

Model Number	Pickup Voltage in Percent of Rating		Dropout Voltage in Percent of Rating		Operating Time at Rated Voltage to Close a N.O. Contact		Operating Time to Open a N.O. Contact When Voltage Reduced to Zero	
	HOT	COLD	Ac	Dc	Ac	Dc	Ac	Dc
HFA151A, -B HF[illegible], -B	80 or Less, Ac or Dc	60 Dc 80 Ac or Higher	30-60	2-10	33 ms or Less	84 ms or Less	14 ms or Less	28 ms or Less
Mh[illegible] HFA173K	8 or Less (Dc Only)	6 or Less (Dc Only)	—	2-10	9 ms or Less for Tripping Duty			9 ms or Less

PROTECTIVE RELAYS

★Type HFA

★Multicontact Auxiliary Relays

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OPERATING CHARACTERISTICS

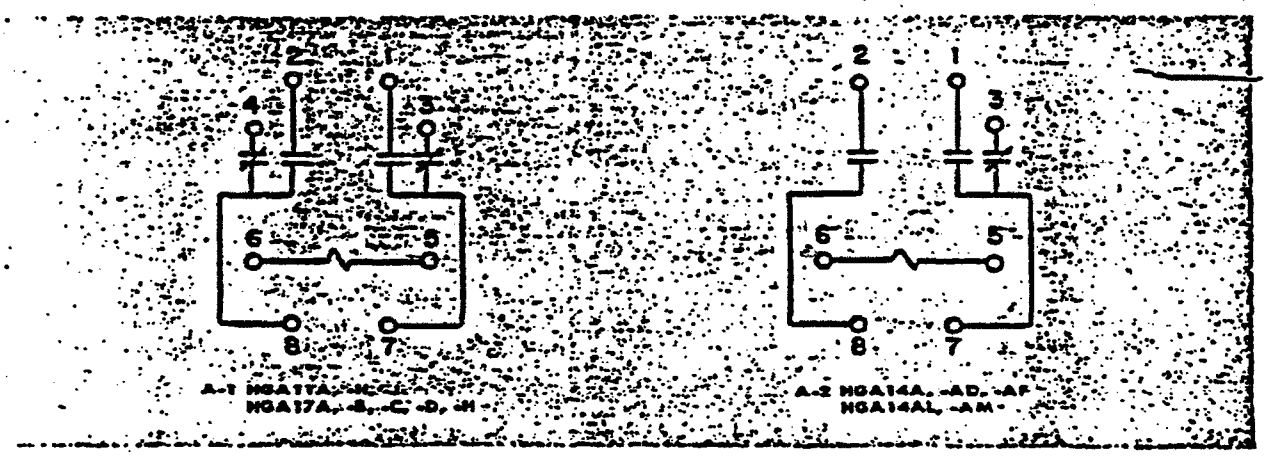
Model Number	Pickup Voltage in Percent of Rating		Dropout Voltage in Percent of Rating		Operating Time at Rated Voltage to Close a N.O. Contact		Operating Time to Open a N.O. Contact When Voltage Reduced from Rated to Zero	
	HOT	COLD	Ac	Dc	Ac	Dc	Ac	Dc
HFA51A, -B HFA54B, -C, -E, -H, -J, -L HFA71A, -B HFA74B, -E, -H, -L	80 or Less, Ac or Dc	60 or Less, Dc	30-60	2-10	33 ms or Less	84 ms or Less	14 ms or Less	28 ms or Less
HFA53K HFA73K	8 or Less (Dc Only)	6 or Less (Dc Only)	—	2-10	9 ms or Less for Tripping Duty			9 ms or Less
HFA65D	▲	35-80 Ac 30-60 Dc	▲	▲			Adjustable 250 to 2000 ms—Fact. Set at 2000 ms	
HFA65E		▲			Adjustable 67-100 ms—Fact. Set at 83 ms		250 ms	

▲ These relays are adjusted to give the proper time delays at rated voltage. Since these adjustments affect the pickup voltage point, it is not possible to accurately predict the pickup voltage.

TABLE V Operating Characteristics, Type HGA Relays

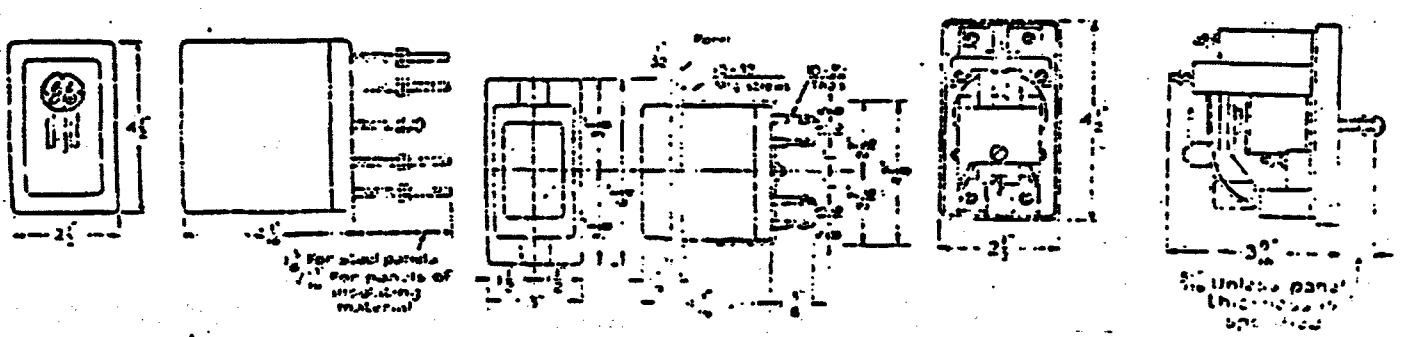
Model	Pickup in Percent of Rating			Dropout in Percent of Rating		Operating Times in Cycles (50 cycle basis)			
						At Pickup		At Dropout	
	Voltage		Current	Voltage	Current	To Close a NO contact	To Open a NC contact	To Open a NO contact	To Close a NC contact
	Hot	Cold							
HGA11A, -H, -J	a-c 80 d-c 80	d-c 60	80	a-c 40-55 d-c 2-10	2-10	2	--	--	--
HGA14A, -AD, -AF	a-c 40 d-c 40	d-c 30	40	a-c 20-30 d-c 2-10	2-10	1	—	—	—
HGA14AL, -AM	—	—	—			½ or less	½ or less	½ or less	½ or less
HGA17A, -B, -C	a-c 40 d-c 40	d-c 30	40	a-c 20-30 d-c 2-10	2-10	—	—	15 or more	15 or more
HGA17D, -H	a-c 80 d-c 80	d-c 80	80	a-c 40-55 d-c 2-10	2-10	3½	—	15 or more	15 or more

INTERNAL CONNECTIONS (FRONT VIEWS)



DIMENSIONS

Dimensions are subject to change and should not be used for construction without approval.



Type HGA back-connected relays.

Type HGA back-connected semiflush relays

Type HGA front-connected

HMA

Hinged-armature Auxiliary Relays

GE Protective Relays

For Ac and Dc Auxiliary Functions

DESCRIPTION

The Type HMA relay is a general purpose, hinged armature, self resetting relay. It is housed in a molded TEXTOLITE case for surface mounting, and can be supplied either front or back connected. Back connected models are supplied with a removable front cover, whereas front connected models are supplied without cover or rear studs.

APPLICATION

The HMA relay is a high speed auxiliary relay designed for use with high speed circuit breaker. The pick-up time at rated voltage is approximately 2 cycles (on a 60 Hertz basis). Relays for dc applications are adjusted to pick up at 60 percent of their rating when cold and 80 percent when hot. Relays for ac application are adjusted to pick up at 80 percent of their rating.

The HMA11A is a back connected relay supplied with cover. The HMA11B is similar except it is front connected and is supplied without cover. The HMA24A is similar to the HMA11A except it is made for semi-flush mounting with a glass cover.

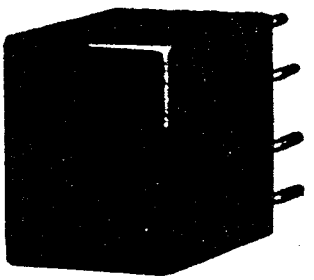
The HMA25A is similar to the HMA24A except it is surface mounted, back connected with glass cover.

RATING

The current closing or momentary rating of the contact is 30 amperes for one minute. The current carrying or steady-state rating is 12 amperes.

The interrupting ratings for the various voltages are as follows:

Contact Circuit		Noninductive		Inductive	
Volts	Freq. or Hz	Single Break Amp	Double Break Amp	Single Break Amp	Double Break Amp
6-32	Dc	15	30	6	12
48		10	20	3	6
62.5		5	10	1.5	3
110		1.5	3	0.6	1.2
125		1.5	3	0.6	1.2
220		0.3	0.5	0.1	0.3
250		0.3	0.5	0.1	0.3
120	60	20	30	15	15
240		13	25	10	10
120	50	20	30	15	15
240		13	25	10	10



(Photo 8011265)

Fig. 1. Type HMA11A back-connected relay with cover

BURDENS

The burdens for dc coils are shown in the Selection Guide. The ac burdens are shown in the following table.

Ac Coils								
COIL RATING		R_{DC} ±10%	R_{DO} ±10%	X_{DO} ±10%	Z_{DO} ±10%	R_{PU} ±5%	X_{PU} ±5%	Z_{PU} ±5%
VOLTS	HZ							
115	60	330	440	864	975	1215	1342	1815
230	60	1300	2580	3310	4180	5160	4500	6900
460	60	5100	7040	13825	15600	19440	21475	29040
115	50	380	503	871	1006	1323	1552	2029
230	50	1500	2010	3480	4025	5300	6200	8120

R_{DC}—Dc Resistance
R_{DO}—Ac resistance with armature not picked up.
X_{DO}—Inductive reactance with armature not picked up
Z_{DO}—Impedance with armature not picked up
R_{PU}—Ac resistance with armature picked up
X_{PU}—Inductive reactance with armature picked up
Z_{PU}—Impedance with armature picked up

REFERENCES:

Dimensions .....Section 16
How to Order .....Section 1
Instruction Books .....Section 17
Target and Contact Data .....Section 16
Relay Standards .....Section 16

HMA100

Hinged-armature Auxiliary Relays

GE Protective Relays

For Ac and Dc Auxiliary Functions

DESCRIPTION

The Type HMA relay is an instantaneous auxiliary device whose contacts are opened and closed by the movement of a hinged armature.

Type HMA Century Series auxiliary relays are designed to provide additional contacts, higher contact carrying and interrupting ratings, timing, interlocking, electrical separation and other auxiliary functions.

The Century Series coil design provides longer operating life than previous designs as a result of changes in the entire coil insulation system.

LONG-LIFE COIL DESIGN

Basic design features of HMA Century Series coils are as follows:

Spool—the spool on which the coil is wound is made of high thermal strength, glass-filled polymer to obtain long life at elevated temperatures. This material shows no signs of cracking or brittleness under accelerated life testing.

Wire Insulation—the wire insulation is a polyamide-imide wire coating (180C rating) which retains insulation integrity and mechanical strength at continuous elevated temperatures and which is also non-hydroscopic and fungus resistant. High temperature insulation is used where required, such as on leads.

Impregnation—Polybutadiene solventless impregnant.

Process

The polyamide-imide insulated coils, wound on high-temperature spools, are pre-baked to drive off all volatile materials, vacuum-pressure-impregnated with the solventless varnish, and then post-baked. The impregnation material is also non-hydroscopic and has temperature expansion coefficients compatible with the spool and with the wire, so that stresses do not develop under temperature cycling.

Nameplates for Century Series relays are green to provide easy visual differentiation from standard life relays.

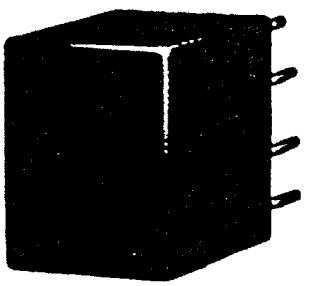
Accelerated life tests—conducted at elevated temperature and maximum voltage—have established a projected service life of 40 years to 1 percent failure (that is, when 1 percent of all such relays have failed) at 55C and 110 percent rated voltage. Under nominal conditions—that is, at an ambient temperature averaging 20C and at 100 percent voltage—that translates to a median life of 100 years (when 50 percent of all such relays could be expected to have failed).

APPLICATION

The HMA111A is a back-connected relay supplied either with or without cover and having a double-pole, double-throw contact arrangement. The HMA111B is similar to the HMA111A except that it is front connected and is available only without cover. Relays for dc service are adjusted to pick up at 60 percent of their rating when cold and 80 percent when hot. Relays for ac service are adjusted to pick up at 80 percent of their rating.

FIELD CONVERSION

For conversion of HMA relays in the field, it is recommended that the entire relay be replaced with a Century Series HMA, since this relay is not readily disassembled and reassembled.



(Photo 8011265)

Fig. 1. Type HMA111A back-connected relay with cover

RATINGS

These relays are available with coil ratings for standard voltages up to and including 240 volts 50 or 60 Hertz ac and up to 250 volts dc. The 250-volt relay uses a resistor in series with the coil.

The current-closing rating of the contact is 30 amperes. The current-carrying rating is 12 amperes continuously or 30 amperes for one minute.

The interrupting ratings for the various voltages are as follows:

Contact Circuit		Noninductive		Inductive	
Volts	Freq. or Hz	Single Break Amp	Double Break Amp	Single Break Amp	Double Break Amp
6-32	Dc	15	30	6	12
48		10	20	3	6
62.5		5	10	1.5	3
110		1.5	3	0.6	1.2
125		1.5	3	0.6	1.2
220		0.3	0.5	0.1	0.3
250		0.3	0.5	0.1	0.3
120	60	20	30	15	15
240		13	25	10	10
120	50	20	30	15	15
240		13	25	10	10

REFERENCES:

Dimensions ..... Section 16
How to Order ..... Section 1
Instruction Books ..... Section 17
Target and Contact Data ..... Section 16
Relay Standards ..... Section 16

Barton, Alex

From: Stott, Al (SUPP) [Al.Stott@gesupply.com]
Sent: Thursday, August 31, 2000 3:42 PM
To: Barton, Alex
Subject: RE: RELAY IC2800-1607AD

Coil is part #1D106G3A

Resistance: 1050 ohm
Pickup: 75 volts
Dropout: 18 volts

Regards, Al

—Original Message—
From: Barton, Alex [mailto:Alex.Barton@nypa.gov]
Sent: Saturday, August 19, 2000 4:22 PM
To: 'Stott, Al (SUPP)'
Subject: RE: RELAY IC2800-1607AD

EQUIPMENT INQUIRY:
Voltage 125 VDC
COMPONENT ID ... 13A-K49
MANUFACTURER ... G080 GENERAL ELECTRIC
MODEL NO IC2800-1607AD

Al,

I need to know pickup, drop out, coil burden or coil resistance for 125VDC IC2800-1607AD Contactor.
Thanks
Alex Barton
NYPA 315-349-6622

Barton, Alex

From: Stott, Al (SUPP) [Al.Stott@gesupply.com]
Sent: Tuesday, September 05, 2000 4:19 PM
To: Barton, Alex
Subject: RE: RELAY IC2820A200A3F

resistance: 830 ohms
pickup voltage: between 50-60% rated voltage
dropout voltage: 7% above rated voltage

regards

-----Original Message-----
From: Barton, Alex [mailto:Alex.Barton@nypa.gov]
Sent: Saturday, September 02, 2000 3:15 PM
To: 'Stott, Al (SUPP)'
Subject: RE: RELAY IC2820A200A3F

Subject: RE: RELAY IC2820A200A3F

EQUIPMENT INQUIRY:
Voltage 125 VDC
MANUFACTURER ... G080 GENERAL ELECTRIC
MODEL NO IC2820A200A3F

Al,

I need to know pickup, drop out, coil burden or coil resistance this relay.

Thanks
Alex Barton
NYPA 315-349-6622

Barton, Alex

From: Stott, Al (SUPP) [Al.Stott@gesupply.com]
Sent: Wednesday, December 19, 2001 7:54 AM
To: Barton, Alex
Subject: RE: RELAY IC2800A501AB23C

Pickup: 63% of panel voltage (72.45 v min)

Dropout: between 6-8%

Resistance: 220 ohms

Regards

-----Original Message-----
From: Barton, Alex [mailto:ABarto1@entergy.com]
Sent: Monday, December 17, 2001 3:17 PM
To: Stott, Al (SUPP)
Subject: RE: RELAY IC2800A501AB23C

Subject: RE: RELAY IIC2800A501AB23C

EQUIPMENT INQUIRY:
Voltage 125 VDC
MANUFACTURER ... G080 GENERAL ELECTRIC
MODEL NO IC2800A501AB23C

Al,

I need to know pickup, drop out, coil burden or coil resistance this relay.

Thanks
Alex Barton
JAF NPP
315-349-6622

Barton, Alex

From: Stott, Al (SUPP) [Al.Stott@gesupply.com]
Sent: Thursday, December 27, 2001 9:30 AM
To: Barton, Alex
Subject: FW: tech help

Here you go
regards

> -----Original Message-----
> From: Tisei, Pam (SUPP)
> Sent: Thursday, December 27, 2001 8:00 AM
> To: Stott, Al (SUPP)
> Subject: FW: tech help
>
>
> Pamela C. Tisei
> GE STRUCTURED SERVICES, LP
> (800) 341-1010 option 1
> Fax 856/ 802-4840, D.C. 8* 433-4840
>
> -----Original Message-----
> From: Deaver, Tim K (IndSys, SalemVA)
> Sent: Wednesday, December 26, 2001 4:23 PM
> To: Tisei, Pam (SUPP)
> Subject: RE: tech help
>
> Pam:
>
> Please see comments below:
>
> Tim
>
> -----Original Message-----
> From: Tisei, Pam (SUPP)
> Sent: Thursday, December 20, 2001 1:38 PM
> To: Deaver, Tim K (IndSys, SalemVA)
> Subject: tech help
>
> I need to know pickup, drop out, coil burden or coil resistance these relays and contactors.
>
> IC2800Y102A3B - coil is part 22D75G3A, 115/120 VDC rated volts, 296 ohms.
> hot pick-up voltage - 80% rated volts
> cold pick-up voltage - 65% rated volts
> max drop-out voltage - 15% rated volts
>
>
> IC2800-1607FEH - (will assume that E is actually 3) coil is part 1D106G3A, 115/120 VDC rated volts, 1050 ohms.
> hot pick-up voltage - 80% rated volts
> cold pick-up voltage - 45% - 65% rated volts
> cold drop-out voltage - 5% rated volts
> hot drop-out voltage - 15% rated volts (max.)
>
>
> IC2820A100AB203F - coil is part 22D13G4A, 115/120 VDC rated volts, 550 ohms.
> hot pick-up voltage - 80% rated volts
> cold pick-up voltage - 63% rated volts
> cold drop-out voltage - approx. 6% rated volts
> hot drop-out voltage - approx. 8% rated volts
>
>

Barton, Alex

From: Stott, Al (SUPP) [Al.Stott@gesupply.com]
Sent: Thursday, December 27, 2001 9:30 AM
To: Barton, Alex
Subject: FW: al stott

here you go
regards

> -----Original Message-----
> From: Tisei, Pam (SUPP)
> Sent: Wednesday, December 26, 2001 1:53 PM
> To: Stott, Al (SUPP)
> Subject: FW: al stott
>
> see below
>
>
>
>
> Pamela C. Tisei
> GE STRUCTURED SERVICES, LP
> (800) 341-1010 option 1
> Fax 856/ 802-4840, D.C. 8* 433-4840
>
> -----Original Message-----
> From: Magoon, Don D (IndSys, SalemVA)
> Sent: Wednesday, December 26, 2001 1:52 PM
> To: Tisei, Pam (SUPP)
> Subject: FW: al stott
>
> HI PAM,
> FYI
> MAGOON
>
>
> -----Original Message-----
> From: Deaver, Tim K (IndSys, SalemVA)
> Sent: Wednesday, December 26, 2001 1:49 PM
> To: Magoon, Don D (IndSys, SalemVA)
> Subject: RE: al stott
>
> Don:
>
> Cat. no. IC2801BA201A2F is an assembly consisting of two IC28001607F
> form contactors (both employing the same coil part number) mounted to a
> single base. If I have translated the catalog number properly (I believe
> I have), then, the coil is 1D106G9. The only coil parameters available to
> me are: 268 ohms @ 25 C, 62 volts. Unfortunately, I do not have a copy
> of the wiring diagram for this contactor assembly - I do believe, however,
> that since the overall contactor control voltage is 115 VDC, then the two
> coils must be wired in series. The pick-up voltage (hot-coil) for this
> unit will be 80% of rated coil voltage (.8X62X2 = 99.2 volts). The
> pick-up voltage (cold coil) will be about 65% of rated coil voltage
> (.65X62X2 = 80.6 V). The drop-out voltage with hot coil should be approx.
> 15% (.15X62X2 = 18.6 volts) and with cold coil should be approx. 5%
> (.05X62X2 = 6.2 volts). I hope this helps.
>
> Tim
>
> -----Original Message-----
> From: Magoon, Don D (IndSys, SalemVA)

> Sent: Thursday, December 20, 2001 11:11 AM
> To: Tisei, Pam (SUPP); Deaver, Tim K (IndSys, SalemVA)
> Cc: Usery, David (IndSys, SalemVA)
> Subject: RE: al stott
>
> HI PAM,
> YOU CAN SEE I AM SENDING THIS TO TIM DEAVER. TIM WILL BE BACK NEXT
> WEDNESDAY. I AM NOT GOING TO ANSWER THIS. I AM NOT AN ENGINEER.
> THANK YOU
> MAGOON
>
>
>
> -----Original Message-----
> From: Tisei, Pam (SUPP)
> Sent: Thursday, December 20, 2001 10:52 AM
> To: Magoon, Don D (IndSys, SalemVA)
> Subject: al stott
>
>
> EQUIPMENT INQUIRY:
> Voltage 125 VDC
> MANUFACTURER ... G080 GENERAL ELECTRIC
> MODEL NO ..... RELAY IC2801-BA201A2F
> DC COIL DATA IC2800160725A
>
> I need to know pickup, drop out, coil burden or coil resistance this
> relay.
>
>
> Pamela C. Tisei
> GE STRUCTURED SERVICES, LP
> (800) 341-1010 option 1
> Fax 856/ 802-4840, D.C. 8* 433-4840
>

GENERAL PURPOSE CONTROL RELAYS

TYPE K

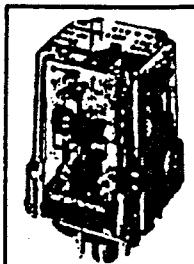
CLASS 8501

Class 8501 Type K relays are designed for multipole switching applications at 240 volts or below. These relays have industr standard wiring and pin arrangements which allows for their use as replacements for many similar relays without wiring or hardwar modifications.

- 240 Volt 10 Amperes
- AC or DC Operation
- DPDT or 3PDT
- DPDT Latching Relay
- Manual Operator/Pilot Light Option
- Horsepower Rated

FOR QUANTITY PRICES CONTACT YOUR LOCAL SQUARE D DISTRIBUTOR

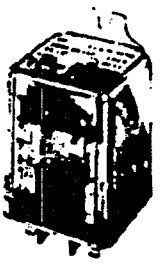
TYPE KP — TUBE TYPE TERMINATION



Type KP
Tube Type

Input Voltage	Contact Arrangement	Options	Type	Form	Price
AC 50/60 Hz	DPDT	None	KP-12	....	$18.
	DPDT	Pilot Light	KP-12	P14	22.
	3PDT	None	KP-13		23.
	3PDT	Pilot Light	KP-13	P14	26.
DC	DPDT	None	KPD-12	....	18.
	DPDT	Pilot Light	KPD-12	P14	22.
	3PDT	None	KPD-13	....	23.
	3PDT	Pilot Light	KPD-13	P14	26.

TYPE KF — FLANGE MOUNTED — SQUARE BASE TERMINATION



Type KF
Flange Mounted

Input Voltage	Contact Arrangement	Options	Type	Price
AC 50/60 Hz	DPDT	None Available	KF-12	$12.
	3PDT		KF-13	13.
DC	DPDT	None Available	KFD-12	12.
	3PDT		KFD-13	13.

TYPE KU — SQUARE BASE TERMINATION

Type KU
Square Base

Input Voltage	Contact Arrangement	Options	Type	Form	Price
AC 50/60 Hz	DPDT	None	KU-12	....	$11.
	DPDT	Pilot Light	KU-12	P14	14.
	DPDT	Manual Operator and Pilot Light	KU-12	M1P14	15.
	3PDT	None	KU-13	....	12.
	3PDT	Pilot Light	KU-13	P14	15.
	3PDT	Manual Operator and Pilot Light	KU-13	M1P14	17.
DC	DPDT	None	KUD-12	....	11.
	DPDT	Pilot Light	KUD-12	P14	14.
	DPDT	Manual Operator and Pilot Light	KUD-12	M1P14	15.
	3PDT	None	KUD-13	....	12.
	3PDT	Pilot Light	KUD-13	P14	15.
	3PDT	Manual Operator and Pilot Light	KUD-13	M1P14	17.

TYPE KL — LATCHING RELAY — SQUARE BASE TERMINATION

Type KL
Square Base

Input Voltage	Contact Arrangement	Options	Type	Price
AC 50/60 Hz	DPDT	None Available	KL-12	$22.
DC	DPDT	None Available	KLD-12	22.

PILOT LIGHT OPTION — Available on Types KP and KU Internal pilot lights are available in both ac and dc versions fc positive indication of power to the coil.

MANUAL OPERATOR OPTION — Available on Type KU only To speed circuit testing a manual operator can be provided. Wit this feature the relay can be manually switched to simulate norm operation.

STOCK RELAYS*

Type	Form	AC Voltage 50/60 Hz 6	12	24	120	240	Type	Form	DC Voltage 6	12	24	48	110	125
KP-12	....	X	X	X	X	X	KPD-12	....	X	X	X	X	X	X
KP-12	P14		X	X	X	X	KPD-12	P14		X	X	X	X	X
KP-13	....		X	X	X	X	KPD-13	....		X	X	X	X	X
KP-13	P14			X	X	X	KPD-13	P14			X			X
KU-12	....	X	X	X	X	X	KUD-12	....		X	X			
KU-12	P14			X	X		KUD-12	P14			X			
KU-12	M1P14			X	X	X	KUD-12	M1P14			X			
KU-13	....		X	X	X	X	KUD-13	....		X	X		X	X
KU-13	P14			X	X		KUD-13	P14			X			
KU-13	M1P14			X	X	X	KUD-13	M1P14			X		X	X
KF-12	....			X	X	X	KFD-12	....			X			
KF-13	....			X	X	X	KFD-13	.....		X	X			
KL-12	....			X	X	X	KLD-12	....		X	X			

* Orders for Type K relays which are not stocked must call for a minimum quantity of 100 identical devices and will have a lead time of 16 weeks.

ORDERING INFORMATION REQUIRED
See page 212

APPLICATION DATA
See page 215

DIMENSIONS
See page 215

SOCKETS
See page 217

GENERAL PURPOSE CONTROL RELA

TYP

CLA 85

APPLICATION DATA — TYPE K

CONTACT RATINGS

AC						DC		
Volts	Amperes				HP	Volts	Amperes	
	Inductive 35% PF			Resistive 75% PF			Make Break	Con-tinuous
	Make	Break	Con-tinuous	Make, Break & Continuous				
120	30	3	10	10	¼Δ	6-120	60 VA	10 A
240	15	1.5	10*	10*	½			

* 3 pole devices have 6Δ5 Amps max. continuous rating.
Δ Type KP rated ⅛ HP.

OPERATING DATA

Pick-Up Time:
Types KF, KP, KU — Approximately 15 ms
Type KL — Approximately 25 ms

Drop-Out Time:
Types KF, KP, KU — Approximately 10 ms
Type KL — Approximately 25 ms

Operating Temperature Range:
Types KF, KP, KU
AC: 2 pole: −45°C to +55°C (−49°F to +131°F)
3 pole: −45°C to +45°C (−49°F to +113°F)
DC: −45°C to +70°C (−49°F to +158°F)
Type KL
AC/DC: −45°C to +70°C (−49°F to +158°F)

CONTACTS

Configuration: 2 or 3PDT (2 or 3 Form C)
Material: Silver cadmium oxide
Ratings: See table above

UL/CSA

UL Component Recognized and CSA Certified

COILS

Duty: Continuous rated coils

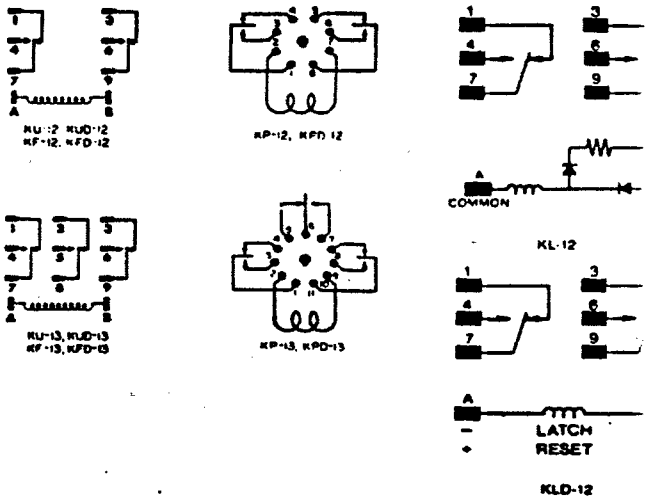
Standard Voltages:

	Type KP	Types KU, KF	Type KL
AC	6,12,24,48,120,240	6,12,24,48,120,240	24,120,240
DC	6,12,24,48,110,125,130	6,12,24,48,110	12,24

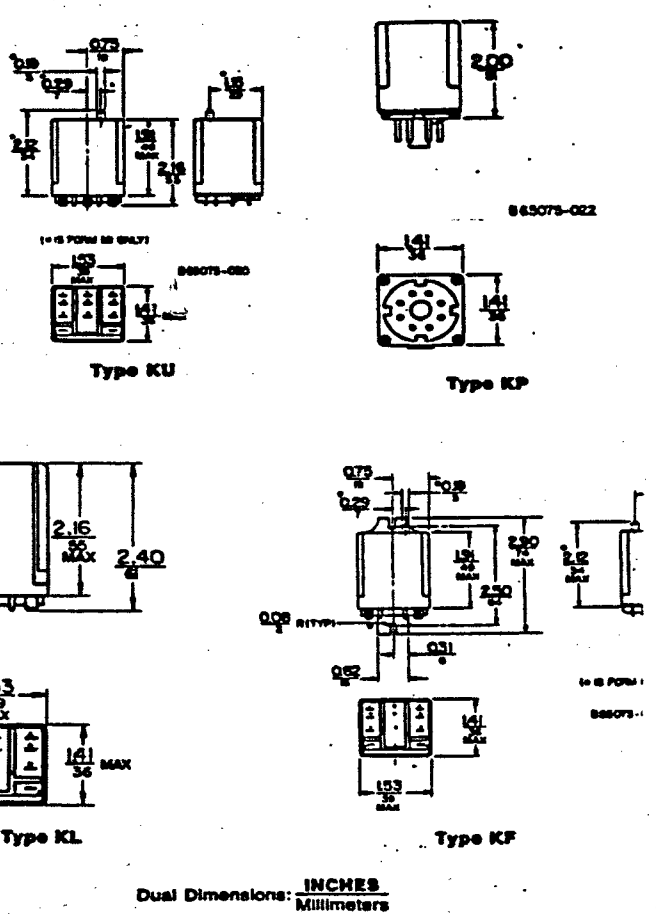
Operate:
AC: 85% of Nominal Voltage at 25°C (77°F)
DC: 75% of Nominal Voltage at 25°C (77°F)

Burden:
Type KP:
AC: 3 VA inrush, 2 VA sealed
DC: 1.2 watts standard
3 watts maximum
Types KU, KF:
AC: 2 pole — 3 VA inrush, 2 VA sealed
3 pole — 5.4 VA inrush, 2.7 VA sealed
DC: 1.2 watts standard
3 watts maximum
Type KL:
AC: 2.0 VA latch, 0.6 VA unlatch
DC: 1.22 watts

WIRING DIAGRAMS



APPROXIMATE DIMENSIONS



Dual Dimensions: INCHES / Millimeters

›nta atings

Type	AC Volts	AC Resistive 75% PF Continuous Amperes	AC HP	DC Volts	DC Resistive Amperes
KP, KU, KL, KF	120	10	½	28	10
	240	10*	½		
KX	120	15	½	28	10
	240	10*	½		

3 pole devices have 6 Amps max. continuous rating.
Type KP rated ⅛ HP
Does not apply to KP or KPD relays.

›erating Data

Pick-Up Time:
Types KF, KP, KU, KX – Approximately 15 ms
Type KL – Approximately 25 ms

Drop-Out Time:
Types KF, KP, KU, KX – Approximately 10 ms
Type KL – Approximately 25 ms

Operating Temperature Range:
Types KF, KP, KU, KX
AC: 2 pole: -45°C to +55°C (-49°F to +131°F)
3 pole: -45°C to +45°C (-49°F to +113°F)
DC: -45°C to +70°C (-49°F to +158°F)
Type KL
AC/DC: -45°C to +70°C (-49°F to +158°F)

ntacts

Configuration: 2 or 3PDT (2 or 3 Form C)
Ratings: See table above
Material: Silver cadmium oxide

il

Duty: Continuous rated coils
Available Voltages:
See Stocked Relays page 2-52. For a 220VDC input, use a 110VDC relay with a 10,000 ohm 5W wire-wound resistor in series.
Operate:
AC: +10, -15% of Nominal Voltage at 25°C (77°F)
DC: +10, -25% of Nominal Voltage at 25°C (77°F)
Burden:
Type KP:
AC: 3 VA inrush, 2 VA sealed
DC: 1.2 watts standard, 3 watts maximum
Types KU, KF:
AC: 2 pole – 3 VA inrush, 2 VA sealed
3 pole – 3.7 VA inrush, 2.7 VA sealed
DC: 1.2 watts standard, 3 watts maximum
Type KX:
AC: 3.7 VA inrush, 2.7 VA sealed
DC: 1.2 watts standard, 3 watts maximum
Type KL:
AC: 2.0 VA latch, 0.6 VA unlatch
DC: 1.22 watts

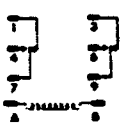
›eral

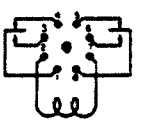
Terminals: Solder/plug–in
UL/CSA: Type K with recommended Class 8501 Type NR Socket

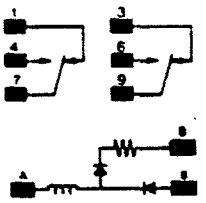
File E78351 CCN NLDX
File LR15734M51 Class 321104

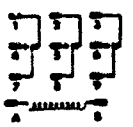
UL component recognized under CCN NLDX2.

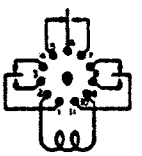
Wiring Diagrams

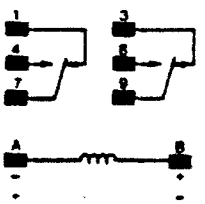

KU12, KUD12
KX12, KXD12
KF12, KFD12


KP12, KPD12

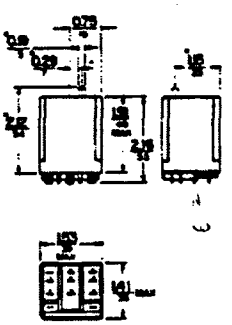

KL12


KU13, KUD13
KX13, KXD13
KF13, KFD13

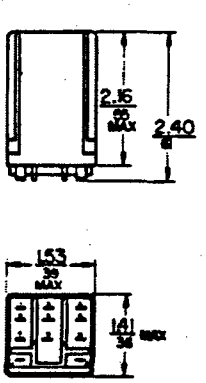

KP13, KPD13

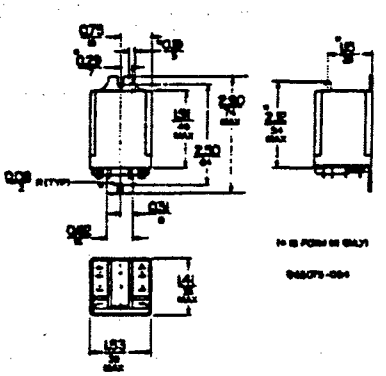

KLD12

Approximate Dimensions


Type KU and KX


Type KP


Type KL


Type KF

Dual Dimensions: Inches / Millimeters

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Documentation of Telephone Discussion

DATE: 5/30/02 TIME: 8:30AM MODIFICATION NO.: _____

SUBJECT: SQUARE D KPD-13 CLASS 8501 RELAY 93-K4, 93-TBR, 93-TBRX, 93-VSR, 93-VSRX RELAYS

REFERENCES: JAF-CALC-ELEC-02609 & JAF-CALC-ELEC-02610 S345-CODE (M21)

	NAME	ORGANIZATION
PARTICIPANTS:	BRIAN MARKS	ENTERGY NUCLEAR NORTHEAST (315) 349-6213
	DON PATRICK	~~(888)~~ SCHNIEDER ELECTRIC (SQUARE D) (888) 778-2733

SUMMARY OF DISCUSSION: I asked Don what the dropout voltage of the KPD relay was. Don indicated that it was significantly less than the pickup. Don indicated that it is typically 30 to 40% of rated voltage (37.5 to 50VDC). Actual testing of a spare relay (SEE JDED-96-0564 in appendix 8) ~~was~~ resulted in a dropout of 44 ± 2VDC. This is consistant with the "typical" range. For conservatism, the subject calculations will use 50VDC for the dropout voltage for the square D KPD-13 CLASS 8501 relays

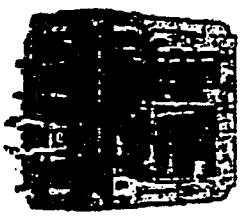
AGREEMENTS/COMMITMENTS: None

Prepared By: Brian Marks Date: 5/30/02
Title: Senior Electrical Engineer
Reviewer: Alex Debes Date: 5/30/02
Title: ELECTRICAL ENGINEER

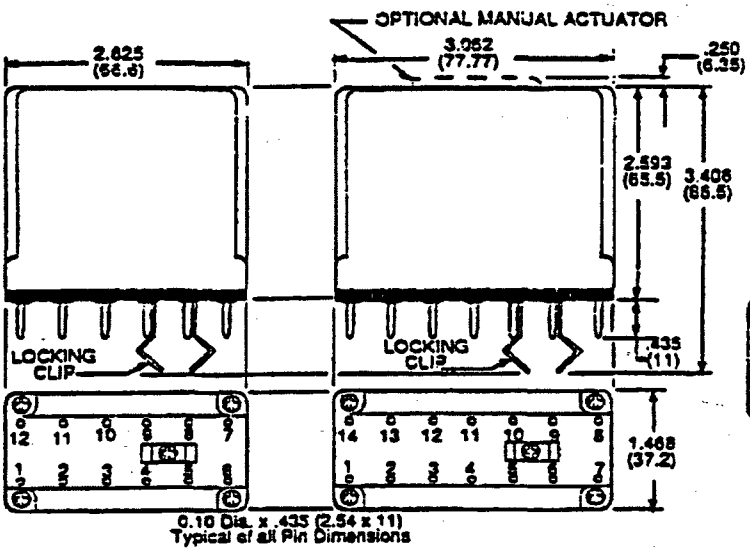
Distribution:

SERIES
219

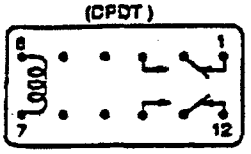
300 VOLT GENERAL PURPOSE PLUG-IN RELAY



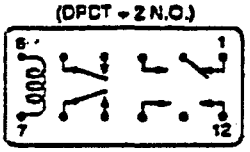
THE SERIES 219 GENERAL PURPOSE INDUSTRIAL PLUG-IN RELAYS FEATURE 12 PIN AND 14 PIN BASES. THE COIL IS ENCAPSULATED FOR PROTECTION.
- NUCLEAR QUALIFIED VERSIONS ARE AVAILABLE. CONSULT FACTORY.



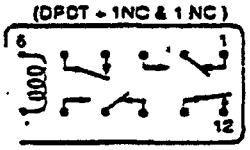
219XBXP (DPDT)



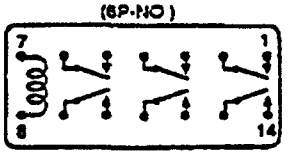
219BBXP (DPDT + 2 N.O.)



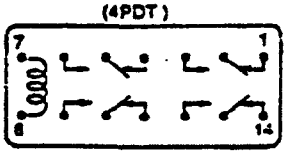
219ABAP (DPDT + 1NC & 1 NC)



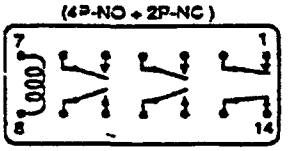
219FXXP (6P-NO)



219XDXP (4PDT)



219DXBP (4P-NO + 2P-NC)



MODELS AVAILABLE

12 PIN	CONTACTS	14 PIN	CONTACTS
219BBXP	DPDT + 2 NO	219XDXP	4PDT
219XBXP	DPDT	219FXXP	6P-NO
219ABAP	DPDT + 1 NO & 1 NC	219DXBP	4P-NO + 2P-NC

CONTACT RATINGS

VOLTS	MAKE	CARRY	BREAK RESISTIVE	BREAK INDUCTIVE
24 VDC	30A	10A	10A	10A
120 VAC	30A	10A	10A	3A
240 VAC	30A	10A	5A	1A
28 VDC	30A	10A	10A	3A
125 VDC	30A	10A	0.5A	0.1A
125 VDC * SM	30A	10A	1.5A	0.5A
125 VDC * SM	30A	10A	4A	1.5A
125 VDC * SM	30A	10A	0.5A	150 mA
125 VDC * SM	30A	10A	1.5A	0.5A

Relays with Code 69 feature (Check with factory for UL & CSA Listing).

GENERAL SPECIFICATIONS

COIL	
Pull-in, min. AC	85% of Nominal Voltage
Pull-in min. DC	80 % of Nominal Voltage
Overvoltage, max.	110% of nominal voltage
CONTACTS	
Contact Material:	Silver Cadmium Oxide, Gold diffused (Standard)
TIMING	
Operate Time:	25 mS Max. @ Nominal Voltage.
Release Time:	20 mS Max. @ Nominal Voltage.
DIELECTRIC STRENGTH	
All Mutually Insulated Points:	1500 V rms
Insulation:	1/4" over surface, 1/8" thru Air
TEMPERATURE	
Rated Operation:	-10°C to +80°C
LIFE EXPECTANCY	
Mechanical:	10 Million Operations no load
Electrical:	100,000 Operations @ Rated Load.
MISCELLANEOUS	
Enclosure:	Clear polycarbonate.

COIL SPECIFICATIONS @ 25°C

AC RELAYS 50/60 HZ (2.6 VA @ 60HZ Voltage)					DC RELAYS: 1.8 WATTS (2.5 W @ 125VDC)			
Nominal Voltage	Resistance Ohms ±10%	Minimum Operate Volts	Minimum Release Volts	Impedance Ohms	Nominal Voltage	Resistance Ohms ±10%	Minimum Operate Volts Cold	Minimum Operate Volts Hot
6	1.1	1500	340	7.2	5	15.5	288	304
12	4.2	750	410	27	12	83.5	169	147
24	15.5	375	200	120	24 (28)*	250	96	77
120	540	75	40	2700	32	375	66	62
240	2100	32	17	13,400	115/125*	6200	20	16

Note: Stock 24 Vdc and 115 Vac relays have nameplates stamped 24-28 and 115-125 Vdc respectively. These relays operate at 80% of the lower voltages and operate within allowable temperature rises at higher voltages. 250 Vdc - Use 125 Vdc relay and series resistor (6000 Ω, 5 W) not supplied.

OPTIONS (CONSULT FACTORY)

ORDERING CODE
Typical Type No. 219 XBX P L -24D

- Series
  - 219 Industrial plug-in style
- Contact Arrangements
  - XBX (2 Form "C")
  - ABa (DPDT + 1 Pole-NO & 1 Pole NC)
  - BBX (2 Pole-NO & DPDT)
  - XDX (4 PDT)
  - FXX (6 Pole-NO)
  - DXB (4 Pole-NO & 2 Pole-NC)
- Standard Features
  - Polycarbonate Cover- CODE "P"
- Optional Features
  - Indicator Lamp - CODE "L"
  - Manual Actuator- CODE "M"
  - 130°C Coil - CODE "U"
  - Bifurcated Contacts - CODE "33"
  - Perm. Magnet Blowout- CODE "69"
- Coil Voltage
  - AC: 6, 12, 24, 120, 240 (Add "A")
  - DC: 6, 12, (24-28), 32, 115/125 (Add "D")

Coil Voltages & Frequencies must be specified.

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SEE SECTION 12 FOR MATING SOCKETS

Westinghouse

MAILING ADDRESS:
Westinghouse Electric Corporation
Replacement Component Services
2000 Cheswick Avenue
Cheswick, PA 15024-1358 USA

Replacement Component Services

FAX (412) 275-3710
(WIN) 298-3710

TO

Name: Alex Barton

Company: NYPA

FAX Number: (315) 349-6981

FROM

Name: SHARON MILLER

Telephone: BELL (412) 275-3927 WIN 298-3927

COMMENTS: 8-26-97

Alex:

Per your fax request 8/25/97. RBS engineering has reviewed your request

The pick up & dropout voltage for 120 VDC relay model ARD660S per nema stds is:

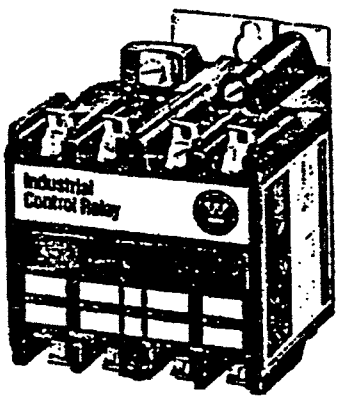
Pickup 80% of rated = 96 VDC

Drop out > 10% of rated = > 12 VDC

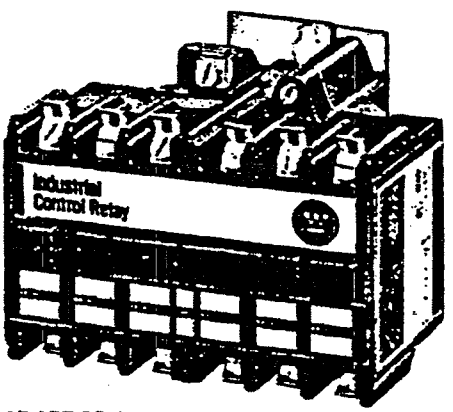
No. of Pages (including cover sheet) 1

Sharon Miller

Type AR/ARB/ARD Convertible Contact Relays



AR/ARB 4 Pole



AR/ARB 6 Pole

Application
AR/ARB/ARD relays are designed for use on machine tools, process lines, conveyors, and similar automatic and semi-automatic equipment that require dependable, precision control over millions of operating cycles.

Description
AR/ARB/ARD relays are electro-mechanical convertible contact relays. AR/ARB relays are Ac devices, and the ARD is for Dc applications. They can be mounted in any position.

Available in either 4 or 6-pole configurations, AR/ARB relays are easily converted to 8 or 10 poles simply by adding a 4-pole deck. In addition, mechanical latch and pneumatic or solid state timer attachments are available for use with 4 and 6-pole relays.

Contacts are convertible from either NO to NC to provide any combination desired, up to a maximum of 10, except that for the ARD, the number of NC poles cannot exceed six in any pole configuration. Wide spacing of contacts simplifies installatien, contact testing, and maintenance. Contacts are electrically and mechanically isolated from each other.

List Prices
AR/ARB/ARD Relays

Number of Pole Spaces	Contacts NO	NC	Blank Cavities	ARB 300 Volt Relays 120/60, 110/50 Ac Coil Catalog Number	List Price	AR 600 Volt Relays 120/60, 110/50 Ac Coil Catalog Number	List Price	ARD Dc Relays 120 Volt Dc Coil Catalog Number	List Price
4	0	0	4	AR/ARB4A	$32	AR/ARB4	$ 32	ARD4S	$ 52
	2	0	2	ARB420A	48	AR420A	56	ARD420S	76
	4	0	0	ARB440A	64	AR440A	80	ARD440S	100
6	0	0	6	AR/ARB6A	48	AR/ARB6A	48	ARD6S	68
	4	0	2	ARB640A	80	AR640A	96	ARD640S	116
	6	0	0	ARB660A	96	AR660A	120	ARD660S	140
8	6	0	2	ARB860A	80	AR860A	104	ARD860S	124
	8	0	0	ARB880A	96	AR880A	128	ARD880S	148

Contact Cartridges

Type Terminal	Standard Cartridges Catalog Number	List Price①	20 Amp. Cartridges Catalog Number	List Price	Overlap Contact Cartridges Catalog Number	List Price②
300 Volt Ac Cartridges						
With Clamp Terminals	ARBC	$ 8	.....	...	ARBOC	$16
With Screw Terminals	ARBCR	8	.....	...	ARBOCR	16
600 Volt Ac Cartridges						
With Clamp Terminals	ARC	12	ARGC	$20	AROC	24
With Screw Terminals	ARCR	12	ARGCR	20	AROCR	24
Dc Cartridges						
With Clamp Terminals	ARDC	12	.....	...	ARDOC	24
With Screw Terminals	ARDCR	12	.....	...	ARDOCR	24

① Standard cartridges are sold only in cartons of 4 cartridges. Catalog number and list price are for single cartridge.

② Overlap contact cartridges are sold in sets of 2 cartridges. Catalog number and list price are for sets of 2.

Contact Ratings

300 Volt Ac Cartridges: NEMA A300

Volts	Cont. Current	Max. Current Make	Break	Max. VA Make	E
120	10	60	6	7200	7
240	10	30	3	7200	7

600 Volt Ac Cartridges: NEMA A600

Volts	Cont. Current	Max. Current Make	Break	Max. VA Make	E
120	10	60	6	7200	7
240	10	30	3	7200	7
480	10	15	1.5	7200	7
600	10	12	1.2	7200	7

Dc Cartridges NEMA N600

Volts	Cont. Current	Make or Break Two Poles in Series	Make or Break Single Pole	Ma VA Ma Bre
125	10	2.2	1.1	275
250	10	1.1	.55	275
600	10	.4	....	275
Resistive Load				
125	10	...	3.0	...
250	10	...	1.5	...

Coil Data (Dependent on Contact Arrangement):
Pick-up Time: 8-14 Ms Ac, 24-30 Ms Dc
Drop-out Time: 8-14 Ms Ac, 11-15 Ms Dc
Coil Power Ac: 96 VA Open, 14 VA Close
Dc: 14 Watts Open, 250 Volts

Ordering Information
Order by Catalog Number

Relays listed in the price table are suppl with NO contacts convertible to NC. Wh ordering relays with NO and NC poles, a $4.00 list per relay. *Order by description*

To order relays with screw terminals for type connectors, add suffix R to catalog number of relay. No extra charge. Exam AR420AR.

Ac relays listed in price tables have 120/ 110/50 coils designated by suffix letter A relays have a 120 volt coil designated by fix letter S. For other coil voltages, see t page 9 and substitute suffix letter show table for desired voltage for suffix letter S in catalog numbers.

93-K2VR-A, -B, -C, -D

Supersedes Issue Dated May, 1950

INSTRUCTION LEAFLET 15-800-M 020/120/220-1B

NOVEMBER, 1952 WESTINGHOUSE INDUSTRIAL CONTROL APPARATUS PAGE 1

Type M D-C Magnetic Contactors Frames 020, 120 and 220 Two Poles Magnet Closed INSTRUCTIONS

APPLICATION

Type M contactors are general-purpose magnetically operated contactors suitable for motor-starting and switching applications.

RATINGS

The contactors have the ratings listed in Fig. 2.

Contactor Type	M-020-2H	M-120-H	M-120-2H	M-220-2H
Voltage Rating	600	600	600	600
8 Hour Ampere Rating	*	25	25	50
1 Hour Ampere Rating	*	33	33	67

* The current rating of this contactor is less than 25 amperes, and depends on the blowout coil rating.

Fig. 1—Rating Table

The contactors whose type designations terminate in "-2H" are alike in every respect except their blowout coils. The Type M-120-H contactor, however, employs a smaller operating coil, and smaller arc shields, contacts, springs and shunts.

In addition to the contactors listed above, related contactors have been built and since retired as obsolete. They are tabulated in Figure 2 (and included in Figures 4, 5 and 6) for the accommodation of their users.

Obsolete Contactor Type	M-020-H	M-220-L	M-220-HØ
Voltage Rating	600	250	600
8 Hour Ampere Rating	*	50	50
1 Hour Ampere Rating	*	67	67
Superseded By	M-020-2H	M-220-2H	M-220-2H

* The current rating of this contactor is less than 25 amperes, and depends on the blowout coil rating.

Ø This contactor is now the M-220-2H contactor. The designation has been changed without any physical alteration of the contactor.

Fig. 2—Ratings of Obsolete Contactors

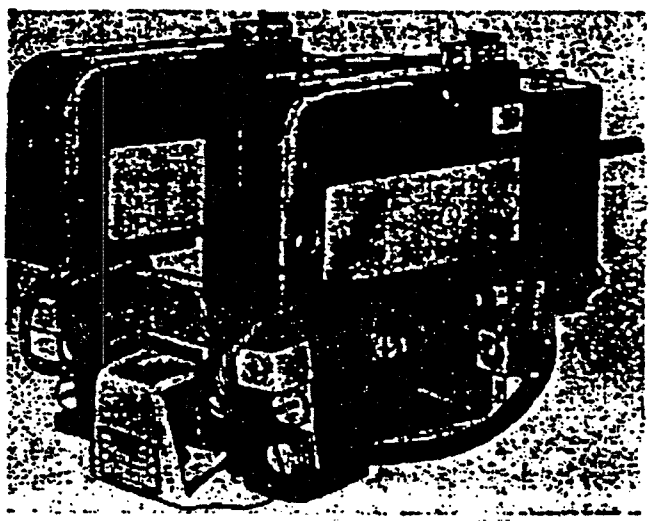


Fig. 3—Type M-220-2H Front-connected Contactor

The operating coils are rated for continuous duty and will operate the contactors at 80% to 110% of their rated voltage.

The contactors are insulated for a maximum potential difference of 600 volts among parts.

CONSTRUCTION

The contactors are of unit construction with all parts assembled on a common frame. The armature hinges on a knife-edge bearing which has an extremely long life and requires little maintenance.

A strong kickout spring minimizes the risk of accidental closing of the contactor under conditions of shock or tilt.

The arc shields are held in place by the blowout pole-pieces and spring clips, and may be removed by pulling them directly forward. An arc horn in each arc shield relieves the moving contact of excessive burning. The arc, which is drawn between the contacts when the contactor opens, moves outward under the influence of the magnetic blowout field and transfers from the moving contact to the arc horn. A flexible connection which is provided to maintain the arc horn at the same potential as the moving contact serves also to prevent loss or misplacement of the arc shield when the latter is removed for inspection of the contacts.

The moving and stationary contacts are faced with solid silver. The moving contact is hinged on the armature in such a way that sliding or rubbing

Type M D-C Magnetic Contactors—Frames 020, 120 and 220

of the surfaces when the contacts meet is practically non-existent, a provision essential to the long life of silver contacts.

A plate of non-magnetic steel is secured to the underside of the armature to insure against a sticking closed of the armature due to residual magnetism following the interruption of voltage to the operating coil.

Rear-connected contactors are held to the panel by five mounting studs, four of which make provision for the electrical connections. Front-connected contactors are provided with pressure-type solderless terminals and are held to the panel by three mounting studs.

The contactors are suitable for mounting only on insulating panels up to 2 inches thick, and special insulating precautions must be taken if they are to be mounted on conducting surfaces.

ELECTRICAL INTERLOCKS

The contactor will accommodate a total of two Type L-46 or L-47 electrical interlocks, which may be selected in any combination which does not exceed the maximum allowable quantities listed in the table in Fig. 4.

Electrical Interlock Type	Maximum Allowable No. of Interlocks to be Applied to Type M Contactors	
	*M-020-H M-120-H	M-020-2H M-120-2H M-220-L M-220-H M-220-2H
L-46 Normally open	2	2
L-46 Normally closed	1	2
L-47 Normally closed (delayed break)	2	2
Total no. of interlocks of all the above types that can be applied to one contactor	2	2

* Contactors shown in light face are obsolete.

Fig. 4—Electrical Interlock Application Table

The Type L-46 electrical interlock is obtainable as a normally-open or a normally-closed interlock, and either combination can be furnished as a front-connected or a rear-connected assembly. For more complete information refer to Instruction Leaflet 15-829-L46-1.

The Type L-47 electrical interlock is a normally-closed delayed-break interlock available in both front-connected and rear-connected assemblies. It differs from the Type L-46 normally-closed interlock in that its contacts separate late rather than early in the closing cycle of the magnet, and it should be applied only where such a delayed-break action is required. For all ordinary applications the Type L-46 interlock should be used. For more complete information refer to Instruction Leaflet 15-829-L47-1.

The stationary contact assembly of either type interlock is mounted on the molded base of the c tactor, occupying a space between the arc shie The moving arm of the interlock is secured to contactor armature by means of a single screw. C should be taken when installing an interlock to m certain that its moving parts function freely a that the contact gaps and overtravels conform the information given in its instruction leaflet.

The sequence in which the various switch operations occur as the contactor magnet closes is follows: (1) the Type L-46 normally closed int lock opens; (2) the main contacts close, (3) Type L-46 normally-open interlock closes, and the Type L-47 normally-closed interlock ope (Note: a single contactor can accommodate only t of the three varieties of interlocks at one time.)

MECHANICAL INTERLOCK

A Type M-25 mechanical interlock (Style N 1320750) may be employed to safeguard a pair contactors against the closing of one if the othe already closed. The contactors are mounted s by side on 6 inch centers.

INSTALLATION AND MAINTENANCE

Arc Shields—The arc shields and their arc ho are essential to the performance of the contac and these should always be in place. The flexi connections leading from the arc horns sho always be securely fastened to the moving contac The arc shields may be removed by pulling th directly forward, allowing the magnetic blow pole-pieces (which act as their fixed supports) guide them in their sliding movement. In replac the arc shields care must be taken that the guid recesses in their sides locate themselves prope on and be gripped firmly by the supporting guid If a pair of guides are found to be spread apart that they no longer grip the arc box firmly, remo the arc box and spring the guides together by sque ing them with the fingers. The arc shields should pushed back as far as they will go, until they held securely against the molded base by the spri grips.

Armature and Bearing—The knife-edge bear requires no maintenance other than the removal accumulated dirt. Oil should not be used as hastens the collection of dust.

The magnet pole-face is secured to the core means of a bolt having a head that projects forwa into a hole in the armature. Care should be tak that the parts maintain proper alignment, a particularly that the bolt-head be accurately ce tered in the armature hole. Dirt should not allowed to accumulate.

Operating Coil—When a new operating coil installed, the identification label should be examin to make certain that the voltage rating and the c style number are correct for the application.

Type M D-C Magnetic Contactors—Frames 020, 120 and 220

The steps to be followed in removing the operating coil are: (a) remove the arc shields by sliding them forward, (b) loosen the two bolts securing the armature stop to the underside of the contactor frame until the armature stop can be lowered clear of the two dowel pins which locate it in position, (c) allow the self-contained assembly comprising the armature, armature stop, moving contacts and springs to hang by the shunt, (d) remove the bolt holding the pole-face to the core of the magnet, and (e) disconnect the coil leads and slide the coil forward until it is clear of the contactor.

Contacts—Oil or other lubricant should not be used on the silver contacts. The discoloration which results from arcing and from exposure to the atmosphere usually is not harmful to their performance, and consequently no filing or dressing is necessary.

When the contacts are new they should meet sufficiently in advance of the final sealing of the armature against the magnet pole-face that a gap of approximately $\frac{1}{8}$ inch appears between the underside of each moving contact and the upper edge of its insulating support, as indicated in Fig. 7. As the contacts wear, the amount of this overtravel diminishes, and when at length it decreases to $\frac{1}{32}$ inch, the contacts should be replaced.

A moving contact can be removed for replacement by first disconnecting its arc horn connection and its main shunt and then removing its contact spring. Each of the stationary contacts is slotted to facilitate removal, and it is necessary only to loosen the screw until the dowel projecting from the back of the contact is free of the locating hole in the stationary arc horn which serves as the contact support.

The contact gap when the contacts are new should be $\frac{11}{32}$ to $\frac{13}{32}$ inch, as shown in Fig. 7.

If, after new contacts are installed, it is found that the overtravel and contact gap do not conform to the dimensions given: first bend the moving contact straps to secure the proper overtravel; then measure the contact gap and, if necessary, bend the armature stop to secure the proper gap.

The contact pressures when the contacts are new should be as indicated in the table in Fig. 5.

Contactor Type	Contact Pressure in Ounces	
	Initial	Final
*M-020-H and M-120-H	4 to 7	9 to 13
M-020-2H and M-120-2H M-220-L and M-220-H M-220-2H	6 to 9	11 to 15

* Contactors shown in light face are obsolete.

Fig. 5—Table of Contact Pressures

To measure the final contact pressure, close the contactor mechanically and by means of a spring scale hooked to a loop of fine wire measure the force necessary to separate the contacts.

If, after new contacts are installed, the pressures are not correct, it may be necessary to replace the contact spring or to adjust the contact overtravel in the manner described previously.

Failure of the magnet to close the contactor may result from an open-circuited operating coil, from a circuit condition in which the voltage is excessively low or from the presence of friction between the parts. Failure of the contactor to open may be caused by friction or by defective kickout springs.

OPERATING COILS

The more commonly used operating coils are listed in the table in Fig. 6.

Coil Volts	Type M Contactor Coils	
	*M-020-H M-120-H	M-020-2H M-120-2H M-220-L M-220-H M-220-2H
	Coil Style No.	Coil Style No.
115	1289407	1289375
230	1289408	1289376
250	560D747G16	30B426SG17
550	1289377	1289377

* Contactors shown in light face are obsolete.

Fig. 6—Style Numbers of Commonly Used Operating Coils

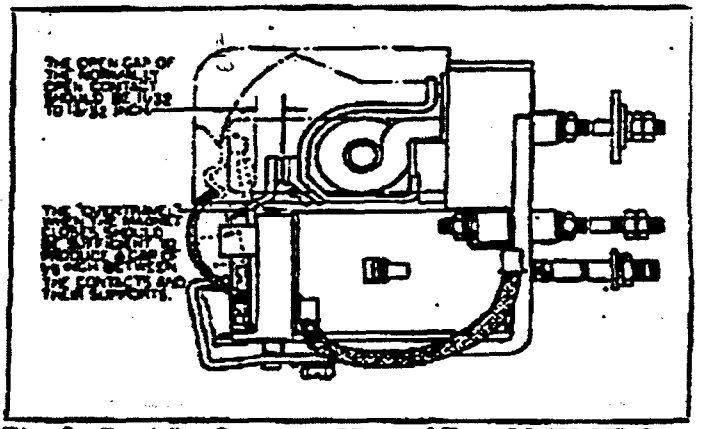


Fig. 7—Partially Cut-away View of Type M-220-2H Contactor with Armature in Closed Position

RENEWAL PARTS

Renewal parts may be obtained from the nearest Westinghouse Sales Office. Be sure to describe the part or parts required and give complete nameplate reading on the contactor for positive identification.

Westinghouse Electric Corporation
Buffalo 5, New York

Printed in U.S.A. (Rep. 5-63)

MAR-22-1993 14:45 FROM GE CONTROL ENGINEERING TO 800-286-5141 P.02

CR123C.F.K.L SIZE 1, 2, 3, 4 HEATER RESISTANCE

3/22/93

HEATER P/N	OHMS	HEATER P/N	OHMS	HEATER P/N	OHMS
CR123C0.54A	10.7	CR123C2.39A	.518	CR123C10.4B	.02
CR123C0.60A	9.16	CR123C2.68A	.428	CR123C11.3B	.0175
CR123C0.66A	7.4	CR123C3.01A	.355	CR123C12.5B	.015
CR123C0.71A	6.1	CR123C3.26A	.294	CR123C13.7B	.0141
CR123C0.78A	5.15	CR123C3.56A	.25	CR123C15.1B	.0122
CR123C0.87A	4.12	CR123C3.79A	.113	CR123C16.3B	.0106
CR123C0.97A	2.85	CR123C4.19A	.098	CR123C18.0B	.0086
CR123C1.09A	2.36	CR123C4.66A	.084	CR123C19.8B	.00734
CR123C1.18A	1.97	CR123C5.26A	.065	CR123C21.4B	.0062
CR123C1.31A	1.77	CR123C5.92A	.054	CR123C22.8B	.0057
CR123C1.48A	1.34	CR123C6.30A	.047	CR123C25.0B	.00485
CR123C1.63A	1.1	CR123C6.95A	.041	CR123C27.3B	.00436
CR123C1.84A	.915	CR123C7.78A	.037	CR123C30.3B	.00427
CR128C1.96A	.759	CR123C8.67A	.0285	CR123C33.0B	.00336
CR123C2.20A	.626	CR123C9.55A	.023		
CR123F23.3B	.0083	CR123F48.7B	.003085	CR123F104C	.000949
CR123F24.3B	.007865	CR123F56.7B	.00231	CR123F114C	.000821
CR123F27.0B	.00638	CR123F61.4B	.0021	CR123F118C	.00074
CR123F30.0B	.00589	CR123F65.8B	.001727	CR123F133C	.000554
CR123F32.7B	.004865	CR123F71.9B	.001521	CR123F149C	.00494
CR123F35.7B	.00442	CR123F77.2B	.001397	CR123F161C	.00043
CR123F39.5B	.00383	CR123F84.8B	.00119	CR123F174C	.000376
CR123F43.0B	.00346	CR123F91.4B	.001105		
CR123K1.23A	1.64	CR123K4.79A	.119	CR123K16.3B	.013
CR123K1.35A	1.37	CR123K5.27A	.103	CR123K17.8B	.00887
CR123K1.50A	1.14	CR123K5.82A	.085	CR123K19.4B	.00815
CR123K1.65A	.947	CR123K6.42A	.064	CR123K21.3B	.0072
CR123K1.82A	.775	CR123K7.13A	.058	CR123K23.6B	.006
CR123K2.00A	.64	CR123K7.91A	.051	CR123K26.0B	.005
CR123K2.22A	.52	CR123K8.75A	.042	CR123K28.8B	.00445
CR123K2.49A	.42	CR123K9.63A	.035	CR123K32.0B	.00302
CR123K2.77A	.343	CR123K10.5B	.028	CR123K35.2B	.00248
CR123K3.01A	.302	CR123K11.4B	.024	CR123K38.7B	.00234
CR123K3.29A	.235	CR123K12.5B	.021	CR123K42.5B	.0023
CR123K3.62A	.214	CR123K13.6B	.017	CR123K46.8b	.00205
CR123K3.98A	.167	CR123K14.8B	.015	CR123K51.5B	.00185
CR123K4.38A	.154				
CR123L1.74A	.387	CR123L5.61A	.047	CR123L18.1B	.0072
CR123L1.93A	.325	CR123L6.18A	.042	CR123L19.9B	.0065
CR123L2.11A	.271	CR123L6.80A	.034	CR123L22.0B	.0053
CR123L2.32A	.238	CR123L7.50A	.028	CR123L24.1B	.0043
CR123L2.55A	.195	CR123L8.25A	.025	CR123L26.5B	.0035
CR123L2.82A	.165	CR123L9.10A	.021	CR123L29.3B	.0031
CR123L3.10A	.14	CR123L10.0B	.0185	CR123L32.2B	.0026
CR123L3.43A	.117	CR123L11.1B	.0168	CR123L35.2B	.0025
CR123L3.80A	.099	CR123L12.2B	.0132	CR123L39.0B	.0023
CR123L4.20A	.079	CR123L13.5B	.011	CR123L42.6B	.0021
CR123L4.63A	.067	CR123L14.7B	.0085	CR123L46.4B	.0018
CR123L5.10A	.055	CR123L16.5B	.0081	CR123L52.0B	.0016

MAR 23 '93 12:06 GE NSC CHARLOTTE P.

JUL-25-1997 15:54 ALLEN-BRADLEY CO. 315 463 5882 P.0

TYPE "H"
HEATER ELEMENT RESISTANCE VALUE TABLES

HEATER CATALOG NUMBER	ENGINEERING PART NUMBER	RESISTANCE (OHMS)		
		MINIMUM (-7%)	NOMINAL	MAXIMUM (+7%)
HH4	X-42901	35.7.	39.5	42.2
HH3X	40033-001-01	31.2	33.5	35.8
HH3	X-42902	26.0	28.0	30.0
HH2X	40033-001-02	21.8	23.5	25.1
HH2	X-42903	18.1	19.5	20.9
HH1X	40033-001-03	14.7	15.8	16.9
HH1	X-42904	12.1	13.0	13.9
H1X	40033-001-04	9.9	10.7	11.4
H1	X-42905	8.4	9.00	9.6
H2X	40033-002-01	7.00	7.50	8.03
H2	X-42906	5.91	6.35	6.79
H3X	40033-002-02	4.83	5.20	5.56
H3	X-42907	3.95	4.25	4.55
H4X	40033-002-03	3.21	3.45	3.69
H4	X-42908	2.62	2.82	3.02
H5	X-42909	2.14	2.31	2.47
H6	X-42910	1.77	1.90	2.03
H7	X-42911	1.43	1.54	1.65
H8	X-42912	1.16	1.25	1.34
H9	X-42913	0.98	1.05	1.12
H10	X-42914	0.80	0.86	0.92
H11	X-42915	0.65	0.70	0.75
H12	X-42916	0.54	0.58	0.62

Post-it® Fax Note 7671	Date 7/25	# of pages ▶ 3
To Alex Barton	From AL STOTT	
Co./Dept.	Co. A-B	
Phone #	Phone #	
Fax #	Fax #	

TYPE "N"
HEATER ELEMENT RESISTANCE VALUE TABLES

HEATER CATALOG NUMBER	ENGINEERING PART NUMBER	RESISTANCE (OHMS)		
		MINIMUM (-7%)	NOMINAL	MAXIMUM (+7%)
N13	X-42917	0.370	0.40	0.430
N14	X-42918	0.321	0.345	0.369
N15	X-42919	0.270	0.290	0.310
N16	X-42920	0.223	0.240	0.257
N17	X-42921	0.186	0.200	0.214
N18	X-42922	0.155	0.167	0.179
N19	X-42923	0.130	0.140	0.150
N20	X-42924	0.110	0.118	0.126
N21	X-42925	0.095	0.102	0.109
N22	X-42926	0.079	0.085	0.091
N23	X-42927	0.066	0.071	0.076
N24	X-42928	0.056	0.060	0.064
N25	X-42929	0.047	0.051	0.055
N26	X-42930	0.0400	0.043	0.046
N27	X-42931	0.0334	0.036	0.039
N28	X-42932	0.0280	0.030	0.032
N29	X-42933	0.0234	0.0250	0.0267
N30	X-42934	0.0195	0.0210	0.0225
N31	X-42935	0.0163	0.0175	0.0187
N32	X-42936	0.0144	0.0152	0.0166
N33	X-42937	0.0123	0.0132	0.0141
N34	X-42938	0.0101	0.0109	0.0117
N35	X-42939	0.0087	0.0094	0.0101

TYPE "M"
HEATER ELEMENT RESISTANCE VALUE TABLES

HEATER CATALOG NUMBER	ENGINEERING PART NUMBER	RESISTANCE (OHMS)		
		MINIMUM (-7%)	NOMINAL	MAXIMUM (+7%)
M36	E-42940	0.0074	0.0080	0.0086
M37	E-42941	0.0066	0.0071	0.0076
M38	E-42942	0.0055	0.0059	0.0063
M39	E-13027	0.0048	0.0052	0.0056
M40	E-13026	0.0040	0.0044	0.0047
M41	E-13029	0.0036	0.0039	0.0041
M42	E-13028	0.0031	0.0033	0.0035
M43	E-13035	0.0025	0.00270	0.0029
M44	E-13034	0.0021	0.00225	0.0024
M45	E-13033	0.00176	0.00190	0.00203
M46	E-13032	0.00154	0.00166	0.00177
M70	E-13031	0.00128	0.00138	0.00147
M71	E-263562	0.00087	0.00094	0.00101
M72	E-263563	0.00074	0.00080	0.00086
M73	E-262564	0.00062	0.00067	0.00072
M74	E-262565	0.000437	0.00470	0.000502
M75	E-262566	0.000367	0.000395	0.000422
M76	E-262567	0.000307	0.000330	0.000355
M77	E-262568	0.000251	0.000270	0.000290
M78	E-262569	0.000209	0.000225	0.000241
M79	E-262570	0.000178	0.000192	0.000205
M80	E-263571	0.000150	0.0001E2	0.000173
M81	E-262572	0.000126	0.000135	0.000144

71DC-B2 CKT 6 2350V-102

DRESSER - RAND
STEAM TURBINE DIVISION
(TURBODYNE-TERRY)

37 Coats Street
Wellsville, NY, 14895
Phone 716-596-3631

FAX No. 716-596-3753
Date: 9/22/97

Receiving Fax No. 315-349-6573
Ph. No. 315-349-6964

Page 1 of 1

To: Bob Sandy
Company: NYPA
Site: Fitzpatrick

From: Ed Grandusky
Nuclear Product Engineer
Copy: R. Kling

SUBJECT: Skinner Valve model L2 LB 5150 p/n 890086A06

TEXT: The current Skinner model number for this valve is 73212BN52N00N0C111C6. This model was Seismically and Environmentally qualified to IEEE 323-1974 and 344-1987 to the same requirements as the original model. It was functionally tested under degraded voltage of 96 VDC.

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
COMPONENT DATA SHEET

Sheet No. 1 of 1

P. O. No. _____

FOXBORO NUCLEAR SPEC 200 MULTINEST POWER SUPPLY

Furnished By: Foxboro Company	Date: 3/15/93
Quantity	Three (3)
Mark or Item No.	16-1 P/S-200A, 16-1 P/S-200B, 16-1 P/S-200
Service or Description	Suppression Pool Temp. Mon. Sys. Power Supply
QA Category	I (Safety-Related)
Seismic Class	I
Location (Panel, Rack)	27 MAP (Relay Room)
Normal (Preferred) Source	120V ac (± 5%), Single Phase, 60 Hz
Alternate Source (Nominal)	125V dc (Battery Back-up) (104-140V dc)
Outputs	+ 15V dc, - 15V dc, 24V ac Single Phase
Alarm Outputs	Loss of ac Power, Module Failure
Base Model No.	N-2ARPS05-A6+BB4
Qualification Code	CS-N/SRC
Documentation	Qualification Reports QOAAA05, QOAAA06, QOAAA37 and Certificate of Conformance with documents listed below. Documentation of the shelf life of the assembly and its component parts.
Delivery Time (in Weeks) ARO	

Remarks: See Attachment 1 for environmental parameters in the Relay Room and Attachment 2 for floor response spectra.

The requirements of 10CFR21, 10CFR50.49, 10CFR50 Appendices A & B, ANSI N45.2.2-1978, IEEE 323-1983, IEEE 344-1987, IEEE 381-1977, IEEE 420-1982, IEEE 627-1980 and IEEE 944-1986 are applicable to this equipment.

To be installed by Mod. No. F1-89-158.

Engineer Prepared By	Engineer Reviewed By	Engineer Approved By	Rev	Rev	Rev	Rev
S. N. Hammada G/C	R. L. Mehl G/C	R. L. Mehl G/C 3/12/93				

HEINZ-

the following is the result of my search & destroy mission for you:

71-BCB-2A-D01 - No Name tag visable

D01 Information:

Breaker: ① THED124100

Resistors: ① # IC9033-AID20 20. Ω

② other resistor no tag

Relays: ① IC2820-BB3J 10A

② IC2820A100-BB3J 10A

Contactor: ① IC2800-A501A823C 100A
might be B

② IC2800-1621AM3H 100A.

Heater: 1@ CR123F71.9B

O.L. Relay: Couldn't read side due to wires running up the side Looked like a possible <CR123E027>

71-BCB-2A-D02 -- No Name tag Visable

Breaker: Mag. Brk. 125A ~~THED6125~~ ~~THFK224125~~ DD213A6384P048

Relays: ① 2 ea. IC2800-A501AB23C 100A

Contactor: ② IC2820A100-BB3K 10A

③ IC2800-1621AM3H 100A

Resistors: ① IC9033-C2B42 .42Ω

② IC9133-476C514G112 ___Ω no value stamped

Heater: CR123F65.8B

OL Relay: CR124E028

(2)

71 BCB-2B-DC2
label ID#
Serial #- 274X0441M02-C02
Amps/H.P. - 7.5 H.P.
25 V DC
Size - 3 Type-RVNR
Cy - DC
Diagram# - 187B8333
Sh. 9

Breaker: THED 12# 100A
Resistors: ① - C4B70 70Ω HARD TO READ - MIGHT BE OFF A LITTLE

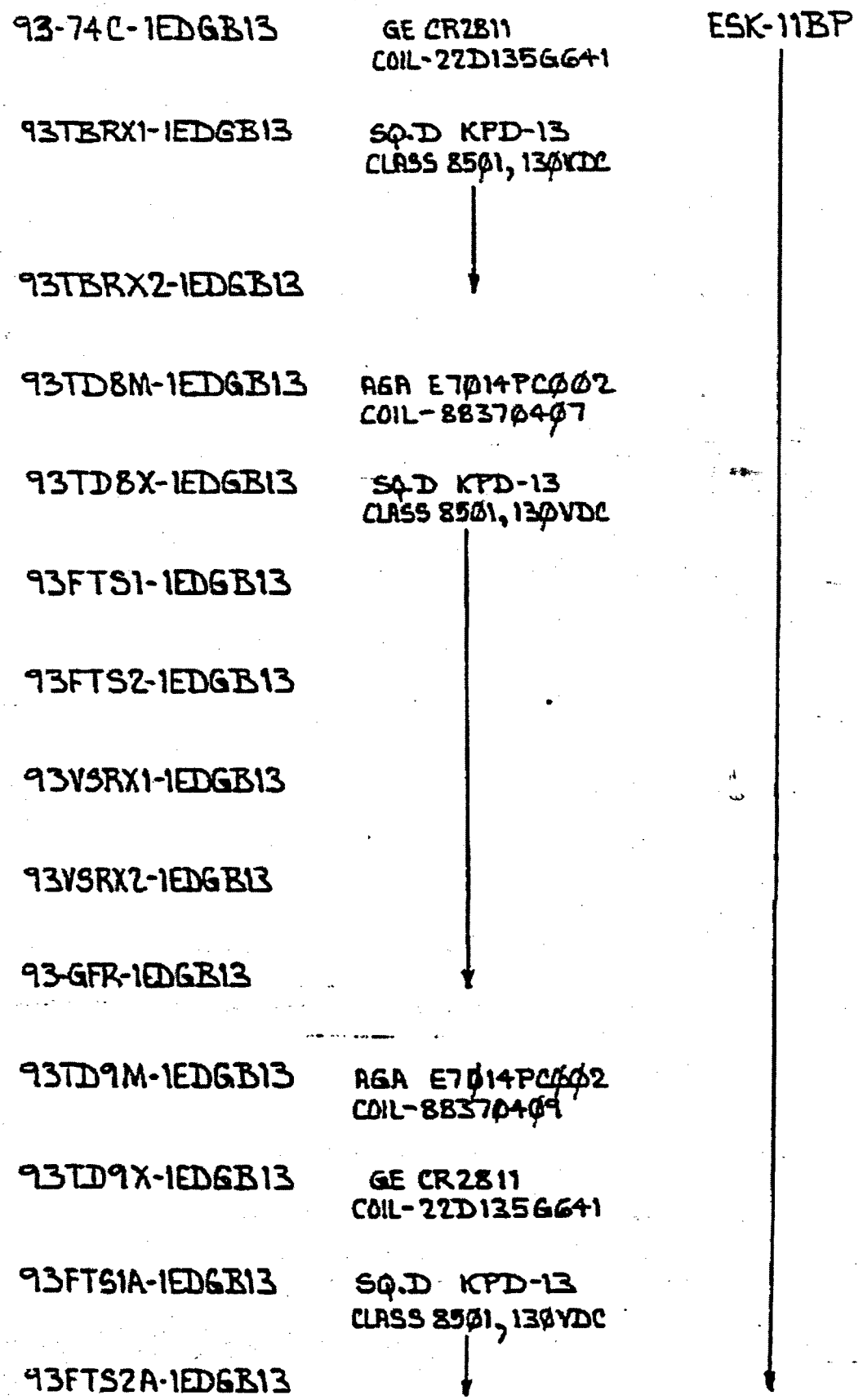
Resistor : ② IC9033- A1D20 20Ω
Relay: ① IC2820A100- BB3J 10A
② IC2800-A501AB23C 100A
Contactor: ③ IC2820A100- BB3J 10A
④ IC2800-1621AM3H 100A

Heater: CR123F71.9B
OL Relay: CR124E027

Some #'s were hard to read - do they might be a misread # or letter - Sarah ☺

93-AR1-1EDGD12 THRU 93-AR18-1EDGD12	SQ.D KPD-13 CLASS 8501, 130YDC	ESK-11BT
93-74-1EDGD12	SQ.D KPD-13 CLASS 8501, 125YDC	ESK-11BQ
93-ISX-1EDGD12	GE 12HFA151A2H	ESK-11BQ
93-K1-1EDGD12	GE CR2811A257AA COIL-22D135G41 COIL-22D1210G41	ESK-11BQ
93-TBR-1EDGD12	SQ.D KPD-13 CLASS 8501, 130YDC	ESK-11BQ
93-TD6-1EDGD12	AGA E70127DØØ2 COIL-8837Ø399	ESK-11BQ
93-TD7-1EDGD12	AGA E7D127DØØ2 COIL-8837Ø4ØØ	ESK-11BQ
93-K4-1EDGD12	SQ.D KPD-13 CLASS 8501, 130VDC	ESK-11BQ
93-FFR-1EDGD12	GE CR2811 COIL-22D135G441	ESK-11BQ
93-VSR-1EDGD12	SQ.D KPD-13 CLASS 8501, 130YDC	ESK-11BQ
93-K3-1EDGD12	GE CR2811A257AA COIL-22D135G641 COIL-22D1210G41	ESK-11BR
93-TD5-1EDGD12	AGA E7D147CØØ2 COIL-8837Ø411	ESK-11BR
93-K2-1EDGD12	GE CR105KØØØBLA COIL-15D216G26	ESK-11BR

93-ESR40-1EDGD12	GE CR2811 COIL-22D135G641	ESK-11BR
93-ESR200-1EDGD12	GE CR2811 COIL-22D135G641	ESK-11BR
93-ESR400-1EDGD12	GE CR2811 COIL-22D135G641	ESK-11BR
93-C2-1EDGD12	GE CR105K000ABLA COIL-15D21G26	ESK-11BS
93-SDR-1EDGD12	GE CR2811 COIL-22D135G641	ESK-11BS
93-SDRX-1EDGD12	SQD KPD-13 CLASS 8501, 130VDC	ESK-11BS
93-32X1-1EDGD12		
93-40X1-1EDGD12		
93-32/SI-1EDGD12		
93-TD10-1EDGD12	AGA E7012PD002 COIL-8837039?	ESK-11BS
93-86X1-1EDGD12	SQD KPD-13 CLASS 8501, 130VDC	
93-TD1-1EDGD12	AGA E7022PK002 COIL-8837042?	
93-62-1EDGD12 (11-1DG12)	AGA E7012PC	


93-74C-1EDGB13
GE CR2811
COIL-22D135G641
ESK-11BP
93TBRX1-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
93TBRX2-1EDGB13
93TD8M-1EDGB13
AGA E7014PC002
COIL-8837047
93TD8X-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
93FTS1-1EDGB13
93FTS2-1EDGB13
93VSRX1-1EDGB13
93VSRX2-1EDGB13
93-GFR-1EDGB13
93TD9M-1EDGB13
AGA E7014PC002
COIL-8837049
93TD9X-1EDGB13
GE CR2811
COIL-22D135G641
93FTS1A-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
93FTS2A-1EDGB13

COVER SHEET

FAX

To: Alex Barton/J.F. Fitzpatrick
Fax #: 1-315-349-6981
Subject: ESSB Information
Date: April 29, 1997
Pages: 3, including this cover sheet.

COMMENTS:

I have enclosed the printed information on the ESSB. You will note on Page 2, the Electrical Power Input, which is terminals 19 and 20, gives you the power input of the voltage. The low voltage is on the left and the high voltage is on the right.

I think that this is what you were looking for.

From the desk of...

Angeline Bazemore
Sales Correspondent/RGA Coordinator
Synchro-Start Products, Inc.
6250 W. Howard Street
Niles, IL 60714

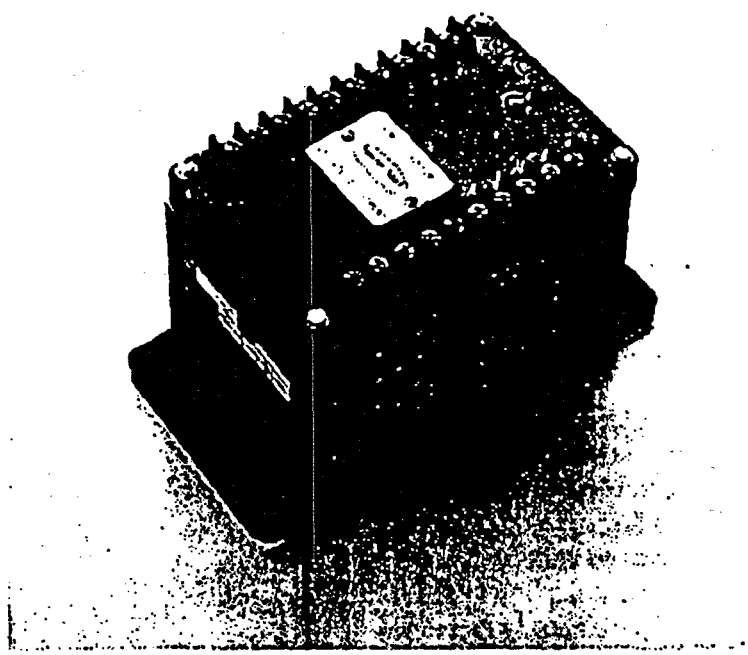
847-967-7730
Fax: 847-967-7832

Synchro-Start PRODUCTS, INC.

Electronic Speed Switches

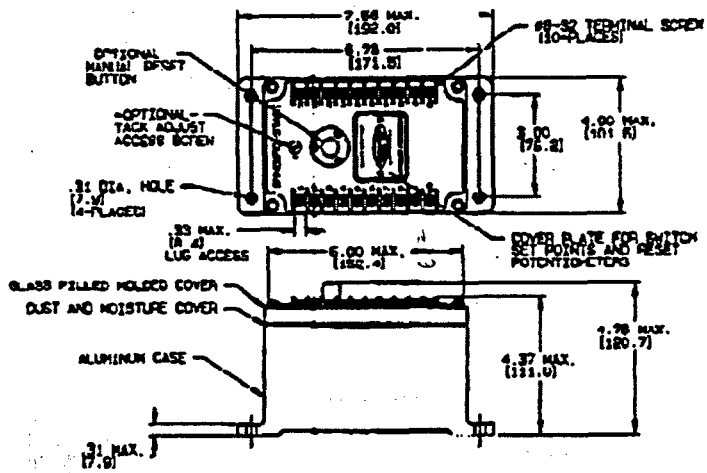
ESSB

The model ESSB Electronic Speed Switch has many years of proven service. It is engineered to provide a wide variety of features and options including up to four switch points, adjustable reset, a selection of voltage inputs and tachometer output.



Features/Options

- Adjustable Switch Points
- Sealed NEMA 4 Enclosure
- Transient and Reverse Polarity Protection
- Precise Repetitive Speed Switch Points
- Automatic, Manual or Remote Manual Reset
- Power Loss Protection
- D.C. Output for Model 30 Tach (1 ma)
- 8-40 VDC; 64 VDC; 100-140 VDC; or 100-130 VAC Power
- Broken Signal Lead Protection
- Standard or Reverse Relay Logic
- Lockwire Seal
- Vibration Isolation Kit
- Conduit Cover



Electronic Speed Switches

ESSB

Specifications

Electrical

- **Power Input** = Terminals 19-20
  8-40 VDC
  64 VDC
  100-140 VDC
  100-130VAC
- **Reverse Polarity Protection**
  1000 VDC
- **Maximum Current**

(2 ch.8-40 VDC)	12 Volt	24 Volt
Operating	200 ma	220 ma
Standby	50 ma	60 ma

- **Signal Input**
  Minimum— 1.2 VRMS
  Impedance—2K OHMS
- **Relay Contact Ratings**
  200 ma 220 ma
  50 ma 60 ma
  Resistive Load—0.1 to 10 amps 28 VDC
  Inductive Load— 0.1 to 8 amps 28 VDC
- **Overspeed Response Time**
  100 Milliseconds Typical
- **Setpoint Reset**
  Automatic—80% to 90% of Setpoint
  Adjustable—(Variable Automatic)
  50% to 98% of Setpoint
- **Setpoint Stability**
  0.8% over voltage range and 0.01% per °F Typical

Mechanical

- **Operating Temperature**
  —40°C to +85°C (—40°F to +185°F)
- **Vibration**
  4g's 9 to 200 Hz
- **Shock**
  4 Foot Drop Test
- **Case**
  NEMA 4 High Impact Molded Enclosure
- **Weight**
  4.5 lb. (2 kg.)

Ordering Information

ESSB

1. Complete the following model descriptions.

ESS B X X X X

- C Conduit Cover Option
- T Tachometer Model 30 Option
- A Automatic Reset
- M Manual Reset on One Switch Point
- R Remote Manual Reset
- 1, 2, 3 or 4 Switch Points
- Switch Model
- Electronic Speed Switch

2. Give power supply voltage
3. For each switch point specify set and reset frequency:
   (1) Hertz and increasing or decreasing speed direction.
   (2) Standard or reverse relay logic (See Page 5).
   (3) Optional special reset differential adjustment.
   (4) Optional broken signal lead protection.
4. Optional tachometer (Model 30).
   (1) Specify scale and rated speed.
5. Accessories:
   Conduit Cover.
   Vibration Isolator.

Synchro-Start Products, Inc. Subsidiary of Knowles Electronics, Inc.
6250 West Howard Street, Niles, IL 60714 USA Telephone: 708/967-7130 FAX: 708/967-7832

Synchro-Start Products Europe Limited
71 Victoria Road Burgess Hill West Sussex RH15 9LP. England Telephone: (44) 01444-872836 FAX: (44) 01444-239226

JUN-23-2000(FRI) 13:18 SYNCHRO START (FAX)847 967 1492 P.001/0

Post-it® Fax Note 7671	Date	# of pages ▶
To ALEX BARTON	From CECIL MAHONEY	
Co./Dept.	Co.	
Phone # 315 349 6622	Phone # 847 967 5119	
Fax #	Fax #	

6/27

ESSB-4AT 125 VDC TEST

REQUEST BY NY POWER

ALEC BARTON

PHONE 315 349 6622

TEST ESSB FOR CURRENT CONSUMPTION @ 125 VDC. RELAYS ENERGIZED + DE-ENERGIZED

DENERGIZED	ENERGIZED			
STANDBY	1 RELAY	2 RELAYS	3 RELAYS	4 RELAYS
39.6 mA	51 mA	63 mA	74.7 mA	86 mA

Synchro-Start Products, Inc.
6250 West Howard Street
Niles, Illinois 60714-3433
USA

Control & Sensor Technology

Cecil G. Mahoney
Senior Electronics Engineer

847/967-7730
847/967-7832 Fax

cecil.mahoney@sspi.com

www.sspi.com

a Knowles company

NOTE: WITH THE ESSB ON STANDBY (RELAYS DE-ENERGI
THE CURRENT IS 39.6 mA
THE CURRENT INCREASES BY ≈ 10
PER ADDITIONAL RELAY TO A
MAXIMUM OF 86 mA

CONTACT RATING: 1A TO 10A @ 28 VDC
≈ 250 mA @ 125 VDC

Cecil Mahoney
6/27/00

ATTACHMENT TO M494-0254

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Documentation of Telephone Discussion

JAF-CALC-ELEC

DATE: 2/18/02 **TIME:** 15:30 **MODIFICATION NO.:** 02609 & 02610

SUBJECT: EDG ELECTRONIC SPEED SWITCH, 93ESS-A,B,C & D

REFERENCES: M494-0254, ESK-11BC, ESK-11BH, ESK-11BM, ESK-11BS

	NAME	ORGANIZATION
PARTICIPANTS:	BRIAN MARKS	ENTERGY NUCLEAR NORTHEAST (315) 349-6213
	CECIL MAHONY	SYNCHRO-START PRODUCTS (847) 967-7930

SUMMARY OF DISCUSSION: CECIL MAHONY OF SYNCHRO-START INDICATED THAT THE ESSB-4AT ELECTRONIC SPEED SWITCH WILL FUNCTION PROPERLY WITH A MINIMUM INPUT VOLTAGE OF 90VDC. CECIL FURTHER INDICATED THAT THIS HAS BEEN PROVEN VIA FACTORY TESTING. IN FACT, CECIL INDICATED THEY WOULD PROBABLY FUNCTION PROPERLY DOWN TO 80V, HOWEVER, THEY DO NOT HAVE TEST DATA TO PROVE.

AGREEMENTS/COMMITMENTS:

Prepared By: BRIAN MARKS **Date:** 2/11/02
Title: SENIOR DESIGN ENGINEER
Reviewer: ALEX DOLL **Date:** 2/11/02
Title: ELECTRICAL DESIGN ENGINEER

Distribution:

NEW YORK POWER AUTHORITY

TSSO-1
Figure 1

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Documentation of Telephone Discussion

DATE: 11/20/96 TIME: 11:20 AM MODIFICATION NO.: N/A
SUBJECT: DROP OUT & PICKUP FOR EDG AIR START SOV's
REFERENCES:

	NAME	ORGANIZATION
PARTICIPANTS:	GAIL	GRAHAM WHITE MANUFACTURING
	ROBERT BAKER	NYPA

SUMMARY OF DISCUSSION:

COMPONENTS 93 SOV-1A, B C, D
93 SOV-2A, B C, D
GRAHAM WHITE No 712-051
125 VDC OR 125V AC/DC
TELEPHONE (540) 327-5620

REQUESTED DO & PU SOV DATA
PICKUP 87.5 VDC @ 200 PSI
DROP OUT BETWEEN 10 — 30 VDC @ 200PSI

AGREEMENTS/COMMITMENTS:

NONE

Prepared By: Robert Baker Date: 11/20/96
Title: Maint Engr.
Reviewer: _____ Date _____

MAXIMA TECHNOLOGIES

FAX

TO: Tim COMPANY:
FAX #: (315) 349-6981
FROM: Robert Viscosi
PHONE: (717) 581-1000, ext. 287
DATE: June 30, 2000
SUBJECT: Hourmeter
TOTAL PAGES: 1 (including cover sheet)

The Datcon 40/130 VDC hourmeter will draw ~.50 amps at 120 VDC ~ every 10sec. for ~ 50 milliseconds. As you can see the duty cycle is very low so the total power consumption is also very low.

1811 Rohrerstown Road, Lancaster, PA 17601
PHONE: 717-581-1000 FAX: 717-569-6372

PROCUREMENT DOCUMENT TECHNICAL REVIEW SUMMARY Page 1 of 5

PART 1 - PROCUREMENT REQUIREMENTS

Review No. PE-01-019

Revision No. 1

A. GENERAL

1. Material Requisition (DTO) or Purchase Order No.: N/A

2. Material Number 14525 QA Category: 1

3. Upgrade from Inventory: Current Material No. N/A P.O. No. N/A

New Material No. N/A

4. Stock No.(s) 14525

5. Complete Material Description: POWER SUPPLY, INPUT: 120 – 330 VDC, OUTPUT: 48VDC, 158.4 WATTS, -10 DEG C TO + 60 DEG C , LAMBDA P/N JWS – 150 – 48/A. QUALIFIED PER IEEE-323-1974 AND IEEE-344-1975. JAF SEISMIC RESPONSE SPECTRA (FLOOR) CURVES WILL BE PROVIDED. SEE VENDOR LITERATURE: POWER SUPPLY IS TO BE SHAKEN IN MOUNTING 'A' (STANDARD MOUNTING) USING MOUNTING BRACKET (L-DIN100/150) AND 12 INCH LONG DIN RAIL (SPC 10578). UNDERVOLTAGE TESTING AT 85VDC AT FULL LOAD IS REQUIRED. TRENTEC TO PROVIDE: QUALIFIED POWER SUPPLY WITH ACCESSORIES (DIN RAIL, MOUNTING BRACKET AND MOUNTING HARDWARE). DIN RAILS ARE TO BE PROVIDED UNCUT TO ACCOMMODATE NUMBER OF POWER SUPPLIES ORDERED (ASSUME 12 INCHES FOR EACH POWER SUPPLY). MOUNTING HARDWARE WILL CONSIST OF THREE (3) M4 X 0.7 SCREWS WITH LOCK WASHERS AND THREE (3) #10-24 UNC-2B x 0.5 INCH LONG DIN RAIL MOUNTING SCREWS FOR EACH POWER SUPPLY (2 WILL BE USED FOR TESTING). ALL SCREWS WILL BE SLOTTED HEAD.

6. End Use Component ID No. 13TU-3-12 AND 23TU –3-12, 93P/S-A THRU D

7. Environmental Qualification Requirements Apply (10CFR50.49, Reference AP-16.04) Harsh Environment YES/NO

8. Seismic Design Requirements Apply YES/NO

B. APPLICABLE SPECIFICATIONS AND DESIGN REQUIREMENTS

1. JAF Plant Specification (AP, APO, JAF Procurement Specification, etc.): N/A

2. Modification No. (if applicable): JE-01-013 , JE-00-115 (REV. 1)

3. Controlled Plant Design Drawing (include revision): 1.61 SERIES & 1.61 SERIES

4. Controlled Technical Manual (include revision): L045-0144 REV. 0 (L09) & L045-142 REV.2

5. Request for Engineering Services Submitted: WR/PID No. YES/NA

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Documentation of Telephone Discussion

DATE: 9/19/02 TIME: 14:00 MODIFICATION NO.: _____

SUBJECT: 02-3V/V-K613C&D. ATS DC POWER SUPPIES FOR ECCS TRIP CIRCUITS

REFERENCES: 6080-0166, 6080-0207, 1.60-16

	NAME	ORGANIZATION
PARTICIPANTS:	BRIAN MARKS	ENTERGY NUCLEAR NORTHEAST (315) 349-6213
	DAVE JORGENSON	DATAMETRICS CORP
	DAN MOORE	(407) 251-4577, x3058

SUMMARY OF DISCUSSION: I ASKED DAVE IF THE INPUT VOLTAGE WERE TO DROP BELOW THE MINIMUM RECOMMENDED OF 105VDC MOMENTARILY (E.G. APPROXIMATELY 1 SECOND FOR 1 VOLT DURING MOTOR STARTING) WHAT WOULD HAPPEN TO THE POWER SUPPLY AND OUTPUT. DAVE (IN CONJUNCTION WITH DAN) INDICATED THAT THE POWER SUPPLY WOULD "RIDE THRU" THE TRANSIENTS AND THE OUTPUT WOULD NOT BE AFFECTED.

AGREEMENTS/COMMITMENTS: _____

Prepared By: Brian Marks Date: 9/19/02
Title: Senior Electrical Engineer
Reviewer: Dong Kim Date: 9/19/02
Title: Senior Electrical Engineer

Distribution:

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Documentation of Telephone Discussion

DATE: 3/26/02 **TIME:** 1400 **MODIFICATION NO.:** N/A

SUBJECT: Efficiency of 02-3-K613C (Power Supply for ATTS Division 01 cabinet 9-95)

REFERENCES: G080-0166

	NAME	ORGANIZATION
PARTICIPANTS:	Conrad Dove	Datametrics Corp (407) 251-4577, x3054
	BRIAN MARKS	Entergy Nuclear Northeast (315) 349-6213

SUMMARY OF DISCUSSION: I had asked Conrad what the efficiency of the subject power supply is. Conrad indicated that although he did not have that specification (due to age of equipment), he did indicate that the expected efficiency should be about 80% (at least). Therefore, the fact that we use 65% is considered conservative and appropriate.

AGREEMENTS/COMMITMENTS: N/A

Prepared By: Brian Marks **Date:** 3/26/02
Title: Senior Elect Engineer
Reviewer: Alex Dabbs **Date:** 3/27/02
Title: Elec Eng.

Distribution:

Barton, Alex

From: Brad Abernathy [Brad.Abernathy@kmtc.com]
Sent: Tuesday, June 27, 2000 1:38 PM
To: Alex.Barton@nypa.gov
Subject: Re: FLASH

Mr. Barton,

I apologize for the delay in getting this response to you.

I have researched the original file (Bruce GM Diesel A-940) and files for similar machines and have been unable to locat information relating to minimum field flashing voltage.

We can state with assurance that your machine will satisfactorily operate with a field flashing voltage as low as 90 VDC. This is the lower battery voltage range for which all EP machines provided by us were designed to operate.

I regret that I am unable to provided to you a specific number representing the minimum field flashing voltage.

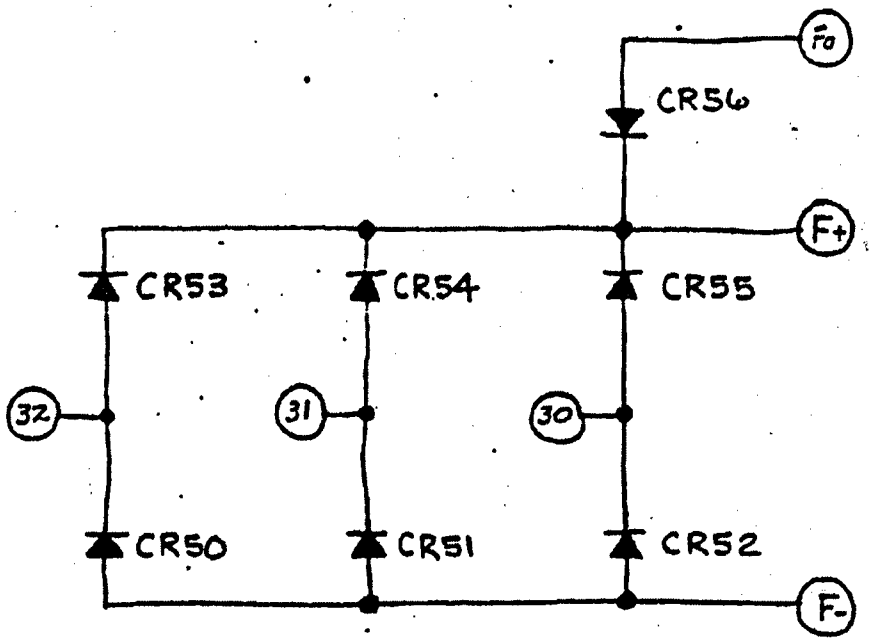
Sincerely,

J. B. Abernathy

>>> "Barton, Alex" <Alex.Barton@nypa.gov> 06/23/00 01:35PM >>>
For Sync Generator L-10823 I need a minimum Flushing Voltage

Thanks
Alex Barton
JAF
315-349-6622

SIZE		REV.
A	90 34519 911	



CR50, CR51, CR52 = 300U120A
CR53, CR54, CR55 = 300UR120A
CR56 = 1N3296

LETTER	REVISION	DATE	BY

DO NOT SCALE ALL DIMENSIONS ARE IN INCHES TOLERANCE UNLESS OTHERWISE SPECIFIED DECIMALS ± FRACTIONS ± ANGLES ±

TITLE: SCHEMATIC - RECTIFIER ASSY. 1200V

MATERIAL:

DRAWN BY	DATE	CHKD BY	DATE	APPR. BY	DATE	SCALE
RJO	3-23-70			M.S.	5-13-70	

BASLER ELECTRIC CO.
HIGHLAND, ILLINOIS

DWG SIZE	DRAWING NO.	REV
A	90 34519 911	

NTE Semiconductor Cross Reference

Manufacturer Part No.	1N3296
NTE Part No.	NTE6162
Data Sheets	[redacted]
Manufacturer Notes:	
Date Updated:	12/12/2001

NTE
ELECTRONICS. INC.
44 FARRAND STREET
BLOOMFIELD, NJ 07003
(973) 748-5089

NTE6154t hru NTE6165
Silicon Industrial Rectifier,1 50A mp, General Purpose

Description:

The NTE6154 through NTE6165 power rectifiers are stud mounted DO8 type packages. Because the silicon junction is carefully fitted within a glass–to–metal hermetically sealed case, reliableo peration is assured even with extreme humidity and under other severe environmental conditions.

These power rectifiers are ideal for a broad range of commercial uses including power supplies, ultrasonic systems, inverters, welders, emergency generators, batterych argers, DCmo tors,a nd motor controls.

Features:

- Standard DO8 Type Package
- Availabe in Standard (Cathode to Case) and Reverse (Anode to Case) Polarity
- Recommended Stud Mounting Torque: 120in. lbs. Lubricated.

Electrical Ratings:

Peak Reverse Voltage, P_{RV}
- NTE6154, NTE6155* 400V
- NTE6156, NTE6157* 600V
- NTE6158, NTE6159* 1000V
- NTE6162, NTE6163* 1400V
- NTE6164, NTE6165* 1600V

Maximum ForwardCu rrent SinglePha se Half Wave (T_C =+1 25°C), I_O 150A
Maximum Surge Current, Single Cycle, I_{FSM} 2100A
Maximum Forward Voltage Drop (T_C=+ 25°C, I_O =2 00A), V_F 1.1V
Maximum Reverse Current (FCA@ +150°C), I_R 5mA
Maximuml ^2t for Fusing (lesst han8 ms) ..... 18200A^{2}Sec
Reverse Powerfo r Bulk Available 1.0Joules
Storage Temperature Range, T_{stg} ..... –65° to +200°C
OperatingT emperature Range, T_{opr} ..... –65° to +190°C
Maximum Thermal Impedance (Junction–to–Case) ..... 0.35°C/WMa x

* Indicates Anode to Case polarity

July 29, 1997
PMQ 97-010

To: Tom Anderson, NYPA Senior Electrical Design Engineer

From: Paul Quinn, GE Site Services Manager PWQ

Subject: Request for Rated Inrush Current for several GE Motors

Alex Barton of your organization made two requests for the "Rated Inrush Current" for several GE motors earlier this month. These motors were supplied by GE either as a part of the nuclear steam supply or turbine/generator & auxiliaries packages. I contacted both GE Nuclear Energy (GE-NE) and GE Power Systems (GE-PS) for response to these requests.

Both GE-NE and GE-PS advise that as a general "rule of thumb" for all motors the Maximum Inrush Current is five (5) times the Rated Full Load Current on the motor's nameplate. Typically there is no "Rated Inrush Current" or Maximum Inrush Current determined by either design or testing for any GE motors.

As the Inrush Current of a specific motor is not only effected by the driven component design and its system design, but also by the way it is being operated and site specific operating conditions, GE can not provide unique Inrush Currents for any of these motors.

GE-PS specifically recommends testing of their supplied motors to determine Inrush Currents referencing GE Turbine Information Letter (TIL) No. 914-2 (which can be obtained from ORG or Mike Tallents of Maintenance). GE-NE agrees that testing of the specific motors is the most appropriate way to determine the unique Inrush Current for the FitzPatrick operating conditions.

Cc: T. Savory, A. Barton, L. Hajos

Facsimile Message Pg. 1 of 1

→ TO Carla Russom	Fax # (814) 681-6450	Company or Component	Location
			Date Sent 2/9/92
FROM Heidi Hewitt	Fax # (814) 875-2983	Company or Component GE MOTORS	Location Erie, PA

SUBJECT your request for information

5CD164U JA 803A 800 - 10HP. 1750RPM. 120V ARMATURE, 120V FIELD,
(94P-13) ARM AMPS • 71, FIELD AMPS • 1.15. TEFC
ENCLOSURE. CD259AT FRAME (94P-13)

5CD193B6801A601 - THIS MODEL # DOES NOT EXIST - PLEASE RE-CHECK

5CC14C5A341520 1 HP, 1750RPM, 125V ARMATURE, 162 V FIELD (calc)
SN = 1211 ARM AMPS = 7.45. FIELD AMPS = .574, TENV
(02-184P-3A,B) ENCLOSURE, CD186AT FRAME

5CD256E105C 7.5HP, 3500RPM, 125V ARMATURE, 120V FIELD,
SN = EG-1-978 ARM AMPS = 58, FIELD AMPS = 1.38, TEFC
(31P-7A,B) ENCLOSURE, CD256A4 FRAME

5CD366E735 25HP, 1800RPM, 125V ARMATURE, 120V FIELD.
SN = LG-1-930 ARM AMPS = 169, FIELD AMPS = 3.11, TEFC
(94P-2) ENCLOSURE. CD366A4 FRAME.

Please do not hesitate to call if you need any
more help.

Heidi
ph (814) 875-2480

76 (8/90)

3-16-99

31P-7A/31P-7B
7.5 HP, 3500 RPM, 125 VOLTS
ARM AMPS 58, WOUND SHUNT
FLD AMPS 1.38, FLD OHMS 25°C 65.6
INSUL CLASS B, DUTY CONT
MAX AMBIENT 40°C

PWR. SUP. CODE — DC GEN.

TYPE CD256AY
ENCLOSURE TEFC
INSTR GEH2304
MOD. 5CD256E1050
SER. EG-1-1057 (31P-7A)
SER. EG-1-978 (31P-7B)

31P-7A(M) & 31P-7B(M) Walkdown Data

Page: 1 . Electric Motor Data Sheet

System/Component No: 31 P- 7B . QA: .
Equipment Description: "B" RX FEED PUMP TURBINE EMERG OIL PUMP .
Building: TB . Elevation: 256-0. Column: 18.7 . Line: Z .

Manufacturer: GENERAL ELECTRIC . Model No. CD 256 AY .
Serial No. 5 CD 256 E 1050 .
Horsepower: 7.5 . Service Factor: . Time Rating/Duty: .
Voltage: 125 . Phases: . Cycles: . RPM: 3500 .
Full Load Amps: 58 . Locked Rotor Amps .
Frame: 256A . Type: . Code: .
Insulation Class: B . Enclosure: TEFC.
Max. Ambient Temp: 40 . Max. Temp. Rise: .
Drive End Bearing: . Opp Drive End Bearing: .
Remarks:

Verified by: Jim Kile . Verified on: 09/11/85.
Revision No: .

SYSTEM/COMPONENT: 31P-7B (m)

FOR REFERENCE ONLY

ELECTRIC MOTOR DATA

COMPONENT NUMBER	COMPONENT NAME
31P-7B (m)	"B" Rx Feed Pump Turbine Emergency oil Pump

MANUFACTURER	MCC	MCC LOCATION	COMP. LOCATION	ESK	SE	FE
GE	RCB2B	"B" Batt charger Rm	TB 252' FPR	11B	10P	44U

HP	TYPE	BREAKER SIZE	STARTER SIZE	STARTER MODEL NO.	MOTOR MODEL NO.
7.5	CD256AY	100 Amp			5CD256E1050 CD256 AY

VOLTAGE	PHASE	SERIAL NUMBER	DESIGN	CODE	HERTZ	SERVICE FACTOR
125 v DC		EG-1-978		DC Gen		

ARM AMPS	FIELD AMPS	DUTY	FRAME	AMPS (FULL LOAD)	RPM	TEMPERATURE RISE
58	1.38	Cont	256A		3500	40°C

INSULATION CLASS	OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS
B	CR124E027	123F71.9B	61.6

DRIVE END BEARING	STOCK NO.	LOCATION

OPPOSITE END BEARING -	STOCK NO.	LOCATION

REMARKS: Shunt wound - Field Ω at 25°C = 65.6 Ω - communication Jack E4

DATE	WRED #	BRIEF DESCRIPTION OF JOB	DATE	WRED #	BRIEF DESCRIPTION OF JOB
2/2/95	94 05007-00	MP 101.04 - Grease Motor Brgs.			

94P-2 3/16/99

Hp 25, RPM 1800, VOLTS 125
ARM AMPS 169, WOUND SHUNT
FLD AMPS 3.11, FLD OHMS @25°C 29.1
INSUL CLASS F, DUTY CONT, MAX AMB 40
PWR SUP CODE DC 615A, NO. 222A8831
TYPE CD366AY ENCL TEFC
INSTR GEH2304
MOD SCD366E735
SER LG-1-930

94P-2(M) Walkdown Data

COMP. # P-2

ELECTRIC MOTOR DATA

COMP. NO.	COMP. NAME					
94 P-2	Emergency Bearing Oil Pump					
MANUFACTURER	MCC	MCC LOCATION	COMP LOCATION	ESK	SE	FE
G.E.	71BMCC2	"B" Charger Room	TB 280'	11A	10E	44K

H.P.	TYPE	BKR. SIZE	STARTER SIZE	Starter Model #	Motor Model #
25	CD366AV	250			5CD366E735

VOLTAGE	PHASE	SERIAL NUMBER	DESIGN	CODE	HERTZ
125		LG-1-930			N/A

SERV. FACTOR	DUTY	FRAME	AMP. (F.L.)	RPM	TEMP. RISE
	Cont.			1800	

INSUL. CLASS	OVERLOAD RELAY #	HEATER #	HEATER AMPS.
F	CR124EO27	CR123F71.98	

ARM AMPS.	FIELD AMPS.	
169	3.11	2 HEATERS IN PARALLEL IN ONE RELAY

DRIVE END BEARING	STOCK #	LOCATION

OPPOSITE END BEARING	STOCK #	LOCATION

REMARKS: Motor does not Require a mark-up to Grease

DATE	WRED #	BRIEF DESCRIPTION OF JOB	DATE	WRED #	BRIEF DESCRIPTION OF JOB
10/21/88	7133	Greased Motor Bearings			
9/20/89	84153	Greased Motor Bearings			
10/15/90	68661	Trouble Alarm after 5 min.			
3/10/92	5058/2	Greased Motor Bearings			
11/27/92	WR/88582	test run (logic test)			
3/29/96	96-05116-00	Grease Motor Bearings			

REFERENCE ONLY

SYSTEM # 02-18
COMP. # PM-3

ELECTRIC MOTOR DATA

COMP. NO.	COMP. NAME					
02-184 PM 3B	Recirc Fluid Dr. Emerg. Lube Oil Pump					
MANUFACTURER	MCC	MCC LOCATION	COMP LOCATION	ESK	BE	FE
GE "Reliance"		RR	MG Set Room	11CA	10A2	46n

H.P.	TYPE	BKR. SIZE	STARTER SIZE	Starter Model #	Motor Model #
1					

VOLTAGE	PHASE	SERIAL NUMBER	DESIGN	CODE	HERTZ
125	DC	LF-1-1233			

SERV. FACTOR	DUTY	FRAME	AMP. (F.L.)	RPM	TEMP. RISE
	Cont		—	1750	

INSUL. CLASS	OVERLOAD RELAY #	HEATER #	HEATER AMPS.
B			

ARM AMPS.	FIELD AMPS.
7.45	.574

DRIVE END BEARING	STOCK #	LOCATION

OPPOSITE END BEARING	STOCK #	LOCATION

REMARKS:

DATE	WRED #	BRIEF DESCRIPTION OF JOB	DATE	WRED #	BRIEF DESCRIPTION OF JOB
1/15/92		Grease PM Motor MP 101.13			
12/13/95	94 5072-00	CHECK BRUSHES QS1			

FOR REFERENCE ONLY

NEW YORK POWER AUTHORITY
NUCLEAR ENGINEERING & DESIGN SECTION
TELEPHONE DISCUSSION DOCUMENTATION FORM

CALL DATE 2/6/92 TIME 4:35 PM OUTGOING ____ INCOMING X

BETWEEN KJ NELSON OF THE AUTHORITY

AND DAN STEHR OF CARTER MOTOR CO

AND ____ OF ____

REFERENCE (615) 745-2100 (IL) FAX -2135 (FAX)

SUBJECT 3/4HP PERMENT TYPE DC MOTOR DATA

DISCUSSION/ACTION:

MODEL # MUD9C75BB ; TAG #s 93A6-5A, 5B, 5C, 5D
MUD=UNIVERSAL MOTOR→RUNS ON AC OR DC;
VERY UNSTABLE CHARACTERISTICS - LRA=STARTING AMPS
9C75= 9000 RPM AND 0.75 HP
FROM TEST DATA: [redacted] (@ 115 VDC)
FLA=9 A ; LRA=40 A
STARTING CURRENT=LRA (AS AN AC MOTOR)

DISTRIBUTION:

NUC GEN FILES NO. ____

MOD FILE NO. ____

K Nelson 2/6/92
SIGNATURE DATE

NEW YORK POWER AUTHORITY
NUCLEAR ENGINEERING & DESIGN SECTION
TELEPHONE DISCUSSION DOCUMENTATION FORM

CALL DATE 2/5/92 TIME 2:25pm OUTGOING ____ INCOMING X

BETWEEN K.J NELSON OF THE AUTHORITY

AND ART MILES OF RELIANCE

AND ____ OF ____

REFERENCE 216) 266-7000 (OHIO- INDUSTRIAL ; ENGINEERED MOTORS DIV.)

SUBJECT DC MOTOR DATA

DISCUSSION/ACTION:

MODEL # 502674 JW ; TAG #S 93P-4A, 4B, 4C, 4D
120 VDC ; 0.64A FIELD CURRENT;
38A FLA; STARTING AMPS NTE 150% FLA
MODEL # L24437 ITI-AM ; 23-MOV-19- TAG #
125 VDC; 1.11 A MAX FIELD CURRENT;
80A FLA; STARTING AMPS NTE 150% FLA
ALL RELIANCE DC MOTORS ARE DESIGNED FOR
A STARTING CURRENT NTE (NOT TO EXCEED)
150% FLA.

150 ft lb start: 30 secs
30 ft lb run: 5 min.

DISTRIBUTION:

NUC GEN FILES NO. ____

MOD FILE NO. ____

K.J Nelson 2/5/92
SIGNATURE DATE

New York Power Authority

TSSO-1
Figure 1

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Documentation of Telephone Discussion

DATE: 10/11/96 TIME: 1315 MODIFICATION NO.: N/A

SUBJECT: Reliance Motor Model #502674-JW

REFERENCES: PEDB for 93P-4A, B, C, D Motors

	NAME	ORGANIZATION
PARTICIPANTS:	Ben Carlson	FitzPatrick
	Jeff Wallent	Reliance Electric
		(315)446-0946

SUMMARY OF DISCUSSION: It was asked, what the minimum starting voltage would be for subject motor. Jeff stated that with this type of DC motor, there is no minimum voltage. The motor will run with basically any voltage applied as long as torque is overcome in the system. The motor will run but slower.

AGREEMENTS/COMMITMENTS: None

Prepared By: Ben Carlson Ben Carlson Date: 10/11/96
Title: Lead Systems Engineer
Reviewer: Pete Donahue Pete Donahue Date: 10/11/96
Title: Acting Tech Services Manager

Distribution: (other than participants) J. Stead T. Powers T. Andersen

SYSTEM # 23
COMP. # P-140

ELECTRIC MOTOR DATA

COMP. NO.	COMP. NAME				
23 P-140	HPCI TURBINE & GLAND SEAL EXHAUSTER CONDENSER				
MANUFACTURER	MCC	MCC LOCATION	COMP LOCATION	ESK	SE FE
G.E.	BMCC2	Σ, CRES.	HPCI TURBINE	11CB	10AR
H.P. / TYPE	BKR. SIZE	STARTER SIZE	Starter Model #	Motor Model #	
1/3 DC/Compound	TED124020 20 Amp			5BCJ56ED56A	
VOLTAGE / PHASE	SERIAL NUMBER	DESIGN	CODE / HERTZ		
120VDC —	PBN1				
SERV. FACTOR	DUTY / FRAME	AMP. (F.L.)	RPM	TEMP. RISE	
	CONT 56	3.5	3450	40°C	
INSUL. CLASS	OVERLOAD RELAY #	HEATER #	HEATER AMPS.		
B-R	CR124C	~~CR123C466A~~ On 4/23/88 CR123C5.42A			
ARM AMPS.	FIELD AMPS.				
	—				
DRIVE END BEARING	STOCK #	LOCATION			
OPPOSITE END BEARING	STOCK #	LOCATION			

REMARKS:
120 VAC RESISTOR HEATER IN MOTOR - CONNECTED TO R-1 & UNMARKED WIRE (71ACB3 #7) Do not Grease
NEW UNIT INSTALLED 1-88 Sheet on back

REWIND DATA:

MISC. INFORMATION:
NEW MOTOR 1/88

FOR REFERENCE ONLY

Currently Installed 2-0-1

System: 23

Comp: P-141
~~Spare~~

POWER AUTHORITY OF THE STATE OF NEW YORK
JAMES A. FITZPATRICK NUCLEAR POWER PLANT

ELECTRIC MOTOR DATA (< 50 HP)

Comp. No.	Comp. Name		
23P-141	HPCI Gland Seal Exhaust Condensate Pump Motor		
Manufacturer: Baldor (ESK-11CB)	Date Rcvd.: 9-3-80	Comp. Location: E. Crescent El. 227'	
H.P.: 1.3	Type: 4 Lead Compensated Shunt Motor	Model No.:	
Voltage: 125 VDC	Phase:	Serial No.: 880	Order No.:
Hz: DC	Serv. Factor: 1.25	Duty: Cont.	Frame: 184 6229D
Amp (F.L.): 10.0	RPM: 1750	Temp. Rise: 40° C Amb.	Insul. Class: B
Drive End Bearing			Stock
Opp. End Bearing			Stock

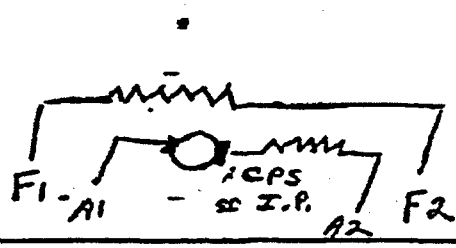
Remarks:

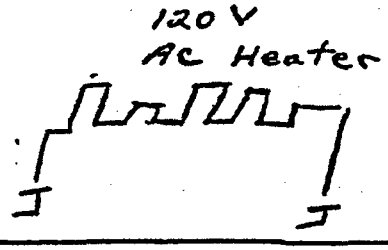
Note: Has 120 VAC Single Phase Heater.

Spec. #28F 180-822

BMCC-2

Rewind Data:





CITY OF NEW YORK

DEPT. OF WATER SUPPLY, GAS & ELECTRICITY—BUREAU OF GAS & ELECTRICITY
DIVISION OF PLANS & SPECIFICATIONS

ALTERNATING CURRENT MOTOR TEST DATA

BUILDING _____ JOB NO. _____ ITEM NO. _____

APPLICATION

BALDOR MOTOR

MECH. WIND. 28-822
FRAME 62290 H.P. 1.0
VOLTS 125 AMP. 10.0
PHASE SHUNT CYC. DC
R.P.M. 1750 °C. 55
SERIAL NO.

BALDOR ELECTRIC CO.
FT. SMITH, ARK. U.S.A.

TYPE OF BEARING BALL LUBRICATION GREASE ENCLOSURE TEFC

RESISTANCE—STATOR WINDING (BETWEEN LINES) (25 C) _____ OHMS

TORQUE—BREAKDOWN	—	LB. FT.
STARTING	41	LB. FT.
FULL LOAD	3	LB. FT.
EFFICIENCY—FULL LOAD	78	PERCENT
¾ LOAD	70	PERCENT
½ LOAD	61	PERCENT
POWER FACTOR—FULL LOAD	—	PERCENT
¾ LOAD	—	PERCENT
½ LOAD	—	PERCENT
~~SLIP~~ F.L. SPEED	1800	R.P.M. ~~PERCENT~~
AMPERES—FULL LOAD	10	AMPS.
RUNNING LIGHT	1.6	AMPS.
STARTING CURRENT (LOCKED ROTOR	114.0	AMPS.

TEMPERATURE TESTS
HOURS RUN _____ HRS.
LINE VOLTS _____ VOLTS
LINE AMPERES _____ AMPS.
SPEED _____ R.P.M.

TEMP. RISE BY THERMOMETER
ARMATURE WINDINGS 55 °C
STATOR CORE _____ °C
ROTOR WINDINGS _____ °C
ROTOR CORE _____ °C
COOLING AIR _____ °C

DIELECTRIC TESTS STATOR INS. 1800 VOLTS FOR 3 SEC.
ROTOR INS. _____ VOLTS FOR _____ SEC.

CLASS OF INSULATION B

THESE DATA FROM TEST OF MOTOR SERIAL NO _____
THESE DATA OBTAINED FROM TEST OF DUPLICATE MOTOR. ABOVE MOTOR IS GUARANTEED. ENTIRE THESE DATA SUBJECT TO USUAL MANUFACTURING VARIATIONS

DATA REQUESTED BY
FITZPATRIC
23P-141

BY W. Beaty ENG. DEPT. DATE 3-3-70
BALDOR ELECTRIC COMPANY
FT. SMITH, ARK.

ELECTRIC MOTOR DATA

SYSTEM # 23
COMP. # P-150

COMP. NO.	COMP. NAME					
23 P-150	HPCI TB. Lube Oil Pump					
MANUFACTURER	**B MCC**	**MCC LOCATION**	**COMP LOCATION**	**ESK**	**SE**	**FE**
Baldor	4	E. Cres.	E. Cres. INSIDE RCIC ENC.	11CB	10AT	46F .1+T

H.P.	TYPE	BKR. SIZE	STARTER SIZE	Starter Model #	Motor Model #
7.5					

VOLTAGE	PHASE	SERIAL NUMBER	DESIGN	CODE	HERTZ
120 DC	—	669			

SERV. FACTOR	DUTY	FRAME	AMP. (F.L.)	RPM	TEMP. RISE
1.0		286Ɑ 1040D	50	1800	Rating 55°C

INSUL. CLASS	OVERLOAD RELAY #	HEATER #	HEATER AMPS.
B	CR124E027	F65.BB	

ARM AMPS.	FIELD AMPS.

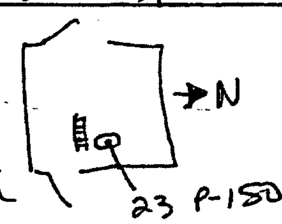
Brian Marks says "sealed" bearings - don't grease

DRIVE END BEARING	STOCK #	LOCATION
~~OPPOSITE END BEARING~~	~~STOCK #~~	LOCATION
2 shroud studs on top side need to be removed to get shroud off		

REMARKS:

SPEC 310-406-404
Compound Wound

END SHROUD BOLTS 7/16
BRUSH CAP BOLTS 7/16
THERE 4/8 BRUSH CAPS
8 BRUSHES
AC heater fed from 71ACB-3 Bkr #6



~~OPPOSITE END SHROUD - HANDRAIL NEEDS REMOVAL IN ORDER TO GET SHROUD OFF.~~

WR# 65477 wrk to remove handrail 5-16-90

DATE	WRED #	BRIEF DESCRIPTION OF JOB	DATE	WRED #	BRIEF DESCRIPTION OF JOB
5-16-90	PM 9010	OPP. END N.S. DONE Grease Bearings SV			
5-16-90	9011	Chk. Brushes SV			
10-6-91	10912	Check Brushes OLD Brush Length - 1 7/32" LFS			
10-29-93	930107800	Check brushes			
12-6-94	94-08499-00	Check Brushes (1" long) BK			
10/22/97	96-03123	check Brushes			
4-21-99	98-26350	Checked Brushes JDEnson/Kill			

* New Brushes ~ 1 1/4"
* See next page for more notes

FOR REFERENCE ONLY

8-3-7

No. 23-PM-150	Equip. Name HPC1 System Aux. Oil Pump	
Date Rec'd. 8-3-71	Storage Crescent Area	
Manu. Baldor Elec. Co.	Bearing Type ----	
H. P. 7.5	Phase D.C.	Duty ----
Voltage 120	H. F. Insl. Cl. B	S.F. 1.0
Amps. 50	Frame 286U 1040D	S/N 669
RPM. 1800	Inst. Man. ~~Yes~~/No	No.

Remarks: Type I, Rec. Insp. 8/5/71

SPEC. NO. 310-406-404

115V Heater Connecte
8/26/71.

Note: Special Case.
Refer to L/C #
in permanent f

LORD/COMSTOCK - Form 1

FOR REFERENCE ONLY

JUL-07-97 MON 12:59 PM BALDOR FAX NO. 3152539923 P.01
SENT BY:NYPA : 7- 7-97 : 9:43 :NYPA JAF SUPPORT/ALM-

Nuclear Power Plant
P.O. Box 41
Lycoming, New York 13093
315 342-3840

New York Power Authority

Attn: Alex Barton
1 of 1

DESIGN ENGINEERING DEPARTMENT

DATE: 7-7-97

TO: JULIE PRINE FAX #: 315-253-9923
BALDOR ELEC PHONE: 315-255-3403

FROM: ALEX BARTON PHONE: 315-349-6622.
DES. ENG.

Sending No. [315] 349-6981

Confirmation or Problems Call [315] 349-6910 (Patty)

3 Pages INCLUDING This Cover Sheet

MESSAGE: I need RATED INRUSH CURRENT FOR 7.5 H.P. 120V DC SPEC NO 310-406-404
Inrush current - 2000 amps @ rated 125 VDC. Julie

23P-150 Inrush Current Data

ITEM	REQ.	DRAWING NO.	DESCRIPTION
X	Ref	129716AK	Outline
X	Ref	L-69716AK	Assembly
X	Ref	151552X23N	Wiring Diagram
*1	2	126807X3-CA	Terminal Block (12 wire)
*2	1	L-68382, Gr.3	Motor & Cutout Switch
3	1	54350X3 10 STAGE	Auxiliary Switch (al, bl, 4a, 4b CONTACTS)
*4	1	126807X3-BA	Terminal Block (8 wire)
*5	1	153050X3	Heater Unit 120 V. A.C.
*6	1	127349X1	PUSH-BUTTON STA.
7	2		250-V "FRN-2" FUSETRONS
*8	2		250-V 3-Amp. Fuses
9			
10	1	153050X11	RESIS. UNIT 100 W. 100 Ω
11	1	L-68385X5 Gr.2	Control Solenoid 125-V. D.C.
12			
*13	1	151695X7, Gr.6	Motor 1/4 hp /125-V. D.C. 1150 R.P.M.
14			
15			
*16	1	153047X6	Motor Support
17	1	127329X59B	Terminal Block Support
*18			
*19	1	127332X	Conduit Plate
*20	1	151665X3	PUSH BUTTON SW. SUPP.
21			
22			
23	1	127337X15	Cover
24			
25			
*26	1	L-68383	Mechanism Housing
27			
*28	1	L-68381X4	St'd. Gear Box & Control Mechanism
29			
30			
31			
32			
33	1	149721X19 Gr.5	Thermoswitch Attachment
*34	1	28650-A	Operating Crank
*35	1	126020X3, Gr.2	Motor Coupling
*36	1	N370	Closed Indicator
*37	1	N371	Open Indicator
*38	1	153050	Heater Unit
*39	2	114259	Fuse Block
*40	4 Ft.		#4 Black Cambric Tubing
*41	1	N556XA	Operating Shaft Knuckle
42	1	129751X5H	Hardware List
43			
*44	2	Cat. AN931, 10-14	Atlantic India Grommet
45			
46			
47			
*48	6	119095	Conduit Hole Covers
*49	1	124280X2	Crank Indicator
*50	1	158855	Nameplate

(* - Stock Item)

3/13/72 AT. GEN. REV.

DWG.
CHKD.
APPROVED

LIST OF MATERIAL
SF2R3 MOTOR MECHANISM.

T-21161

H. K. PORTER COMPANY, INC.

129716AK-M, Gr.6

DATE 11-12-71

FORM NO 60 OPC 90
EL 5758A

Mechanism Type	Mechanism Form	Nom. Motor Volts	Oper. Volts. Range	Frequency Cycles	Rated H.P. Motor	Current @ Rated Volts: Rated Load	Current @ Rated Volts: Inrush	Current @ Rated Volts: Closing Coil Inrush	Circuit Breaker Amps. (Blow 60-90 Sec.)	Fuse Tron #FRN (Blow 10- Se[c.])
SF-1	R-0	24	18-26	DC	1/2	30	110	11	———	20
		48	36-52	DC	1/2	15	55	6	12.2-13.01	10
		125	90-130	DC	1/2	6	22	2.5	5.86-6.41	4
		250	180-260	DC	1/2	3	11	1.5	3.07-3.45	2
		115	95-125	60	1/2	11	22	14	12.2-13.01	4
		230	190-250	60	1/2	5.5	11	7	5.86-6.41	2
	R-1	24	18-26	DC	1/4	20	70	7.5	12.2-13.01	15
		48	36-52	DC	1/4	10	35	3.7	5.86-6.41	8
		125	90-130	DC	1/4	4	14	1.6	3.07-3.45	2.5
		250	180-260	DC	1/4	2	7	0.8	2.16-2.38	2
		115	95-125	60	1/3	7	17	11	5.86-6.41	4
		230	190-250	60	1/3	3.5	8.5	6	3.07-3.45	2
SF-2	R-0	24	18-26	DC	3/4	40	160	11	———	35
		48	36-52	DC	3/4	20	80	6	12.2-13.01	15
		125	90-130	DC	3/4	9	35	2.5	5.86-6.41	8
		250	180-260	DC	3/4	4.5	17	1.2	3.07-3.45	4
		115	95-125	60	3/4	16	35	14	12.2-13.01	8
		230	190-250	60	3/4	8	17	7	7.58-8.15	4
	R-1	24	18-26	DC	1/2	30	110	7.5	———	20
		48	36-52	DC	1/2	15	55	3.7	12.2-13.01	10
		125	90-130	DC	1/2	6	22	1.6	5.86-6.41	4
		250	180-260	DC	1/2	3	11	0.8	3.07-3.45	2
		115	95-125	60	1/2	11	22	11	12.2-13.01	4
		230	190-250	60	1/2	5.5	11	6	5.86-6.41	2
	R-2	24	18-26	DC	1/3	22	76	7.5	12.2-13.01	15
		48	36-52	DC	1/3	11	38	3.7	7.58-8.15	8
		125	90-130	DC	1/3	5	17	1.6	3.07-3.45	4
		250	180-260	DC	1/3	2.5	8.5	0.8	2.16-2.38	2
		115	95-125	60	1/3	7	17	11	5.86-6.41	4
		230	190-250	60	1/3	3.5	8.5	6	3.07-3.45	2
	R 3	24	18-26	DC	1/4	16	50	7.5	12.2-13.01	10
		48	36-52	DC	1/4	8	25	3.7	5.86-6.41	5
		125	90-130	DC	1/4	3.5	12	1.6	3.07-3.45	2.5
		250	180-260	DC	1/4	1.7	6	0.8	2.16-2.38	1.2
		115	95-125	60	1/4	5.2	12	11	5.86-6.41	2.5
		230	190-250	60	1/4	2.6	6	6	3.07-3.45	1.2

Revisions

Date	By	Description
4-4-72	C.M.T	Revised & Redrawn

D. C. [signature] DIV. C.
APPROVED [signature]

TECHNICAL DATA FOR WIRING DIAGRAMS

EMS 151552X97 J.O. 1-11114

H. K. PORTER COMPANY, INC.
ELECTRICAL DIVISION

130003

DATE 1-7-72

SYS/ VALVE NO. 12 MOV 1
Q.A. CAT. 1 E Q

FOR REFERENCE C*

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
12 MOV 18	Rx Water C.U. to P.A & P.B			
MANUFACTURER	MCC	ESK	SE	COMP. LOCATION & ELEVATION
Peerless	BMCC 4 E.C.	15AD FEAK	10R	R.W.C.U Mezz

H.P./TORQUE	TYPE	MODEL NO.
2.89/140 ft lb	Windings Compound	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125	—	DC	8Y61998		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
104		5 MIN.	D 202H

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
26.0	1900	115°C / Amb 40°C	RH

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124K028	L19.98				

TOTAL STEM TRAVEL		INCHES OR TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES 5 7/8	TURNS			5 1/2"	2"	5 1/2"	FC

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. GE ~~ALDV~~	TYPE SB 0	NO. 1PC1B09	RECOMMENDED: OPEN 2 1/4 CLOSE 2 1/4
TYPE ~~D.C. GATE~~	SER. NO. L477013	BKR. AMPS 15	MAX: OPEN 2 1/2 CLOSE 2 1/2
SIZE 6"	ORDER NO. 226546.04	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) 2 1/2 2 3/4 NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

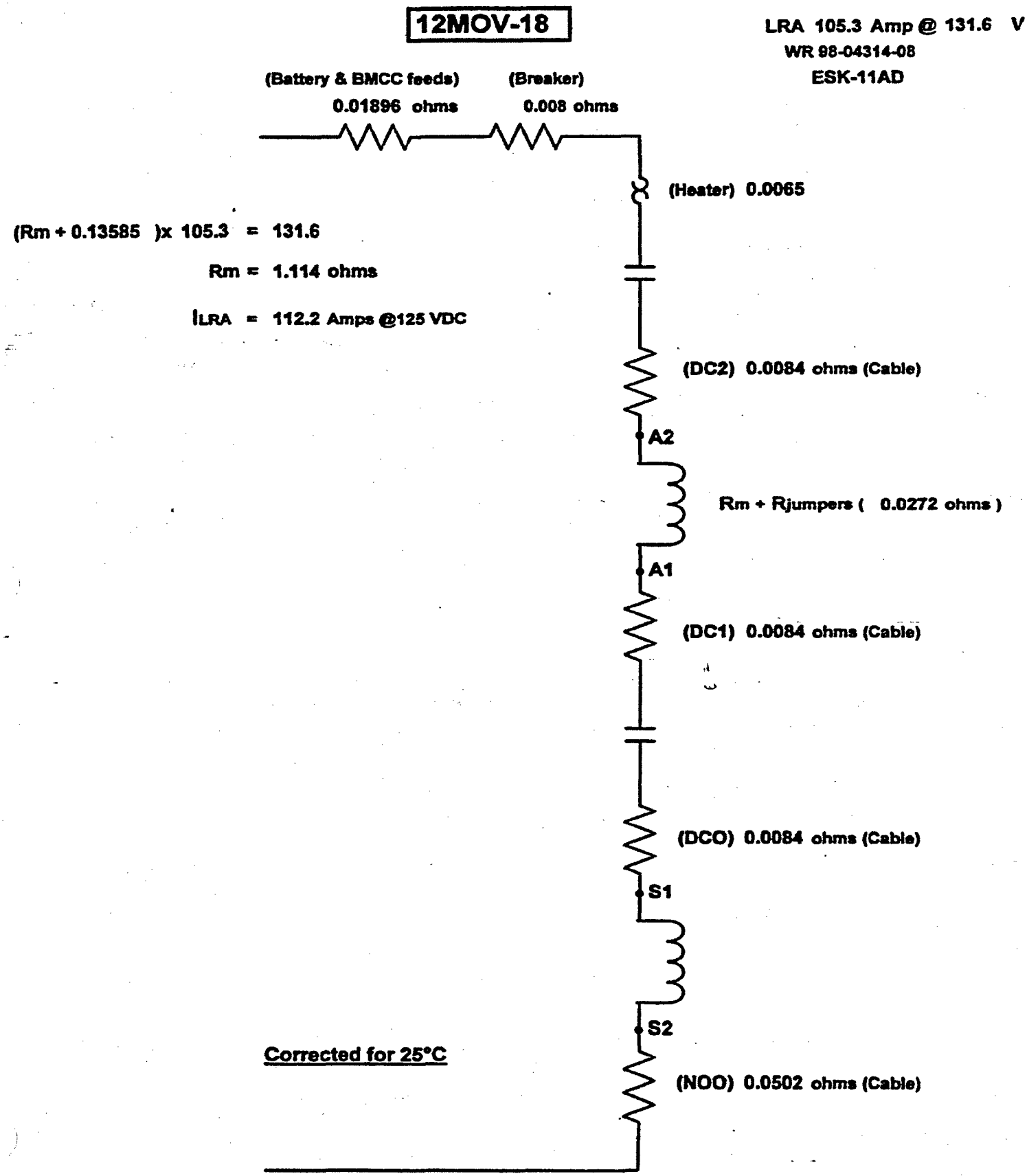
RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	15.5	15.2		11.2	12.5	LIMITORQUE	B-17
AMPS F.L. AT TORQUE TRIP		50	TORQUE SWITCH SETTING	2 1/4	2 1/4	MCC	C1

BRAKE INFO, BOLTING TORQUE, MISC INFO of mtg 5/8 allen

12MOV-18

Date	Inrush	O/C	Battery Voltage	Votes Test No.	Stroke Time	WR Number	Notes
1/25/95	97.4	C	129.6	2	11.7	94-08466-05	
1/25/95	100.4	O	129.6	2	11.1	94-08466-05	
11/13/96	92.1	C	129.6	4	11.5	96-05849-05	
11/13/96	90.1	O	129.6	4	10.8	96-05849-05	
11/20/98	97.4	C	132.8	2	10.7	98-05184-04	
11/20/98	97.9	O	132.8	2	10.1	98-05184-04	
10/22/00	102.8	C	131.6	12	11.4	98-04314-08	
10/22/00	**105.3**	**O**	**131.6**	**12**	**10.6**	**98-04314-08**	
Operator was replaced in 1995							

12MOV-18 Votes Tests Data



12MOV-18 Inrush Current

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/02, 1:13 PM

Select Valve--> 12MOV-18, dynamic close blowdown

General Information	Required?	Value
Valve Type	yes	wedge gate
Flow type	yes	blowdown
Stroke direction	yes	close
Fluid (blowdown only)	yes	flashing water
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.500
Seat ring face ID, $D_{body-ID}$ (inches)	yes	4.740
Seat ring inner diameter, D_{sr} (inches)	no	4.740
Globe valve stroke length, D (inches)	no	0.000
Isolation-to-wedging travel, X (percent)	yes	16.36%
Packing load, F_{pack} (lbs)	yes	1,500
Required thrust (including water inertia), F_R (lbs)	yes	14,108
Required thrust due to water inertia, F_{wi} (lbs)	yes	162
Flow coefficient, C_V (gpm/psi$^{1/2}$)	no	0
Actuator overall ratio, OAR	yes	39.11
Motor gear set ratio, MGSR	yes	0.946
Actuator rated torque, τ_{rated}	yes	500
Stem factor, SF (ft-lbs/lb)	yes	0.01890
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00508
Voltage at MCC, V_{mcc} (volts)	yes	103.52
Cable resistance, R_{cable} (ohms)	yes	0.1210
Thermal overload resistance, R_{tol} (ohms)	yes	0.0065
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	40 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.500
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.55
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	no	1062
Valve pressure at full open, P_s (psig)	yes	1046
Flow rate, Q_{max} (gpm)	no	0
Fluid density, ρ (lbs/ft^3)	no	45.850
Ambient temperature (C)	yes	102
Length of upstream piping, L_{up} (pipe diameters)	yes	222
Calculated Values		
System resistance, K_{sys}	no	—
Fully open stem thrust, F_O (lbs)	yes	3,348
Nominal motor torque, τ_{nom} (ft-lbs)	yes	50.6
Maximum motor torque (ft-lbs)	yes	14.5
Maximum adjusted motor torque (ft-lbs)	yes	24.1
Minimum motor speed (rpm)	yes	836
Minimum instantaneous actuator capability (lbs)	yes	26,255
Minimum instantaneous margin (lbs)	yes	15,393
Maximum allowable thrust at torque switch trip	yes	22,976
Efficiency at minimum instantaneous capability	yes	0.400

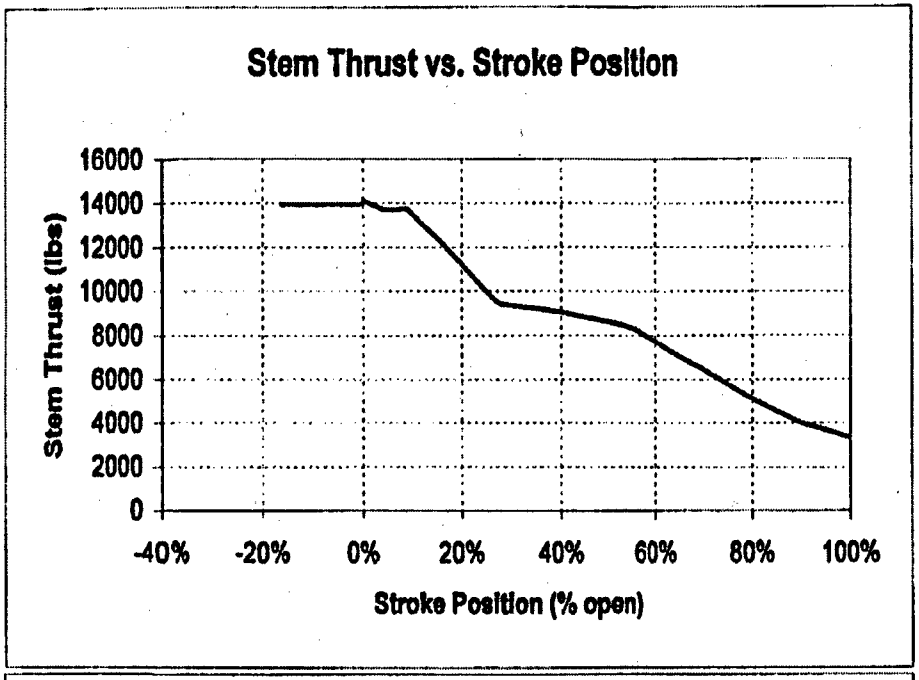
Warnings

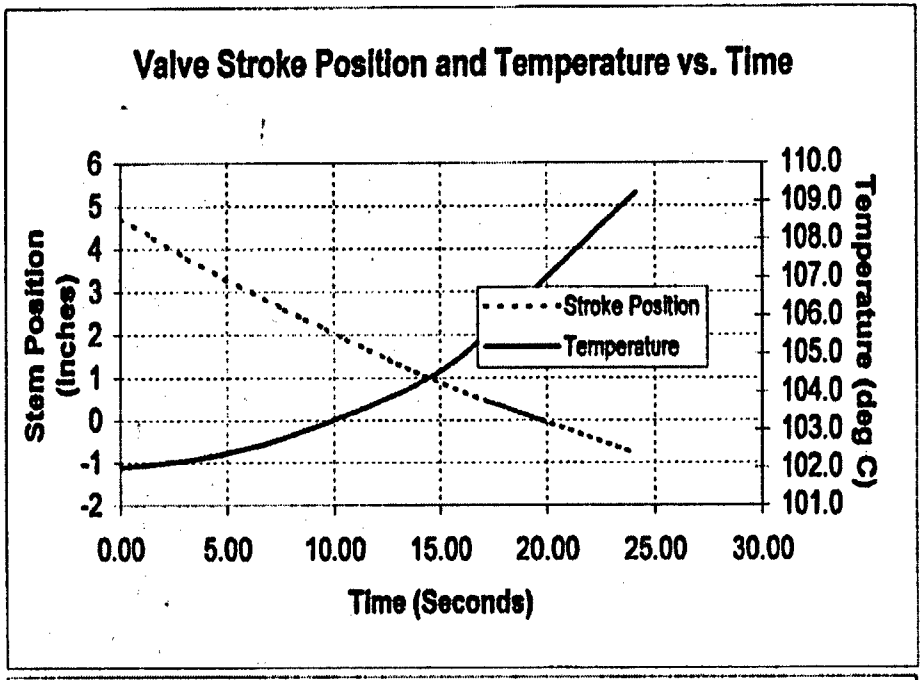
Predicted Stroke Time (Seconds): **24.08**

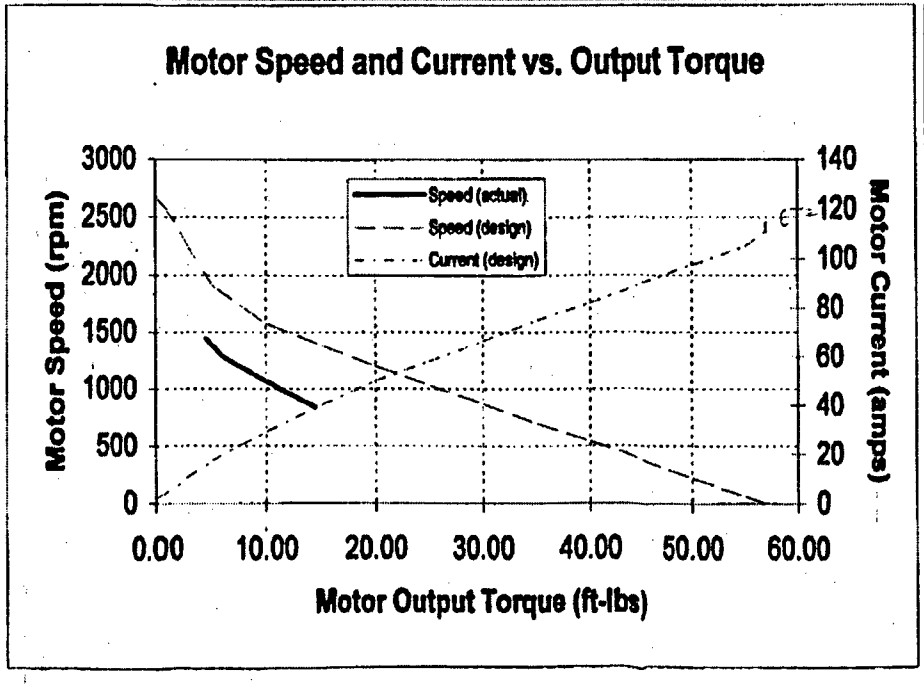
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

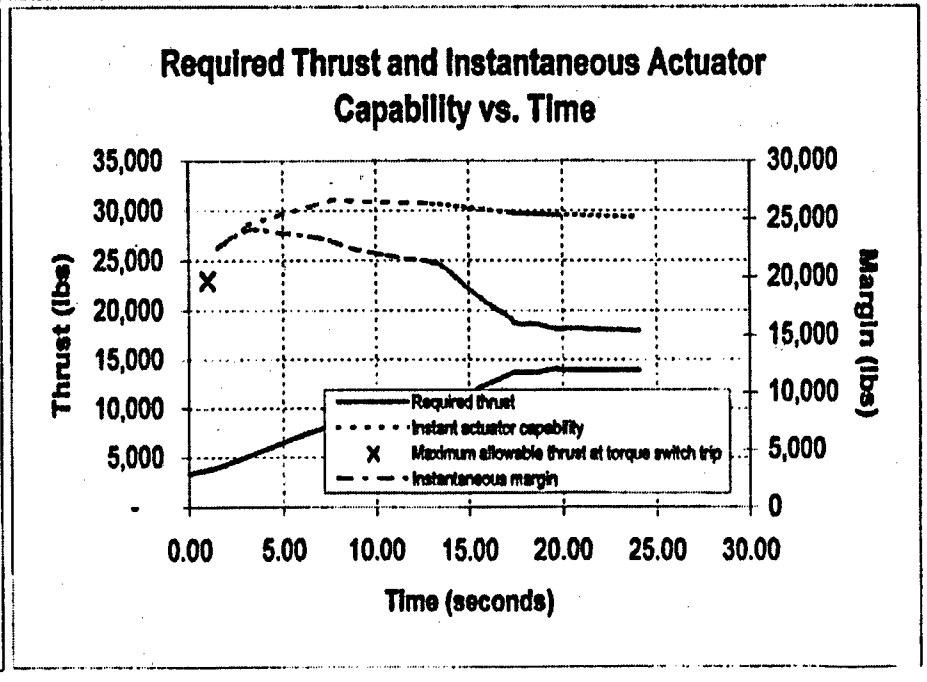
BWROG DCM for B Battery (batch), Version 2.0.xls, Results, 9/16/02, 1:13 PM

Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
100%	4.74	3348												0.00	102.0				--
90%	4.27	4002	3675	69.46		0.400	4.44	15.32	103.52	102	7.09	1443	1.54	1.54	102.1	496	26,255	22,579	--
80%	3.79	5118	4560	86.16	1365	0.437	5.04	17.10	103.52	101	8.07	1385	1.61	3.15	102.2	541	28,610	24,050	--
70%	3.32	6436	5777	109.16	1310	0.454	6.15	19.77	103.52	101	9.86	1279	1.74	4.89	102.4	559	29,595	23,818	--
60%	2.84	7706	7071	133.64	1210	0.470	7.27	22.45	103.52	101	11.73	1215	1.83	6.72	102.6	577	30,529	23,459	--
55%	2.61	8319	8012	151.43	1150	0.480	8.06	24.35	103.52	100	13.04	1172	0.95	7.67	102.8	588	31,111	23,099	--
50%	2.37	8595	8457	159.84	1109	0.479	8.53	25.47	103.52	100	13.82	1147	0.97	8.64	103.0	585	30,976	22,519	--
45%	2.13	8821	8708	164.58	1085	0.478	8.80	26.11	103.52	100	14.27	1132	0.98	9.62	103.2	584	30,888	22,180	--
40%	1.90	9047	8934	168.85	1071	0.478	9.03	26.68	103.52	100	14.67	1119	0.99	10.61	103.4	583	30,821	21,887	--
35%	1.66	9216	9131	172.58	1059	0.478	9.24	27.17	103.52	100	15.03	1108	1.00	11.62	103.6	581	30,759	21,628	--
30%	1.42	9348	9282	175.43	1048	0.477	9.40	27.55	103.52	100	15.30	1099	1.01	12.63	103.9	580	30,703	21,421	--
28%	1.33	9401	9375	177.18	1040	0.477	9.50	27.79	103.52	100	15.48	1094	0.41	13.03	104.0	579	30,657	21,263	--
26%	1.23	9714	9558	180.64	1034	0.477	9.68	28.24	103.52	100	15.80	1083	0.41	13.45	104.1	579	30,621	21,063	--
24%	1.14	10212	9963	188.30	1025	0.477	10.10	29.22	103.52	100	16.51	1061	0.42	13.86	104.2	577	30,555	20,592	--
22%	1.04	10710	10461	197.71	1004	0.476	10.62	30.36	103.52	100	17.39	1034	0.43	14.30	104.3	576	30,462	20,001	--
20%	0.95	11208	10959	207.12	978	0.475	11.14	31.51	103.52	100	18.28	1006	0.44	14.74	104.4	574	30,357	19,398	--
18%	0.85	11706	11457	216.54	952	0.475	11.67	32.67	103.52	99	19.17	978	0.45	15.19	104.6	572	30,251	18,794	--
16%	0.76	12191	11948	225.82	925	0.474	12.19	33.81	103.52	99	20.07	951	0.47	15.66	104.8	570	30,143	18,194	--
14%	0.66	12601	12396	234.28	899	0.473	12.66	34.86	103.52	99	20.89	927	0.48	16.14	105.0	568	30,038	17,642	--
12%	0.57	13011	12806	242.03	877	0.472	13.10	35.82	103.52	99	21.65	905	0.49	16.63	105.2	566	29,942	17,138	--
10%	0.47	13459	13235	250.14	857	0.472	13.56	36.82	103.52	99	22.45	883	0.50	17.14	105.5	564	29,846	16,610	--
9%	0.43	13708	13584	256.73	835	0.471	13.93	37.65	103.52	99	23.11	864	0.26	17.39	105.6	562	29,753	16,169	--
8%	0.38	13753	13730	259.50	817	0.471	14.10	38.01	103.52	99	23.41	856	0.26	17.65	105.7	561	29,695	15,964	--
7%	0.33	13709	13731	259.51	810	0.470	14.10	38.03	103.52	99	23.43	855	0.26	17.91	105.9	561	29,668	15,937	--
6%	0.28	13687	13698	258.90	809	0.470	14.07	37.96	103.52	99	23.38	857	0.26	18.17	106.0	561	29,658	15,959	--
5%	0.24	13685	13686	258.67	810	0.470	14.06	37.93	103.52	99	23.37	857	0.26	18.43	106.1	560	29,649	15,963	--
4%	0.19	13718	13701	258.95	811	0.470	14.07	37.96	103.52	99	23.40	856	0.26	18.69	106.3	560	29,637	15,935	--
3%	0.14	13815	13766	260.18	810	0.470	14.14	38.11	103.52	99	23.53	852	0.26	18.95	106.4	560	29,617	15,851	--
2%	0.09	13912	13863	262.01	806	0.470	14.24	38.34	103.52	99	23.72	847	0.26	19.22	106.6	559	29,591	15,727	--
1%	0.05	14009	13960	263.85	801	0.470	14.35	38.57	103.52	99	23.91	842	0.26	19.48	106.7	559	29,560	15,600	--
0%	0.00	14106	14057	265.69	796	0.470	14.45	38.79	103.52	99	24.10	838	0.27	19.75	106.9	558	29,530	15,472	--
0%	0.00	13944	14025	265.07	791	0.470	14.42	38.73	103.52	99	24.06	838	0.03	19.77	106.9	558	29,510	15,485	--
-2%	-0.08	13944	13944	263.54	792	0.470	14.34	38.55	103.52	99	23.91	842	0.41	20.18	107.1	558	29,518	15,574	--
-3%	-0.16	13944	13944	263.54	796	0.470	14.34	38.54	103.52	99	23.92	841	0.43	20.61	107.3	558	29,506	15,562	--
-5%	-0.23	13944	13944	263.54	796	0.470	14.34	38.54	103.52	99	23.94	841	0.43	21.04	107.6	557	29,485	15,541	--
-7%	-0.31	13944	13944	263.54	795	0.470	14.34	38.54	103.52	99	23.96	840	0.43	21.48	107.8	557	29,464	15,520	--
-8%	-0.39	13944	13944	263.54	795	0.470	14.34	38.54	103.52	99	23.98	840	0.43	21.91	108.0	556	29,443	15,499	--
-10%	-0.47	13944	13944	263.54	795	0.470	14.34	38.54	103.52	99	23.99	840	0.43	22.34	108.3	556	29,422	15,478	--
-11%	-0.54	13944	13944	263.54	794	0.470	14.34	38.54	103.52	99	24.01	839	0.43	22.78	108.5	556	29,401	15,457	--
-13%	-0.62	13944	13944	263.54	794	0.470	14.34	38.54	103.52	99	24.03	839	0.43	23.21	108.7	555	29,380	15,436	--
-15%	-0.70	13944	13944	263.54	793	0.470	14.34	38.54	103.52	99	24.04	838	0.43	23.65	109.0	555	29,358	15,414	--
-16%	-0.78	13944	13944	263.54	793	0.470	14.34	38.54	103.52	99	24.06	838	0.43	24.08	109.2	554	29,337	15,393	--
TST	--	--	22976	434.24	144	0.381	29.12	65.00	103.52	95	50.63	152	--	--	--	434	22,976	(0)	--
Screen	--	--	14106	266.60	--	0.400	17.04	115.00	103.52	89	32.02	670	--	45.4	137.1	393	20,801	6,695	--
w/ter	--	--	14106	266.60	764	0.469	14.53	38.97	103.52	99	25.18	808	--	32.1	120.0	536	28,361	14,255	--


Stem Thrust vs. Stroke Position
Stem Thrust (lbs)
16000
14000
12000
10000
8000
6000
4000
2000
0
-40%
-20%
0%
20%
40%
60%
80%
100%
Stroke Position (% open)


Valve Stroke Position and Temperature vs. Time
Stem Position (inches)
6
5
4
3
2
1
0
-1
-2
Temperature (deg C)
110.0
109.0
108.0
107.0
106.0
105.0
104.0
103.0
102.0
101.0
Stroke Position
Temperature
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Time (Seconds)


Motor Speed and Current vs. Output Torque
Motor Speed (rpm)
3000
2500
2000
1500
1000
500
0
Motor Current (amps)
140
120
100
80
60
40
20
0
Speed (actual)
Speed (design)
Current (design)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Motor Output Torque (ft-lbs)


Required Thrust and Instantaneous Actuator Capability vs. Time
Thrust (lbs)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
-
Margin (lbs)
30,000
25,000
20,000
15,000
10,000
5,000
0
Required thrust
Instant actuator capability
Maximum allowable thrust at torque switch trip
Instantaneous margin
0.00
5.00
10.00
15.00
20.00
25.00
30.00
Time (seconds)

SYS/ VALVE NO. 23 MOV -14
Q.A. CAT. 1EQ

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME				
23 Mov -14	HPCI Steam Isolation Valve				
MANUFACTURER	MCC	ESK	SE	COMP. LOCATION & ELEVATION	
Peerless	2-0A2	11AK	10AF	Back side of HPCI	
H.P./TORQUE 60 ft lbs	TYPE	MODEL NO.			
4.232	Compound	1764200150			
VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125			VY 62288		
AMP(L.R.)	SERV. FACTOR	DUTY		FRAME	
≈ 174		5 min		DS 204	
AMP.(F.L.)	RPM	TEMP. RISE		INSUL. CLASS	
34	1900	115°C		RH	

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124M028	K21,38				

TOTAL STEM TRAVEL	INCHES OR TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES 9.0625 TURNS ____			8.375	3.253	FC	FC

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Anchor/Darling	TYPE SB-1	NO. 1HPI B01	RECOMMENDED: OPEN 1.25 CLOSE 1.25
TYPE Gate Double Disc	SER. NO. L477015	BKR. AMPS 70	MAX: OPEN 2.50 CLOSE 2.50
SIZE 10"	ORDER NO. 226546-06	CONTACTOR SIZE 2	STOP PLATE IN PLACE (YES) 2.50 NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	18	19		8.5	8.5	LIMITORQUE	C-2
AMPS F.L. AT TORQUE TRIP	18	61	TORQUE SWITCH SETTING	1.75	1.75	MCC Control	C-1 A-15

BRAKE INFO, BOLTING TORQUE, MISC INFO
* Ball Screw ½" Allen to Bonnet Bolts
Cover bolts 5/16 Allen need T handle or ball drive works best
Extended G 7" below lifting screw
Mod installed to use limit sw 3 for closed
Need scaffolding

ATTACHMENT 12 - PRE-TEST DATA SHEET

Page 1 of 2

Component No. 23MOV-14 WR No. _____ Date: 3-29-C

DESIGN DOCUMENTS:

Design Calculation: JAF-CALC-HPCI-02962-08, JAF-CALC-HPCI-03099 R0 Rev. C

Valve Dwg. (File) No. 6.37-360 & 361 Rev. F

Other: _____ Rev. _____

Enter/compare data shown in data blanks below with data shown in VOTES Setup Menu/Valve Identification/Examine or Edit Existing Valve Information Data pages.

VOTES INFORMATION

* Tag No. (Note 1)	23MOV-14	Target Thrust (Note 2)	–
Type of Valve	ADDO	Target Tolerance (Note 2)	–
Size	10"	Stem Material	4/6
Location	W CLES	* Stem Diameter	2
Orientation	23°	* Threads per Inch	2
VOTES Sensor Ser. #	14754	* E/P ratio	119.4
BFSL Sensitivity	(Note 3)	* Threads per Rev.	2
Cal Date	(Note 3)	GenP, RRGenP, Stub, RRStub (G,R, S, b)	Ball Screw

NOTE 1: Asterisks (*) denote essential data which must be entered.
NOTE 2: Reference second page of attachment (includes errors)
NOTE 3: Software generated (input not required/leave blank).

VALVE ACTUATOR

Mfg.:	Limitorque
Type/Size:	SB-1
Serial No.:	L477015
Order No.:	L26546
*Max Thrust Rating:	45000
No. Worm Gear Teeth:	34
Overall Gear	40
Spring Pack	0701-212

ACTUATOR MOTOR

* Voltage Type (AC/DC:)	DC
* Volts:	125
Running Amps:	36
Nominal Speed:	1900
Start Torque:	60
Run Torque:	12
Horsepower:	4.7
Locked Rotor Amps:	174

Data matches data in Examine or Edit Existing Valve Info. of Setup. 3-29-07

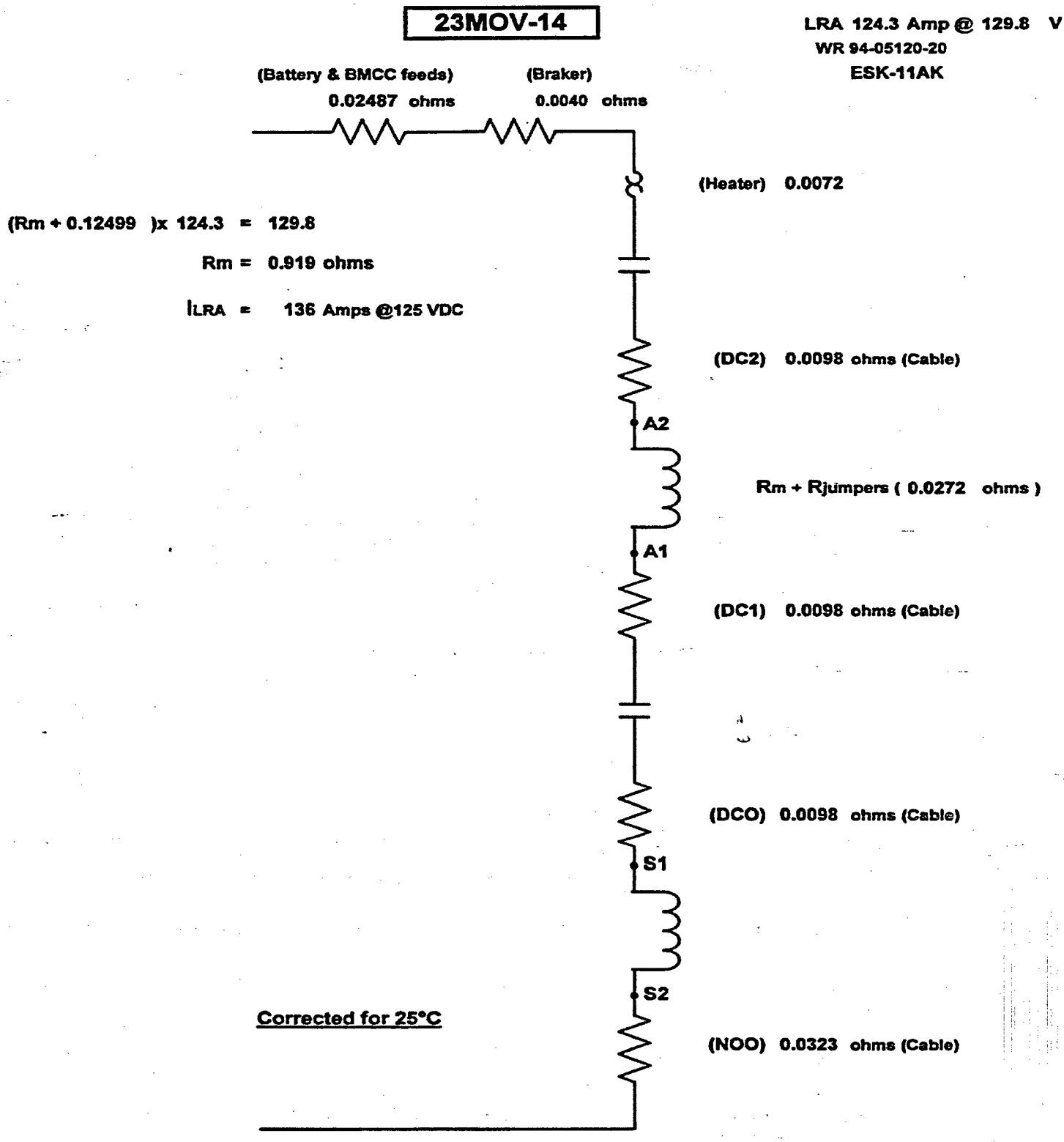
MOV Eng./Da

2.	1.0	NA	
Effective Diameter	TCF	Liberty Data Sheet	MOV Eng/De

23MOV-14

Date	Inrush	O/C	Battery Voltage	Votes Test No.	Stroke Time	WR Number	Notes
2/15/92	120.9	C	129.6	5	9.8	94-08468-05	
2/15/92	117.0	O	129.6	5	9.6	94-08468-05	
3/19/95	119.0	C	129.7	8	9.7	94-05120-06	
3/19/95	116.0	O	129.7	8	9.3	94-05120-06	
5/18/95	124.3	C	129.8	9	9.5	94-05120-20	
5/18/95	120.4	O	129.8	9	9.2	94-05120-20	
11/22/96	88.2	C	132.0	4	9.2	95-06137-12	Anomoly
11/22/96	89.1	O	132.0	4	9.0	95-06137-12	Anomoly
11/27/98	117.5	C	132.9	5	8.8	97-00994-06	Battery Voltage from weekly ST
11/27/98	116.5	O	132.9	5	8.9	97-00994-06	Battery Voltage from weekly ST
11/6/00	118.9	C	131.8	15	8.8	00-08213-00	Battery Voltage from weekly ST
11/6/00	117.9	O	131.8	15	8.6	00-08213-00	Battery Voltage from weekly ST
3/30/01							Anomoly
Operator was replaced in 1995							

23MOV-14 Votes Tests Data



23MOV-14 Inrush Current

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/02, 1:08 PM

Select Valve--> 23MOV-14, dynamic open with blowdown model

General Information	Required?	Value
Valve Type	yes	double disk
Flow type	yes	blowdown
Stroke direction	yes	open
Fluid (blowdown only)	yes	steam
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	2.500
Seat ring face ID, $D_{body-ID}$ (inches)	yes	8.034
Seat ring inner diameter, D_{sr} (inches)	no	7.909
Globe valve stroke length, D (inches)	no	9.750
Isolation-to-wedging travel, X (percent)	yes	10.00%
Packing load, F_{pack} (lbs)	yes	2,500
Required thrust (including water inertia), F_R (lbs)	yes	34,535
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	no	1
Actuator overall ratio, OAR	yes	40.18
Motor gear set ratio, MGSR	yes	0.846
Actuator rated torque, τ_{rated}	yes	850
Stem factor, SF (ft-lbs/lb)	yes	0.01470
Overhauling stem factor, SF_O (ft-lbs/lb)	yes	0.01190
Voltage at MCC, V_{mcc} (volts)	yes	103.95
Cable resistance, R_{cable} (ohms)	yes	0.1515
Thermal overload resistance, R_{tol} (ohms)	yes	0.0112
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	60 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	1.000
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.50
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	no	0
Valve pressure at full open, P_s (psig)	yes	1195
Flow rate, Q_{max} (gpm)	no	0
Fluid density, ρ (lbs/ft^3)	no	2.786
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	yes	10000
Calculated Values		
System resistance, K_{sys}	no	—
Fully open stem thrust, F_O (lbs)	yes	-3,366
Nominal motor torque, τ_{nom} (ft-lbs)	yes	74.7
Maximum motor torque (ft-lbs)	yes	31.6
Maximum adjusted motor torque (ft-lbs)	yes	45.6
Minimum motor speed (rpm)	yes	587
Minimum instantaneous actuator capability (lbs)	yes	56,595
Minimum instantaneous margin (lbs)	yes	22,060
Maximum allowable thrust at unwedging	yes	51,054
Efficiency at minimum instantaneous capability	yes	0.400

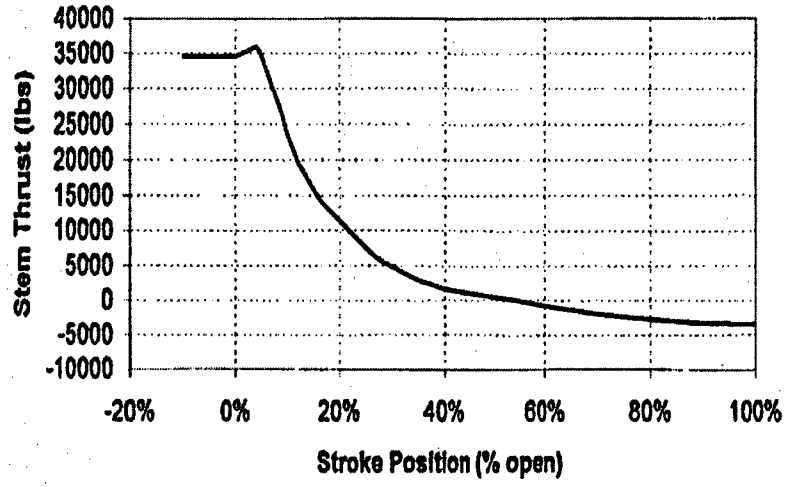
Warnings

Predicted Stroke Time (Seconds): 15.20

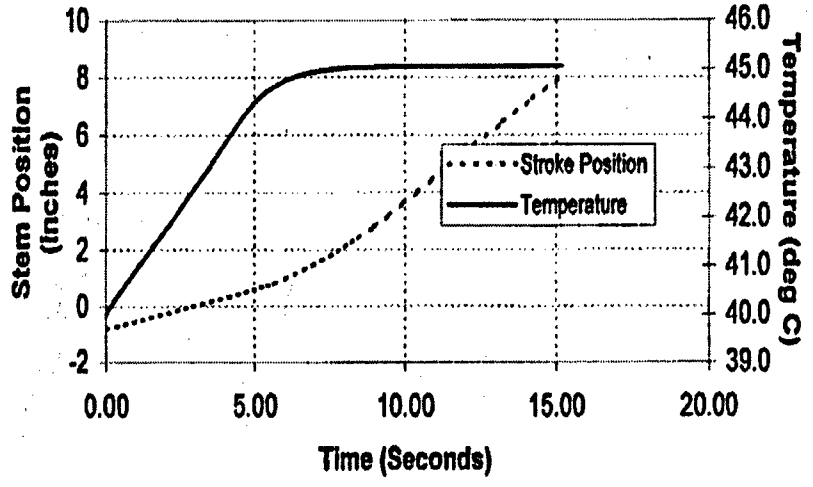
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	q
-10%	-0.80	34535												0.00	40.0				
-9%	-0.72	34535	34535	507.66		0.400	31.59	76.02	103.95	92	45.61	587	0.33	0.33	40.3	832	56,595	22,060	
-8%	-0.64	34535	34535	507.66	497	0.441	28.66	70.04	103.95	93	40.99	672	0.29	0.62	40.6	926	62,965	28,430	
-7%	-0.56	34535	34535	507.66	568	0.442	28.57	69.85	103.95	93	40.89	674	0.29	0.91	40.8	926	63,126	28,593	
-6%	-0.48	34535	34535	507.66	570	0.442	28.56	69.84	103.95	93	40.92	673	0.29	1.19	41.1	927	63,076	28,543	
-5%	-0.40	34535	34535	507.66	570	0.442	28.56	69.84	103.95	93	40.96	673	0.29	1.48	41.3	926	63,020	28,485	
-4%	-0.32	34535	34535	507.66	569	0.442	28.57	69.84	103.95	93	40.99	672	0.29	1.77	41.6	926	62,963	28,428	
-3%	-0.24	34535	34535	507.66	569	0.442	28.57	69.85	103.95	93	41.03	671	0.29	2.06	41.8	925	62,905	28,370	
-2%	-0.16	34535	34535	507.66	568	0.442	28.57	69.85	103.95	93	41.07	671	0.29	2.35	42.1	924	62,848	28,313	
-1%	-0.08	34535	34535	507.66	567	0.442	28.57	69.85	103.95	93	41.11	670	0.29	2.64	42.3	923	62,790	28,255	
0%	-0.01	34535	34535	507.66	567	0.442	28.57	69.85	103.95	93	41.14	669	0.26	2.90	42.5	922	62,733	28,198	
0%	0.00	34535	34535	507.66	566	0.442	28.57	69.85	103.95	93	41.18	669	0.03	2.93	42.6	921	62,681	28,146	
1%	0.08	34876	34705	510.17	566	0.442	28.71	70.16	103.95	93	41.41	664	0.29	3.22	42.8	921	62,640	27,934	
2%	0.16	35216	35046	515.18	562	0.442	29.00	70.79	103.95	92	41.91	655	0.30	3.51	43.1	919	62,504	27,458	
3%	0.24	35557	35387	520.18	555	0.442	29.29	71.44	103.95	92	42.41	646	0.30	3.81	43.3	917	62,354	26,967	
4%	0.32	35898	35727	525.19	547	0.442	29.58	72.08	103.95	92	42.93	636	0.30	4.12	43.6	914	62,201	26,474	
5%	0.40	34621	35259	518.31	539	0.442	29.20	71.25	103.95	92	42.36	647	0.30	4.42	43.9	914	62,209	26,949	
6%	0.48	32472	33546	493.13	548	0.442	27.77	68.10	103.95	93	40.10	689	0.28	4.70	44.1	919	62,518	28,972	
7%	0.56	30410	31441	462.18	583	0.443	25.99	64.18	103.95	94	37.30	746	0.26	4.96	44.3	926	62,995	31,554	
8%	0.64	28440	29425	432.54	631	0.444	24.27	60.40	103.95	94	34.63	801	0.24	5.20	44.4	933	63,501	34,077	
9%	0.72	26239	27339	401.89	678	0.444	22.51	56.51	103.95	95	31.91	858	0.23	5.42	44.5	941	64,024	36,685	
10%	0.80	23498	24869	365.57	726	0.445	20.43	51.95	103.95	95	28.76	930	0.21	5.63	44.6	950	64,634	39,765	
12%	0.96	19696	21597	317.48	787	0.447	17.70	45.70	103.95	97	24.65	1035	0.37	6.01	44.8	962	65,473	43,876	
14%	1.12	17186	18441	271.08	876	0.448	15.05	39.62	103.95	98	20.77	1137	0.34	6.35	44.8	976	66,369	47,928	
16%	1.29	14676	15931	234.19	962	0.444	13.12	35.18	103.95	98	17.97	1231	0.31	6.66	44.9	974	66,239	50,308	
18%	1.45	12991	13834	203.35	1042	0.437	11.58	31.64	103.95	99	15.78	1313	0.29	6.96	44.9	963	65,533	51,699	
20%	1.61	11451	12221	179.65	1111	0.431	10.37	28.84	103.95	99	14.06	1378	0.26	7.24	45.0	955	64,966	52,745	
22%	1.77	9911	10681	157.01	1166	0.425	9.18	25.96	103.95	100	12.40	1442	0.27	7.51	45.0	946	64,387	53,705	
24%	1.93	8372	9142	134.38	1220	0.419	7.97	22.93	103.95	100	10.71	1507	0.26	7.76	45.0	938	63,786	54,644	
26%	2.09	6832	7602	111.75	1275	0.413	6.73	19.82	103.95	101	9.00	1595	0.24	8.01	45.0	928	63,159	55,558	
28%	2.25	5618	6225	91.51	1350	0.408	5.58	16.95	103.95	101	7.43	1690	0.23	8.24	45.0	920	62,602	56,378	
30%	2.41	4863	5241	77.04	1430	0.404	4.75	14.87	103.95	102	6.30	1759	0.22	8.46	45.0	914	62,207	56,966	
35%	2.81	2977	3920	57.63	1488	0.398	3.60	12.01	103.95	102	4.76	1854	0.52	8.98	45.0	906	61,601	57,681	
40%	3.21	1616	2297	33.76	1569	0.391	2.15	8.38	103.95	103	2.82	1974	0.49	9.47	45.0	894	60,821	58,525	
45%	3.62	1070	1343	19.74	1670	0.386	1.27	6.18	103.95	103	1.66	2047	0.47	9.94	45.0	887	60,356	59,013	
50%	4.02	524	797	11.72	1732	0.384	0.76	4.90	103.95	103	0.99	2089	0.46	10.41	45.0	883	60,074	59,277	
55%	4.42	-45	240	3.52	1768	0.381	0.23	3.57	103.95	103	0.30	2133	0.45	10.86	45.0	879	59,774	59,534	
60%	4.82	-767	-406	4.83	1805	0.382	0.31	3.79	103.95	103	0.41	2126	0.46	11.32	45.0	879	73,901	73,495	
70%	5.62	-1901	-1334	15.87	1799	0.385	1.03	5.56	103.95	103	1.34	2067	0.94	12.25	45.0	886	74,414	73,080	
80%	6.43	-2698	-2299	27.36	1749	0.389	1.75	7.38	103.95	103	2.29	2007	0.96	13.22	45.0	892	74,926	72,629	
90%	7.23	-3279	-2988	35.56	1698	0.392	2.26	8.65	103.95	103	2.97	1965	0.99	14.20	45.1	896	75,276	72,288	
100%	8.03	-3366	-3322	39.54	1663	0.393	2.50	9.26	103.95	102	3.29	1945	1.00	15.20	45.1	898	75,433	72,110	
UNW	--	--	*51054*	*750.49*	*117*	*0.383*	*48.78*	107.80	103.95	86	*74.74*	138	--	--	--	*750*	51,054	(0)	
Screen	--	--	*34535*	*507.66*	---	*0.400*	31.59	*172.00*	103.95	76	*56.98*	334	--	*63.8*	*106.3*	*556*	37,812	3,277	
w/filter	--	--	*34535*	*507.66*	*504*	*0.441*	28.65	70.03	103.95	93	*45.49*	595	--	*35.8*	*70.6*	*834*	56,736	22,201	
Valve:	23MOV-14, dynamic open with blowdown model																		

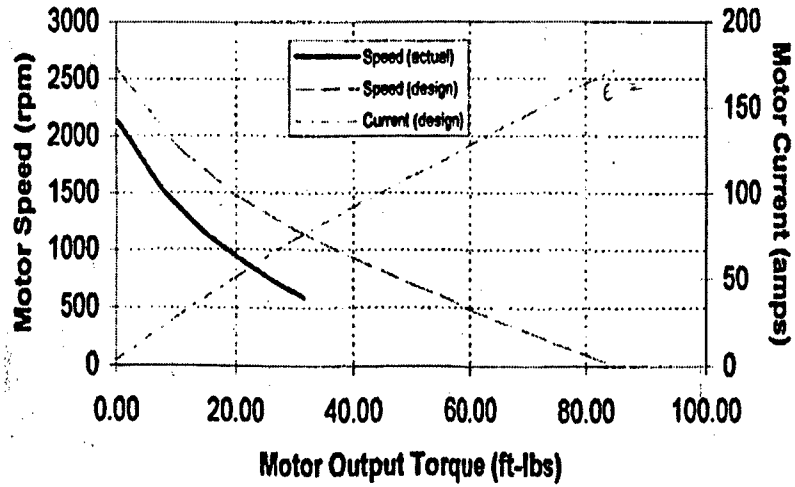
Stem Thrust vs. Stroke Position



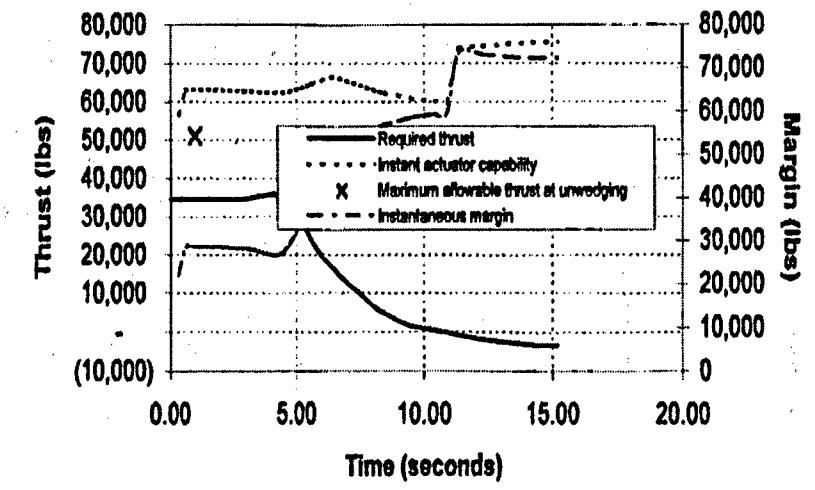
Valve Stroke Position and Temperature vs. Time



Motor Speed and Current vs. Output Torque



Required Thrust and Instantaneous Actuator Capability vs. Time



FOR REFERENCE ONLY

SYS/ VALVE NO. 23MOV160
Q.A. CAT. 1 EQ

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
23MOV160	HPCI Steam Supply OutBrd ISOL Valve			
MANUFACTURER	BMCC-6	ESK	SE	COMP. LOCATION & ELEVATION
Peerless	0A1	11AK	10AG	Drywell Entrance East Side stairs
H.P./ TORQUE	TYPE	MODEL NO.		
4.332 60Ftlbs	Comp	order 22C546.08 SN VY62289		
VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125VDC	—	DC	SN VY62289		
AMP(L.R.)	SERV. FACTOR	DUTY	FRAME		
174		5min	~~RH~~		
AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS		
34	1900	115°C	RH		
OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
DD31A7863P002	K21.3B				

TOTAL STEM TRAVEL	INCHES OR TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES 9 TURNS ____			8½	3	8½	0

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. A.D	TYPE SB-1	NO.	RECOMMENDED: OPEN ~~3~~ 2.25 CLOSE ~~3~~ 2.25
TYPE Gate	SER. NO. L477017	BKR. AMPS 70	MAX: OPEN 2.25 ~~3~~ CLOSE 2.25 ~~3~~ 12/5
SIZE 10"	ORDER NO.	CONTACTOR SIZE 2	STOP PLATE IN PLACE (YES) 2.25 NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

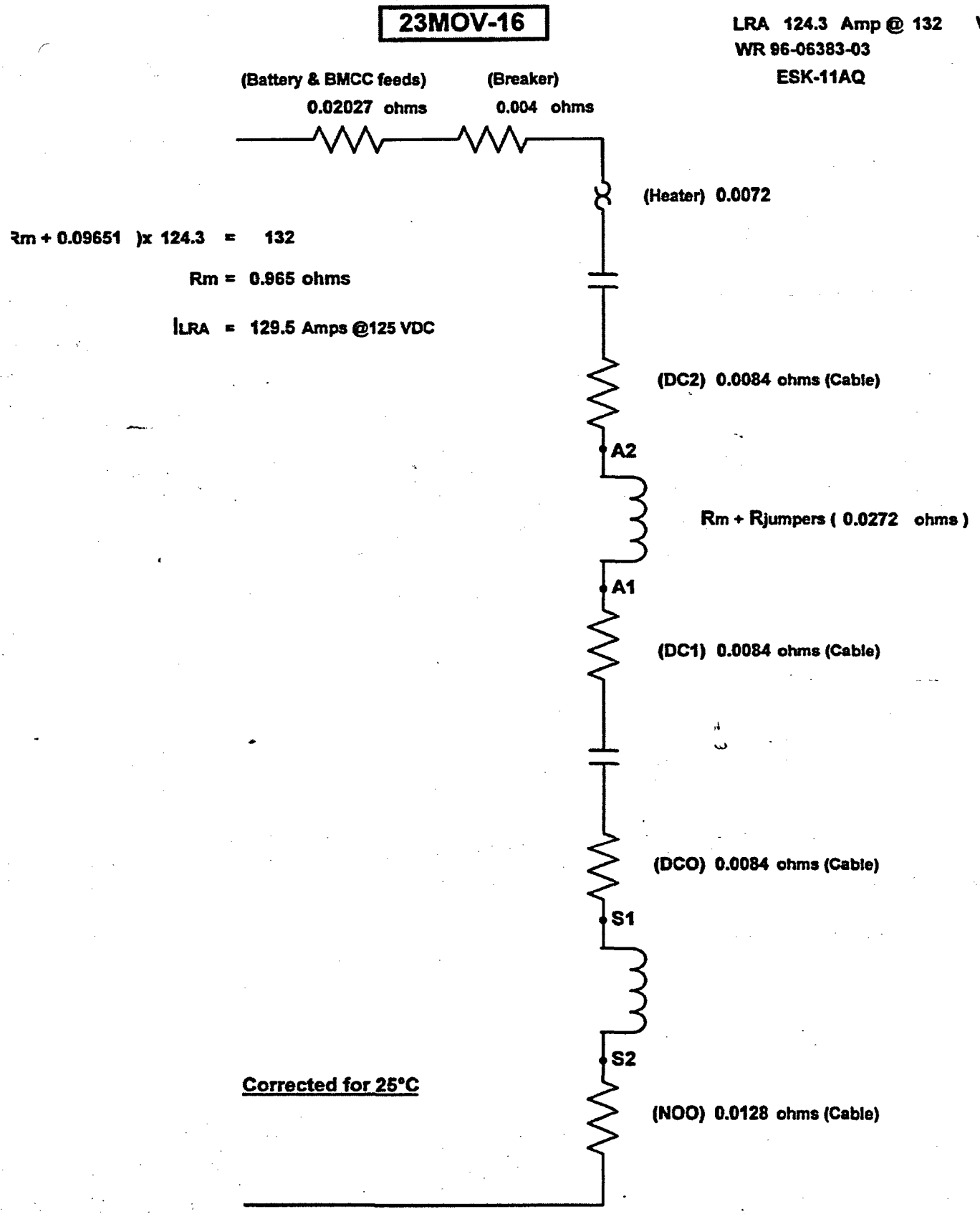
RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	22	22		9	9	LIMITORQUE	C-1 Outside understair
							C17 inside
AMPS F.L. AT TORQUE TRIP		87	TORQUE SWITCH SETTING	1.75	1.75	MCC	C 14

BRAKE INFO, BOLTING TORQUE, MISC INFO Rd:0 90:15 Compartment L.S. A Gasket Non Asbestos
5/16" allen head / Lim. + Switch Cover
1/2" allen head / Bonnet bolts
LIMIT CLOSED ... REVERSE TO NORMAL (RIGHT SIDE OPENS FOR CLOSE)
... SIDE OPENS FOR OPEN)

23MOV-16

Date	Inrush	O/C	Battery Voltage	Votes Test No.	Stroke Time	WR Number	Notes
2/1/95	114.5	C	129.5	13	10.0	94-08470-05	Battery voltage from weekly ST
2/1/95	110.6	O	129.5	13	9.4	94-08470-05	Battery voltage from weekly ST
2/1/95	114.5	C	129.5	14	10.0	94-08470-05	Battery voltage from weekly ST
2/1/95	111.1	O	129.5	14	9.5	94-08470-05	Battery voltage from weekly ST
3/18/95	115.0	C	129.5	24	10.0	94-08470-18	
3/18/95	111.2	O	129.5	24	9.3	94-08470-18	
12/5/96	124.3	C	132.0	1	9.6	96-06383-03	
12/5/96	119.4	O	132.0	1	9.2	96-06383-03	
12/5/96	122.8	C	132.0	5	9.4	96-06383-03	
12/5/96	120.4	O	132.0	5	9.1	96-06383-03	
11/11/98	120.4	C	132.5	5	9.0	98-05000-02	
11/11/98	117.5	O	132.5	5	8.7	98-05000-02	
11/11/98	119.9	C	132.5	4	9.0	98-05000-02	For repeatability
11/11/98	117.9	O	132.5	4	8.8	98-05000-02	
11/3/00	116.5	C	132.0	17	8.6	99-05715-06	
11/3/00	114.0	O	132.0	17	8.4	99-05715-06	
Operator was replaced in 1995							

23MOV-16 Votes Tests Data



23MOV-16 Inrush Current

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/02, 1:07 PM

Select Valve--> 23MOV-16, dynamic open with blowdown model

General Information	Required?	Value
Valve Type	yes	double disk
Flow type	yes	blowdown
Stroke direction	yes	open
Fluid (blowdown only)	yes	steam
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	2.500
Seat ring face ID, $D_{body-ID}$ (inches)	yes	8.034
Seat ring inner diameter, D_{sr} (inches)	no	7.909
Globe valve stroke length, D (inches)	no	9.750
Isolation-to-wedging travel, X (percent)	yes	10.00%
Packing load, F_{pack} (lbs)	yes	2,500
Required thrust (including water inertia), F_R (lbs)	yes	6,019
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	no	1
Actuator overall ratio, OAR	yes	40.18
Motor gear set ratio, MGSR	yes	0.846
Actuator rated torque, τ_{rated}	yes	850
Stem factor, SF (ft-lbs/lb)	yes	0.01470
Overhauling stem factor, SF_O (ft-lbs/lb)	yes	0.01190
Voltage at MCC, V_{mcc} (volts)	yes	99.02
Cable resistance, R_{cable} (ohms)	yes	0.0715
Thermal overload resistance, R_{ol} (ohms)	yes	0.0112
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	60 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	1.000
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.50
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	no	0
Valve pressure at full open, P_s (psig)	yes	1120
Flow rate, Q_{max} (gpm)	no	0
Fluid density, ρ (lbs/ft^3)	no	2.786
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	yes	200
Calculated Values		
System resistance, K_{sys}	no	—
Fully open stem thrust, F_O (lbs)	yes	-2,998
Nominal motor torque, τ_{nom} (ft-lbs)	yes	74.7
Maximum motor torque (ft-lbs)	yes	5.9
Maximum adjusted motor torque (ft-lbs)	yes	8.0
Minimum motor speed (rpm)	yes	1598
Minimum instantaneous actuator capability (lbs)	yes	57,978
Minimum instantaneous margin (lbs)	yes	54,315
Maximum allowable thrust at unwedging	yes	53,237
Efficiency at minimum instantaneous capability	yes	0.380

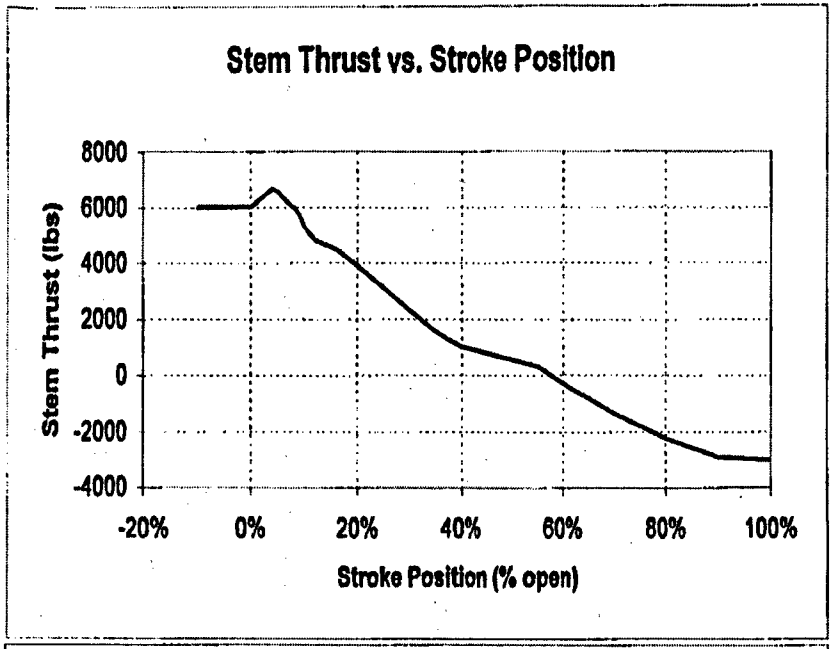
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

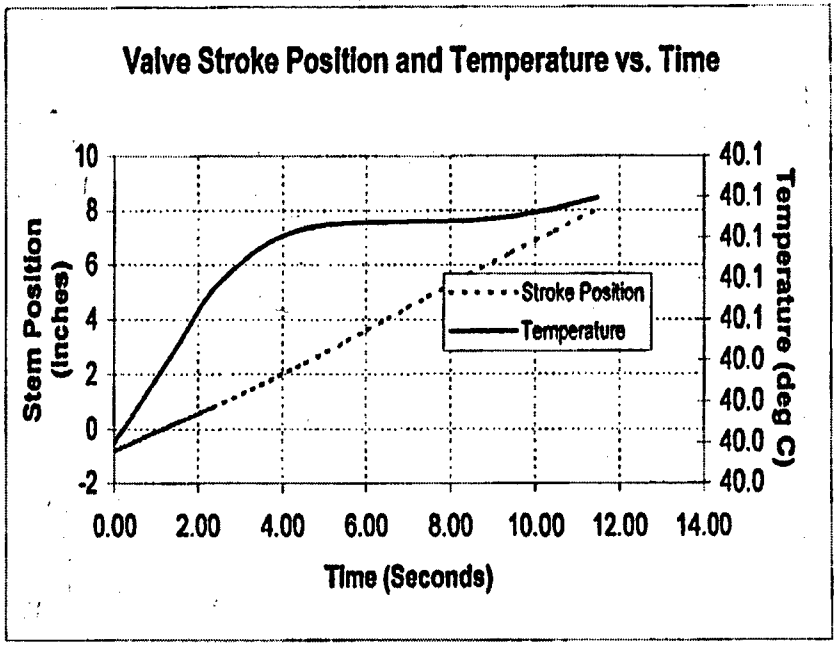
Warnings

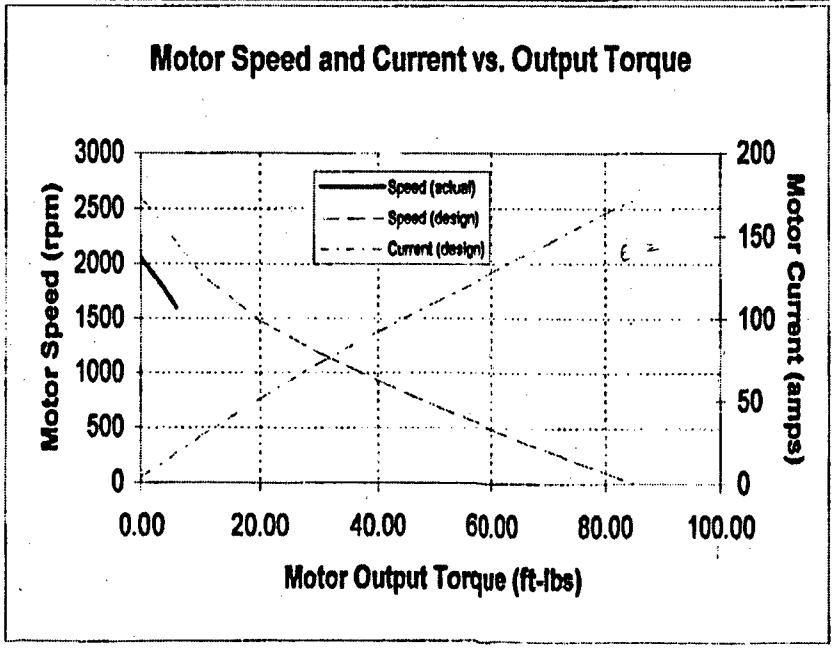
Predicted Stroke Time (Seconds): 11.48

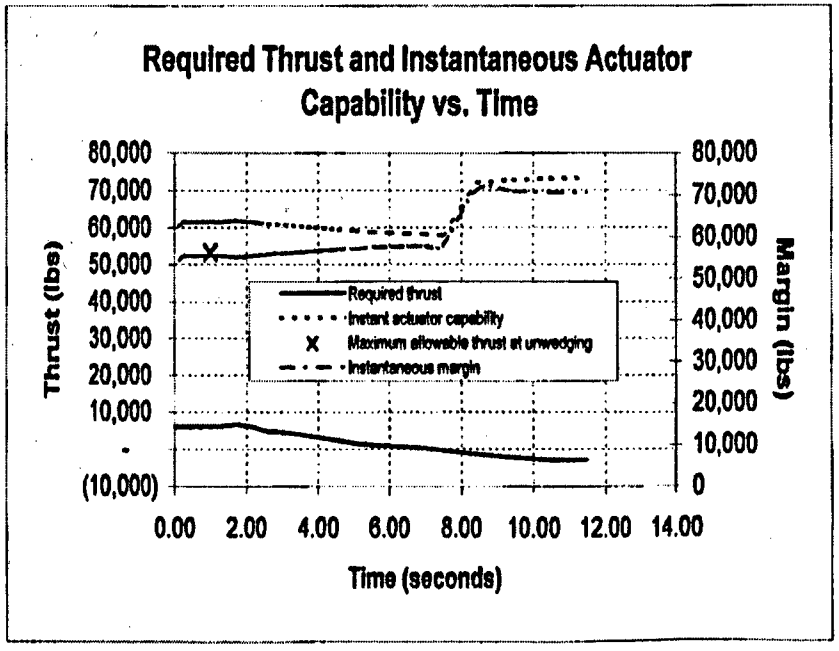
BWROG DCM for B Battery (batch), Version 2.0.xls, Results, 9/16/02, 1:07 PM

Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	α
-10%	-0.80	6019												0.00	40.0				"
-9%	-0.72	6019	6019	88.48		0.400	5.51	16.76	99.02	98	7.46	1629	0.12	0.12	40.0	887	60,334	54,315	"
-8%	-0.64	6019	6019	88.48	1378	0.407	5.41	16.52	99.02	98	7.33	1636	0.12	0.24	40.0	903	61,410	55,391	"
-7%	-0.56	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.32	1636	0.12	0.36	40.0	903	61,415	55,396	"
-6%	-0.48	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.32	1636	0.12	0.47	40.0	903	61,414	55,395	"
-5%	-0.40	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.32	1636	0.12	0.59	40.0	903	61,414	55,395	"
-4%	-0.32	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.32	1636	0.12	0.71	40.0	903	61,413	55,394	"
-3%	-0.24	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.32	1636	0.12	0.83	40.0	903	61,412	55,393	"
-2%	-0.16	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.33	1636	0.12	0.95	40.0	903	61,411	55,392	"
-1%	-0.08	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.33	1636	0.12	1.07	40.0	903	61,410	55,391	"
0%	-0.01	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.33	1636	0.11	1.17	40.0	903	61,410	55,391	"
0%	0.00	6019	6019	88.48	1385	0.407	5.41	16.52	99.02	98	7.33	1636	0.01	1.18	40.0	903	61,409	55,390	"
1%	0.08	6180	6099	89.66	1385	0.407	5.48	16.69	99.02	98	7.42	1631	0.12	1.30	40.0	903	61,455	55,355	"
2%	0.16	6341	6260	92.03	1380	0.406	5.61	17.03	99.02	98	7.60	1621	0.12	1.42	40.0	905	61,541	55,280	"
3%	0.24	6502	6421	94.39	1371	0.409	5.75	17.37	99.02	98	7.79	1610	0.12	1.54	40.0	906	61,622	55,201	"
4%	0.32	6662	6582	96.76	1363	0.409	5.88	17.70	99.02	98	7.97	1600	0.12	1.66	40.1	907	61,702	55,120	"
5%	0.40	6571	6617	97.26	1354	0.410	5.91	17.78	99.02	98	8.01	1598	0.12	1.79	40.1	907	61,711	55,094	"
6%	0.48	6342	6457	94.91	1352	0.409	5.78	17.44	99.02	98	7.83	1608	0.12	1.91	40.1	906	61,617	55,161	"
7%	0.56	6148	6245	91.80	1361	0.408	5.60	17.00	99.02	98	7.59	1621	0.12	2.02	40.1	904	61,506	55,261	"
8%	0.64	5989	6068	89.20	1372	0.407	5.45	16.63	99.02	98	7.38	1633	0.12	2.14	40.1	903	61,417	55,349	"
9%	0.72	5742	5865	86.22	1382	0.406	5.28	16.20	99.02	98	7.15	1648	0.12	2.26	40.1	901	61,311	55,446	"
10%	0.80	5290	5516	81.08	1393	0.405	4.98	15.46	99.02	98	6.74	1669	0.12	2.38	40.1	898	61,122	55,606	"
12%	0.96	4808	5049	74.22	1412	0.403	4.58	14.46	99.02	98	6.20	1700	0.23	2.61	40.1	895	60,871	55,822	"
14%	1.12	4652	4730	69.53	1439	0.402	4.31	13.77	99.02	98	5.82	1721	0.23	2.83	40.1	892	60,708	55,978	"
16%	1.29	4497	4575	67.25	1457	0.401	4.17	13.44	99.02	98	5.64	1732	0.22	3.05	40.1	891	60,631	56,056	"
18%	1.45	4206	4351	63.96	1465	0.400	3.98	12.95	99.02	98	5.37	1747	0.22	3.28	40.1	889	60,506	56,155	"
20%	1.61	3891	4049	59.51	1476	0.399	3.72	12.29	99.02	98	5.01	1767	0.22	3.49	40.1	887	60,338	56,289	"
22%	1.77	3577	3734	54.89	1495	0.397	3.44	11.60	99.02	98	4.64	1789	0.22	3.71	40.1	884	60,164	56,430	"
24%	1.93	3262	3419	50.27	1514	0.396	3.16	10.90	99.02	98	4.26	1810	0.21	3.93	40.1	882	59,989	56,589	"
26%	2.09	2948	3105	45.64	1532	0.394	2.88	10.20	99.02	98	3.88	1832	0.21	4.14	40.1	879	59,812	56,767	"
28%	2.25	2636	2792	41.04	1550	0.393	2.60	9.50	99.02	98	3.50	1854	0.21	4.35	40.1	877	59,634	56,842	"
30%	2.41	2328	2482	36.48	1568	0.392	2.32	8.80	99.02	98	3.12	1875	0.21	4.55	40.1	874	59,456	56,974	"
35%	2.81	1558	1943	28.56	1587	0.389	1.83	7.57	99.02	98	2.46	1913	0.51	5.06	40.1	869	59,138	57,195	"
40%	3.21	1007	1283	18.85	1619	0.388	1.22	6.04	99.02	99	1.63	1960	0.49	5.55	40.1	864	58,745	57,483	"
45%	3.62	794	900	13.24	1659	0.384	0.86	5.14	99.02	99	1.15	1988	0.49	6.04	40.1	860	58,518	57,818	"
50%	4.02	581	687	10.11	1682	0.383	0.66	4.64	99.02	99	0.88	2004	0.48	6.52	40.1	858	58,389	57,702	"
55%	4.42	319	450	6.62	1696	0.382	0.43	4.08	99.02	99	0.58	2021	0.48	7.00	40.1	856	58,243	57,793	"
60%	4.82	-270	25	0.36	1710	0.380	0.02	3.06	99.02	99	0.03	2053	0.47	7.47	40.1	852	57,978	57,954	"
70%	5.62	-1321	-795	9.46	1737	0.383	0.61	4.54	99.02	99	0.82	2007	0.97	8.44	40.1	858	72,102	71,307	"
80%	6.43	-2235	-1778	21.16	1698	0.387	1.36	6.40	99.02	98	1.83	1949	0.99	9.43	40.1	865	72,709	70,931	"
90%	7.23	-2900	-2567	30.55	1649	0.390	1.95	7.87	99.02	98	2.62	1904	1.02	10.45	40.1	871	73,179	70,612	"
100%	8.03	-2998	-2949	35.09	1611	0.391	2.23	8.58	99.02	98	3.00	1882	1.03	11.48	40.1	873	73,393	70,445	"
UNW	—	—	*53237*	*782.59*	*122*	*0.384*	*50.76*	*111.37*	*99.02*	*90*	*74.74*	*144*	—	—	"	*783*	*53,237*	*0*	"
Screen	—	—	*6019*	*88.48*	—	*0.400*	*5.51*	*172.00*	*99.02*	*85*	*8.90*	*1347*	—	*15.8*	*40.5*	*769*	*52,305*	*46,286*	"
wfter	—	—	*6019*	*88.48*	*1384*	*0.407*	*5.41*	*16.52*	*99.02*	*98*	*7.34*	*1636*	—	*13.0*	*40.4*	*902*	*61,328*	*55,309*	"
Valve:	23MOV-16, dynamic open with blowdown model																		









Valve: 23MOV-16, dynamic open with blowdown model

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/02, 1:30 PM

Select Valve—> 23MOV-16, dynamic close with blowdown model

General Information	*Required?*	*Value*
Valve Type	yes	double disk
Flow type	yes	blowdown
Stroke direction	yes	close
Fluid (blowdown only)	yes	steam
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	2.000
Seat ring face ID, $D_{body-ID}$ (inches)	yes	8.034
Seat ring inner diameter, D_{si} (inches)	no	7.909
Globe valve stroke length, D (inches)	no	9.750
Isolation-to-wedging travel, X (percent)	yes	10.00%
Packing load, F_{pack} (lbs)	yes	2,500
Required thrust (including water inertia), F_R (lbs)	yes	6,019
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	no	1
Actuator overall ratio, OAR	yes	40.18
Motor gear set ratio, MGSR	yes	0.846
Actuator rated torque, τ_{rated}	yes	850
Stem factor, SF (ft-lbs/lb)	yes	0.01470
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.01190
Voltage at MCC, V_{mcc} (volts)	yes	103.69
Cable resistance, R_{cable} (ohms)	yes	0.0715
Thermal overload resistance, R_{tol} (ohms)	yes	0.0112
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	60 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	1.000
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.50
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	no	0
Valve pressure at full open, P_s (psig)	yes	1120
Flow rate, Q_{max} (gpm)	no	0
Fluid density, ρ (lbs/ft^3)	no	2.786
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	yes	200
Calculated Values		
System resistance, K_{sys}	no	—
Fully open stem thrust, F_O (lbs)	yes	6,019
Nominal motor torque, τ_{nom} (ft-lbs)	yes	74.7
Maximum motor torque (ft-lbs)	yes	5.5
Maximum adjusted motor torque (ft-lbs)	yes	7.1
Minimum motor speed (rpm)	yes	1726
Minimum instantaneous actuator capability (lbs)	yes	63,220
Minimum instantaneous margin (lbs)	yes	57,201
Maximum allowable thrust at torque switch trip	yes	55,867
Efficiency at minimum instantaneous capability	yes	0.400

Warnings

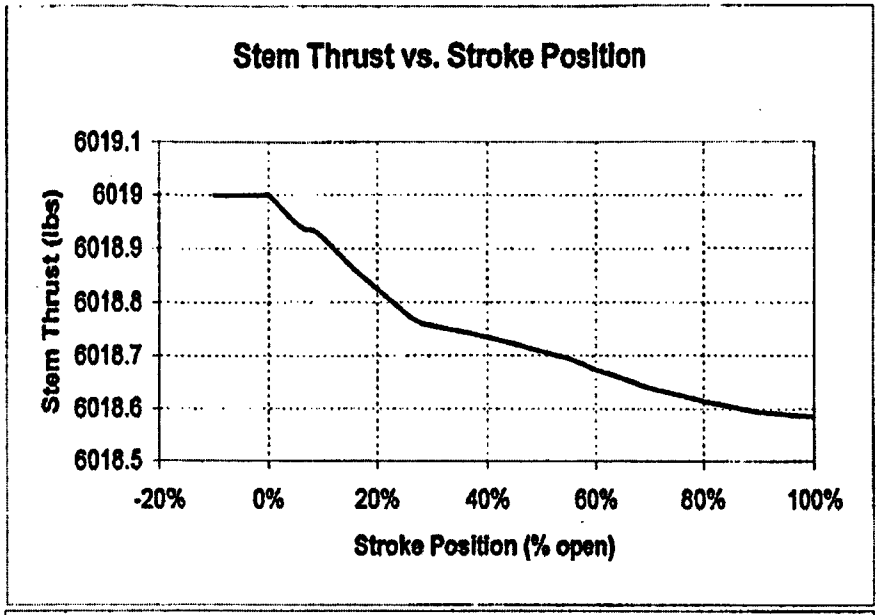
Predicted Stroke Time (Seconds): **12.29**

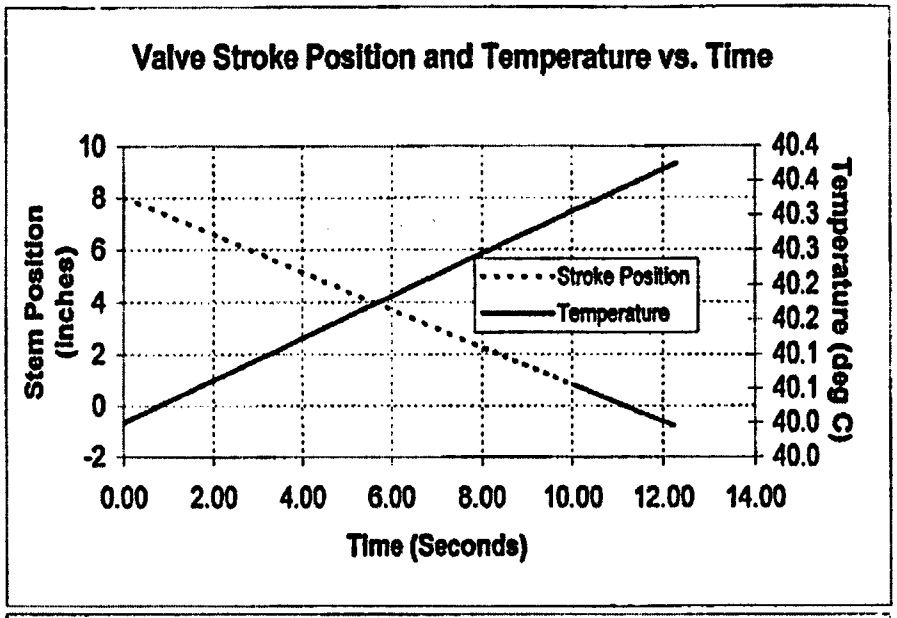
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

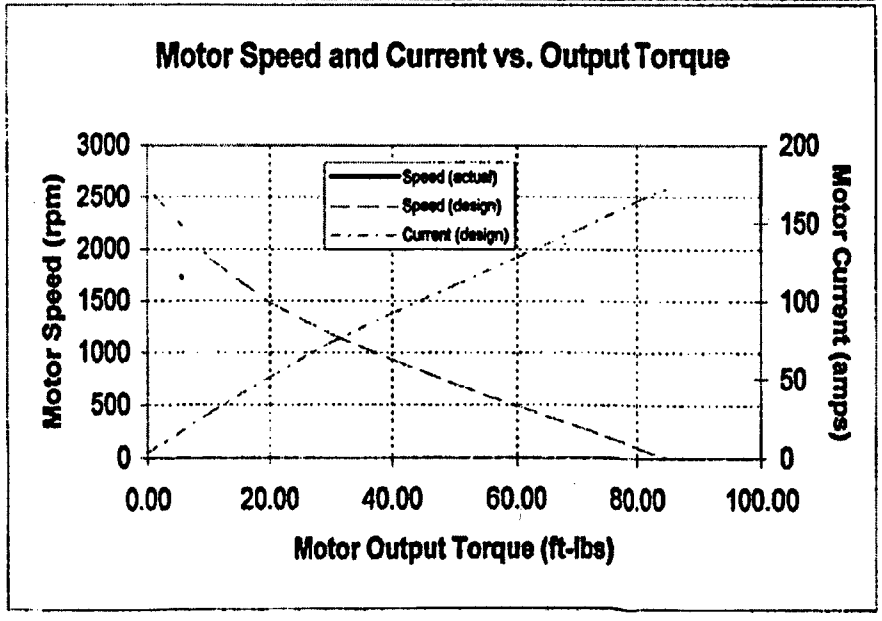
BWROG DCM for B Battery (batch), Version 2.0.xls, Results, 9/16/02, 1:30 PM

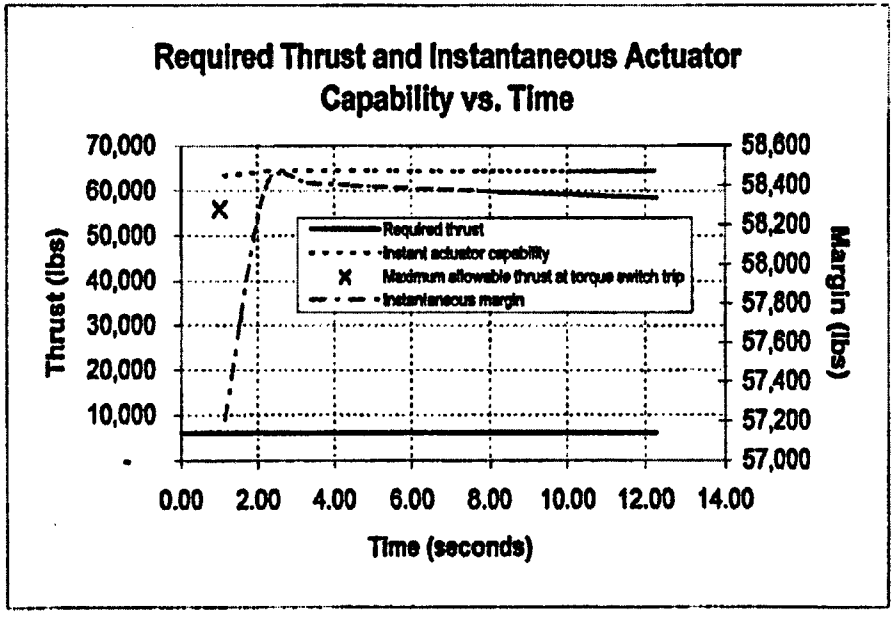
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
100%	8.03	6019												0.00	40.0				
90%	7.23	6019	6019	88.47		0.400	5.50	16.76	103.69	102	7.11	1726	1.12	1.12	40.0	929	63,220	57,201	
80%	6.43	6019	6019	88.47	1461	0.408	5.40	16.51	103.69	102	6.98	1734	1.12	2.24	40.1	947	64,427	58,408	
70%	5.62	6019	6019	88.47	1467	0.408	5.40	16.50	103.69	102	6.98	1734	1.12	3.36	40.1	947	64,426	58,406	
60%	4.82	6019	6019	88.47	1467	0.408	5.40	16.50	103.69	102	6.98	1734	1.12	4.47	40.1	947	64,418	58,400	
55%	4.42	6019	6019	88.47	1467	0.408	5.40	16.50	103.69	102	6.98	1734	0.56	5.03	40.2	947	64,410	58,391	
50%	4.02	6019	6019	88.47	1467	0.408	5.40	16.50	103.69	102	6.98	1734	0.56	5.59	40.2	947	64,406	58,387	
45%	3.62	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.98	1734	0.56	6.15	40.2	947	64,402	58,383	
40%	3.21	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.98	1734	0.56	6.71	40.2	947	64,398	58,379	
35%	2.81	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.56	7.27	40.2	947	64,394	58,375	
30%	2.41	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.56	7.82	40.2	947	64,390	58,371	
28%	2.25	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	8.05	40.2	946	64,388	58,367	
26%	2.09	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	8.27	40.3	946	64,385	58,366	
24%	1.93	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	8.49	40.3	946	64,383	58,364	
22%	1.77	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	8.72	40.3	946	64,381	58,363	
20%	1.61	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	8.94	40.3	946	64,380	58,361	
18%	1.45	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	9.16	40.3	946	64,378	58,359	
16%	1.29	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	9.39	40.3	946	64,377	58,358	
14%	1.12	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	9.61	40.3	946	64,375	58,356	
12%	0.96	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	9.84	40.3	946	64,373	58,355	
10%	0.80	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.22	10.06	40.3	946	64,372	58,353	
9%	0.72	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	10.17	40.3	946	64,370	58,351	
8%	0.64	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	10.28	40.3	946	64,369	58,351	
7%	0.56	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	10.39	40.3	946	64,369	58,350	
6%	0.48	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	10.51	40.3	946	64,368	58,349	
5%	0.40	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	10.62	40.3	946	64,367	58,348	
4%	0.32	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	10.73	40.3	946	64,366	58,347	
3%	0.24	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	10.84	40.3	946	64,365	58,347	
2%	0.16	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	10.95	40.3	946	64,365	58,346	
1%	0.08	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	11.06	40.3	946	64,364	58,345	
0%	0.00	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	11.18	40.3	946	64,363	58,344	
0%	-0.01	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.01	11.19	40.3	946	64,362	58,343	
-1%	-0.08	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.10	11.29	40.3	946	64,362	58,343	
-2%	-0.16	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	11.40	40.3	946	64,361	58,342	
-3%	-0.24	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	11.51	40.4	946	64,361	58,342	
-4%	-0.32	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	11.62	40.4	946	64,360	58,341	
-5%	-0.40	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	11.73	40.4	946	64,359	58,340	
-6%	-0.48	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	11.85	40.4	946	64,358	58,339	
-7%	-0.56	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	11.96	40.4	946	64,357	58,338	
-8%	-0.64	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	12.07	40.4	946	64,357	58,338	
-9%	-0.72	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	12.18	40.4	946	64,356	58,337	
-10%	-0.80	6019	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	0.11	12.29	40.4	946	64,355	58,336	
TST	—	—	55867	821.24	127	0.385	53.13	115.63	103.69	94	74.74	151	—	—	—	821	55,867	0	
Screen	—	—	6019	88.48	—	0.400	5.51	172.00	103.69	89	8.43	1444	—	14.6	40.5	811	55,193	49,174	
w/ter	—	—	6019	88.48	1467	0.408	5.40	16.50	103.69	102	6.99	1734	—	12.3	40.4	946	64,355	58,336	
Valve:	23MOV-16, dynamic close with blowdown model																		

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 9/16/02, 1:30 PM









Valve: 23MOV-16, dynamic close with blowdown model

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
23MOV19	HPCI Discharge To Inboard Isol.			
MANUFACTURER	**MCC**	**ESK**	**SE**	**COMP. LOCATION & ELEVATION**
PEERLES-WINSMITH	BMCC 6	11AL	10AJ	TOP OF TORUS (North)

H.P./TORQUE	TYPE	MODEL NO.
10.83 150 ST / 150 Lr 30 RUN	Compound	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125	DC		TR04841		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
~~450~~ 810		5 MIN	D225
AMP.(F.L.)	**RPM**	**TEMP. RISE**	**INSUL. CLASS**
~~76~~ 80	1900	115°C	RH

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124G011	~~F104C~~		300		

TOTAL STEM TRAVEL F43.0B	INCHES OR TURNS FROM FULL CLOSED (INCHES circled) ROTORS	1	2	3	4
INCHES 12½" TURNS ____		11½	4½	11½	FC

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. LIMITORQUE	TYPE SB-3	NO. HPIB04	RECOMMENDED: OPEN ~~2⅞~~ 2 CLOSE ~~2½~~ 2
TYPE GATE	SER. NO. L396684	BKR. AMPS 125	MAX: OPEN 3¼ CLOSE 3¼
SIZE 14"	ORDER NO. 11011901	CONTACTOR SIZE DC 3	STOP PLATE IN PLACE (YES) ~~2½ BK~~ 3.25 NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

	OPEN	CLOSE		OPEN	CLOSE	PLANT COMM JACKS	
RUNNING AMPS F.L.	39	32	OPERATING TIME MIN/(SEC)	20	20	LIMITORQUE	Drop thru Floor C-14
AMPS F.L. AT TORQUE TRIP	170	170	TORQUE SWITCH SETTING	1.5	1.5	BMCC-6	C-14

BRAKE INFO, BOLTING TORQUE, MISC INFO RAT 25.76

Cover Bolts 3/4"

FOR REFERENCE ONLY

LIMITORQUE CORPORATION
P.O. Box 11318, Lynchburg, VA 24506
CERTIFIED INFORMATION SHEET — ELECTRIC ACTUATOR

Limitorque Order No.	110119.01				
Customer Name	N.Y. Power Authority				
Customer P.O. No.	86-6500	S.O. No.			
Unit Type & Size	SB-3	Motor 150 Ft. Lbs.		Suitable for	Volts
DC Phase		Cycle 125	Volts	1900 RPM	
Approximate Amps Full Load	80	Approximate Amps Locked Rotor	810	Approximate H.P.	10.86
Unit Enclosure	☐ Weatherproof	☐ Submersible (	ft. Head for	hrs.)	
☐ Explosionproof	Class	Group(s)	Div.	☒ Nuclear	
Outline Drawing:	02-416-0004-4				
Wiring Diagram:	15-477-1941-3				
Limit Switch Compartment Heater	120 volt 50 watt	Motor Heater	N/S volt	watt	
Control Compartment Heater	☒ not supplied	☐ supplied	volt	watt	
Mechanical Dial Position Indicator	☒ not supplied	☐ supplied			
Spur or Bevel Gear Attachment	☒ not supplied	☐ supplied	Ratio		
Handwheel Diameter	inches (If other than standard)	☐ with spinner			
Position ☐ A	☐ B supplied	(Applies to Electric/Manual Combinations only)			

Tagging and Remarks:

Inside Containment, safety related, qualified by Limitorque Qualification Report #B0009.

In accordance with the actuator qualification, motor "T" drains must be field installed in place of the two lowest motor drain plugs. Motor "T" drains are tagged and located in the limit switch compartment on shipment from Limitorque.

We recommend the use of a 500 OHM, 50 Watt field discharge resistor.

Torque switch settings/Torque= 2/41800#, 3 3/4 / 807036#

ENCLOSED: (3) PRINTS (1) SEPIA (Sent Under Separate Covers)

All drawings and information listed above are certified for construction. Please advise us at once should you require any changes or corrections, as we are proceeding to manufacture in accordance with the above information.

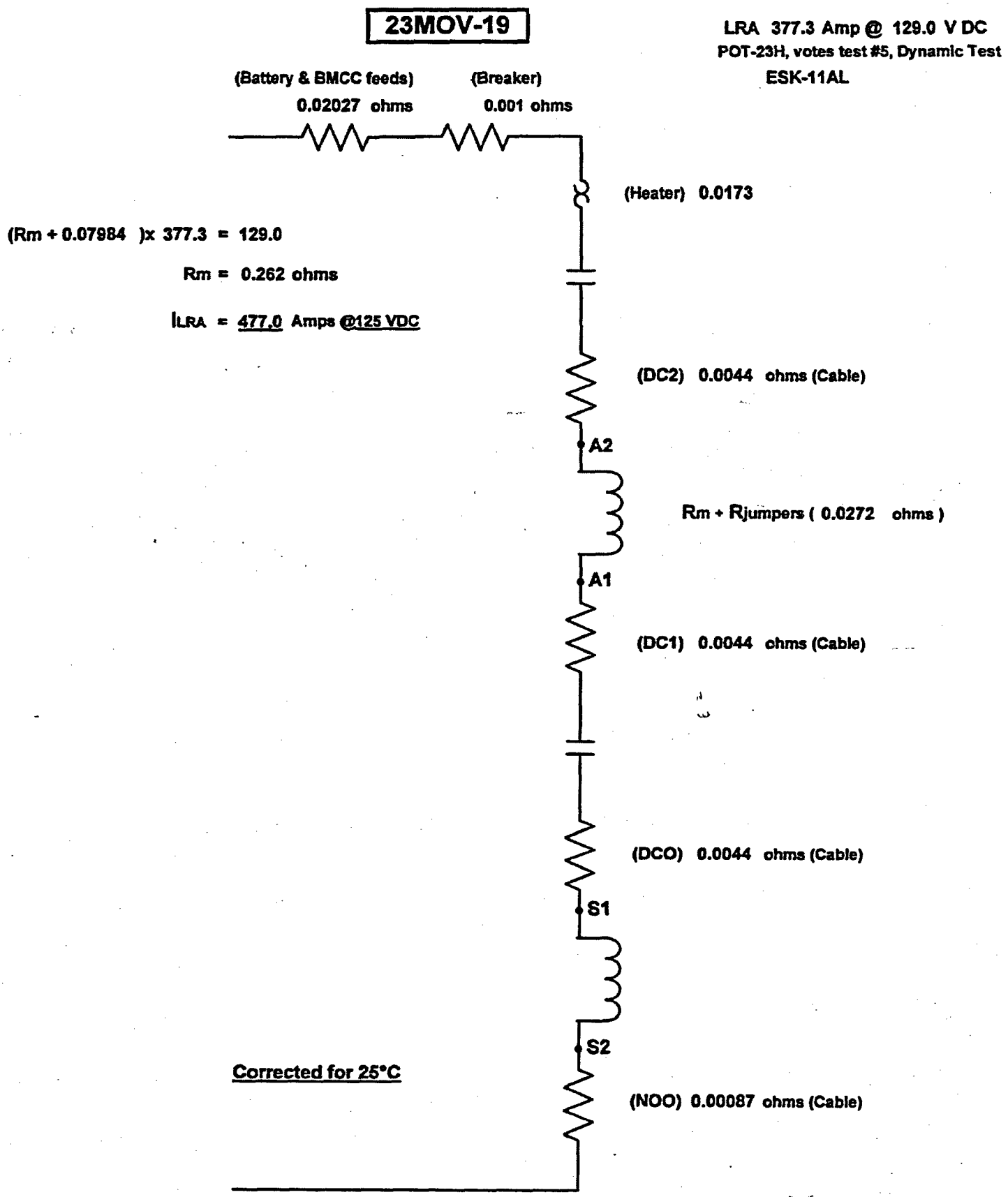
Limitorque Certification Department Name *(signature)*	Date	FEB 03 1987	Revision A Date	3/5/87	By *(signature)*

[RELEASE] L-69

23MOV-19

Date	Inrush	O/C	Battery Voltage	Votes Test No.	Stroke Time	WR Number	Notes
9/1/92	320.2	C	129.3	1	18.7	23/108052	Inrush considered an anomoly
9/1/92	319.6	O	129.3	1	17.7	23/108052	Inrush considered an anomoly
11/22/92	376.8	C	129.0	4	18.4	23/108052	
11/22/92	362.1	O	129.0	4	17.4	23/108052	
11/22/92	**377.3**	**C**	**129.0**	**5**	**18.5**	**POT-23H**	**Dynamic Votes Test (Hydro)**
11/22/92	360.2	O	129.0	5	17.5	POT-23H	Dynamic Votes Test (Hydro)
11/22/92	342.6	C	~117.6	6	**21.0**	POT-23H	Degraded Voltage Test & Dynamic
11/22/92	329.4	O	~117.6	6	20.0	POT-23H	Degraded Voltage Test & Dynamic
4/23/93	446.2	C	129.5	2	17.8	23/97737	Inrush considered an anomoly
4/23/93	363.6	O	129.5	2	17.3	23/97737	
10/30/98	360.2	C	~131	3	17.2	97-03247-00	repeatability test
10/30/98	365.1	O	~131	3	16.2	97-03247-00	repeatability test
10/30/98	354.3	C	~131	4	17.2	97-03247-00	
10/30/98	366.5	O	~131	4	16.2	97-03247-00	
11/12/98	373.4	C	132.6	7	16.5	97-03247-02	
11/12/98	373.9	O	132.6	7	15.9	97-03247-02	
11/12/98	371.4	C	132.6	8	16.5	97-03247-02	
11/12/98	366.1	O	132.6	8	15.8	97-03247-02	
Operator was replaced 9/92							

23MOV-19 Votes Tests Data



23MOV-19 Inrush Current

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/02, 1:40 PM

Select Valve--> 23MOV-19, dynamic open with pump flow

General Information	Required?	Value
Valve Type	yes	wedge gate
Flow type	yes	pumped flow
Stroke direction	yes	open
Fluid (blowdown only)	no	flashing water
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	2.250
Seat ring face ID, $D_{body-ID}$ (inches)	yes	11.500
Seat ring inner diameter, D_{sr} (inches)	yes	11.375
Globe valve stroke length, D (inches)	no	0.000
Isolation-to-wedging travel, X (percent)	yes	8.00%
Packing load, F_{pack} (lbs)	yes	2,500
Required thrust (including water inertia), F_R (lbs)	yes	84,901
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	no	1
Actuator overall ratio, OAR	yes	50.11
Motor gear set ratio, MGSR	yes	0.818
Actuator rated torque, τ_{rated}	yes	4,200
Stem factor, SF (ft-lbs/lb)	yes	0.02736
Overhauling stem factor, SF_O (ft-lbs/lb)	yes	0.00018
Voltage at MCC, V_{mcc} (volts)	yes	99.02
Cable resistance, R_{cable} (ohms)	yes	0.0474
Thermal overload resistance, R_{tol} (ohms)	yes	0.0184
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	150 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	1.000
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.55
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	yes	1224
Valve pressure at full open, P_s (psig)	yes	1223
Flow rate, Q_{max} (gpm)	yes	4250
Fluid density, ρ (lbs/ft^3)	yes	62.000
Ambient temperature (C)	yes	96
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	1020.8
Fully open stem thrust, F_O (lbs)	yes	-2,363
Nominal motor torque, τ_{nom} (ft-lbs)	yes	340.0
Maximum motor torque (ft-lbs)	yes	115.9
Maximum adjusted motor torque (ft-lbs)	yes	237.3
Minimum motor speed (rpm)	yes	444
Minimum instantaneous actuator capability (lbs)	yes	121,661
Minimum instantaneous margin (lbs)	yes	36,760
Maximum allowable thrust at unwedging	yes	101,918
Efficiency at minimum instantaneous capability	yes	0.400

Warnings

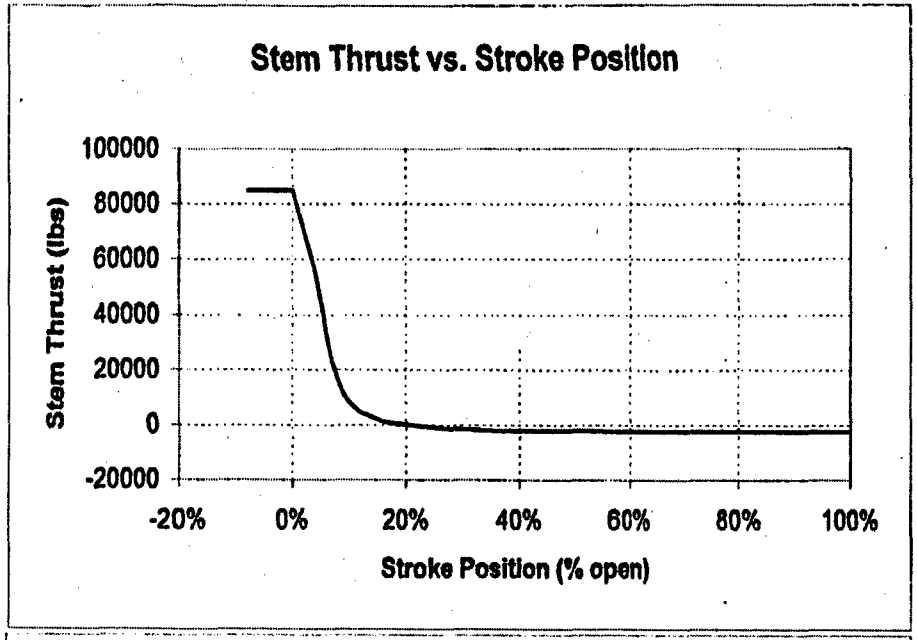
Predicted Stroke Time (Seconds): **26.07**

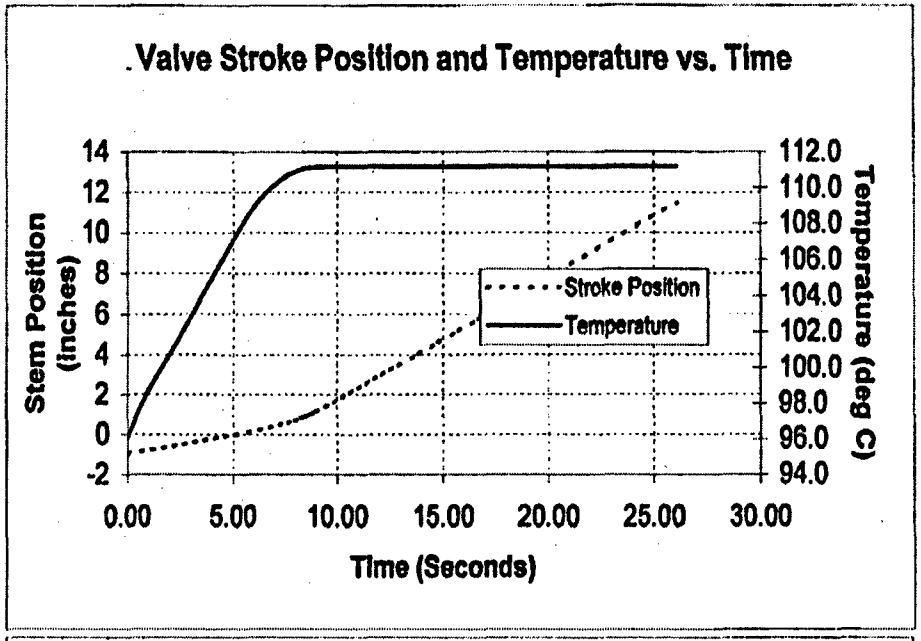
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

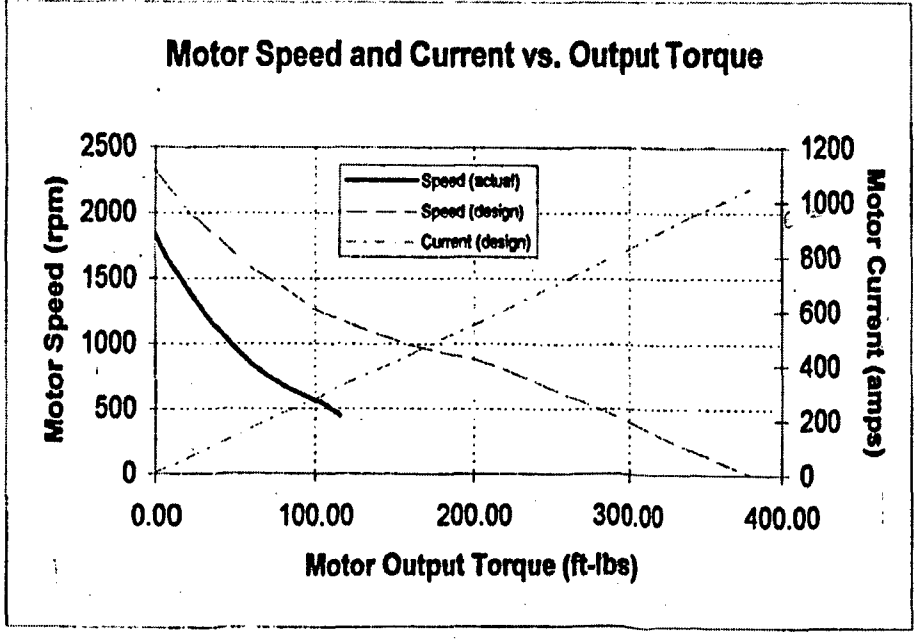
BWROG DCM for B Battery (batch), Version 2.0.xls, Results, 9/16/02, 1:40 PM

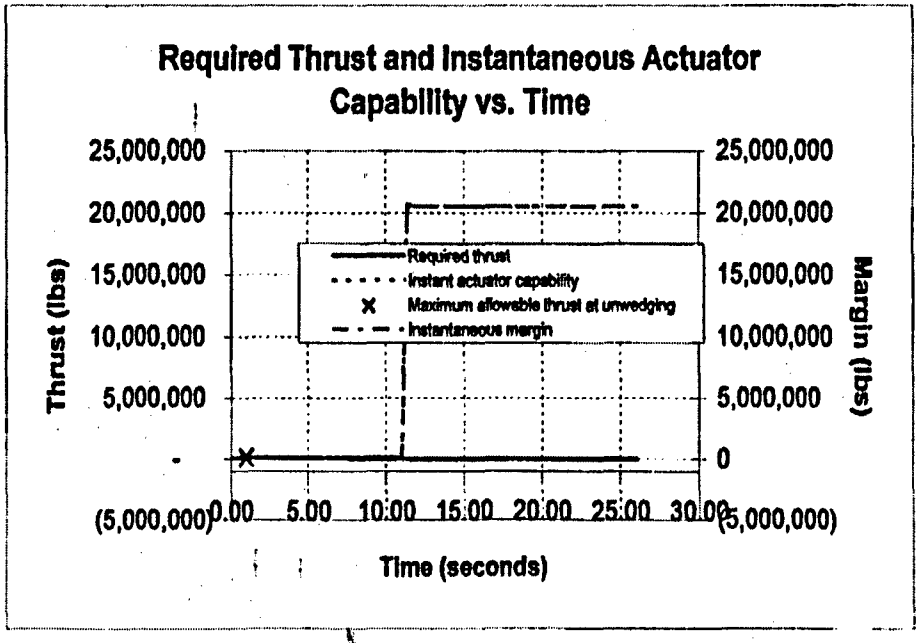
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
-8%	-0.92	84901												0.00	96.1				0
-7%	-0.83	84901	84901	2322.89		0.400	115.89	322.67	99.02	78	237.27	444	0.62	0.62	97.6	3,329	121,661	36,760	0
-6%	-0.74	84901	84901	2322.89	363	0.438	105.90	292.71	99.02	80	212.56	529	0.52	1.15	99.0	3,716	135,803	50,902	0
-6%	-0.64	84901	84901	2322.89	433	0.456	101.73	280.19	99.02	81	202.63	560	0.49	1.64	100.1	3,894	142,317	57,416	0
-5%	-0.55	84901	84901	2322.89	458	0.460	100.72	277.18	99.02	81	200.96	566	0.49	2.13	101.1	3,930	143,643	58,742	0
-4%	-0.46	84901	84901	2322.89	463	0.460	100.69	277.07	99.02	81	201.49	565	0.49	2.62	102.1	3,920	143,264	58,363	0
-3%	-0.37	84901	84901	2322.89	462	0.460	100.70	277.09	99.02	81	202.12	563	0.49	3.11	103.1	3,907	142,817	57,916	0
-2%	-0.28	84901	84901	2322.89	461	0.460	100.70	277.11	99.02	81	202.76	562	0.49	3.60	104.2	3,895	142,369	57,468	0
-2%	-0.18	84901	84901	2322.89	460	0.460	100.71	277.14	99.02	81	203.40	560	0.49	4.09	105.2	3,883	141,923	57,022	0
-1%	-0.09	84901	84901	2322.89	458	0.460	100.72	277.17	99.02	81	204.04	558	0.50	4.59	106.2	3,871	141,477	56,576	0
0%	-0.01	84901	84901	2322.89	457	0.460	100.73	277.19	99.02	81	204.68	557	0.43	5.03	107.1	3,859	141,033	56,132	0
0%	0.00	84901	84901	2322.89	455	0.460	100.74	277.22	99.02	81	205.25	555	0.06	5.09	107.3	3,848	140,643	55,742	1
1%	0.12	77636	81269	2223.51	454	0.460	96.44	266.09	99.02	82	194.79	582	0.59	5.68	108.4	3,681	141,853	60,584	583
2%	0.23	70371	74004	2024.74	476	0.461	87.69	244.23	99.02	83	174.63	626	0.55	6.23	109.3	3,942	144,080	70,078	1293
3%	0.35	63107	66739	1825.98	514	0.462	78.90	221.97	99.02	84	154.79	683	0.51	6.74	109.9	4,011	146,596	79,857	1996
4%	0.46	55842	59474	1627.22	559	0.463	70.11	197.81	99.02	86	135.26	751	0.46	7.20	110.4	4,090	149,496	90,022	2649
5%	0.58	45099	50470	1380.87	614	0.465	59.29	168.05	99.02	88	111.99	844	0.41	7.61	110.7	4,192	153,228	102,758	3163
6%	0.69	32482	38791	1061.31	691	0.452	46.69	133.94	99.02	90	86.43	992	0.35	7.96	110.8	4,175	152,587	113,796	3522
7%	0.81	22948	27715	758.29	812	0.430	35.15	101.67	99.02	92	63.34	1145	0.30	8.26	111.0	4,071	148,778	121,062	3711
8%	0.92	16753	19850	543.11	937	0.415	26.12	76.84	99.02	94	46.27	1292	0.27	8.53	111.1	3,991	145,854	126,003	3854
9%	1.04	11496	14124	386.44	1057	0.403	19.14	57.62	99.02	95	33.45	1415	0.24	8.77	111.1	3,928	143,550	129,426	3943
10%	1.15	6427	9961	272.55	1158	0.394	13.81	42.97	99.02	96	23.90	1510	0.23	9.00	111.1	3,877	141,713	131,751	4007
12%	1.38	4769	5598	180.53	1235	0.386	9.33	30.66	99.02	97	16.01	1605	0.43	9.43	111.2	3,833	140,088	133,489	4080
14%	1.61	3019	3894	106.54	1314	0.380	5.60	20.40	99.02	98	9.55	1697	0.41	9.84	111.2	3,795	138,706	134,812	4125
16%	1.84	1269	2144	58.65	1389	0.375	3.12	13.57	99.02	98	5.29	1759	0.39	10.23	111.2	3,769	137,774	135,630	4155
18%	2.07	628	948	25.94	1439	0.372	1.39	8.82	99.02	98	2.35	1801	0.38	10.61	111.2	3,751	137,103	136,155	4175
20%	2.30	182	405	11.06	1474	0.371	0.60	6.64	99.02	99	1.01	1821	0.38	10.99	111.2	3,743	136,790	136,385	4188
22%	2.53	-263	-40	0.01	1490	0.370	0.00	5.00	99.02	99	0.00	1836	0.38	11.37	111.2	3,736	########	########	4196
24%	2.76	-708	-485	0.09	1502	0.370	0.00	5.01	99.02	99	0.01	1836	0.38	11.75	111.2	3,736	########	########	4204
26%	2.99	-1153	-931	0.17	1502	0.370	0.01	5.03	99.02	99	0.02	1835	0.38	12.12	111.2	3,736	########	########	4210
28%	3.22	-1460	-1307	0.24	1502	0.370	0.01	5.04	99.02	99	0.02	1835	0.38	12.50	111.2	3,736	########	########	4214
30%	3.45	-1571	-1515	0.28	1502	0.370	0.01	5.04	99.02	99	0.03	1835	0.38	12.88	111.2	3,736	########	########	4216
35%	4.03	-1849	-1710	0.31	1502	0.370	0.02	5.05	99.02	99	0.03	1835	0.94	13.82	111.2	3,736	########	########	4224
40%	4.60	-2038	-1943	0.35	1502	0.370	0.02	5.05	99.02	99	0.03	1835	0.94	14.76	111.2	3,736	########	########	4227
45%	5.18	-2091	-2065	0.38	1502	0.370	0.02	5.06	99.02	99	0.03	1835	0.94	15.70	111.2	3,736	########	########	4230
50%	5.75	-2144	-2117	0.39	1502	0.370	0.02	5.06	99.02	99	0.04	1835	0.94	16.65	111.2	3,736	########	########	4231
55%	6.33	-2195	-2170	0.39	1502	0.370	0.02	5.06	99.02	99	0.04	1835	0.94	17.59	111.2	3,736	########	########	4232
60%	6.90	-2235	-2215	0.40	1502	0.370	0.02	5.06	99.02	99	0.04	1835	0.94	18.53	111.2	3,736	########	########	4233
70%	8.05	-2296	-2266	0.41	1501	0.370	0.02	5.06	99.02	99	0.04	1835	1.88	20.41	111.2	3,736	########	########	4234
80%	9.20	-2335	-2316	0.42	1501	0.370	0.02	5.06	99.02	99	0.04	1835	1.88	22.30	111.2	3,736	########	########	4235
90%	10.35	-2363	-2349	0.43	1501	0.370	0.02	5.06	99.02	99	0.04	1835	1.88	24.18	111.2	3,736	########	########	4235
100%	11.50	-2383	-2383	0.43	1501	0.370	0.02	5.06	99.02	99	0.04	1835	1.88	26.07	111.2	3,736	########	########	4235
UNW	—	—	*101918*	*2786.46*	*94*	*0.366*	*151.96*	*417.48*	99.02	72	*340.00*	114	—	—	—	*2,788*	101,918	0	—
Screen	—	—	*84901*	*2322.89*	—	*0.400*	*115.89*	*1050.00*	99.02	30	*635.32*	#REF!	—	*#REF!*	*#REF!*	*#REF!*	#REF!	#REF!	—
wfter	—	—	84901	2322.89	*#REF!*	*1.000*	46.36	132.48	99.02	90	*1.00*	1668	—	*22.4*	*106.0*	*9,360*	342,626	257,925	—
Valve:	23MOV-19, dynamic open with pump flow																		

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 9/16/02, 1:41 PM









Valve: 23MOV-19, dynamic open with pump flow

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/2002, 4:07 PM

Select Valve--> 23MOV-19, dynamic close with pump flow

General Information	Required?	Value
Valve Type	yes	wedge gate
Flow type	yes	pumped flow
Stroke direction	yes	close
Fluid (blowdown only)	no	flashing water
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	2.250
Seat ring face ID, $D_{body-ID}$ (inches)	yes	11.500
Seat ring inner diameter, D_w (inches)	yes	11.375
Globe valve stroke length, D (inches)	no	0.000
Isolation-to-wedging travel, X (percent)	yes	8.00%
Packing load, F_{pack} (lbs)	yes	2,500
Required thrust (including water inertia), F_R (lbs)	yes	18,724
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	no	1
Actuator overall ratio, OAR	yes	50.11
Motor gear set ratio, MGSR	yes	0.818
Actuator rated torque, τ_{rated}	yes	4,200
Stem factor, SF (ft-lbs/lb)	yes	0.02736
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00018
Voltage at MCC, V_{mcc} (volts)	yes	101.00
Cable resistance, R_{cable} (ohms)	yes	0.0474
Thermal overload resistance, R_{tol} (ohms)	yes	0.0184
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	150 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	1.000
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.55
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	yes	151
Valve pressure at full open, P_B (psig)	yes	1373
Flow rate, Q_{max} (gpm)	yes	4250
Fluid density, ρ (lbs/ft^3)	yes	62.000
Ambient temperature (C)	yes	96
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	125.9
Fully open stem thrust, F_O (lbs)	yes	7,959
Nominal motor torque, τ_{nom} (ft-lbs)	yes	340.0
Maximum motor torque (ft-lbs)	yes	24.7
Maximum adjusted motor torque (ft-lbs)	yes	41.1
Minimum motor speed (rpm)	yes	1365
Minimum instantaneous actuator capability (lbs)	yes	150,230
Minimum instantaneous margin (lbs)	yes	136,141
Maximum allowable thrust at torque switch trip	yes	104,143
Efficiency at minimum instantaneous capability	yes	0.390

Warnings

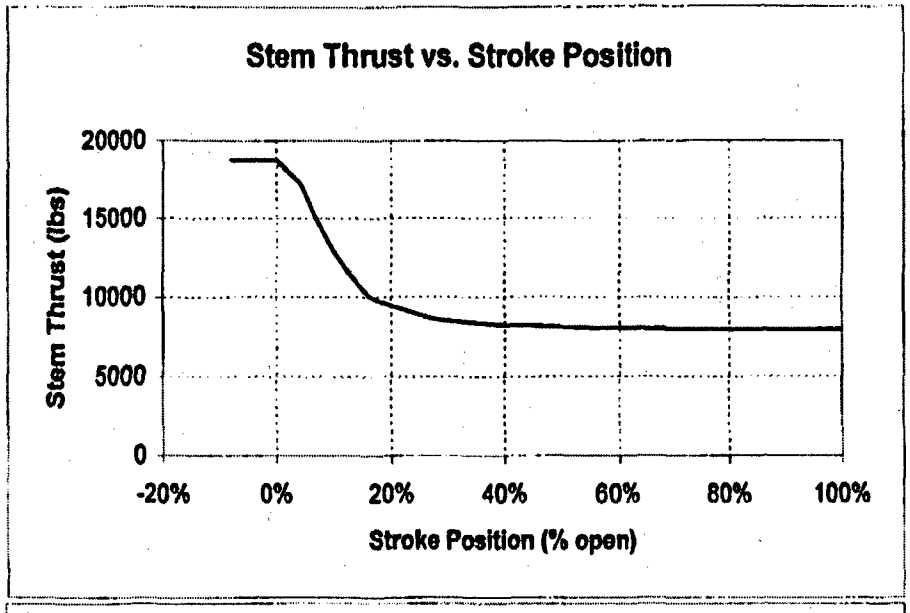
Predicted Stroke Time (Seconds): 23.99

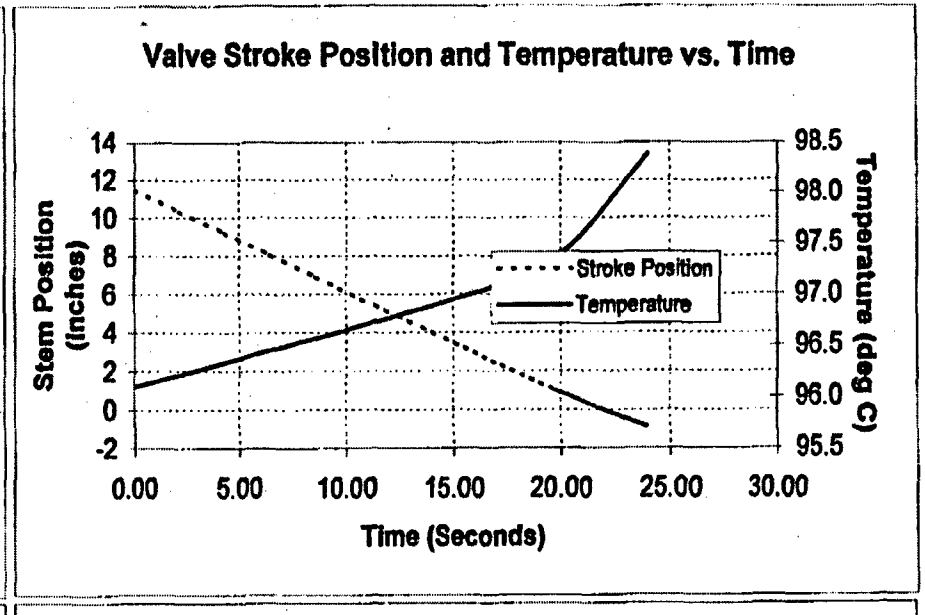
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

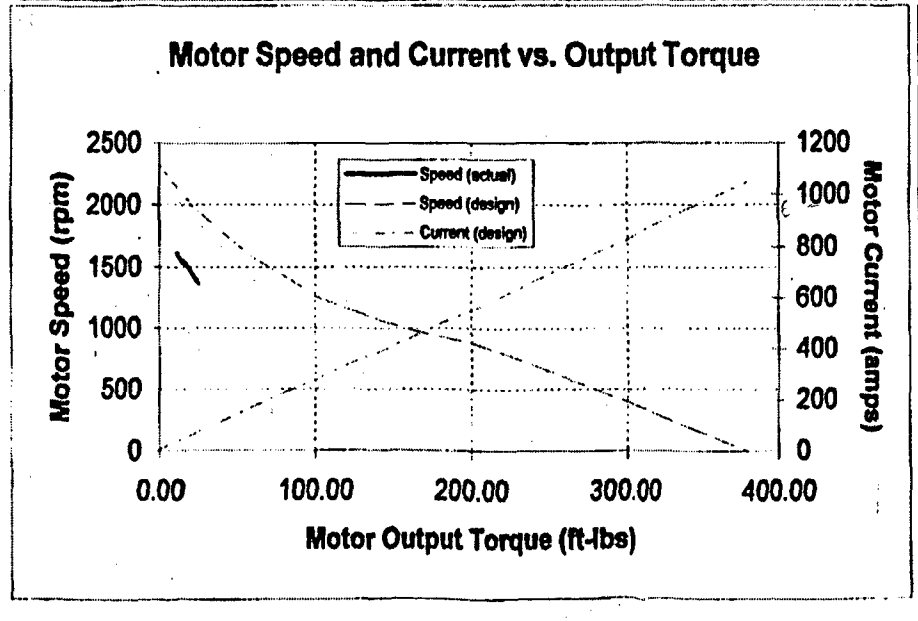
BWROG DCM for B Battery (batch), Version 2.0.xls, Results, 9/16/2002, 4:11 PM

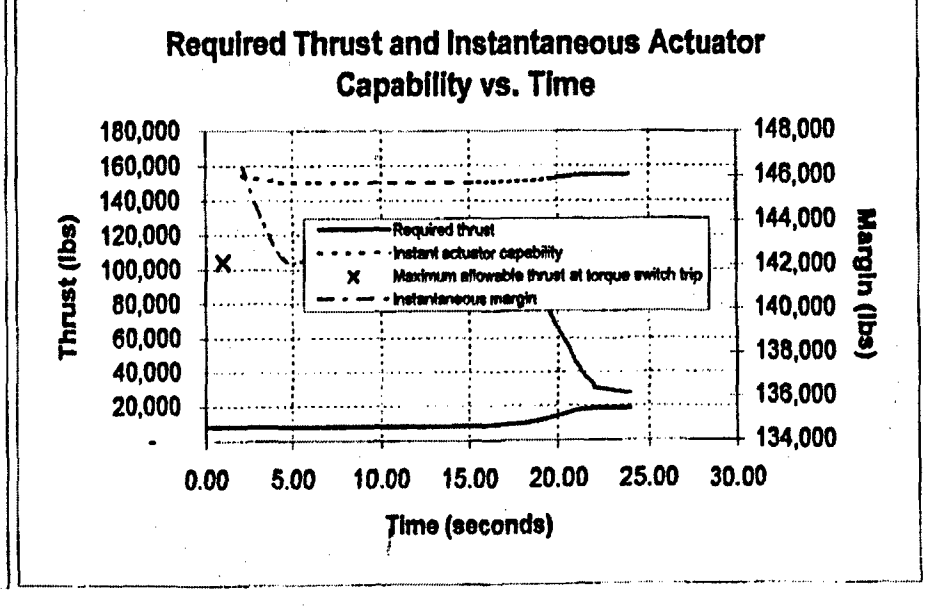
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
100%	11.50	7959												0.00	96.1				4227
90%	10.35	7965	7962	217.85		0.400	10.87	34.89	101.00	99	17.54	1614	2.14	2.14	96.2	4,224	154,373	146,411	4226
80%	9.20	7983	7974	218.17	1321	0.390	11.16	35.70	101.00	99	18.03	1607	2.15	4.29	96.3	4,114	150,366	142,392	4224
70%	8.05	8005	7994	218.71	1315	0.390	11.19	35.78	101.00	99	18.08	1607	2.15	6.45	96.5	4,113	150,312	142,318	4220
60%	6.90	8042	8024	219.52	1314	0.390	11.23	35.89	101.00	99	18.15	1605	2.15	8.60	96.6	4,112	150,274	142,251	4210
55%	6.33	8068	8055	220.39	1314	0.390	11.27	36.00	101.00	99	18.23	1604	1.08	9.68	96.6	4,110	150,237	142,181	4202
50%	5.75	8119	8094	221.45	1313	0.390	11.32	36.14	101.00	99	18.32	1603	1.08	10.75	96.7	4,110	150,230	142,137	4193
45%	5.18	8174	8147	222.90	1312	0.390	11.40	36.34	101.00	99	18.44	1601	1.08	11.83	96.8	4,110	150,232	142,085	4182
40%	4.60	8229	8202	224.40	1310	0.390	11.47	36.54	101.00	99	18.56	1600	1.08	12.92	96.8	4,110	150,234	142,032	4164
35%	4.03	8349	8289	226.79	1309	0.391	11.58	36.86	101.00	99	18.76	1597	1.08	14.00	96.9	4,111	150,254	141,965	4138
30%	3.45	8510	8430	230.64	1307	0.391	11.77	37.37	101.00	99	19.07	1592	1.09	15.08	97.0	4,112	150,303	141,874	4094
28%	3.22	8575	8543	233.73	1303	0.391	11.92	37.78	101.00	99	19.32	1589	0.44	15.52	97.0	4,113	150,332	141,790	4063
26%	2.99	8743	8659	236.92	1300	0.392	12.07	38.21	101.00	98	19.56	1585	0.44	15.96	97.0	4,114	150,383	141,723	4034
24%	2.76	8986	8865	242.53	1297	0.392	12.35	38.95	101.00	98	20.03	1579	0.44	16.39	97.0	4,117	150,485	141,620	3992
22%	2.53	9228	9107	249.16	1292	0.393	12.66	39.83	101.00	98	20.56	1573	0.44	16.83	97.1	4,120	150,603	141,496	3938
20%	2.30	9470	9349	255.78	1287	0.393	12.98	40.70	101.00	98	21.09	1568	0.44	17.27	97.1	4,124	150,721	141,372	3887
18%	2.07	9712	9591	262.41	1283	0.394	13.30	41.57	101.00	98	21.62	1562	0.44	17.72	97.1	4,127	150,838	141,247	3803
16%	1.84	10048	9880	270.31	1278	0.394	13.68	42.61	101.00	98	22.25	1556	0.44	18.16	97.2	4,131	150,981	141,101	3685
14%	1.61	10913	10480	286.74	1273	0.396	14.45	44.75	101.00	98	23.55	1542	0.45	18.61	97.2	4,140	151,302	140,822	3526
12%	1.38	11778	11345	310.41	1262	0.398	15.56	47.80	101.00	98	25.42	1523	0.45	19.06	97.3	4,152	151,759	140,413	3316
10%	1.15	12856	12317	337.00	1246	0.400	16.80	51.21	101.00	98	27.51	1502	0.46	19.52	97.3	4,166	152,254	139,937	3032
9%	1.04	13534	13195	361.03	1229	0.402	17.91	54.25	101.00	97	29.38	1482	0.23	19.76	97.4	4,177	152,679	139,483	2822
8%	0.92	14211	13873	379.56	1213	0.404	18.76	56.59	101.00	97	30.83	1466	0.24	19.99	97.4	4,186	152,998	139,125	2583
7%	0.81	14888	14550	398.08	1201	0.405	19.60	58.90	101.00	97	32.26	1453	0.24	20.23	97.4	4,195	153,324	138,774	2279
6%	0.69	15676	15282	418.11	1189	0.407	20.50	61.38	101.00	97	33.81	1437	0.24	20.47	97.5	4,205	153,675	138,393	1971
5%	0.58	16565	16120	441.05	1176	0.409	21.53	64.20	101.00	97	35.57	1420	0.24	20.71	97.5	4,216	154,076	137,956	1553
4%	0.46	17271	16918	462.88	1162	0.411	22.49	66.86	101.00	97	37.25	1403	0.25	20.96	97.6	4,225	154,439	137,522	1148
3%	0.35	17634	17452	477.50	1148	0.412	23.14	68.64	101.00	96	38.37	1392	0.25	21.21	97.6	4,231	154,652	137,200	781
2%	0.23	17997	17816	487.44	1139	0.413	23.58	69.84	101.00	96	39.13	1384	0.25	21.46	97.7	4,235	154,785	136,970	474
1%	0.12	18361	18179	497.38	1132	0.413	24.01	71.04	101.00	96	39.89	1376	0.25	21.71	97.8	4,239	154,929	136,750	206
0%	0.00	18724	18542	507.32	1126	0.414	24.45	72.23	101.00	96	40.66	1369	0.25	21.96	97.8	4,243	155,070	136,528	0
0%	-0.01	18724	18724	512.29	1120	0.415	24.66	72.83	101.00	96	41.04	1365	0.03	21.99	97.8	4,244	155,111	136,387	0
-1%	-0.09	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.05	1365	0.18	22.17	97.9	4,243	155,093	136,369	0
-2%	-0.18	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.05	1365	0.20	22.37	97.9	4,243	155,071	136,347	0
-2%	-0.28	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.06	1365	0.20	22.57	98.0	4,242	155,045	136,321	0
-3%	-0.37	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.07	1365	0.20	22.77	98.1	4,241	155,019	136,295	0
-4%	-0.46	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.07	1365	0.20	22.98	98.1	4,241	154,994	136,270	0
-5%	-0.55	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.08	1365	0.20	23.18	98.2	4,240	154,968	136,244	0
-6%	-0.64	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.09	1365	0.20	23.38	98.2	4,239	154,942	136,218	0
-6%	-0.74	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.09	1365	0.20	23.58	98.3	4,239	154,916	136,192	0
-7%	-0.83	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.10	1365	0.20	23.79	98.3	4,238	154,891	136,167	0
-8%	-0.92	18724	18724	512.29	1117	0.414	24.67	72.83	101.00	96	41.11	1365	0.20	23.99	98.4	4,237	154,865	136,141	0
TST	—	—	*104143*	*2849.35*	*96*	*0.367*	*154.79*	425.42	101.00	73	*340.00*	117	—	—	—	*2,849*	104,143	(0)	—
Screen	—	—	*18724*	*512.29*	—	*0.400*	25.56	*1050.00*	101.00	32	*131.42*	283	—	*131.9*	*134.4*	*1,224*	44,723	25,999	—
wlter	—	—	*18724*	*512.29*	*1112*	*0.414*	24.67	72.84	101.00	96	*41.76*	1360	—	*27.5*	*103.5*	*4,171*	152,462	133,738	—
Valve:	23MOV-19, dynamic close with pump flow																		

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 9/16/2002, 4:10 PM









Valve: 23MOV-19, dynamic close with pump flow

SYS/VALVE NO. 23MOV-25
Q.A. CAT. 1EQ

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
23 MOV-25	HPCI Pump Min Flow Isol. Valve			
MANUFACTURER	**BMCC**	**ESK**	**SE**	**COMP. LOCATION & ELEVATION**
Peerless	4-0B1	11AN	10AN	Top of Torus over Catwalk North Hatch

H.P./TORQUE	TYPE	MODEL NO.
1.8 Start 25 Ft lb Run 5 Ft lb	D.C. Compound	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125 VDC			TC05359		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
82.0		5 min	DK56H

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
14.5	1900	75°C	B

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124L028	K42.5B	37.5	260%		

TOTAL STEM TRAVEL	INCHES OR TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES _____ TURNS _____						

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Velan	TYPE SMB-00	NO. B-1	RECOMMENDED: OPEN 1.75 CLOSE 1.75
TYPE Globe	SER. NO. 96516A	BKR. AMPS 40	MAX: OPEN 3.0 CLOSE 3.0
SIZE 4"	ORDER NO. 333688I	CONTACTOR SIZE	STOP PLATE IN PLACE (YES) NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	15	15		7	7	LIMITORQUE	C-9
AMPS F.L. AT TORQUE TRIP	16	16	TORQUE SWITCH SETTING	1	1.5	MCC	C-1

BRAKE INFO, BOLTING TORQUE, MISC INFO

NEED SCAFFOLD TO WORK OPERATOR.

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/2002, 4:47 PM

Select Valve--> 23MOV-25, dynamic open with pump flow

General Information	Required?	Value
Valve Type	yes	globe
Flow type	no	pumped flow
Stroke direction	yes	open
Fluid (blowdown only)	no	0
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.375
Seat ring face ID, $D_{body-ID}$ (inches)	no	0.000
Seat ring inner diameter, D_{sr} (inches)	yes	2.500
Globe valve stroke length, D (inches)	yes	1.750
Isolation-to-wedging travel, X (percent)	no	0.00%
Packing load, F_{pack} (lbs)	yes	1,500
Required thrust (including water inertia), F_R (lbs)	yes	(6,007)
Required thrust due to water inertia, F_W (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	yes	170
Actuator overall ratio, OAR	yes	31.97
Motor gear set ratio, MGSR	yes	1.407
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.01150
Overhauling stem factor, SF_O (ft-lbs/lb)	yes	0.00471
Voltage at MCC, V_{mcc} (volts)	yes	104.77
Cable resistance, R_{cable} (ohms)	yes	0.1530
Thermal overload resistance, R_{ol} (ohms)	yes	0.0083
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	25 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.250
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.50
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	yes	1350
Valve pressure at full open, P_B (psig)	yes	1350
Flow rate, Q_{max} (gpm)	yes	800
Fluid density, ρ (lbs/ft^3)	yes	62.000
Ambient temperature (C)	yes	43
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	74.1
Fully open stem thrust, F_O (lbs)	yes	-505
Nominal motor torque, τ_{nom} (ft-lbs)	yes	35.0
Maximum motor torque (ft-lbs)	yes	2.2
Maximum adjusted motor torque (ft-lbs)	yes	2.9
Minimum motor speed (rpm)	yes	1841
Minimum instantaneous actuator capability (lbs)	yes	71,064
Minimum instantaneous margin (lbs)	yes	67,524
Maximum allowable thrust at unwedging	no	—
Efficiency at minimum instantaneous capability	yes	0.383

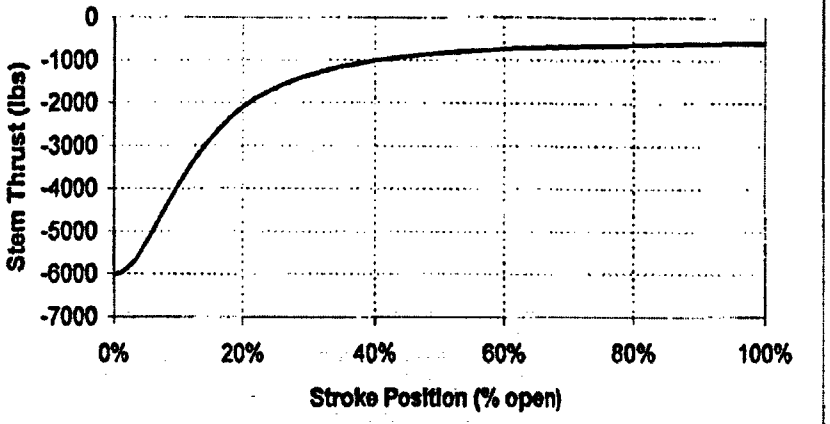
Warnings

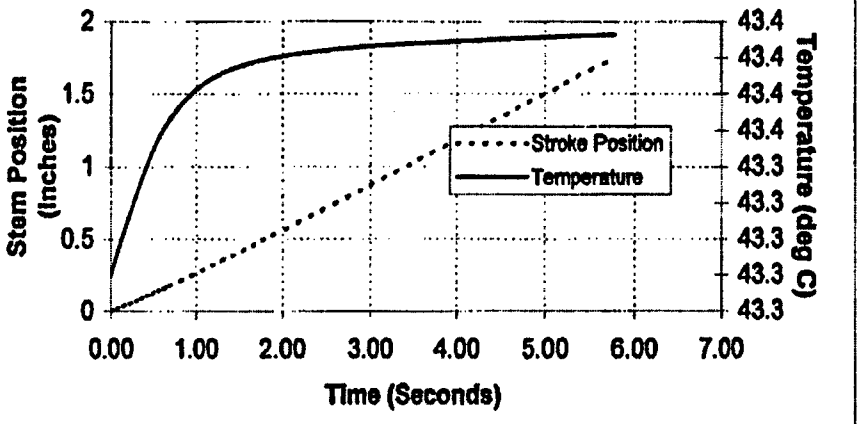
Predicted Stroke Time (Seconds): 6.77

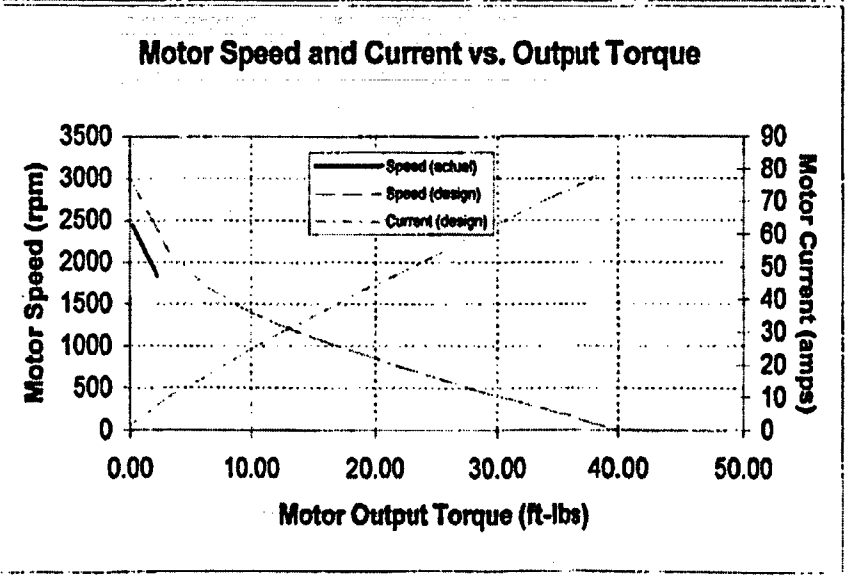
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

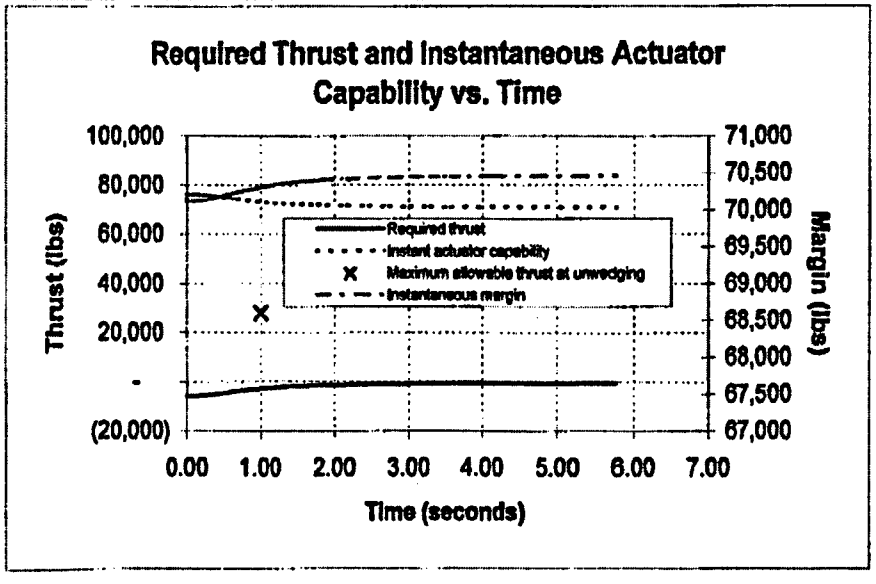
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
0%	0.00	-6007												*0.00*	*43.3*				0
0%	0.00	-6007	-6007	28.29		*0.400*	2.21	7.52	104.77	104	2.86	1841	0.00	0.00	43.3	346	73,531	67,524	0
0%	0.00	-6007	-6007	28.29	2591	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
0%	0.00	-6007	-6007	28.29	2623	0.414	2.14	7.32	104.77	104	2.76	1864	0.00	0.00	43.3	359	76,119	70,112	0
1%	0.02	-5973	-5990	28.21	2623	0.414	2.13	7.30	104.77	104	2.75	1865	0.07	0.07	43.3	358	76,104	70,113	62
2%	0.04	-5875	-5924	27.90	2625	0.413	2.11	7.24	104.77	104	2.73	1872	0.07	0.14	43.3	358	76,041	70,117	124
3%	0.05	-5719	-5797	27.30	2634	0.413	2.07	7.13	104.77	104	2.67	1884	0.07	0.21	43.3	358	75,922	70,125	183
4%	0.07	-5515	-5617	26.46	2652	0.412	2.01	6.97	104.77	104	2.60	1902	0.07	0.29	43.3	357	75,753	70,136	239
5%	0.09	-5275	-5395	25.41	2677	0.410	1.94	6.77	104.77	104	2.50	1924	0.07	0.36	43.3	356	75,545	70,150	291
6%	0.11	-5012	-5143	24.23	2708	0.409	1.85	6.54	104.77	104	2.39	1950	0.07	0.42	43.3	355	75,309	70,166	340
7%	0.12	-4735	-4873	22.95	2744	0.408	1.76	6.29	104.77	104	2.27	1977	0.07	0.49	43.3	354	75,056	70,183	384
8%	0.14	-4456	-4595	21.64	2783	0.406	1.67	6.04	104.77	104	2.15	2005	0.07	0.56	43.3	352	74,796	70,201	424
9%	0.16	-4180	-4318	20.34	2822	0.404	1.57	5.78	104.77	104	2.03	2034	0.07	0.63	43.4	351	74,537	70,219	460
10%	0.18	-3915	-4048	19.06	2863	0.403	1.48	5.53	104.77	104	1.91	2062	0.07	0.69	43.4	350	74,284	70,236	492
12%	0.21	-3426	-3670	17.29	2902	0.401	1.35	5.17	104.77	104	1.74	2101	0.13	0.82	43.4	348	73,931	70,261	547
14%	0.25	-3003	-3214	15.14	2958	0.398	1.19	4.74	104.77	104	1.53	2150	0.12	0.94	43.4	346	73,505	70,290	590
16%	0.28	-2645	-2824	13.30	3028	0.396	1.05	4.36	104.77	104	1.35	2192	0.12	1.07	43.4	344	73,140	70,316	624
18%	0.32	-2346	-2496	11.75	3084	0.394	0.93	4.04	104.77	104	1.20	2227	0.12	1.19	43.4	343	72,833	70,337	651
20%	0.35	-2098	-2222	10.47	3134	0.393	0.83	3.77	104.77	104	1.07	2257	0.12	1.31	43.4	342	72,577	70,355	672
22%	0.39	-1891	-1994	9.39	3177	0.391	0.75	3.54	104.77	104	0.96	2282	0.12	1.42	43.4	341	72,364	70,370	690
24%	0.42	-1718	-1804	8.50	3212	0.390	0.68	3.35	104.77	104	0.87	2303	0.12	1.54	43.4	340	72,187	70,382	704
26%	0.46	-1574	-1646	7.75	3241	0.389	0.62	3.19	104.77	104	0.80	2321	0.12	1.66	43.4	339	72,039	70,393	716
28%	0.49	-1452	-1513	7.12	3266	0.389	0.57	3.06	104.77	104	0.74	2336	0.11	1.77	43.4	339	71,914	70,401	726
30%	0.53	-1348	-1400	6.59	3287	0.388	0.53	2.95	104.77	104	0.68	2348	0.11	1.88	43.4	338	71,809	70,409	734
35%	0.61	-1151	-1250	5.89	3305	0.387	0.48	2.79	104.77	104	0.61	2365	0.28	2.17	43.4	338	71,668	70,419	749
40%	0.70	-1013	-1082	5.10	3329	0.386	0.41	2.62	104.77	104	0.53	2384	0.28	2.45	43.4	337	71,512	70,430	760
45%	0.79	-914	-964	4.54	3355	0.385	0.37	2.50	104.77	104	0.47	2397	0.28	2.73	43.4	336	71,401	70,437	767
50%	0.88	-841	-878	4.14	3374	0.385	0.34	2.41	104.77	104	0.43	2407	0.28	3.01	43.4	336	71,321	70,443	773
55%	0.96	-786	-814	3.83	3388	0.385	0.31	2.35	104.77	104	0.40	2415	0.28	3.29	43.4	336	71,261	70,447	777
60%	1.05	-743	-764	3.60	3398	0.384	0.29	2.30	104.77	104	0.38	2420	0.28	3.56	43.4	335	71,215	70,450	780
70%	1.23	-682	-712	3.36	3406	0.384	0.27	2.24	104.77	104	0.35	2426	0.55	4.12	43.4	335	71,166	70,454	785
80%	1.40	-641	-661	3.12	3415	0.384	0.25	2.19	104.77	104	0.33	2432	0.55	4.67	43.4	335	71,118	70,457	788
90%	1.58	-613	-627	2.95	3423	0.384	0.24	2.16	104.77	104	0.31	2436	0.55	5.22	43.4	335	71,086	70,459	790
100%	1.75	-593	-603	2.84	3428	0.383	0.23	2.13	104.77	104	0.30	2439	0.55	5.77	43.4	335	71,064	70,461	791
UNW	—	—	*27943*	*321.34*	*216*	*0.400*	*25.13*	53.77	104.77	96	*35.00*	154	—	—	—	*321*	27,943	(0)	—
Screen	—	—	*-6007*	*28.29*	—	*0.400*	2.21	*82.00*	104.77	92	*3.35*	1551	—	*8.7*	*43.7*	*306*	64,913	58,906	—
w/filter	—	—	*-6007*	*28.29*	*2622*	*0.414*	2.14	7.32	104.77	104	*2.76*	1863	—	*7.2*	*43.6*	*358*	76,040	70,033	—
Valve:	23MOV-25, dynamic open with pump flow																		

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 9/16/2002, 4:47 PM









Valve: 23MOV-25, dynamic open with pump flow

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/2002, 4:48 PM

Select Valve--> 23MOV-25, dynamic close with pump flow

General Information	Required?	Value
Valve Type	yes	globe
Flow type	no	pumped flow
Stroke direction	yes	close
Fluid (blowdown only)	no	0
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.375
Seat ring face ID, $D_{seat,ID}$ (inches)	no	0.000
Seat ring inner diameter, D_{si} (inches)	yes	2.600
Globe valve stroke length, D (inches)	yes	1.750
Isolation-to-wedging travel, X (percent)	no	0.00%
Packing load, F_{pack} (lbs)	yes	1,500
Required thrust (including water inertia), F_R (lbs)	yes	9,068
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	yes	170
Actuator overall ratio, OAR	yes	31.97
Motor gear set ratio, MGSR	yes	1.407
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.01150
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00471
Voltage at MCC, V_{mcc} (volts)	yes	108.13
Cable resistance, R_{cable} (ohms)	yes	0.1530
Thermal overload resistance, R_{ol} (ohms)	yes	0.0083
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	25 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.250
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.60
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	yes	1365
Valve pressure at full open, P_B (psig)	yes	1350
Flow rate, Q_{max} (gpm)	yes	800
Fluid density, ρ (lbs/ft^3)	yes	62.000
Ambient temperature (C)	yes	43
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	75.0
Fully open stem thrust, F_O (lbs)	yes	3,505
Nominal motor torque, τ_{nom} (ft-lbs)	yes	35.0
Maximum motor torque (ft-lbs)	yes	7.0
Maximum adjusted motor torque (ft-lbs)	yes	9.0
Minimum motor speed (rpm)	yes	1246
Minimum instantaneous actuator capability (lbs)	yes	30,965
Minimum instantaneous margin (lbs)	yes	26,369
Maximum allowable thrust at torque switch trip	yes	28,821
Efficiency at minimum instantaneous capability	yes	0.400

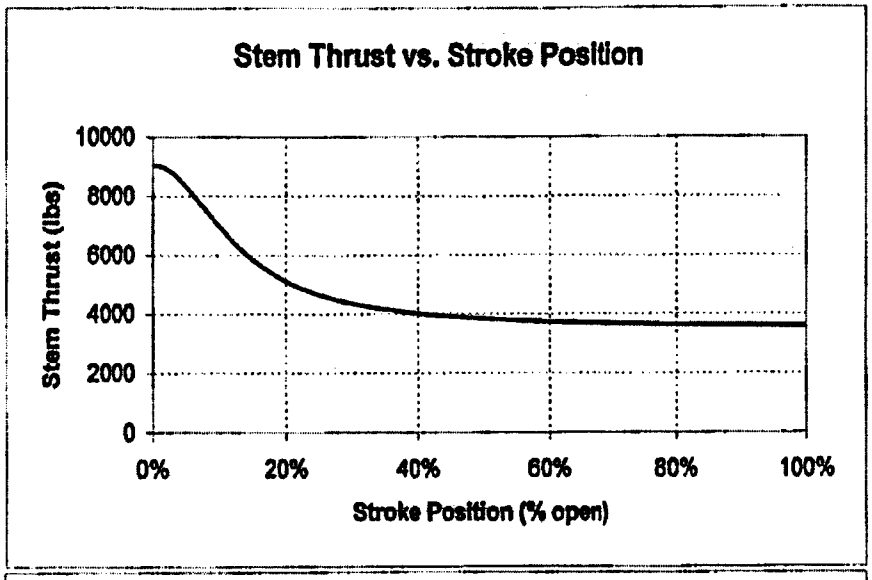
Warnings

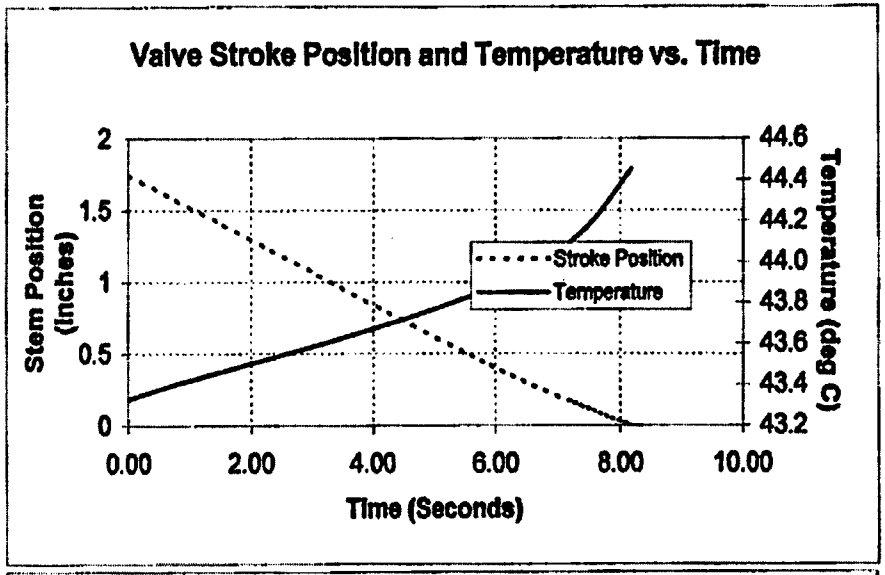
Predicted Stroke Time (Seconds): 8.18

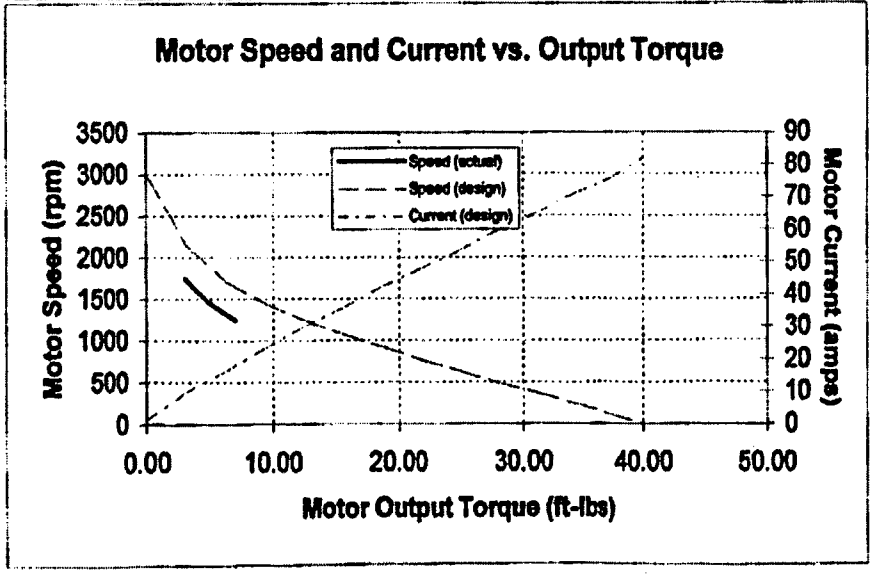
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

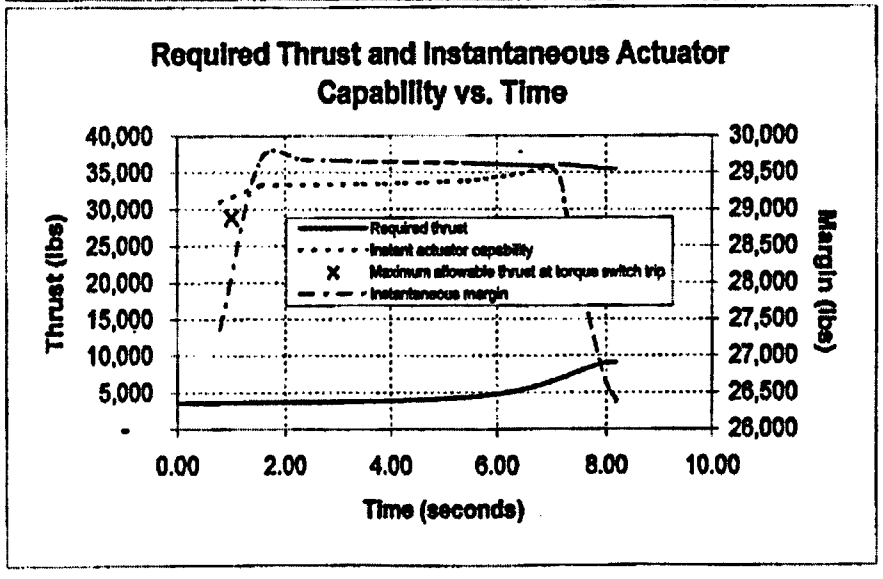
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
100%	1.75	3593												*0.00*	43.3				791
90%	1.58	3613	3603	41.43		*0.400*	3.24	10.24	108.13	106	4.07	1718	0.78	0.78	43.4	356	30,965	27,362	790
80%	1.40	3641	3627	41.71	2418	0.430	3.03	9.75	108.13	107	3.81	1750	0.77	1.55	43.5	383	33,308	29,680	788
70%	1.23	3682	3662	42.11	2463	0.431	3.06	9.82	108.13	107	3.84	1746	0.77	2.32	43.5	383	33,333	29,672	785
60%	1.05	3743	3712	42.69	2458	0.431	3.10	9.92	108.13	107	3.89	1740	0.77	3.09	43.6	384	33,375	29,663	780
55%	0.96	3786	3765	43.29	2449	0.432	3.13	10.02	108.13	107	3.94	1734	0.39	3.48	43.6	384	33,418	29,653	777
50%	0.88	3842	3814	43.86	2440	0.433	3.17	10.10	108.13	107	3.99	1728	0.39	3.87	43.7	385	33,463	29,649	773
45%	0.79	3915	3878	44.60	2432	0.434	3.22	10.19	108.13	106	4.05	1721	0.39	4.26	43.7	386	33,522	29,644	768
40%	0.70	4014	3964	45.59	2422	0.435	3.28	10.32	108.13	106	4.13	1711	0.39	4.65	43.7	386	33,603	29,639	760
35%	0.61	4152	4083	46.95	2408	0.436	3.37	10.50	108.13	106	4.24	1697	0.40	5.04	43.8	388	33,716	29,633	750
30%	0.53	4350	4251	48.88	2389	0.439	3.49	10.75	108.13	106	4.39	1678	0.40	5.44	43.8	390	33,877	29,627	735
28%	0.49	4453	4402	50.62	2362	0.441	3.59	10.97	108.13	106	4.53	1661	0.16	5.60	43.8	391	34,022	29,620	726
26%	0.46	4576	4515	51.92	2338	0.442	3.67	11.14	108.13	106	4.63	1649	0.16	5.77	43.9	393	34,131	29,617	717
24%	0.42	4721	4648	53.46	2320	0.444	3.76	11.33	108.13	106	4.75	1634	0.16	5.93	43.9	394	34,261	29,613	705
22%	0.39	4895	4808	55.29	2300	0.446	3.87	11.56	108.13	106	4.89	1617	0.17	6.10	43.9	396	34,416	29,609	691
20%	0.35	5103	4999	57.48	2275	0.449	4.00	11.83	108.13	106	5.06	1596	0.17	6.27	43.9	398	34,603	29,604	674
18%	0.32	5353	5228	60.12	2246	0.452	4.16	12.15	108.13	106	5.25	1572	0.17	6.44	43.9	401	34,826	29,599	652
16%	0.28	5654	5504	63.29	2212	0.456	4.34	12.53	108.13	106	5.49	1543	0.17	6.61	44.0	404	35,096	29,592	625
14%	0.25	6015	5835	67.10	2171	0.461	4.56	12.98	108.13	106	5.77	1508	0.18	6.79	44.0	407	35,420	29,585	591
12%	0.21	6443	6229	71.64	2123	0.466	4.81	13.50	108.13	106	6.09	1469	0.18	6.97	44.0	412	35,806	29,577	548
10%	0.18	6938	6691	76.94	2067	0.470	5.12	14.15	108.13	106	6.49	1431	0.19	7.16	44.1	415	36,076	29,385	494
9%	0.16	7207	7073	81.34	2014	0.470	5.41	14.76	108.13	106	6.87	1402	0.10	7.26	44.1	414	36,037	28,964	462
8%	0.14	7487	7347	84.49	1973	0.469	5.63	15.21	108.13	106	7.15	1381	0.10	7.35	44.1	414	35,969	28,622	426
7%	0.12	7771	7629	87.73	1944	0.469	5.85	15.67	108.13	106	7.44	1359	0.10	7.45	44.2	413	35,896	28,267	386
6%	0.11	8052	7912	90.98	1913	0.468	6.08	16.14	108.13	106	7.73	1338	0.10	7.55	44.2	412	35,822	27,910	341
5%	0.09	8321	8187	94.15	1883	0.468	6.30	16.60	108.13	105	8.02	1316	0.10	7.65	44.2	411	35,747	27,560	293
4%	0.07	8566	8443	97.10	1853	0.467	6.50	17.06	108.13	105	8.28	1296	0.10	7.76	44.3	410	35,673	27,229	240
3%	0.05	8774	8670	99.70	1824	0.467	6.68	17.47	108.13	105	8.52	1278	0.11	7.86	44.3	409	35,604	26,934	184
2%	0.04	8933	8854	101.82	1799	0.466	6.83	17.80	108.13	105	8.72	1264	0.11	7.97	44.4	409	35,543	26,689	124
1%	0.02	9034	8983	103.31	1778	0.466	6.94	18.04	108.13	105	8.86	1253	0.11	8.08	44.4	408	35,494	26,511	63
0%	0.00	9068	9051	104.08	1764	0.465	7.00	18.17	108.13	105	8.93	1248	0.11	8.18	44.5	408	35,460	26,409	0
0%	0.00	9068	9068	104.28	1756	0.465	7.01	18.20	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,440	26,372	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
0%	0.00	9068	9068	104.28	1754	0.465	7.01	18.21	108.13	105	8.96	1246	0.00	8.18	44.5	408	35,437	26,369	0
TST	—	—	*28821*	*331.44*	223	*0.401*	25.84	55.25	108.13	99	*35.00*	159	—	—	—	*331*	28,821	(0)	—
Screen	—	—	*9068*	*104.28*	—	*0.400*	8.15	*82.00*	108.13	95	*11.91*	971	—	*13.8*	*51.4*	*308*	26,817	17,749	—
w/iter	—	—	*9068*	*104.28*	*1741*	*0.465*	7.01	18.21	108.13	105	*9.08*	1237	—	*10.9*	*48.0*	*402*	34,970	25,902	—
Valve:	23MOV-25, dynamic close with pump flow																		

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 9/16/2002, 4:48 PM









Valve: 23MOV-25, dynamic close with pump flow

SYS/VALVE NO. 23MOV-57
Q.A. CAT. 1EQ

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
23MOV-57	HPCI Pump Suct From Suppr. Pool Out BD ISOL Valve			
MANUFACTURER	**MCC**	**ESK**	**SE**	**COMP. LOCATION & ELEVATION**
Peerless	E.C. 4-0C1	11AP	LOAD 10	HPCI Rm 236' EL Below BMCC1.

H.P./TORQUE	TYPE	MODEL NO.
542 Start 2.5 FtLb Run 1.5 FtLb	D.C. Compound	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125 DC	—	—	RG 79131		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
32		5 min	DG56C

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
5.5	1900	75°	B

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124K028	K23.6	20.7	370%		

TOTAL STEM TRAVEL		INCHES ~~OR TURNS~~ FROM FULL CLOSED ROTORS	1	2	3	4
INCHES 16 3/4	TURNS ____		14 7/8"	5 7/8"	14 7/8"	FC

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Powell	TYPE SMB-0	NO. 1HB1B09	RECOMMENDED: OPEN 2.25 CLOSE 2.25
TYPE GATE	SER. NO. 125222	BKR. AMPS 25	MAX: OPEN 3.0 CLOSE 3.0
SIZE 16"	ORDER NO. 348543A	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) (3) NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

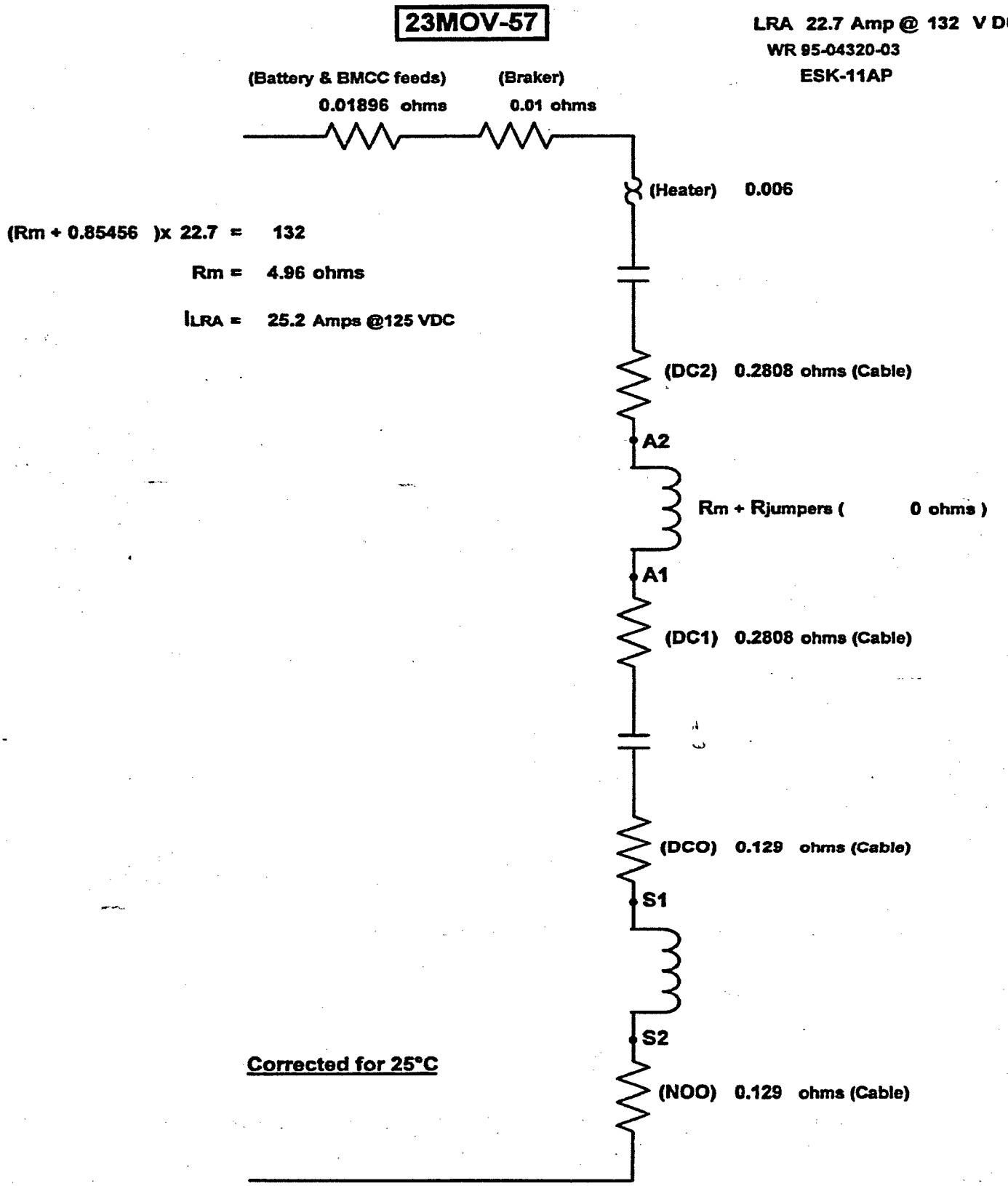
RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME ~~MIN~~/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	2.5	2.5		61	61	LIMITORQUE	C-2 In Back of HPCI
AMPS F.L. AT TORQUE TRIP		6.0	TORQUE SWITCH SETTING	1	2	MCC	C-1

BRAKE INFO, BOLTING TORQUE, MISC INFO

23MOV-57

Date	Inrush	O/C	Battery Voltage	Votes Test No.	Stroke Time	WR Number	Notes
11/26/98	19.7	C	133.0	1	66.4	97-03248-02	
11/26/98	21.0	O	133.0	1	68.8	97-03248-02	
11/22/96	21.2	C	132.0	4	67.6	95-04320-03	
11/22/96	**22.7**	**O**	**132.0**	**4**	**67.9**	**95-04320-03**	
Operator was overhauled in 1992							

23MOV-57 Votes Tests Data



23MOV-57 Inrush Current

SYS/ VALVE NO. 23MOV-58
Q.A. CAT. 1EQ

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
23 MOV-58	HPCI Pump Suct From Suppr Pool In BD Isol. Valve			
MANUFACTURER	**MCC**	**ESK**	**SE**	**COMP. LOCATION & ELEVATION**
Peerless	E.C. 4-0C2	11AP	10AQ	Torus 232' South Bottom of Torus

H.P./ TORQUE	TYPE	MODEL NO.
.546 START 7.5 ft lb RUN 1.5 ft lb	DC Compound	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125 DC	—	—	QR01922		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
32.0		5 min	D56C

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
5.5	1900	115°C	RH

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124K028	~~K23.6B~~ 1932-192 K6.42A	20.7	370%		

TOTAL STEM TRAVEL	INCHES ~~OR TURNS~~ ROTORS FROM FULL CLOSED	1	2	3	4
INCHES 16 1/4" TURNS ____		1.5"	5 7/8"	15"	FC

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Powell	TYPE SMB-0	NO. 1HP1B10C-2	RECOMMENDED: OPEN 2.25 CLOSE 2.25
TYPE GATE	SER. NO. 125223	BKR. AMPS 25	MAX: OPEN 4.0 CLOSE 4.0
SIZE 16"	ORDER NO. 3485434	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME ~~MIN~~/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	4.75	4.75		64	64	LIMITORQUE	C-9
AMPS F.L. AT TORQUE TRIP		10	TORQUE SWITCH SETTING	1.5	1	MCC	C-1

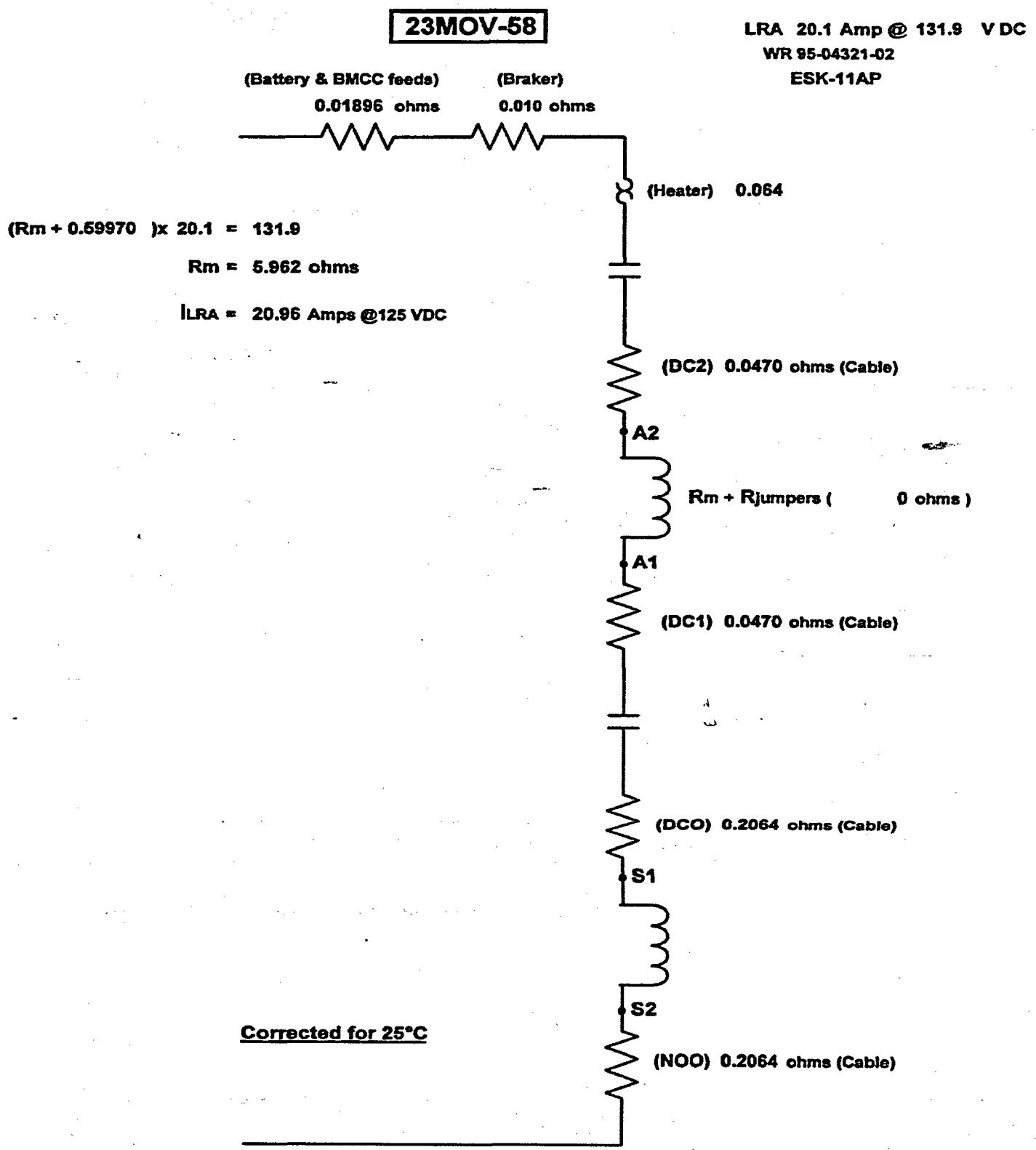
BRAKE INFO, BOLTING TORQUE, MISC INFO

New Stem Nut Installed (Old one worn out) 3/4/92
NOTE: Position Indicating Rod is present on this MOV as shown on drwg. 6.37-44 (4-2099)

23MOV-58

Date	Inrush	O/C	Battery Voltage	Votes Test No.	Stroke Time	WR Number	Notes
12/2/98	19.8	C	132.7	2	65.0	97-03249-02	
12/2/98	18.8	O	132.7	2	64.4	97-03249-02	
10/23/97	**20.1**	**C**	**131.9**	**6**	**65.5**	**95-04321-02**	
10/23/97	18.8	O	131.9	6	63.8	95-04321-02	
Operator was overhauled in 1992							

23MOV-58 Votes Tests Data



23MOV-58 Inrush Current

SYS/VALVE NO. 27MOV-~~123~~ 122
Q.A. CAT. 1EQ

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
27MOV-122	CAD Drywell Exhaust Bypass Inbd Isol. Valve			
MANUFACTURER	BMCC E.C.	ESK	SE	COMP. LOCATION & ELEVATION
Peerless	4-0E1	11AAN	9AAH	Reactor Bld. 326'El Northside

H.P./TORQUE	TYPE	MODEL NO.
2.89 START 40 Ft lb RUN 8 Ft lb	DC Compound	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125 VDC	—	—	XF-64297		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
135		5 MIN	D202G

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
24	1900	115°C	RH

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124K028	C22.8B	22.6	100%		

TOTAL STEM TRAVEL		TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES _____	TURNS 118			108	42	108	FC

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Borg-Warner	TYPE SMB-1	NO. 1PCPB14	RECOMMENDED: OPEN 1.0 CLOSE 1.0
TYPE Globe	SER. NO. 286560	BKR. AMPS 40	MAX: OPEN 2.75 CLOSE 2.75
SIZE 3"	ORDER NO. 3C1052A	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) NO

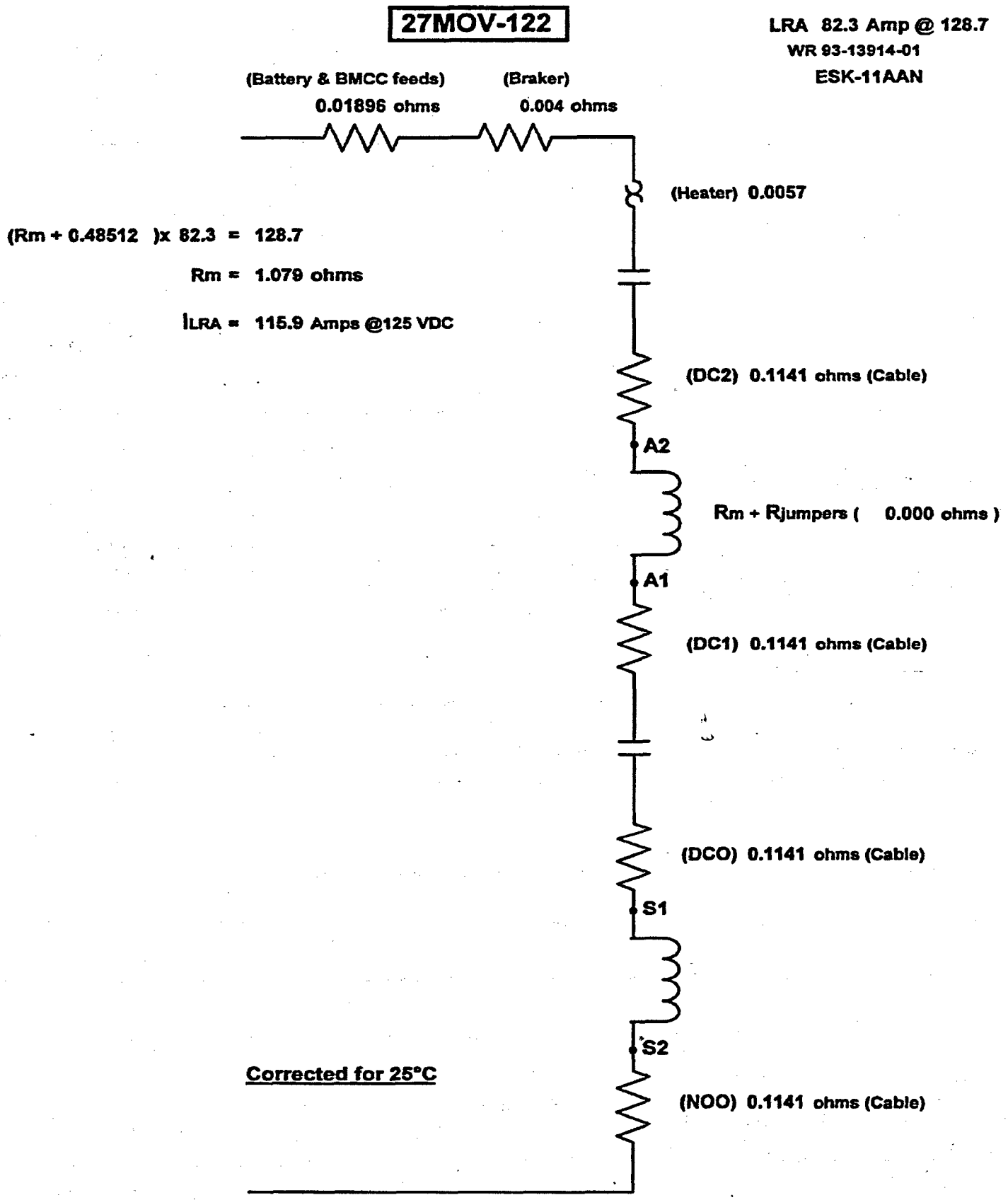
ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	23	31		4	4	LIMITORQUE	B-13
AMPS F.L. AT TORQUE TRIP			TORQUE SWITCH SETTING	2.75	2.75	MCC	C-1
BRAKE INFO, BOLTING TORQUE, MISC INFO						RP Panel	A-5

27MOV-122

Date	Inrush	O/C	Battery Voltage	Votes Test No.	Stroke Time	WR Number	Notes
1/8/92	80.8	C	unknown	2	3.7	WR-090829	
1/8/92	79.4	O	unknown	2	3.7	WR-090829	
2/6/92	76.4	C	129.5	2	3.1	WR-087564	
2/6/92	75.0	O	129.5	2	3.1	WR-087564	
4/25/92	77.9	C	129.3	1	3.2	WR-098064	
4/25/92	76.9	O	129.3	1	3.1	WR-098064	
12/27/94	**82.3**	**C**	**128.7**	**2**	**3.2**	**93-13914-01**	
12/27/94	80.3	O	128.7	2	3.0	93-13914-01	

27MOV-122 Votes Tests Data



27MOV-122 Inrush Current

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/2002, 4:57 PM

Select Valve--> 27MOV-122, open with pump flow model

General Information	Required?	Value
Valve Type	yes	globe
Flow type	no	pumped flow
Stroke direction	yes	open
Fluid (blowdown only)	no	0
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.000
Seat ring face ID, $D_{body-ID}$ (inches)	no	0.000
Seat ring inner diameter, D_v (inches)	yes	2.400
Globe valve stroke length, D (inches)	yes	2.069
Isolation-to-wedging travel, X (percent)	no	0.00%
Packing load, F_{pack} (lbs)	yes	1,000
Required thrust (including water inertia), F_R (lbs)	yes	779
Required thrust due to water inertia, F_{Wi} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	yes	115
Actuator overall ratio, OAR	yes	27.20
Motor gear set ratio, MGSR	yes	1.250
Actuator rated torque, τ_{rated}	yes	850
Stem factor, SF (ft-lbs/lb)	yes	0.01138
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00049
Voltage at MCC, V_{mcc} (volts)	yes	112.95
Cable resistance, R_{cable} (ohms)	yes	0.5004
Thermal overload resistance, R_{to} (ohms)	yes	0.0097
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	40 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.400
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.50
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	yes	41
Valve pressure at full open, P_B (psig)	yes	41
Flow rate, Q_{max} (gpm)	yes	740
Fluid density, ρ (lbs/ft^3)	yes	62.000
Ambient temperature (C)	yes	38
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	2.2
Fully open stem thrust, F_O (lbs)	yes	968
Nominal motor torque, τ_{nom} (ft-lbs)	yes	50.6
Maximum motor torque (ft-lbs)	yes	0.9
Maximum adjusted motor torque (ft-lbs)	yes	1.1
Minimum motor speed (rpm)	yes	2228
Minimum instantaneous actuator capability (lbs)	yes	39,152
Minimum instantaneous margin (lbs)	yes	38,284
Maximum allowable thrust at unwedging	no	—
Efficiency at minimum instantaneous capability	yes	0.383

Warnings

Ksys is less than 10. The load profile for Ksys=10 is used.

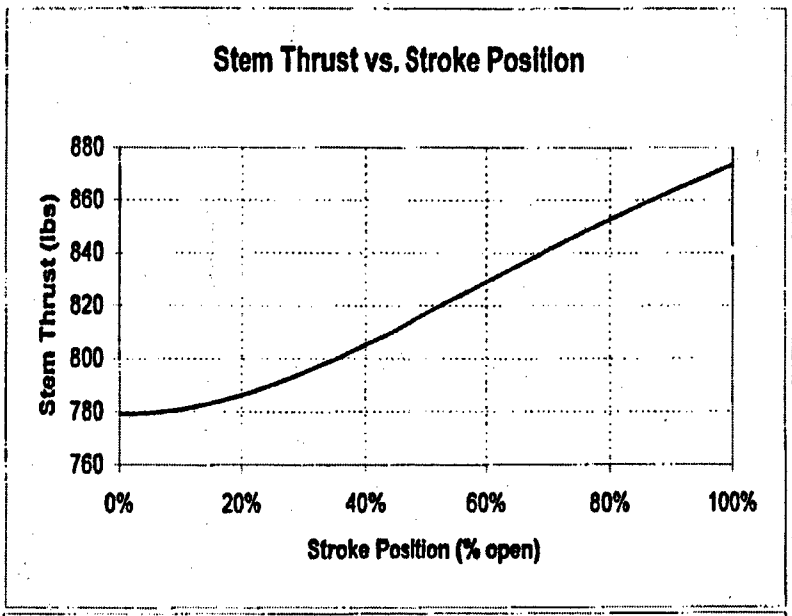
Predicted Stroke Time (Seconds): 3.77

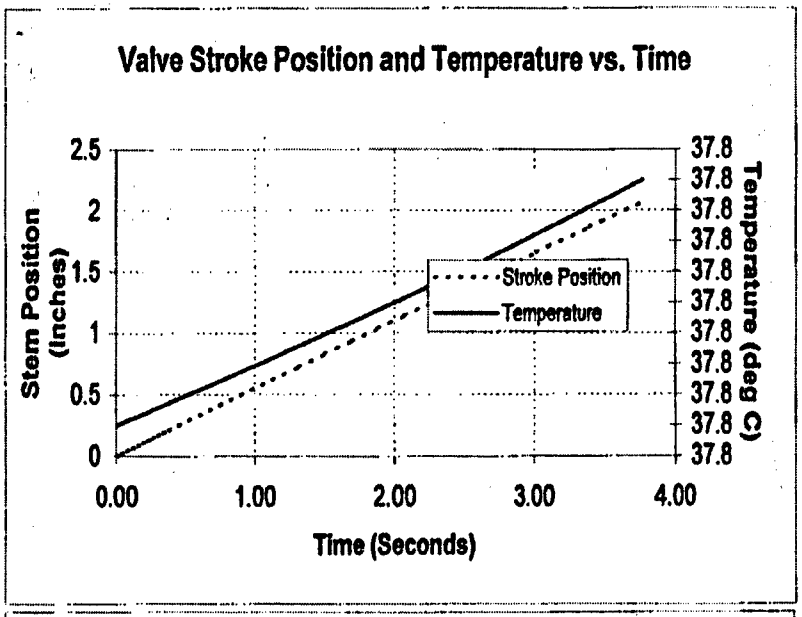
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
25%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

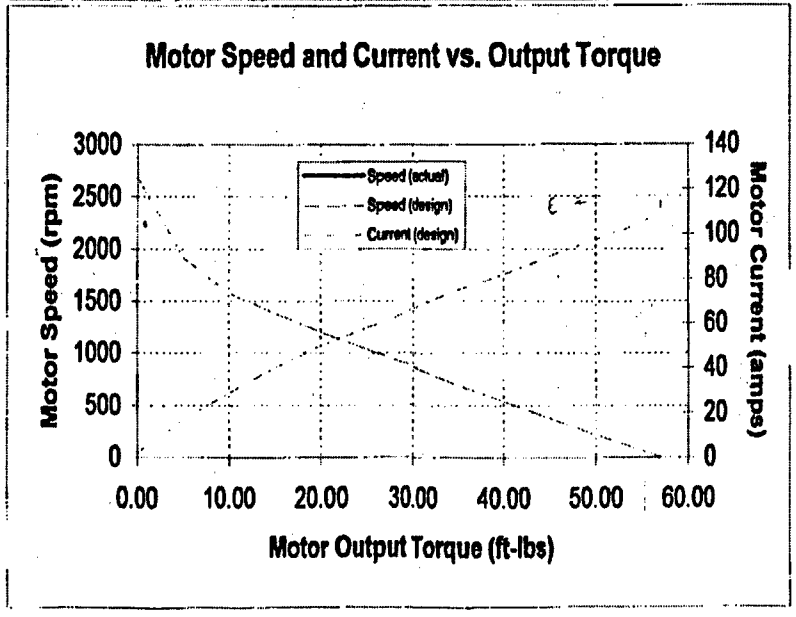
BWROG DCM for B Battery (batch), Version 2.0.xls; Results, 9/16/2002, 4:56 PM

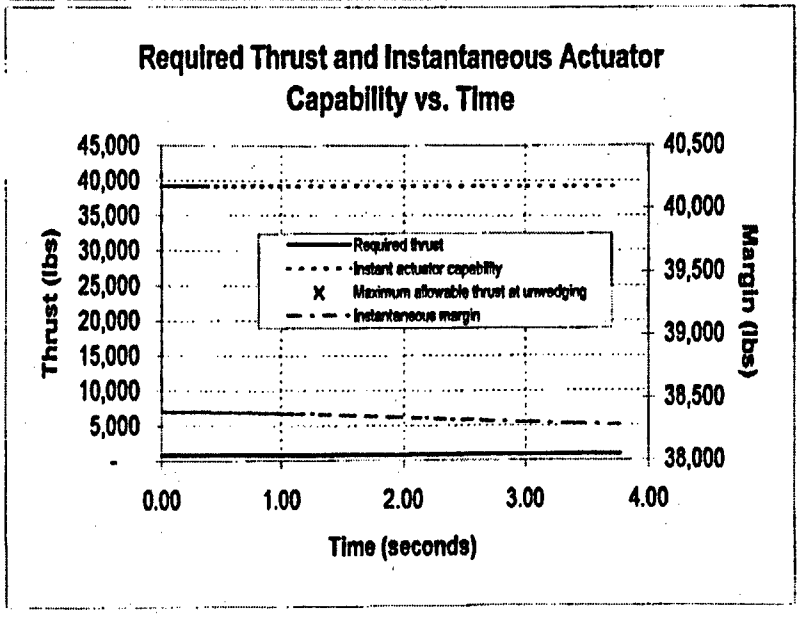
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
0%	0.00	779												*0.00*	*37.8*				0
0%	0.00	779	779	8.85		*0.400*	0.81	4.44	112.95	111	0.96	2254	0.00	0.00	37.8	465	40,914	40,135	0
0%	0.00	779	779	8.85	2818	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
0%	0.00	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.00	0.00	37.8	445	39,169	38,390	0
1%	0.02	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.04	37.8	445	39,169	38,390	7
2%	0.04	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.08	37.8	445	39,169	38,390	15
3%	0.06	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.11	37.8	445	39,169	38,390	22
4%	0.08	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.15	37.8	445	39,169	38,389	30
5%	0.10	779	779	8.85	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.19	37.8	445	39,169	38,389	37
6%	0.12	780	780	8.86	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.23	37.8	445	39,169	38,389	44
7%	0.14	780	780	8.86	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.26	37.8	445	39,169	38,389	52
8%	0.17	780	780	8.86	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.30	37.8	445	39,169	38,388	59
9%	0.19	781	780	8.86	2809	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.34	37.8	445	39,168	38,388	66
10%	0.21	781	781	8.87	2808	0.383	0.85	4.55	112.95	111	1.01	2247	0.04	0.38	37.8	445	39,168	38,388	74
12%	0.25	782	781	8.88	2808	0.383	0.85	4.55	112.95	111	1.01	2247	0.08	0.45	37.8	445	39,168	38,387	88
14%	0.29	783	782	8.89	2808	0.383	0.85	4.56	112.95	111	1.01	2246	0.08	0.53	37.8	445	39,168	38,386	103
16%	0.33	784	783	8.90	2808	0.383	0.85	4.56	112.95	111	1.01	2246	0.08	0.60	37.8	445	39,168	38,385	117
18%	0.37	785	784	8.91	2808	0.383	0.85	4.56	112.95	111	1.01	2246	0.08	0.68	37.8	445	39,168	38,383	131
20%	0.41	786	786	8.92	2807	0.383	0.86	4.57	112.95	111	1.02	2246	0.08	0.75	37.8	445	39,167	38,382	145
22%	0.46	788	787	8.94	2807	0.383	0.86	4.57	112.95	111	1.02	2245	0.08	0.83	37.8	445	39,167	38,380	159
24%	0.50	789	789	8.96	2807	0.383	0.86	4.58	112.95	111	1.02	2245	0.08	0.90	37.8	445	39,167	38,378	173
26%	0.54	791	790	8.98	2806	0.383	0.86	4.58	112.95	111	1.02	2245	0.08	0.98	37.8	445	39,167	38,376	186
28%	0.58	793	792	9.00	2806	0.383	0.86	4.59	112.95	111	1.02	2244	0.08	1.05	37.8	445	39,166	38,374	199
30%	0.62	795	794	9.02	2805	0.383	0.87	4.60	112.95	111	1.03	2244	0.08	1.13	37.8	445	39,166	38,372	212
35%	0.72	800	797	9.06	2805	0.383	0.87	4.61	112.95	111	1.03	2243	0.19	1.32	37.8	445	39,165	38,368	244
40%	0.83	805	802	9.11	2804	0.383	0.87	4.62	112.95	111	1.04	2242	0.19	1.50	37.8	445	39,164	38,362	275
45%	0.93	811	808	9.18	2803	0.383	0.88	4.64	112.95	111	1.04	2241	0.19	1.69	37.8	445	39,163	38,355	303
50%	1.03	817	814	9.24	2801	0.383	0.89	4.66	112.95	111	1.05	2240	0.19	1.88	37.8	445	39,162	38,348	331
55%	1.14	823	820	9.31	2800	0.383	0.89	4.68	112.95	111	1.06	2238	0.19	2.07	37.8	445	39,161	38,341	356
60%	1.24	829	826	9.38	2798	0.383	0.90	4.70	112.95	111	1.07	2237	0.19	2.26	37.8	445	39,160	38,334	380
70%	1.45	841	835	9.49	2796	0.383	0.91	4.73	112.95	111	1.08	2235	0.38	2.64	37.8	445	39,158	38,323	424
80%	1.66	853	847	9.62	2794	0.383	0.92	4.77	112.95	111	1.09	2233	0.38	3.01	37.8	445	39,156	38,309	461
90%	1.86	863	858	9.75	2791	0.383	0.93	4.80	112.95	110	1.11	2230	0.38	3.39	37.8	445	39,154	38,296	494
100%	2.07	873	868	9.87	2788	0.383	0.95	4.84	112.95	110	1.12	2228	0.38	3.77	37.8	445	39,152	38,284	522
UNW	—	—	*28353*	*322.09*	*157*	*0.390*	*30.38*	67.14	112.95	79	*50.63*	126	—	—	—	322	28,353	(0)	—
Screen	—	—	*779*	*8.85*	—	*0.400*	0.81	*115.00*	112.95	54	*2.04*	1033	—	*8.2*	*37.8*	228	20,067	19,288	—
w/iter	—	—	*779*	*8.85*	*2809*	*0.383*	0.85	4.55	112.95	111	*1.01*	2247	—	*3.8*	*37.8*	*445*	39,168	38,389	—
Valve:	27MOV-122, open with pump flow model																		

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 9/16/2002, 4:58 PM









Valve: 27MOV-122, open with pump flow model

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/16/2002, 4:58 PM

Select Valve--> 27MOV-122, close with pump flow model

General Information	Required?	Value
Valve Type	yes	globe
Flow type	no	pumped flow
Stroke direction	yes	close
Fluid (blowdown only)	no	0
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.000
Seat ring face ID, $D_{body-ID}$ (inches)	no	0.000
Seat ring inner diameter, D_{sr} (inches)	yes	2.400
Globe valve stroke length, D (inches)	yes	2.069
Isolation-to-wedging travel, X (percent)	no	0.00%
Packing load, F_{pack} (lbs)	yes	1,000
Required thrust (including water inertia), F_R (lbs)	yes	1,221
Required thrust due to water inertia, F_{wi} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	yes	115
Actuator overall ratio, OAR	yes	27.20
Motor gear set ratio, MGSR	yes	1.250
Actuator rated torque, τ_{rated}	yes	850
Stem factor, SF (ft-lbs/lb)	yes	0.01136
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00049
Voltage at MCC, V_{mcc} (volts)	yes	112.75
Cable resistance, R_{cable} (ohms)	yes	0.5004
Thermal overload resistance, R_{ol} (ohms)	yes	0.0097
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	40 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.400
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.50
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	yes	41
Valve pressure at full open, P_B (psig)	yes	41
Flow rate, Q_{max} (gpm)	yes	740
Fluid density, ρ (lbs/ft^3)	yes	62.000
Ambient temperature (C)	yes	38
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	2.2
Fully open stem thrust, F_O (lbs)	yes	1,032
Nominal motor torque, τ_{nom} (ft-lbs)	yes	50.6
Maximum motor torque (ft-lbs)	yes	1.3
Maximum adjusted motor torque (ft-lbs)	yes	1.6
Minimum motor speed (rpm)	yes	2150
Minimum instantaneous actuator capability (lbs)	yes	39,017
Minimum instantaneous margin (lbs)	yes	37,796
Maximum allowable thrust at torque switch trip	yes	28,294
Efficiency at minimum instantaneous capability	yes	0.385

Warnings

Ksys is less than 10. The load profile for Ksys=10 is used.

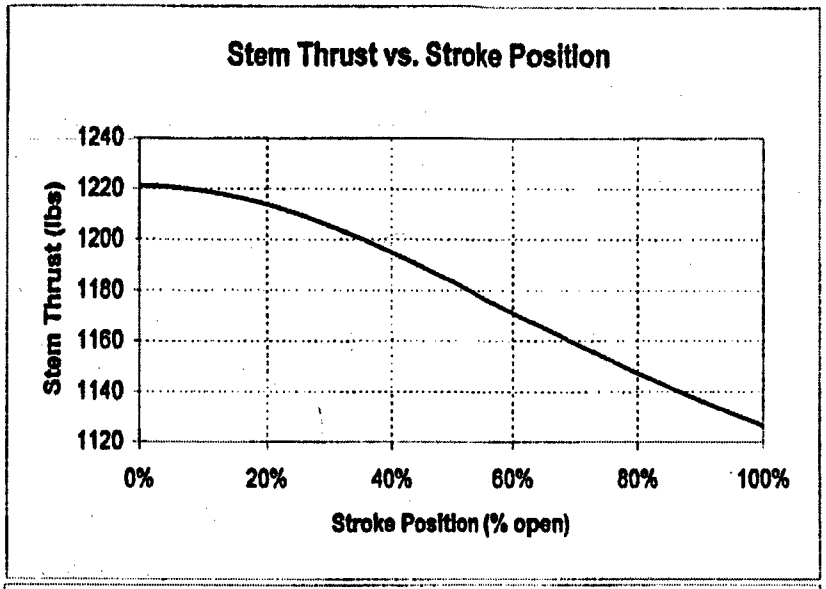
Predicted Stroke Time (Seconds): **3.91**

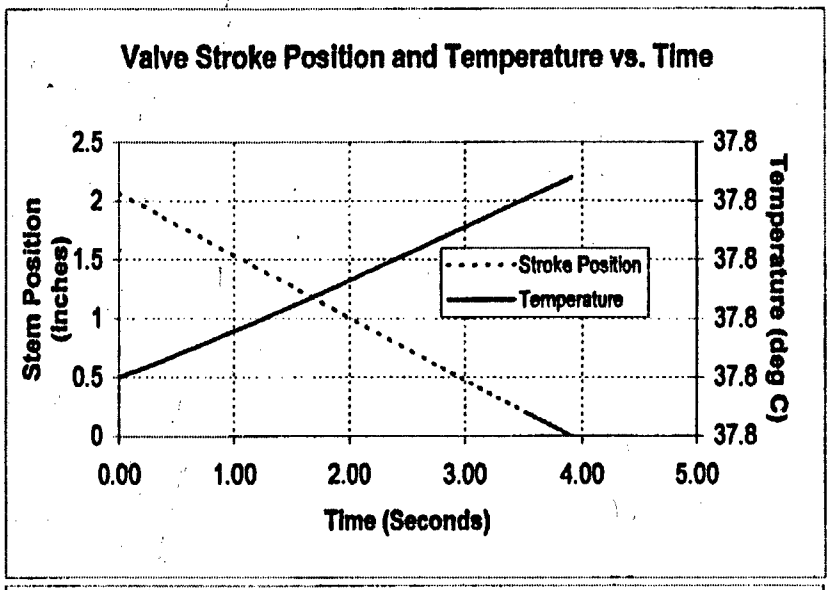
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

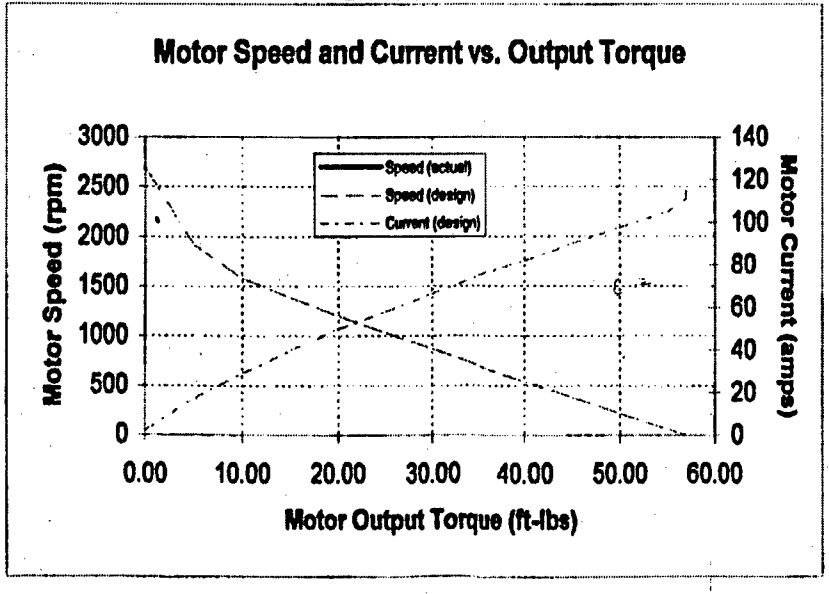
BWROG DCM for B Battery (batch), Version 2.0.xls, Results, 9/16/2002, 4:58 PM

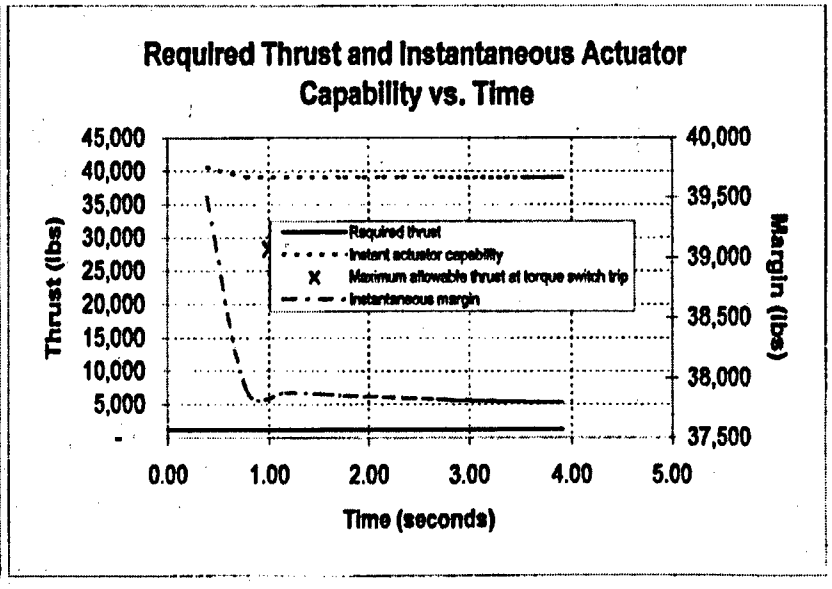
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
100%	2.07	1127												*0.00*	*37.8*				522
90%	1.86	1137	1132	12.85		*0.400*	1.18	5.54	112.75	110	1.41	2178	0.39	0.39	37.8	462	40,632	39,501	494
80%	1.66	1147	1142	12.97	2722	0.385	1.24	5.72	112.75	110	1.48	2166	0.39	0.78	37.8	443	39,034	37,892	461
70%	1.45	1159	1153	13.10	2708	0.385	1.25	5.76	112.75	110	1.50	2164	0.39	1.17	37.8	443	39,031	37,878	424
60%	1.24	1171	1165	13.23	2705	0.385	1.26	5.79	112.75	110	1.51	2161	0.39	1.56	37.8	443	39,029	37,864	380
55%	1.14	1177	1174	13.34	2702	0.385	1.27	5.82	112.75	110	1.52	2160	0.20	1.75	37.8	443	39,027	37,853	356
50%	1.03	1183	1180	13.41	2699	0.385	1.28	5.84	112.75	110	1.53	2158	0.20	1.95	37.8	443	39,026	37,846	331
45%	0.93	1189	1186	13.48	2698	0.385	1.29	5.86	112.75	110	1.54	2157	0.20	2.14	37.8	443	39,025	37,839	303
40%	0.83	1195	1192	13.54	2696	0.385	1.29	5.88	112.75	110	1.55	2156	0.20	2.34	37.8	443	39,024	37,832	275
35%	0.72	1200	1198	13.61	2695	0.385	1.30	5.90	112.75	110	1.55	2155	0.20	2.54	37.8	443	39,023	37,825	244
30%	0.62	1205	1203	13.66	2693	0.385	1.31	5.92	112.75	110	1.56	2153	0.20	2.73	37.8	443	39,022	37,819	212
28%	0.58	1207	1206	13.70	2692	0.385	1.31	5.93	112.75	110	1.57	2153	0.08	2.81	37.8	443	39,021	37,814	199
26%	0.54	1209	1208	13.72	2691	0.385	1.31	5.93	112.75	110	1.57	2152	0.08	2.89	37.8	443	39,020	37,812	186
24%	0.50	1211	1210	13.74	2690	0.385	1.31	5.94	112.75	110	1.57	2152	0.08	2.97	37.8	443	39,020	37,810	173
22%	0.46	1212	1211	13.76	2690	0.385	1.31	5.94	112.75	110	1.57	2152	0.08	3.05	37.8	443	39,020	37,808	159
20%	0.41	1214	1213	13.78	2690	0.385	1.32	5.95	112.75	110	1.57	2151	0.08	3.12	37.8	443	39,019	37,806	145
18%	0.37	1215	1214	13.80	2689	0.385	1.32	5.95	112.75	110	1.58	2151	0.08	3.20	37.8	443	39,019	37,805	131
16%	0.33	1216	1216	13.81	2689	0.385	1.32	5.96	112.75	110	1.58	2151	0.08	3.28	37.8	443	39,019	37,803	117
14%	0.29	1217	1217	13.82	2688	0.385	1.32	5.96	112.75	110	1.58	2151	0.08	3.36	37.8	443	39,019	37,802	103
12%	0.25	1218	1218	13.83	2688	0.385	1.32	5.96	112.75	110	1.58	2150	0.08	3.44	37.8	443	39,018	37,801	88
10%	0.21	1219	1219	13.84	2688	0.385	1.32	5.97	112.75	110	1.58	2150	0.08	3.52	37.8	443	39,018	37,799	74
9%	0.19	1219	1219	13.85	2688	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.56	37.8	443	39,018	37,799	66
8%	0.17	1220	1220	13.86	2688	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.60	37.8	443	39,018	37,798	59
7%	0.14	1220	1220	13.86	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.63	37.8	443	39,018	37,798	52
6%	0.12	1220	1220	13.86	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.67	37.8	443	39,018	37,798	44
5%	0.10	1221	1220	13.86	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.71	37.8	443	39,018	37,797	37
4%	0.08	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.75	37.8	443	39,018	37,797	30
3%	0.06	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.79	37.8	443	39,018	37,797	22
2%	0.04	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.83	37.8	443	39,018	37,797	15
1%	0.02	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.87	37.8	443	39,018	37,797	7
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.04	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
0%	0.00	1221	1221	13.87	2687	0.385	1.32	5.97	112.75	110	1.58	2150	0.00	3.91	37.8	443	39,017	37,796	0
TST	—	—	*28294*	*321.42*	*157*	*0.390*	*30.32*	67.04	112.75	79	*50.63*	126	—	—	—	*321*	28,294	(0)	—
Screen	—	—	*1221*	*13.87*	—	*0.400*	1.27	*115.00*	112.75	54	*3.21*	951	—	*8.9*	*37.8*	*227*	19,991	18,770	—
w/iter	—	—	*1221*	*13.87*	*2687*	*0.385*	1.32	5.97	112.75	110	*1.58*	2150	—	*3.9*	*37.8*	*443*	39,017	37,796	—
Valve:	27MOV-122, close with pump flow model																		

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 9/16/2002, 4:58 PM









Valve: 27MOV-122, close with pump flow model

FOR REFERENCE ONLY

SYS/ VALVE NO. 38 MOV VB-2
Q.A. CAT. II

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
38 MOV-VB-2	Cond Vacuum Breaker MOV			
MANUFACTURER	**MCC**	**ESK**	**SE**	**COMP. LOCATION & ELEVATION**
Peerless	71DC63 BKR#13 (Fe-44Q)	11AB	10M 10AY	295' TURBINE DECK E. SIDE ON GRATING 5' BELOW 300' FLOOR

H.P./ TORQUE	TYPE	MODEL NO.
.722 / 10 ft/lb.	COMPOUND	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125 DC	—	—	CE 26754		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
29	—	5 MIN	DG 56D

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
6.0	1900	75°C / 40°C AMB	B

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
	N-25 ALLEN BRADLY	6.22			

TOTAL STEM TRAVEL		INCHES OR TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES _____	TURNS _____						

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Stockham	TYPE SMB-00	NO. 1VAC-B06	RECOMMENDED: OPEN 1 CLOSE 1
TYPE GATE	SER. NO. 147742	BKR. AMPS 20	MAX: OPEN 2 3/4 CLOSE 2 3/4
SIZE 12 INCH	ORDER NO. 360340A	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) 2 3/4 NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	3	3		48	48	LIMITORQUE	ON BIO WALL BY GAITRONICS 75' AWAY J-3
AMPS F.L. AT TORQUE TRIP	5	5	TORQUE SWITCH SETTING	1	1	MCC NO MCC M.I. CONTROLS ARE AT the VALVE	

BRAKE INFO, BOLTING TORQUE, MISC INFO

NO Brake
5/16" ALLEN - COVER BOLTS
LOCAL LIGHTS & SWITCHES

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 9/18/02, 10:22 AM

Select Valve--> 38MOV-VB2, open with pump flow model

General Information	*Required?*	*Value*
Valve Type	yes	wedge gate
Flow type	yes	pumped flow
Stroke direction	yes	open
Fluid (blowdown only)	no	0
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.500
Seat ring face ID, $D_{body-ID}$ (inches)	yes	12.000
Seat ring inner diameter, D_{sr} (inches)	yes	12.000
Globe valve stroke length, D (inches)	no	0.000
Isolation-to-wedging travel, X (percent)	yes	8.00%
Packing load, F_{pack} (lbs)	yes	1,500
Required thrust (including water inertia), F_R (lbs)	yes	3,334
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	no	0
Actuator overall ratio, OAR	yes	76.67
Motor gear set ratio, MGSR	yes	0.585
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.01892
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00508
Voltage at MCC, V_{mcc} (volts)	yes	105.59
Cable resistance, R_{cable} (ohms)	yes	1.4191
Thermal overload resistance, R_{tol} (ohms)	yes	0.0651
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	10 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.500
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.50
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	yes	33
Valve pressure at full open, P_s (psig)	yes	18
Flow rate, Q_{max} (gpm)	yes	11547
Fluid density, ρ (lbs/ft^3)	yes	61.862
Ambient temperature (C)	yes	43
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	4.6
Fully open stem thrust, F_O (lbs)	yes	1,468
Nominal motor torque, τ_{nom} (ft-lbs)	yes	14.3
Maximum motor torque (ft-lbs)	yes	2.1
Maximum adjusted motor torque (ft-lbs)	yes	2.9
Minimum motor speed (rpm)	yes	1314
Minimum instantaneous actuator capability (lbs)	yes	16,694
Minimum instantaneous margin (lbs)	yes	13,360
Maximum allowable thrust at unwedging	yes	12,037
Efficiency at minimum instantaneous capability	yes	0.400

Warnings

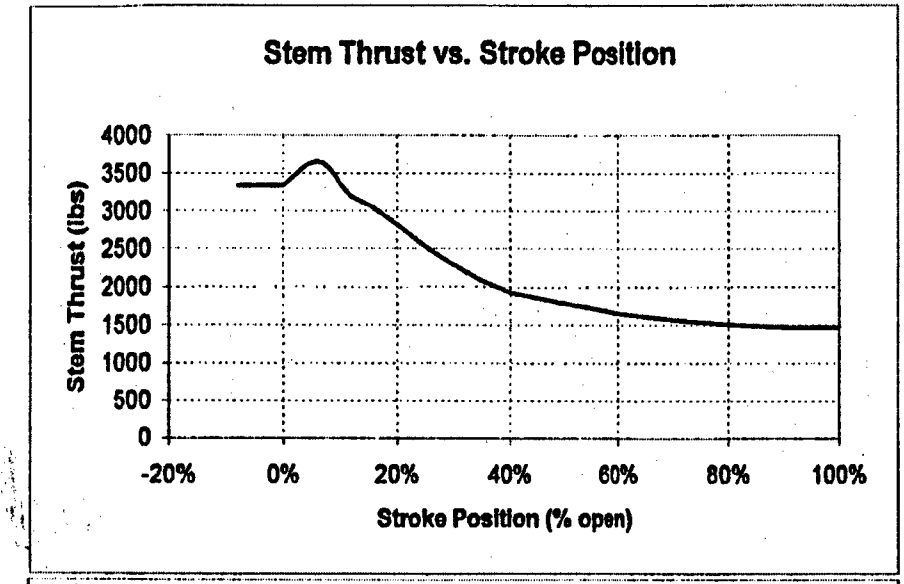
Ksys is less than 10. The load profile for Ksys=10 is used.

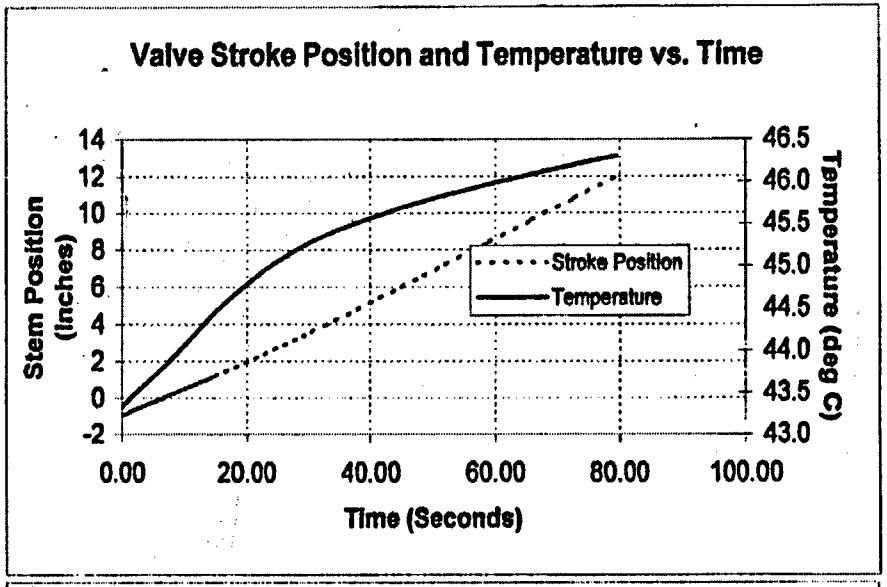
Predicted Stroke Time (Seconds): 79.62

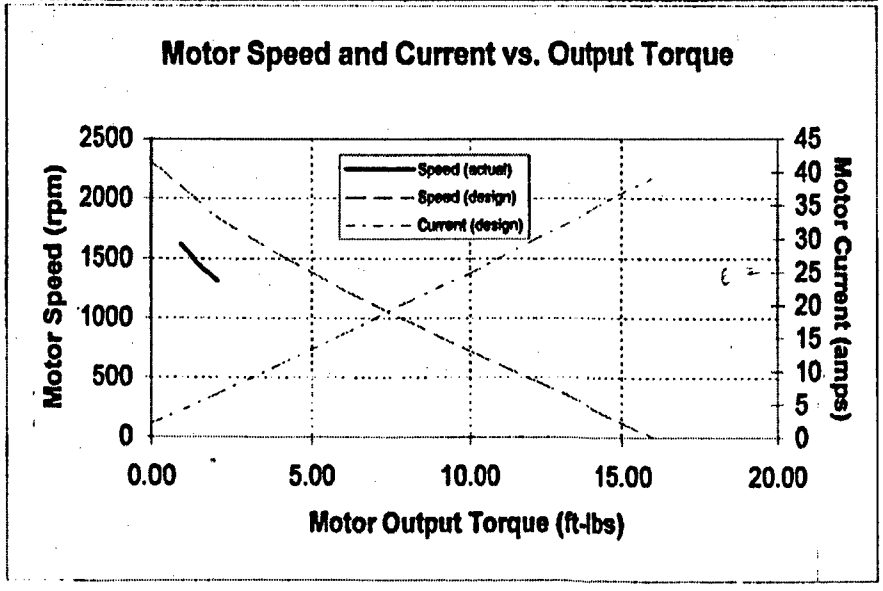
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

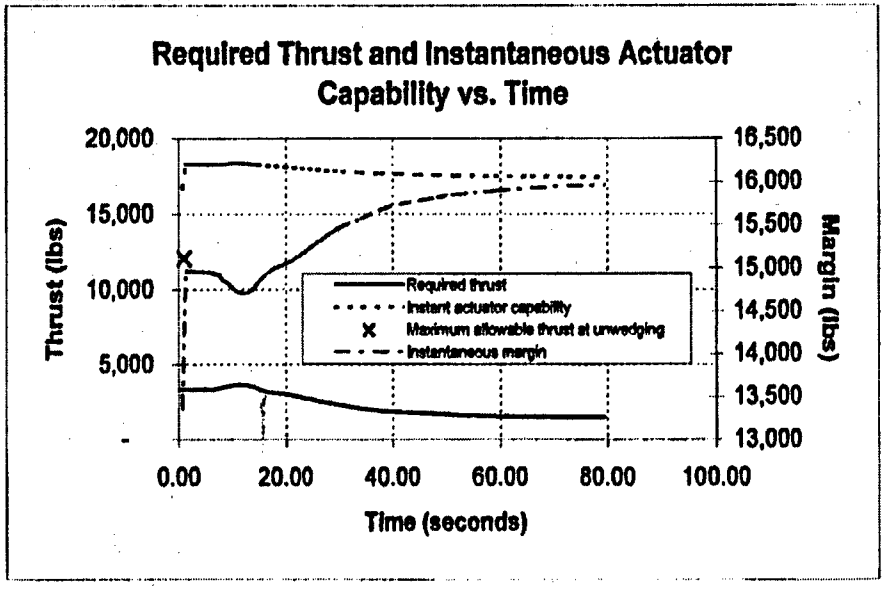
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
-8%	-0.96	3334												*0.00*	*43.3*				0
-7%	-0.86	3334	3334	63.08		*0.400*	2.05	6.52	105.59	96	2.86	1314	0.67	0.67	43.4	316	16,694	13,360	0
-6%	-0.77	3334	3334	63.08	768	0.436	1.88	6.14	105.59	96	2.61	1352	0.65	1.33	43.4	346	18,284	14,950	0
-6%	-0.67	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.61	1352	0.65	1.98	43.5	346	18,297	14,963	0
-5%	-0.58	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.61	1352	0.65	2.64	43.5	346	18,294	14,960	0
-4%	-0.48	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.61	1352	0.65	3.29	43.6	346	18,291	14,957	0
-3%	-0.38	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.61	1352	0.65	3.95	43.6	346	18,288	14,954	0
-2%	-0.29	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.61	1352	0.65	4.60	43.7	346	18,285	14,951	0
-2%	-0.19	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.61	1352	0.65	5.26	43.7	346	18,282	14,948	0
-1%	-0.10	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.61	1352	0.65	5.91	43.8	346	18,279	14,945	0
0%	-0.01	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.61	1352	0.57	6.49	43.8	346	18,276	14,942	0
0%	0.00	3334	3334	63.08	791	0.436	1.88	6.14	105.59	96	2.62	1352	0.08	6.57	43.8	346	18,273	14,939	0
1%	0.12	3402	3368	63.72	791	0.437	1.90	6.18	105.59	96	2.64	1348	0.82	7.39	43.9	346	18,286	14,918	108
2%	0.24	3470	3436	65.00	789	0.438	1.93	6.25	105.59	96	2.69	1340	0.83	8.22	43.9	346	18,308	14,872	248
3%	0.36	3537	3503	66.28	784	0.439	1.97	6.32	105.59	96	2.74	1333	0.83	9.05	44.0	347	18,327	14,824	413
4%	0.48	3605	3571	67.57	780	0.440	2.00	6.40	105.59	96	2.79	1325	0.84	9.88	44.1	347	18,346	14,775	620
5%	0.60	3641	3623	68.55	775	0.441	2.02	6.46	105.59	96	2.83	1319	0.84	10.72	44.1	347	18,358	14,735	866
6%	0.72	3660	3651	69.07	772	0.441	2.04	6.49	105.59	96	2.85	1316	0.84	11.56	44.2	347	18,362	14,711	1152
7%	0.84	3639	3649	69.05	770	0.441	2.04	6.49	105.59	96	2.85	1316	0.84	12.40	44.3	347	18,355	14,706	1396
8%	0.96	3574	3606	68.23	770	0.440	2.02	6.44	105.59	96	2.82	1321	0.84	13.24	44.3	347	18,334	14,726	1678
9%	1.08	3486	3530	66.79	773	0.439	1.98	6.35	105.59	96	2.76	1329	0.83	14.07	44.4	346	18,302	14,772	1941
10%	1.20	3347	3417	64.64	778	0.437	1.92	6.23	105.59	96	2.68	1342	0.83	14.90	44.5	345	18,257	14,840	2216
12%	1.44	3185	3266	61.80	785	0.435	1.85	6.07	105.59	97	2.57	1359	1.63	16.53	44.6	344	18,198	14,932	2694
14%	1.68	3114	3150	59.59	795	0.433	1.79	5.94	105.59	97	2.49	1372	1.61	18.14	44.7	343	18,152	15,002	3180
16%	1.92	3042	3078	58.24	803	0.432	1.75	5.86	105.59	97	2.43	1380	1.60	19.75	44.8	343	18,121	15,043	3683
18%	2.16	2934	2988	56.54	807	0.430	1.71	5.76	105.59	97	2.37	1390	1.59	21.34	44.9	342	18,082	15,094	4184
20%	2.40	2819	2876	54.42	813	0.429	1.65	5.63	105.59	97	2.29	1403	1.58	22.92	45.0	341	18,035	15,158	4652
22%	2.64	2704	2761	52.25	821	0.427	1.59	5.50	105.59	97	2.20	1417	1.56	24.48	45.0	340	17,988	15,226	5007
24%	2.88	2589	2646	50.07	829	0.425	1.53	5.37	105.59	98	2.11	1430	1.55	26.03	45.1	339	17,940	15,294	5459
26%	3.12	2474	2531	47.90	837	0.423	1.47	5.24	105.59	98	2.03	1444	1.53	27.56	45.2	339	17,893	15,362	5897
28%	3.36	2372	2423	45.84	845	0.421	1.42	5.11	105.59	98	1.95	1460	1.52	29.08	45.2	338	17,849	15,426	6266
30%	3.60	2289	2330	44.09	854	0.420	1.37	5.01	105.59	98	1.88	1475	1.50	30.58	45.3	337	17,812	15,482	6715
35%	4.20	2080	2184	41.33	863	0.417	1.29	4.83	105.59	98	1.76	1499	3.69	34.27	45.4	336	17,753	15,568	7514
40%	4.80	1926	2003	37.90	877	0.414	1.19	4.62	105.59	99	1.62	1530	3.62	37.89	45.5	334	17,676	15,673	8216
45%	5.40	1855	1891	35.77	895	0.413	1.13	4.48	105.59	99	1.54	1549	3.57	41.46	45.6	334	17,630	15,739	8793
50%	6.00	1785	1820	34.44	906	0.412	1.09	4.39	105.59	99	1.48	1561	3.55	45.01	45.7	333	17,599	15,779	9192
55%	6.60	1716	1751	33.12	913	0.410	1.05	4.31	105.59	99	1.43	1572	3.52	48.53	45.8	332	17,567	15,816	9548
60%	7.20	1658	1687	31.92	920	0.409	1.01	4.23	105.59	99	1.38	1583	3.50	52.02	45.8	332	17,538	15,851	9949
70%	8.40	1570	1614	30.54	926	0.408	0.97	4.14	105.59	99	1.32	1596	6.94	58.96	46.0	331	17,505	15,891	10432
80%	9.60	1514	1542	29.16	934	0.407	0.93	4.05	105.59	100	1.27	1608	6.88	65.84	46.1	330	17,468	15,926	10664
90%	10.80	1474	1494	28.27	941	0.406	0.91	3.99	105.59	100	1.23	1617	6.85	72.69	46.2	330	17,443	15,948	10798
100%	12.00	1468	1471	27.83	946	0.406	0.89	3.96	105.59	100	1.21	1621	6.83	79.52	46.3	330	17,427	15,956	10860
UNW	—	—	*12037*	*227.74*	*70*	*0.368*	*8.05*	*20.50*	105.59	75	*14.33*	120	—	—	—	228	12,037	0	—
Screen	—	—	*3334*	*63.08*	—	*0.400*	2.05	*39.20*	105.59	47	*6.00*	470	—	*254.2*	*64.7*	*145*	7,661	4,327	—
w/ter	—	—	*3334*	*63.08*	*787*	*0.436*	1.88	6.14	105.59	96	*2.67*	1345	—	*88.9*	*49.6*	339	17,895	14,561	—
Valve:	38MOV-VB2, open with pump flow model																		

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 9/18/02, 10:22 AM









Valve: 38MOV-VB2, open with pump flow model

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 9
Battery Sizing Sheets

SIZING LEAD-ACID BATTERIES FOR STATIONARY APPLICATIONS — IEEE Std 485-1997

Project: 71SB-2 (Min voltage 109.7V), LOCA — Date: 4/25/03 — Page: 1 of 1

Lowest Expected Electrolyte Temp: 65°F — Minimum Cell Voltage: 1.828 — Cell Mfg: GNB — Cell Type: NCN — Sized By: A. Barton

(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= 980.96	A1-0= 980.96	M1= 1	T=M1= 1	86.1	11.39	***
					Sec 1 Total	11.39	***
Section 2 - First Two Periods Only - If A3 is greater than A2, go to Section 3.							
1	A1= 980.96	A1-0= 980.96	M1= 1	T=M1+M2= 120	44.16	22.21	
2	A2= 444.76	A2-A1= -536.20	M2= 119	T=M2= 119	44.16		12.14
					Sec 2 Sub Total	22.21	12.14
					Total	10.07	***
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 Total		
					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 Total		
					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=			
2	A2=	A2-A1=	M2=	T=M2+. . .M5=			
3	A3=	A3-A2=	M3=	T=M3+M4+M5=			
4	A4=	A4-A3=	M4=	T=M4+M5=			
5	A5=	A5-A4=	M5=	T=M5=			
					Sec 5 Sub Total		
					Total		***
Section 6 - First Six Periods Only - If A7 is greater than A6, go to Section 7.							
1	A1=	A1-0=	M1=	T=M1+. . .M6=			
2	A2=	A2-A1=	M2=	T=M2+. . .M6=			
3	A3=	A3-A2=	M3=	T=M3+. . .M6=			
4	A4=	A4-A3=	M4=	T=M4+M5+M6=			
5	A5=	A5-A4=	M5=	T=M5+M6=			
6	A6=	A6-A5=	M6=	T=M6=			
					Sec 6 Sub Total		
					Total		***
Section 7 - First Seven Periods Only - If A8 is greater than A7, go to Section 8.							
1	A1=	A1-0=	M1=	T=M1+. . .M7=			
2	A2=	A2-A1=	M2=	T=M2+. . .M7=			
3	A3=	A3-A2=	M3=	T=M3+. . .M7=			
4	A4=	A4-A3=	M4=	T=M4+. . .M7=			
5	A5=	A5-A4=	M5=	T=M5+M6+M7=			
6	A6=	A6-A5=	M6=	T=M6+M7=			
7	A7=	A7-A8=	M7=	T=M7=			
					Sec 7 Sub Total		
					Total		***
Random Equipment Load Only (if Needed)							
R	AR=	AR-0=	MR=	T=MR=			***

Maximum Section Size (8) 11.39 + Random Section Size (9) - = Uncorrected Size - (us) (10) 11.39

US (11) 11.39 x Temp Corr (12) 1.08 x Design Marg (13) 1.040 x Aging Factor (14) 1.25 = (15) 16.0

When the cell size (15) is greater than a standard cell size, the next larger cell is requir 9

Required cell size (16) 16 (A) - Positive Plates (B) - Ampere Hours Therefore cell (17) NCN-33 is required

Figure 3 - Cell sizing worksheet

IEEE
SIZING LEAD-ACID BATTERIES FOR STATIONARY APPLICATIONS Std 485-1997

Project: 71SB-2 (Min voltage 109.86V), SBO Date: 4/25/03 Page: 1 of 2

Lowest Expected Electrolyte Temp: 65°F | Minimum Cell Voltage: 1.831 | Cell Mfg: GNB | Cell Type: NCN | Sized By: A. Barton

(1)	(2)	(3)	(4)	(5)		(6)	(7)	
Period	Load (amperes)	Change in Load (amperes)	Duration of Period (minutes)	Time to End of Section (minutes)		Capacity at T Min Rate (6A) Amps/Pos (R_T) or (6B) K Factor (K_T)	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= 907.8	A1-0= 907.8	M1= 1	T=M1=	1	83.95	10.81	***
						Sec 1 Total	10.81	***
Section 2 - First Two Periods Only - If A3 is greater than A2, go to Section 3.								
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+M2=	-2			
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2=	1			
						Sec Sub Total		
						2 Total		***
Section 3 - First Three Periods Only - If A4 is greater than A3, go to Section 4.								
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+M2+M3=	3	83.95	10.81	
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+M3=	2	83.95		-7.39
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3=	1	83.95	5.66	
						Sec Sub Total	16.47	-7.39
						3 Total	9.08	***
Section 4 - First Four Periods Only - If A5 is greater than A4, go to Section 5.								
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+. . .M4=	4			
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+M3+M4=	3			
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3+M4=	2			
4	A4= 486.41	A4-A3= -275.94	M4= 1	T=M4=	1			
						Sec Sub Total		
						4 Total		***
Section 5 - First Five Periods Only - If A6 is greater than A5, go to Section 6.								
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+. . .M5=	5	83.74	10.84	
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+. . .M5=	4	83.89		-7.40
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3+M4+M5=	3	83.95	5.66	
4	A4= 486.41	A4-A3= -275.94	M4= 1	T=M4+M5=	2	83.95		-3.29
5	A5= 949.71	A5-A4= 463.3	M5= 1	T=M5=	1	83.95	5.52	
						Sec Sub Total	22.02	-10.68
						5 Total	11.33	***
Section 6 - First Six Periods Only - If A7 is greater than A6, go to Section 7.								
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+. . .M6=	30			
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+. . .M6=	29			
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3+. . .M6=	28			
4	A4= 486.41	A4-A3= -275.94	M4= 1	T=M4+M5+M6=	27			
5	A5= 949.71	A5-A4= 463.3	M5= 1	T=M5+M6=	26			
6	A6= 556.43	A6-A5= -393.28	M6= 25	T=M6=	25			
						Sec Sub Total		
						6 Total		***
Section 7 - First Seven Periods Only - If A8 is greater than A7, go to Section 8.								
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+. . .M7=	35			
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+. . .M7=	34			
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3+. . .M7=	33			
4	A4= 486.41	A4-A3= -275.94	M4= 1	T=M4+. . .M7=	32			
5	A5= 949.71	A5-A4= 463.3	M5= 1	T=M5+M6+M7=	31			
6	A6= 556.43	A6-A5= -393.28	M6= 25	T=M6+M7=	30			
7	A7= 236.63	A7-A6= -319.8	M7= 5	T=M7=	5			
						Sec Sub Total		
						7 Total		***

Figure 3 - Cell sizing worksheet cont'd on page 3

IEEE
SIZING LEAD-ACID BATTERIES FOR STATIONARY APPLICATIONS Std 485-1997

Project: **71SB-2 (Min voltage 109.86V), SBO** Date: **4/25/03** Page: **2 of 2**

Lowest Expected Electrolyte Temp: **65°F** Minimum Cell Voltage: **1.831** Cell Mfg: **GNB** Cell Type: **NCN** Sized By: **Alec Barton**

(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 8 - First Eight Periods Only - If A9 is greater than A8, go to Section 9.							
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+. . .M8= 41	70.1	12.95	
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+. . .M8= 40	70.6		-8.79
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3+. . .M8= 39	71.1	6.68	
4	A4= 486.41	A4-A3= -275.94	M4= 1	T=M4+. . .M8= 38	71.6		-3.85
5	A5= 949.71	A5-A4= 463.3	M5= 1	T=M5+M6+M8= 37	72.1	6.43	
6	A6= 556.43	A6-A5= -393.28	M6= 25	T=M6+M7+M8= 36	72.6		-5.42
7	A7= 236.63	A7-A6= -319.8	M7= 5	T=M7+M8= 11	83.2		-3.84
8	A8= 561.23	A8-A7= 324.6	M8= 6	T=M8= 6	83.57	3.88	
					Sec 8 Sub Total	29.94	-21.90
					Total	8.04	***
Section 9 - First Nine Periods Only - If A10 is greater than A9, go to Section 10.							
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+. . .M9= 60			
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+. . .M9= 59			
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3+. . .M9= 58			
4	A4= 486.41	A4-A3= -275.94	M4= 1	T=M4+. . .M9= 57			
5	A5= 949.71	A5-A4= 463.3	M5= 1	T=M5+ ... M9= 56			
6	A6= 556.43	A6-A5= -393.28	M6= 25	T=M6+. . .M9= 55			
7	A7= 236.63	A7-A6= -319.8	M7= 5	T=M7+M8+M9= 30			
8	A8= 561.23	A8-A7= 324.6	M8= 6	T=M8+M9= 25			
9	A9= 236.65	A9-A8= -324.58	M9= 19	T=M9= 19			
					Sec 9 Sub Total		
					Total		***
Section 10 - First Ten Periods Only - If A11 is greater than A10, go to Section 11.							
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+. . .M10= 239	28.5	31.85	
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+. . .M10= 238	28.5		-21.78
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3+. . .M10= 237	28.45	16.70	
4	A4= 486.41	A4-A3= -275.94	M4= 1	T=M4+. . .M10= 236	28.4		-9.72
5	A5= 949.71	A5-A4= 463.3	M5= 1	T=M5+ ... M10= 235	28.35	16.34	
6	A6= 556.43	A6-A5= -393.28	M6= 25	T=M6+. . .M10= 234	28.3		-13.90
7	A7= 236.63	A7-A6= -319.8	M7= 5	T=M7+. . .M10= 209	31.11		-10.28
8	A8= 561.23	A8-A7= 324.6	M8= 6	T=M8+M9+M10= 204	31.65	10.26	
9	A9= 236.65	A9-A8= -324.58	M9= 19	T=M9+M10= 198	32.3		-10.05
10	A10= 237.75	A10-A9= 1.1	M10= 179	T=M10= 179	34.35	0.03	
					Sec 10 Sub Total	75.18	-65.72
					Total	9.47	***
Section 11 - First Eleven Periods Only - If A12 is greater than A11, go to Section 12.							
1	A1= 907.8	A1-0= 907.8	M1= 1	T=M1+. . .M11= 240	28.5	31.85	
2	A2= 287.21	A2-A1= -620.59	M2= 1	T=M2+. . .M11= 239	28.5		-21.78
3	A3= 762.35	A3-A2= 475.14	M3= 1	T=M3+. . .M11= 238	28.45	16.70	
4	A4= 486.41	A4-A3= -275.94	M4= 1	T=M4+. . .M11= 237	28.4		-9.72
5	A5= 949.71	A5-A4= 463.3	M5= 1	T=M5+ ... M11= 236	28.35	16.34	
6	A6= 556.43	A6-A5= -393.28	M6= 25	T=M6+. . .M11= 235	28.3		-13.90
7	A7= 236.63	A7-A6= -319.8	M7= 5	T=M7+. . .M11= 210	31.0		-10.32
8	A8= 561.23	A8-A7= 324.6	M8= 6	T=M8+. . .M11= 205	31.5	10.29	
9	A9= 236.65	A9-A8= -324.58	M9= 19	T=M9+. . .M11= 199	32.2		-10.08
10	A10= 237.75	A10-A9= 1.1	M10= 179	T=M10+M11= 180	34.24	0.03	
11	A11= 293.59	A11-A1(55.84	M11= 1	T=M11= 1	84.0	0.67	
					Sec 11 Sub Total	75.88	-65.78
					Total	10.10	***
Random Equipment Load Only (if Needed)							
R	AR=	AR-0=	MR=	T=MR=			***

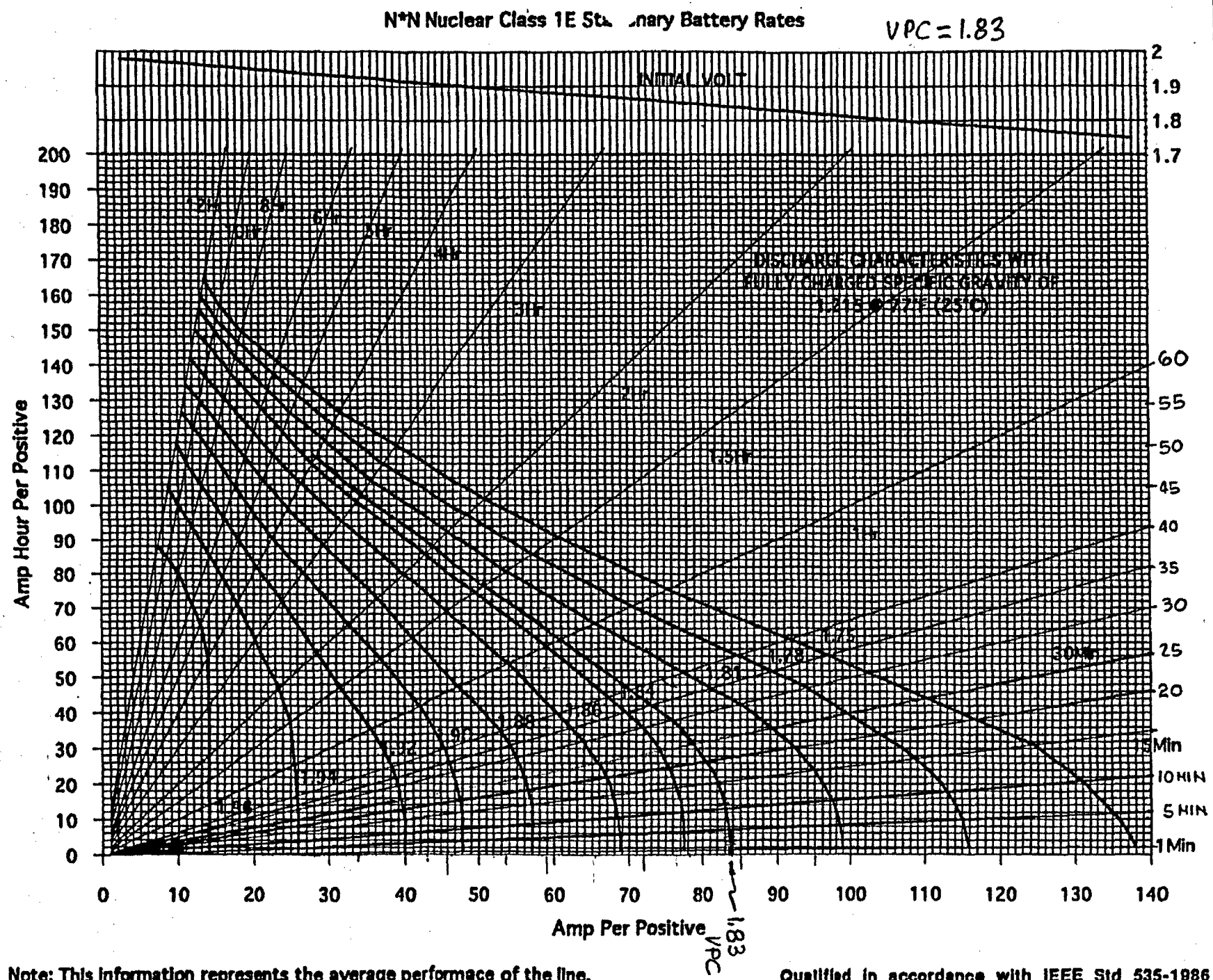
Maximum Section Size (8) **11.33** + Random Section Size (9) **-** = Uncorrected Size - (us) (10)- **11.33**

US (11) **11.33** x Temp Corr (12) **1.08** x Design Marg (13) **1.046** x Aging Factor (14) **1.25** = (15) **16.00**

When the cell size (15) is greater than a standard cell size, the next larger cell is required.

Required cell size (16) **16** (A) - Positive Plates (B) - Ampere Hours Therefore cell (17) **NCN-33** is required

Figure 3 - Cell sizing worksheet



Note: This information represents the average performace of the line.
Refer to the tables for actual discharge data

Qualified in accordance with IEEE Std 535-1986

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 10
Tabulation of Circuit Breaker Resistance Measured Data

BCB	WR#	As Found Contact Resistance (mOhms) Pos/Neg	As Left Contact Resistance (mOhms) Pos/Neg	Breaker Model Number	Notes	Breaker Rating
71BCB-2A-AO3	90-01098-00	8.1/6.7	5.36/5.35	THED126015		15
71BCB-2A-AO7	90-01101-00	6.6/15	5.5/5.5	THED126015		15
71BCB-2A-BO6	90-01106-00	7.14/7.7	5.75/5.35	THED126015		15
71BCB-2B-AO3	93-04178-00	14.5/7.1		THED126015	Old Breaker	15
71BCB-2B-AO3	93-04178-00		5.9/5.8	THED124015		15
71BCB-2B-AO7	93-04179-00	9.4/46.3	6.0/5.7			15
71BCB-2A-AO2	90-01097-00	5.21/5.3	4.2/4.4	THED126025		25
71BCB-2A-AO5	90-01100-00	5.37/7.45	4.2/4.43	THED126025		25
71BCB-2B-AO2	93-04177-00	5.6/3.9	4.3/4.4			25
71BCB-2B-AO8	93-02406-00	12.3/6.14	4.45/4.33			25
71BCB-2A-AO6	90-00760-00	22.17/14.51	2.92/3.55	THED126030		30
71BCB-2B-BO6	94-00290-00	7.5/6.4	3.4/2.2			40
CB-2B-AO5	92-04176-00	2.30/2.07	1.99/2.20			60
71BCB-2A-BO2	90-01102-00	2.84/5.00	1.0/1.0	THED126100		100
71BCB-2A-BO3	90-01103-00	3.03/7.58	1.0/1.0	THED126100		100
71BCB-2A-BO4	90-01104-00	2.27/2.68	0.76/0.75	THED126100		100
71BCB-2A-CO1	90-01107-00	4.18/26.6	0.85/0.79	THED126100		100
71BCB-2A-DO1	90-01109-00	1.64/1.51	0.88/0.9		New Breaker	100
71BCB-2B-BO2	94-00286-00	0.713/0.577	0.713/0.577		New Breaker	100
71BCB-2B-BO3	94-06282-00	0.597/0.585	0.597/0.585		New Breaker	100
71BCB-2B-BO4	94-00288-00	NO DATA	NO DATA			100
71BCB-2B-CO2	93-02665-00	0.667/0.672	0.667/0.672		New Breaker	100
71BCB-2A-DO2	90-01110-00	0.60/0.76	0.59/0.59		New Breaker	125
71BCB-2B-AO6	94-00284-00	0.554/0.553	0.554/0.553		New Breaker	125
B-2B-AO6	94-00284-01	0.64/0.56	0.55/0.57		RTS	125

BCB	WR#	As Found Contact Resistance (mOhms) Pos/Neg	As Left Contact Resistance (mOhms) Pos/Neg	Breaker Model Number	Notes	Breaker Rating
71BCB-2B-BO5	94-00289-00	0.40/0.17	REPLACED BREAKER	THFK		200
71BCB-2B-BO5	95-00060-00	0.33/0.35	0.35/0.39		New Breaker	200
71BCB-2A-AO4	90-01099-00	0.3/0.47	0.27/0.29	THFK236F000 (225A)		225
71BCB-2A-B05	90-01105-00	1.74/1.5	1.0/1.0	THFK226F000 (225A)		225
71BCB-2B-AO4	94-00283-00	0.95/0.56	0.28/0.19			225
71BCB-2B-DO2	93-02666-00	0.261/0.267	0.261/0.267		New Breaker	250
71BCB-2B-DO1	94-00292-00	0.261/0.272	0.261/0.272		New Breaker	300
71BCB-2A-BO1	91-02545-00	0.2/0.15	0.182/0.17	THJK426400		400
71BCB-2B-BO1	94-00285-00	0.121/0.131	0.121/0.131		New Breaker	400
71BCB-2B-CO1	94-00291-00	0.131/0.151	0.131/0.151		New Breaker	400
71BCB-2A-C03	90-01108-00	0.1/0.1		THKM826F000 (600A)		600

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 11
LOCA/LOOP Scenario

The following is a summary of the basis for the battery duty cycle for a LOOP/LOCA.

- Technical Specifications Bases 3.8.4 "Applicable Safety Analysis":

"The OPERABILITY of the DC subsystems is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the plant. This includes maintaining DC sources OPERABLE during accident conditions in the event of:

a. An assumed loss of all normal and reserve AC power or all onsite power; and
b. A worst case single failure. "

- UFSAR Section 8.7.3 (Description) reads as follows:

"The batteries are sized to carry the loads shown in Figure 8.7-1 for 2 hours with the charging source removed, based on a fully charged battery prior to the removal of the charger.
The loads fall into the following general categories:
1. Long-time control loads (such as control relay loads)
2. Short-time control loads in excess of the continuous control loads (such as breaker tripping and closing operations)
3. Short-time power loads (such as motor-operated valve operations and emergency lighting)*
4. Medium-time power loads (such as turbine-generator auxiliary motors)
5. Long-time power loads (such as engineered safeguard system equipment auxiliary motors)
In general, the short-time control loads are less than 1 minute duration and occur at the start of the 2-hour period. The short-time power loads are of less than 2 minute duration and also occur at the start of the period. The medium-time power loads are of approximately 30 minute duration and occur during the first 30 minute portion of the period. The long-time power and control loads are of approximately 2 hour duration which is the total length of the period.

*Emergency DC lighting is operational only from the time of loss of all AC power until emergency AC power is available from the emergency diesel-generators."

The source of the basis for "sizing the batteries with charging source removed" is unclear. FSAR Section 8.7.3 is the only documented requirement which prevents any credit for the redundant safety related Battery Chargers being available following an EDG start. This licensing basis has been incorporated into the load profile for calculating the 125vdc voltage drop to the loads. Not taking credit for either battery charger is similar to assuming a common mode failure of safety related equipment which is beyond regulatory requirements.

The licensing requirement for "concurrent Loss of Offsite Power" is provided in FSAR Section 16.6 "Conformance to AEC Design Criteria" which describes conformance to 10CFR50 Appendix "A". Our compliance to Appendix "A" is "to the extent possible consistent with the state of design and construction at the time of issuance of these criteria" (UFSAR Section 16.6.1). The construction permit was issued 5/20/70 and Appendix "A" was issued 5/21/71.

- 10CFR50 Appendix "A" criterion 35 (Emergency Core Cooling) reads as follows:

"A system to provide abundant emergency core cooling shall be provided. The system safety function shall be to transfer heat from the reactor core following any loss of reactor coolant at a

rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible to negligible amounts.

Suitable redundancy in components and features, and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that for onsite electric power system operation (**assuming offsite power is not available**) and for offsite electric power system operation (assuming onsite power is not available) the safety system function can be accomplished, assuming a single failure."

Conformance to criterion 35 is identified in Section 16.6.2.4 and reads as follows:

"The Emergency Core Cooling Systems (ECCS) are designed to prevent excessive fuel cladding temperatures over the entire spectrum of postulated design basis Reactor Coolant System breaks. Such capability is available concurrent with loss of all off-site power. The ECCS themselves are designed to various levels of component redundancy to prevent a single active component failure, in addition to the accident, from negating the required core cooling capability (Criterion 35)."

This criterion is satisfied (reference UFSAR table 16.6-4) by the following FSAR sections:

- FSAR Section 6.5 "ECCS Safety Evaluation"

(1) "Off-site power is assumed lost at the time of the accident and is not restored during the period of interest."

And

(2) "One of the on-site emergency power sources fails and remains out of service during the entire transient."

- FSAR Section 14.6.1.3.1 "Initial Conditions and Assumptions" (for Accidents) as follows:

"A complete loss of normal AC power occurs simultaneously with the pipe break. This additional condition results in the longest delay time for the Emergency Core Cooling Systems to become operational."

It is identified in FSAR sections 16.6.2.4 and 14.6.1.3.1 that "Loss of Offsite Power" is considered to show that the ECCS systems are capable of "preventing excessive fuel cladding temperatures over the full range of LOCAs" without the benefit of Offsite Power. This is accomplished because it results in the longest time delay for initiating ECCS systems. In as much as FSAR section 14.6.1.3.1 states that the loss of normal AC power occurs simultaneously with the LOCA, the duty cycle calculation will conservatively assume the 115KV undervoltage circuit is initiated at the same time as the LOCA. The 345kV breakers will be assumed to trip at the beginning of the duty cycle. This approach to "Loss of Offsite Power" is very conservative because normally the battery chargers would be available up until the time the breakers are opened. Additionally, any other electrical equipment functioning as a result of the LOCA is being considered in the Duty Cycle. Because of the described licensing basis, the LOCA/LOOP duty cycle does not take credit for a battery charger being available following EDG start.

Page 5 is a graphical analysis of the EDG starting sequence. There are specific points identified for reaching 40RPM (0.32 seconds), 200RPM (1.75 seconds) and 400RPM (3.4 seconds). Additionally, field flashing (3.6 seconds) and EDG output breaker closure (7.2 seconds) are identified. This sequence was developed from primarily DER 96-0841 and ST-9C (1990 thru

1998 data) . Additionally, a review of test results from several performances of ST-9D, ST-9BA and ST-9BB were utilized as supporting documentation. Using actual starting sequence is considered conservative because it "squeezes" the EDG starting loads into a shorter period of time which is the most critical time period for voltage drop. Since the sizing calculation uses the peak load for the first minute, this results in consistent (and conservative) results. Utilizing design starting (i.e. 10 second) tends to stretch out the loads over a longer period of time where loading tends to not overlap which would be non conservative (not result in the highest current in the first minute). Additionally, the design starting period of the EDGs is within 10 seconds. The additional Amphours removed during the additional 2.8 seconds does not affect the resultant battery voltage (using IEEE-485 methodology) or sizing of the battery during the most critical period (i.e. first minute). The sizing in the first minute is based on the maximum current. The amount of cumulative amphours during the first minute doesn't change the calculated voltage. Therefore, the calculation conservatively utilizes the EDG actual starting sequence. It is possible for the EDGs to have start times vary slightly from the above (slightly faster). From time to time there may be slight variances in calculation data. Any variance is considered to be accounted for (and bounded) by the aggregate conservatism and margin built into the calculation.

RCIC initiates on lo-lo water level at the beginning of the duty cycle. HPCI initiates on lo-lo water level (or high drywell pressure) at the beginning of the duty cycle. EDGs also initiate at the beginning of the duty cycle due to lo-lo-lo water level (or high drywell pressure).

HPCI and RCIC trip on low steam pressure at 75PSIG. For sequencing of HPCI or RCIC MOVs see Appendix 15.

The scenario assumes a large break DBA LOCA. A DBA LOCA requires the closing the 4KV switchgear breakers for LPCI and Core Spray pumps, initiation of ADS, and initiation and tripping of RCIC/HPCI in the first minute of the duty cycle (while EDGs are loading on the Bus). A small break LOCA may require the additional loading of a swapover of RCIC or HPCI from CST to Torus (depending upon the size of the break) sometime into the duty cycle after EDGs have loaded on to the bus (earliest swapover would be 18 minutes into the event per JAF-CALC-HPCI-03010). There could also be an initiation at some time during the event of LPCI/CSP due to high drywell pressure during a small break LOCA. However, It is more stressful on the battery to require all of the loads during a DBA LOCA to initiate during the first minute than to "stretch" the loading out over a 2 hour period (as in a small break LOCA). Additionally, tripping of RCIC/HPCI is comparable loading (actually it is more) to a CST to Torus swapover which makes the total loading of DBA LOCA more severe (especially since it mostly occurs at approximately the same time during the first minute). Specifically, the closing 23MOV-16 and 23MOV-19 in a DBA LOCA (during a low reactor pressure trip of 75PSIG) is a much greater load on the battery than the opening of 23MOV-57 and 23MOV-58 and closing of 23MOV-17 during a CST to Torus swapover. Additionally, the cycling of valves at 43 seconds into the duty cycle is a more critical period than cycling of valves at 18 minutes (or later) into the duty cycle. The basis for 43 seconds is contained in Appendix 12 for 23MOV-16. Therefore, swapover of HPCI and RCIC from CST to Torus will not be required to be included in the duty cycle (see also DER-97-01735).

As noted above FSAR section 14.6.1.3.1 states "A complete loss of normal AC power occurs simultaneously with the pipe break. This additional condition results in the longest delay time for the Emergency Core Cooling Systems to become operational." This statement is interpreted to mean that the incoming 115Kv power is lost and there is no onsite power.

The 115Kv power is lost for an unknown reason except that there is no voltage available. Therefore, the 115KV undervoltage is sensed by the station undervoltage trip circuits 1ZLCN04

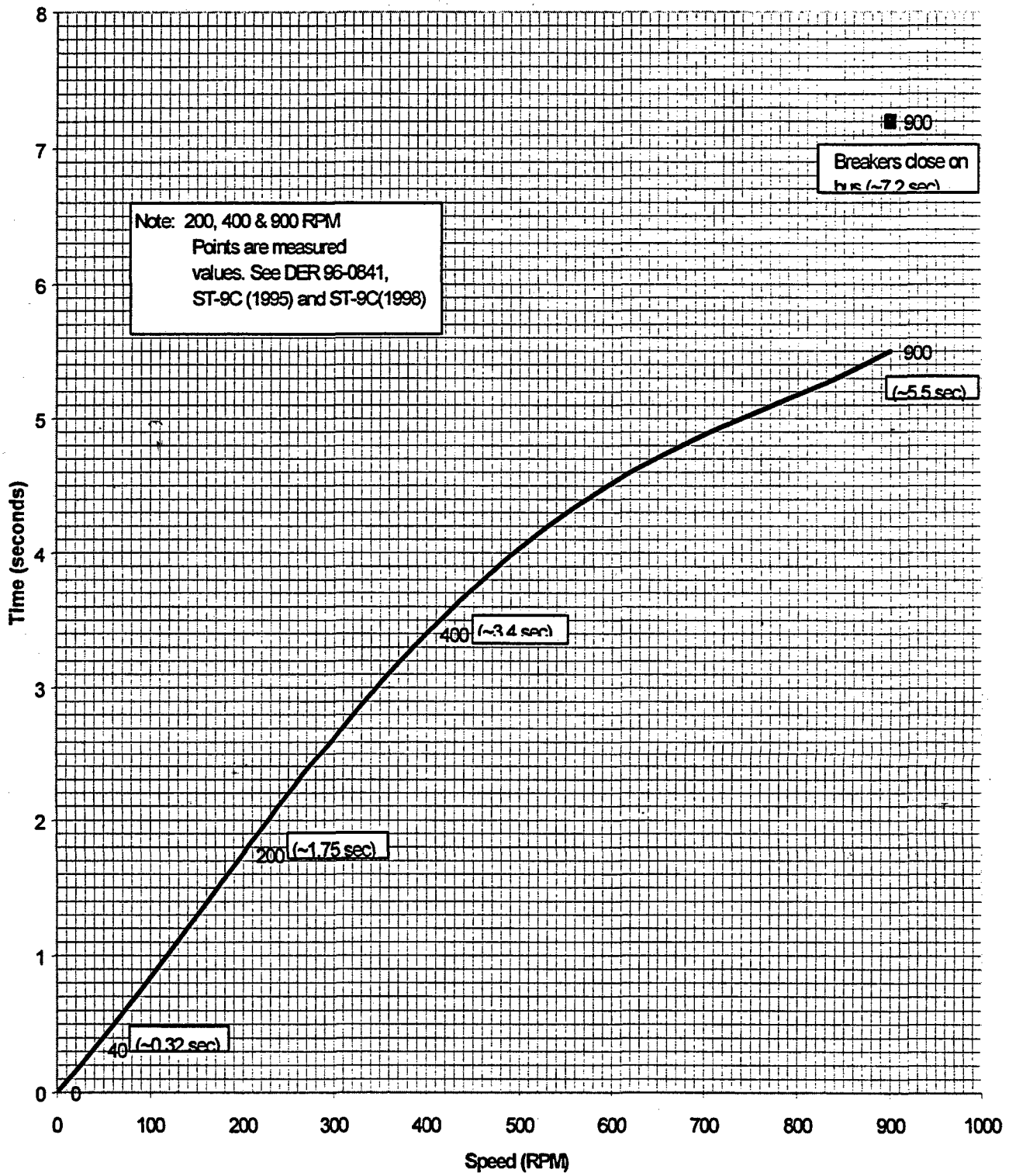
and 1ZLCN05 which prevents all of the reserve power feeds to each switchgear from closing (after a 3 second time delay).

Since normal AC power is lost simultaneously with the LOCA a turbine trip would be anticipated due to loss of EHC pressure, loss of condenser vacuum, loss of Stator Water cooling or due to a Generator Reverse Power Trip (this causes a turbine customer trip). If the turbine tripped first on EHC pressure, condenser vacuum or stator cooling, the generator would subsequently trip on anti-motoring (1UPRN06) because the turbine trip would close all turbine valves (except bypass). If the generator tripped first on reverse power (1UPRN07), the turbine would subsequently trip on a customer trip. In any case you would have a turbine and generator trip. Either sequence of tripping is the same loading and output circuits actuate the same 125VDC Circuits. Typically, these actions all occur randomly within the first minute of a reactor SCRAM. This is consistent with several post trip evaluations reviewed (PTE-1/19/90, PTE-10/19/90, PTE-12/12/90, PTE-93-001, PTE-95-001, PTE-97-001, and PTE-98-002).

As a result of either circuit 1UPRN06 or 1UPRN07 the Main Generator Exciter Breaker, 71-10102, 71-10302, 71-10042, and 71-10052 will trip. Additionally, the 10042 and 10052 mechanical and solid state backup trip circuits 1YL1N14, 1YL1N11, 1YL1N07 and 1YL2N07 will initiate but will time out before the backup trips.

Based on the above batteries are sized to carry all 125VDC loads during a LOCA with concurrent Loss of Offsite Power and with charging source removed for 2 hours.

TYPICAL ACCELERATION CURVE FOR EDG



125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 12
SBO Scenario

Station Black Out (SBO) is defined in Regulatory Guide 1.155, NUMARC 87-00 and the FSAR Section 8.11. The unit enters the event from normal plant operation as defined in 2.1. In accordance with FSAR Section 8.11 the SBO occurs simultaneously with a turbine trip. The duration of the SBO is 4 hours. No operator action is credited for the first 30 minutes into the event.

The Station Batteries are required to power applicable loads to achieve safe shutdown for 4 hours when neither offsite nor onsite emergency power is available (UFSAR Section 8.11.3.2)

Battery load conservation is achieved through the implementation of load shedding per procedure AOP-49 "Station Blackout". Operator actions to shed battery loads which are required to commence within 30 minutes will be completed at approximately 30 minutes. Since the actions are simple (i.e. opening lighting panel breakers and turning off pumps), it is reasonable to expect that commencing this action will complete the action. Additionally, since there are not many actions required to control reactor vessel parameters, it is further justified that these actions will completed by 30 minutes. A PCR has been initiated to revise the word "commence" to "complete" in AOP-49.

The EDGs receive a start signal at the 2.5 second point of the duty cycle as a result of bus undervoltage. To remain within the bounds of the SBO scenario the EDG is assumed to fail to start following field flashing. At the end of the SBO scenario, power is restored by a successful start of an EDG. The battery duty cycle includes an unsuccessful start attempt of the EDG pair at the beginning of the SBO event and a successful single EDG start during the last minute of the event. This is consistent with AOP-49 and NRC Safety Evaluation (and supplement) dated 10/13/91 and 6/9/92.

Restoration of power (after 4 hours) from the 115 kV system to the 10600 bus requires the reclosure of breaker # 10022 and the 4 kV from RSS T2, "through" 10400 to the 10600 bus. This represents an approximate load of 24 amps for less than two cycles. The requirement for restoring the 115 kV system and the start of the EDGs are mutually exclusive. The load imposed on the Station Battery, to start the EDGs, is higher than that required to restore the 115 kV system. The load required to start one EDG has been included in the profile.

The 9/16/96 plant scram included a simultaneous opening of the generator output breakers (71PCB-10042 & 71PCB-10052), turbine trip, generator trip, and residual (slow) transfer. FSAR section 8.11.1 states: "Off-site power is assumed to be lost concurrently with a main turbine trip and unavailability of on-site emergency AC power". During the 9/16/96 event the first 3 seconds simulates an SBO event (residual transfer duration). The only loads that are automatically restored after a residual transfer is the 10500 and 10600 busses (safety related busses). All of the non essential loads were lost. The plant scrammed within 0.1 seconds of the turbine trip due to TCV fast closure and TSV closure. HPCI initiation (Rx Lo-Lo) occurred 10 seconds after the initiating event due to collapsing of the voids caused by the scram, loss of power to the condensate & condensate booster pumps, and almost immediate loss of feedwater. During an actual SBO this should take slightly longer because the MSIV's would go closed earlier due to loss of AC power to the RPS MG sets. The RPS MG set has a flywheel, which, by design, holds the voltage to within 5% for 2 seconds. Within seconds of an SBO the RPS bus would deenergize causing the MSIV's to close. This would eliminate further reduction of reactor level due to steam flow and no makeup (i.e. takes longer to reach Lo-Lo). The MSIV's during the 9/16/96 weren't closed until 8 minutes into the event (turbine bypass valves closed after 29 seconds). Therefore, conservatively we will assume that HPCI and RCIC initiation will occur at 10 seconds after the

initiation of the event. It is more conservative to require HPI/RCIC to initiate at 10 seconds rather than later because the EDGs are attempting to load at this time. Additionally, it can be seen that an SBO with concurrent turbine trip will also initiate a scram concurrently due to TSV closure. The sequence of events log and the PTE 96-002 narrative was used for this analysis.

Additionally, based on PTE-96-002 (turbine trip w/momentary loss of all AC) one SRV is assumed to lift (electrically) at 3 seconds into the event. In the 9/16/96 event only the "G" SRV lifted. However, conservatively we will assume that "K" and "L" SRVs lift for additional loading. These two have the lowest electric lift setpoint at 1135PSIG level (group 1). These valves are only assumed to lift on the "A" Station Battery. To lift on the "B" Station Battery would require an additional single failure which is not required by SBO rules (NUMARC 87-00 section 2.4.1 (4)).

HPCI will automatically start upon receiving a Lo-Lo signal at approximately 10 seconds. 10 seconds is obtained from PTE 96-be manually operated to maintain Reactor Water level within the desired range (OP-19) per AOP-49. AOP-49 indicates that RCIC should be used preferentially over HPCI because RCIC is less likely to cycle on and off due to reactor water level. Although not specifically stated in OP-19, RCIC flow controller 13FIC-91 would be utilized to maintain water level possibly in conjunction with 13MOV-30 and therefore, continuous operation of RCIC. By utilizing this method of level control it is not anticipated that RCIC will require cycling. For "B" Station Battery there will be an initial start of HPCI at 10 seconds with subsequent trip at 4 minutes. Additionally, there will be a restart of HPCI at approximately 35 minutes. After the initial trip of HPCI, Operations uses the SRVs to control pressure. There is a significant time lapse between HPCI restarts. The scenario was run several times on the simulator and the duty cycle response is consistent with the simulator (acknowledging this is not a design basis engineered model). This is consistent with conversations with Operations Training.

Should RCIC not be used for SBO Coping (as preferred by AOP-49), after HPCI starts on Lo-Lo, HPCI would subsequently trip on Reactor Hi level. Hi level is estimated to occur between 4 and 4.5 minutes as indicated by the plant simulator response. During the following time period, Operators would assess plant conditions and perform necessary operator action per AOP-49 and EOP-2. Operations would be controlling pressure by using SRVs. There would be significant time between restarts of HPCI. An additional restart is anticipated to occur at approximately 35 minutes with a trip occurring at approximately 5 minutes later. This scenario was run several times on the simulator with maximum available decay heat (i.e. a full cycle run) and the duty cycle response is consistent with the simulator (acknowledging this is not a design basis engineered model).

Transfer from CST to torus will not occur during an SBO because there is sufficient volume in the CSTs to cope with decay heat (per JAF Coping analysis JAF-89-048).

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 13
Weekly Station Battery Surveillance Test

		Charger Output (at charger)		Charger Voltage		Charger Output (09-8)		
WR #	Date	71SB-1	71SB-2	71SB-1	71SB-2	71SB-1	71SB-2	Comments
96-00890-00	6/20/1996	30	30	129.5	129.87	30	25	
96-00893-00	6/27/1996	32	25	129	129	30	25	
96-00896-00	7/3/1996	30	30	129.4	129.8	30	25	
96-00899-00	7/11/1996	30	30	129.4	129.8	30	30	
96-00902-00	7/18/1996	30	30	129.4	129.7	31	25	
96-00905-00	7/25/1996	30	30	129.5	129.6	30	29	
96-00908-00	8/1/1996	35	30	129.3	129.7	30	25	
96-00911-00	8/8/1996	30	30	129.7	130	30	25	
96-00914-00	8/15/1996	35	30	129.5	129.8	30	25	
96-00917-00	8/22/1996	35	30	129.5	129.8	30	25	
96-00920-00	8/29/1996	35	30	129.5	130	30	30	
96-00923-00	9/5/1996	35	30	129.48	129.85	30	25	
00-00926-00	9/12/1996	35	30	129.4	129.8	30	25	
00-00929-00	9/19/1996	140	30	129.3	129.5	140	28	Outage
00-00932-00	9/26/1996	30	35	129.4	129.3	30	25	
96-00935-00	10/3/1996	30	30	129	130	30	25	
96-0093800	10/10/1996	35	30	129.3	129.6	30	25	
96-00941-00	10/17/1996	30	30	129.4	129.6	30	25	
96-00944-00	10/24/1996	30	30	129.3	129.6	30	25	
96-00947-00	10/31/1996	20	25	129.4	129.9	20	20	
96-00950-00	11/7/1996	25	25	132.1	129.8	0	0	Taken to float for readings; SB-1 removed @ 1012 hrs, returned @ 1020 hrs
96-00953-00	11/14/1996	25	Nil	132.2	Nil	20	Nil	"On Equalized"; did not mesaure SB-2
96-00956-00	11/21/1996	30	20	131	132			
96-00959-00	11/28/1996	32	30	131	131.9			
96-00962-00	12/5/1996	35	30	131	132			
96-00965-00	12/12/1996	30	30	131	132			
96-00968-00	12/19/1996	32	30	131	131.9			
96-00971-00	12/26/1996	32	28	131	132			

		Charger Output (at charger)		Charger Voltage		Charger Output (09-8)		
WR #	Date	71SB-1	71SB-2	71SB-1	71SB-2	71SB-1	71SB-2	Comments
96-00974-00	1/2/1997	30	29	131	132			
96-04332-00	1/9/1997	30	30	132.5	132			
96-05390-00	1/16/1997	35	30	132.3	132			
96-05395-00	1/23/1997	30	25	132.3	131.9			
96-05400-00	1/30/1997	35	30	132.1	131.9			
96-05405-00	2/6/1997	30	30	132.3	132			
96-05410-00	2/13/1997	30	30	132.1	131.7			
96-05416-00	2/20/1997	30	30	132	131.9			
96-05471-00	2/27/1997	32	29	132.5	132			
96-05483-00	3/6/1997	33	29	132.2	132			
96-05488-00	3/13/1997	30	29	132	132			
96-06136-00	3/20/1997	35	28	131.27	131.88			
96-06863-00	3/27/1997	35	30	132.4	131.9			
96-06869-00	4/3/1997	30	25	131.8	131.6			
96-06874-00	4/10/1997	30	30	132.2	132			
96-06879-00	4/17/1997	30	30	132.15	131.88			
96-06884-00	4/24/1997	30	30	132	131.5			
96-06899-00	5/1/1997	30	30	132	132			
96-06906-00	5/8/1997	35	30	132.3	132			
96-06924-00	5/15/1997	15	15	132.3	132			
97-01414-00	5/22/1997	32	30	132	131.9			
97-01421-00	5/29/1997	32	30	132.2	132			
97-01426-00	6/5/1997	30	30	132.1	132			
97-01431-00	6/12/1997	31	29	132	132			
97-01436-00	6/19/1997	30	30	132.2	131.9			
97-01441-00	6/26/1997	30	22	132	131.8			
97-01447-00	7/3/1997	35	25	132.5	132			
97-01499-00	7/10/1997	30	23	132	131.5			
97-01506-00	7/17/1997	35	3	132.5	132			
97-01636-00	7/24/1997	35	30	132.3	132			
97-31643-00	7/31/1997	32	30	132.3	131..9			
97-01649-00	8/7/1997	30	25	132	132			
97-01655-00	8/14/1997	30	25	132	132			
97-01661-00	8/21/1997	30.5	25	132.2	131.9			
~~97-01667-00~~	~~8/28/1997~~	30	30	132	132			
97-01673-00	9/4/1997	32	25	132	131.8			
97-01679-00	9/11/1997	30	28	132	132			
97-03059-00	9/18/1997	32	25	132.17	131.9			
97-03065-00	9/25/1997	32	25	132	131.7			
97-03071-00	10/2/1997	35	25	132.17	131.7			
97-03078-00	10/9/1997	3	28	133	131.8			
97-03084-00	10/16/1997	35	25	132.3	131.8			
97-03090-00	10/23/1997	35	30	132.28	131.92			
97-03096-00	10/30/1997	30	25	132.3	131.9			
97-04336-00	11/6/1997	30	25	132.2	131.8			
97-05634-00	11/13/1997	30	12.5	132.3	132			
97-05640-00	11/20/1997	130	32	132.17	131.89			DC UPS Drive On
97-05646	11/27/1997	*	*	*	*			No Fiche
97-05656	12/4/1997	32	30	132.4	131.8			
97-05662	12/11/1997	32	25	132.4	131.92			
97-05669	12/18/1997	35	28	132.5	131.8			
97-06626	12/23/1997	32	25	132.5	131.9			
97-06633	12/30/1997	35	27	132.3	132.1			

		Charger Output (at charger)		Charger Voltage		Charger Output (09-8)		
WR #	Date	71SB-1	71SB-2	71SB-1	71SB-2	71SB-1	71SB-2	Comments
97-06645	1/7/1998	32	30	132.1	131.7			
97-06651	1/15/1998	*	*	*	*			Incomplete Report
97-06657	1/22/1998	30	30	132.5	132.7			
97-06664	1/29/1998	32	30	132.5	132.7			
97-08766	2/5/1998	30	25	132.5	132.08			
97-08877	2/12/1998	35	25	132.5	132.3			
97-08886	2/19/1998	35	30	132.5	132.7			
97-08892	2/26/1998	15	9	132.4	132.7			
97-09348	3/5/1998	30	25	132.3	132.7			
97-09354	3/12/1998	32	25	132.4	133			
98-00020	3/19/1998	30	29	132.3	132.5			
98-00637	3/26/1998	35	30	132.5	132.6			
98-00638	4/2/1998	35	30	132.4	132.7			
98-00640	4/9/1998	30	28	132.5	132.6			
98-00642	4/16/1998	30	30	132.4	132.5			
98-00643	4/23/1998	32	30	132.4	132.5			
98-00644	4/30/1998	35	30	132.5	132.7			
98-00645	5/7/1998	35	30	132.2	132.6			
98-006+46	5/14/1998	31	26	132.3	132.5			
98-00647	5/21/1998	33	28	132	132.4			
98-00648	5/28/1998	30	30	132.2	132.7			
98-00649	6/4/1998	30	30	132	132.6			
98-00668	6/11/1998	35	30	132.3	132.7			
98-00674	6/18/1998	35	30	132.35	132.76			
98-00680	6/25/1998	17	15	132	132.6			
98-00691	7/2/1998	17	27	132.1	132.5			
98-00745	7/9/1998	35	30	132.2	132.6			
98-01280	7/16/1998	35	33	132.4	132.9			
98-01306	7/23/1998	30	30	132.2	132.8			
98-01314	7/30/1998	35	30	132.4	132.9			
98-01327	8/6/1998	32	30	132	132.8			
98-02133	8/13/1998	31	29	132.4	132.6			
98-02139	8/20/1998	35	30	132.4	132.7			
98-02145	8/27/1998	30	30	132.5	132.7			
98-02155	9/3/1998	32	30	132.3	132.7			
98-02160	9/10/1998	30	30	132.24	132.86			
98-02169	9/17/1998	40	30	132.4	132.7			
98-02177	9/24/1998	35	28	132.3	132.6			
98-02183	10/1/1998	34	28	132.5	132.7			
98-02199	10/8/1998	35	30	132.5	132.2			
98-02206	10/15/1998	32	30	132.5	132.3			
98-02215	10/22/1998	30	20	132	132			
98-02220	10/29/1998	50	55	132.48	130			Outage
98-02228	11/5/1998	20	15	132.6	134.2			Outage
98-02234	11/12/1998	110	18	132.4	132.4			Outage
98-02241	11/19/1998	18	18	132.8	132.7			Outage
98-02247	11/26/1998	20	40	132.2	132.9			Outage
98-02254	12/3/1998	30	25	131.9	132.8			
98-02260	12/10/1998	32	26	132	132			
98-02267	12/17/1998	30	30	133	132			
98-02273	12/23/1998	30	24	132.9	131.5			
98-02285	12/30/1998	30	25	132.9	132.9			

		Charger Output (at charger)		Charger Voltage		Charger Output (09-8)		
WR #	Date	71SB-1	71SB-2	71SB-1	71SB-2	71SB-1	71SB-2	Comments
98-05653	1/7/1999	30	20	131.8	132			
98-05659	1/14/1999	30	25	132	132			
98-05665	1/21/1999	30	25	131.81	132			
98-05671	1/28/1999	30	25	131.8	132			
98-05696	2/4/1999	30	25	132.63	132.06			
98-05702	2/11/1999	30	22	132.7	131.9			
98-06296	2/18/1999	30	25	133	132.1			
98-06302	2/25/1999	30	20	132.8	132.06			
98-06308	3/4/1999	30	25	133	132			
98-06314	3/11/1999	30	20	133	132.1			
99-00268	3/18/1999	30	30	133	132			
99-00274	3/25/1999	30	20	133	132			
99-00280	4/1/1999	31	20	133	132.6			
99-00286	4/8/1999	30	25	132	131			
99-00292	4/15/1999	31	25	132.3	132			
99-00299	4/22/1999	30	10	132.2	132			
99-00305	4/29/1999	31	25	132.1	131.9			
99-00311	5/6/1999	30	30	132.2	132.16			
99-00317	5/13/1999	30	25	132.2	131.9			
99-00323	5/20/1999	30	25	132.19	131.92			
99-00336	5/27/1999	30	20	132.2	131.9			
99-00341	6/3/1999	30	20	132	131			
99-00349	6/10/1999	30	25	132.2	132			
99-00355	6/17/1999	30	25	132	132			
99-00361	6/24/1999	30	22	132.3	132.1			
99-00367	7/1/1999	30	25	132.2	132.2			
99-00373	7/8/1999	30	16	132.2	132.2			
99-00379	7/15/1999	6	35	132.4	132.4			Outage
99-00385	7/22/1999	30	25	132.1	132.2			
99-00396	7/29/1999	30	30	132.17	132.23			
99-00402	8/5/1999	30	25	132.05	132.14			
99-00408	8/12/1999	30	25	132	132.1			
99-00426	8/19/1999	30	20	132	132			
99-00432	8/26/1999	30	25	132.02	132.18			
99-00438	9/2/1999	30	25	132	132			
99-00444	9/9/1999	30	25	132.1	132.2			
99-00450	9/16/1999	30	22	131.97	132.12			
99-00456	9/23/1999	80	22	132.1	132.2			
99-00473	9/30/1999	30	20	131.9	132			
99-00479	10/7/1999	30	20	132.1	131.8			
99-00485	10/11/1999	30	20	132	132			
99-00491	10/21/1999	32	25	132.1	132.3			
99-00500	10/28/1999	30	30	132	132			
99-00506	11/4/1999	30	25	131.8	131.9			
99-00512	11/10/1999	30	28	132	132.1			
99-00518	11/18/1999	30	20	132	132			
99-03624	11/24/1999	30	25	131.9	132.3			
99-03650	12/2/1999	30	22	131.8	132.1			
99-03658	12/9/1999	35	30	131.98	133			
99-03665	12/16/1999	40	25	131.76	133			
99-03671	12/22/1999	40	25	131.7	132.9			
99-03677	12/29/1999	38	25	131.9	132.9			

		Charger Output (at charger)		Charger Voltage		Charger Output (09-8)		
WR #	Date	71SB-1	71SB-2	71SB-1	71SB-2	71SB-1	71SB-2	Comments
99-03683	1/6/2000	40	25	131.9	133			
99-03689	1/13/2000	40	30	131.8	132.9			
99-04124	1/20/2000	30	30	131.8	132.8			
99-04739	1/27/2000	35	25	131.7	132.9			
99-04754	2/3/2000	30	25	131.7	133			
99-04760	2/10/2000	30	25	132	133.1			
99-04766	2/17/2000	30	30	132	132.97			
99-04772	2/24/2000	30	25	132	133			
99-04784	3/2/2000	30	25	131.8	132.8			
99-04969	3/9/2000	30	25	131.6	132.8			
99-09008	3/16/2000	30	25	131.8	132.8			
99-09015	3/23/2000	30	25	131.6	132			
99-10370	3/30/2000	30	25	131.7	132.9			
99-11123	4/6/2000	15	25	131.95	133			
99-11130	4/13/2000	30	25	132	132.9			
99-11136	4/20/2000	40	25	132.02	132.8			
99-11145	4/27/2000	28	28	131.9	132.8			
99-11239	5/4/2000	28	25	131.8	133			
99-11245	5/11/2000	28	25	131.8	133			
99-11251	5/18/2000	30	30	131.65	133			
99-11260	5/25/2000	30	25	131.9	133.3			
99-11437	6/1/2000	28	25	132	132.7			
99-11529	6/8/2000	30	25	131.76	132.46			
99-11535	6/15/2000	30	25	132	132			

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 14
125 V DC Motors Inrush Current Calculation

INDUSTRIAL POWER SYSTEMS DATA BOOK

GENERAL ELECTRIC

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Dec. 4, 1936

Short-circuit Characteristics of D-c Motors and Generators

INTRODUCTION

Short-circuit currents in direct-current systems are acquiring increased importance as the total capacity of the machines connected to a single bus continues to increase. It is not unusual for 15,000 kw of generation and a similar or greater amount of load to be connected to one bus at 600 volts. Likewise, at 250 volts, concentrations of several thousand kilowatts of source capacity and a like amount of load on one bus are not uncommon.

The magnitude of the short-circuit current available from such concentrations of power is often not fully appreciated. The data in this section is presented to provide fundamental information on the short-circuit characteristics of direct-current motors and generators. Knowledge of these characteristics should permit a better appreciation of the short-circuit currents which can occur in d-c systems.

Motors and generators are probably the most common source of short-circuit current. There has been a considerable amount of investigation on the subject of their behavior under short-circuit conditions and the result is a well-defined method of determining the current for a solid short circuit at the terminals of the machine.

COMPLETE EXPRESSION FOR SHORT-CIRCUIT CURRENT

A complete expression for the short-circuit current is

$$i_a = \frac{e_o}{r_d} - \frac{e_o}{r'_d} e^{-\sigma_a t} + e_o \frac{r_d - r'_d}{r_d r'_d} e^{-\sigma_f t} \qquad (1)$$

i_a = per-unit current
e_o = internal emf prior to short circuit (per-unit)
r_d = steady-state effective resistance of machine (per unit)
r'_d = transient effective resistance of machine (per-unit)
σ_a = armature circuit decrement factor
σ_f = field circuit decrement factor

This expression can be rewritten as follows:

$$i_a = \frac{e_o}{r'_d}(1 - e^{-\sigma_a t}) - \left(\frac{e_o}{r'_d} - \frac{e_o}{r_d}\right)(1 - e^{-\sigma_f t}) \qquad (2)$$

The decrement factors for the two parts of equation (2) are so different that the two parts can be considered independently.

The first part of equation (2) has a time constant which is determined by the armature circuit characteristics. This time constant is relatively short and controls the build-up and peak magnitude of the short-circuit current. The time constant for the second part of equation (2) is determined by the shunt field characteristics and is relatively long. It controls the decay of the current from its peak value.

New page.

Peak Short-circuit Current from Complete Expression

The maximum short-circuit current is given by the expression

$$i'_a = \frac{e_o}{r'_d} \qquad (3)$$

where i'_a is the per-unit peak short-circuit current.

Rate of Rise of Short-circuit Current from Complete Expression

The initial and maximum rate of rise of the short-circuit current is determined by taking the derivative of equation (1). Thus,

$$di_a/dt = \frac{\sigma_a e_o}{r'_d} \qquad (4)$$

where di_a/dt = rate-of-change of current in per-unit amperes per second. The other parts of the derivative of equation (1) are negligible.

Effect of Saturation

Considering only the foregoing four equations, it would appear to be a simple matter to calculate and construct a curve of the short-circuit current from a motor or generator. Indeed, it would be easy to do this if all the terms in equation (1) remained constant during the short circuit. The two decrement factors, however, are affected by magnetic saturation and do not remain constant. This fact makes it a long and laborious task to calculate the curve of short-circuit current versus time.

The effect of saturation on the armature circuit decrement factor is to cause the factor to increase as the machine saturates. As a result, the short-circuit current rises at a faster rate than it would if saturation did not occur. The exact magnitude of the change in the decrement factor is not a matter of agreement among the investigators of this subject. Approximate values suggested for the armature circuit decrement factor under saturated conditions vary from 1.5 to 3.0 times the unsaturated value. To be conservative a value of 3.0 has been recommended. These two values for the armature circuit decrement factor, the saturated and unsaturated values, represent the factor at the initiation of the fault and at the time maximum current is reached. Between these two limits, the decrement factor is changing from one value to the other value and the change for any desired time interval would have to be estimated.

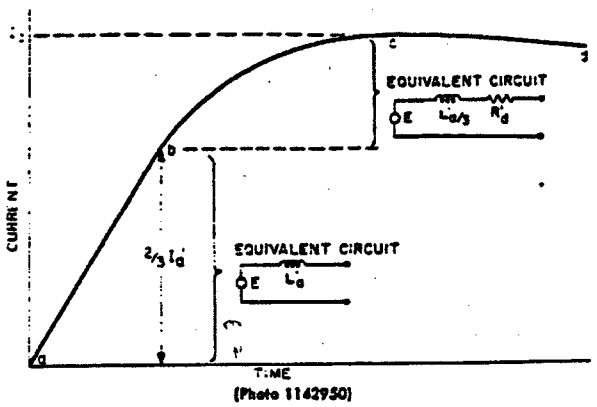
APPROXIMATE CURVE OF SHORT-CIRCUIT CURRENT VS. TIME

The difficulty involved in calculating the curve of short-circuit current versus time by use of the complete expression, equation (1), has led investigators to develop a good approximate method.

Analysis of oscillographs of actual short-circuit currents indicates that the current-time curve is a straight

Short-circuit Characteristics of D-c Motors and Generators

line from the initiation of the fault until the current reaches two-thirds of its maximum value. The rate of rise of the current during this period has been found to remain constant at a value equal to the initial, maximum rate determined by equation (4).



(Photo 1142950)

Fig. 1. Typical short-circuit characteristic of d-c motor or generator

After the current has reached a magnitude approximately equal to two-thirds of the peak current, the current-time curve will become an exponential type of curve and can be closely approximated.

The approximate short-circuit characteristic of the machine, Fig. 1, can be drawn then by determining two factors:

1. Initial rate of rise of current, equation (4) or (11)
2. Peak short-circuit current, equation (3) or (6)

The section of the curve, Fig. 1, between points a and b is determined by the initial rate of rise of the short-circuit current. Point b is the point at which the current magnitude is equal to two-thirds of its maximum value. Point c is the peak short-circuit current as determined by equation (3) or (6). The section of the curve b-c-d is drawn to represent an exponential type of curve with the section b-c being an exponential approaching I'_a and the section c-d being an exponential approaching the reduced steady-state fault current level.

Peak Current for Approximate Curve

The peak short-circuit current is given in equation (3) as

$$i'_a = \frac{e_o}{r'_d} \text{ per-unit amperes} \qquad (3)$$

This can be rewritten and expressed in terms of amperes as

$$I'_a = \frac{I_a\ e_o}{r'_d} \text{ amperes}$$

Where: I'_a = Peak short-circuit current in amperes
I_a = Rated machine current in amperes

Thus, to determine the magnitude of point c, Fig. 1, it is necessary to know the values to be used for I_a, e_o, and r'_d.

The term e_o is normally considered to equal 0.97 for motors and 1.03 for generators. The term r'_d, per-unit transient effective armature circuit resistance, can be determined from Fig. 2 to 10, inclusive, in which the per-unit resistance is plotted against the product of horsepower times base speed or kilowatts times base speed.

In the usual case the results will be sufficiently accurate if e_o is taken to be equal to unity. Thus,

$$\text{Maximum short-circuit current} = \frac{\text{machine rated current}}{\text{per unit transient effective resistance}}$$

$$= \frac{I_a}{r'_d} \qquad (6)$$

Rate of Rise of Current for Approximate Curve

The initial rate of rise of the short-circuit current is given by equation (4) as

$$di_a/dt = \frac{\sigma_a\ e_o}{r'_d} \qquad (4)$$

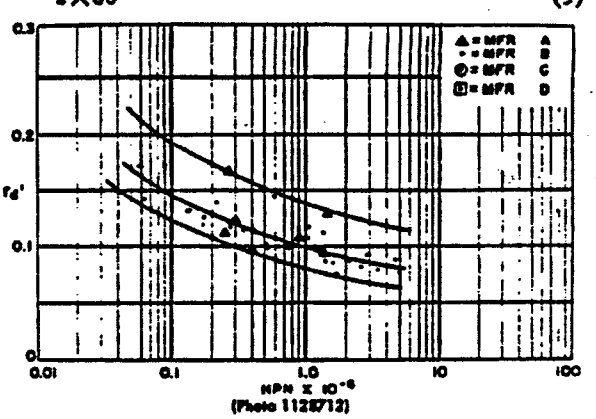
This expression can be written in a more readily usable form by noting that

$$\sigma_a = \frac{r'_d\ 2\pi f}{C_a} \qquad (7)$$

$$C_a = \frac{L'_a\ 2\pi PN_1\ I_a}{2\times 60\quad V_1} \qquad (8)$$

and

$$f = \frac{PN_1}{2\times 60} \qquad (9)$$



(Photo 1128712)

D-c Motor

Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	230-250
Field winding	Shunt or compound wound

Fig. 2. Transient resistance of armature circuit in per-unit vs HPN, of machine

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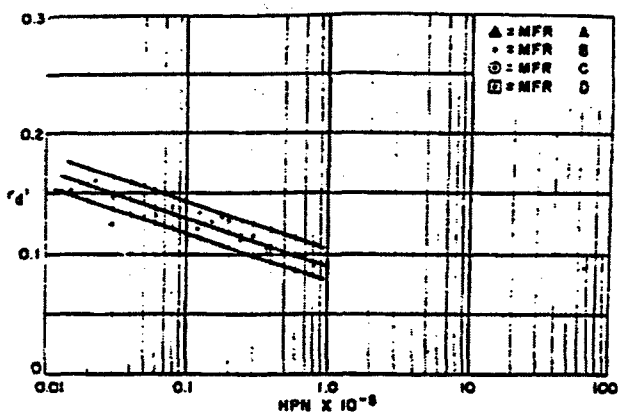
Short-circuit Characteristics of D-c Motors and Generators

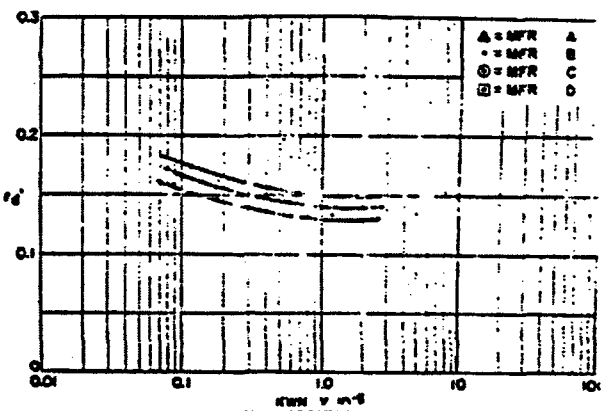


(Photo 1128711)

D-c Motor

Pole face winding	No
Temp. rise	40/50 C
Loading	Nema
Ventilation	Open
Speed	Adjustable
Volts, rated	230
Field winding	Shunt or compound wound

Fig. 3. Transient resistance of armature circuit in per-unit vs HPN, of machine

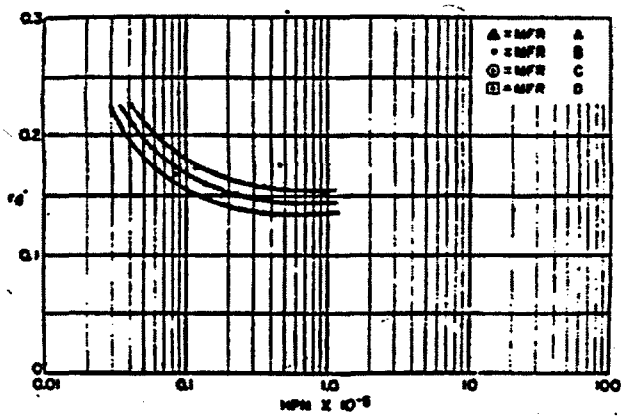


(Photo 1128710)

D-c Generator

Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	120, 125
Field winding	Shunt or compound wound

Fig. 5. Transient resistance of armature circuit in per-unit vs KWN, of machine

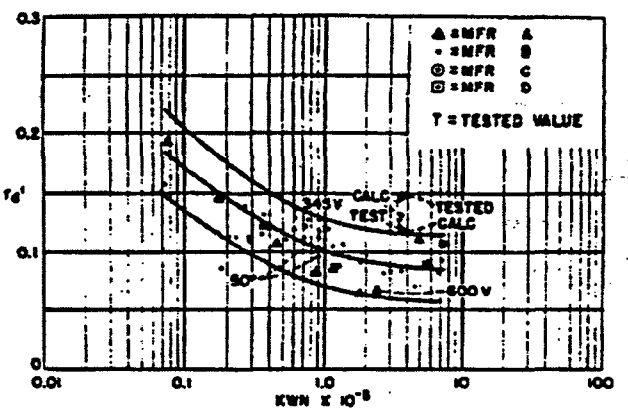


(Photo 1128709)

D-c Motor

Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	115
Field winding	Shunt or compound wound

Fig. 4. Transient resistance of armature circuit in per-unit vs HPN, of machine



(Photo 1128717)

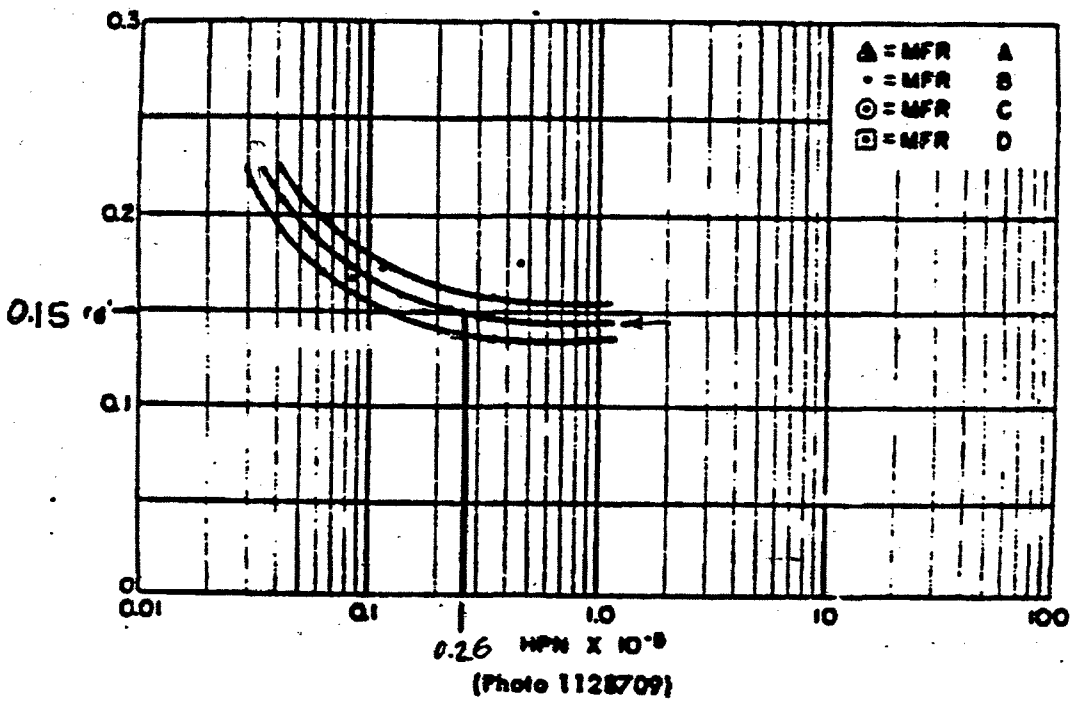
D-c Generator

Pole face winding	No
Temp. rise	40/50 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	230–250
Field winding	Shunt or compound wound

Fig. 6. Transient resistance of armature circuit in per-unit vs KWN, of machine

GE Motor 31P-7B(M) Inrush Current

Starter resistor 0-1 sec = 0.54 ohms
125 VDC FLA=58 Amps Field = 1.38 Amps NEMA Enclosure TEFC 7.5 H. P. 3500 RPM
H.P x Speed = 7.5 x 3500 =26250 HPN 26,250 HPN / 100,000 =0.2625
From curve (Fig. 4) per unit transient effective resistance = 0.15 pu
Maximum short – circuit current = 58 Amp / 0.15 pu =386 Amps
Equivalent motor resistance = 125 VDC / 386Amps = 0.32 ohm
Total inrush current that include starter resistance 0.54 ohm (Ref. drawing. 1.11-257)
125 VDC / (0.54 ohms +0.32 ohms) = 145 Amps
The results of this calculation is consistent with test data fromTIL-914 (141Amp @ 125VDC). The duration of the inrush is 1.7 seconds per TIL-914. However, for conservatism, we will use 2 seconds.
Inrush Current is equal to 145 Amps + 1.38 Amps = 146.38 Amps (See Appendix 2)
Nominal Current is equal to FLA + Field Current (58 Amps + 1.38 Amps) = 59.38 Amps (See Appendix 2)



D-c Motor	
Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	115
Field winding	Shunt or compound wound

Fig. 4. Transient resistance of armature circuit in per-unit vs HPN, of machine

37P-7B Motor Per Unit Transient Effective Resistance

GE Motor 94P-2(M) Inrush Current

.25 VDC FLA= 169 Amps Field = 3.11 Amps NEMA Enclosure TEFC 25 H. P. 1800 RPM

Total starting resistance in first step is .0.18 ohms (0.13 ohms + 0.05 ohms) per drawing 1.11-129. After 1 seconds the 0.13 ohm resistor is shorted out for the second step. The remaining resistance for the second step is 0.05 ohms and is shorted out after 0.75 second (total of 1.75 seconds for starter resistances)

TIL-914 test this motor in 1981. From TIL-914 the maximum measured inrush current of EBOB during startup is equal 540 Amps at 127 VDC and the inrush durations last approximately 2.3 –2.4 sec.. Therefore, this calculation will use 3.5 seconds as the duration of the inrush (i.e. 2.5 seconds total timing circuit plus 1 second for margin).

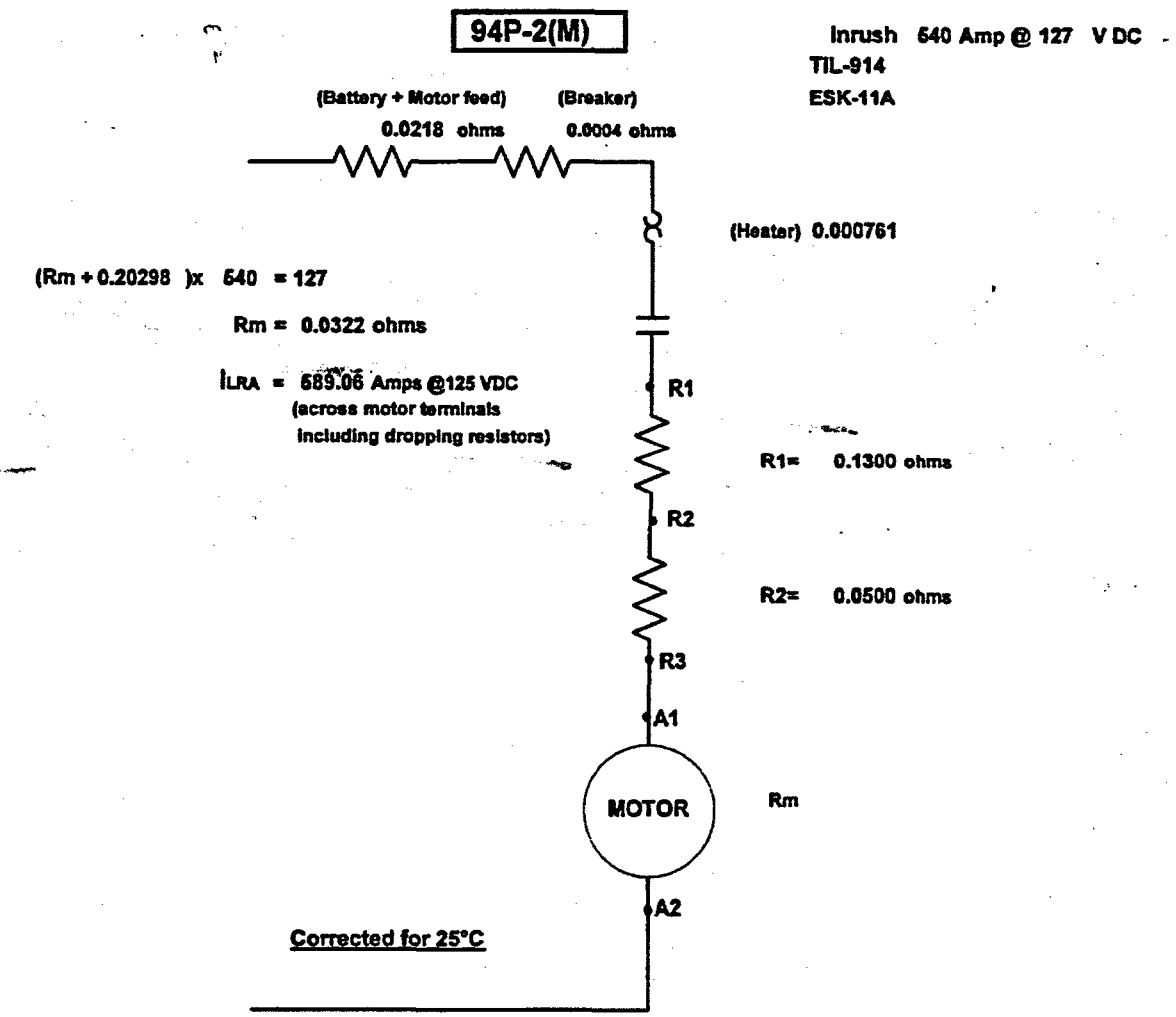
For 125 V DC the current is equal to 589.07 Amps.

Since counter EMF has developed after 2.5 seconds the equivalent motor resistance would be much greater than the calculated 0.0322 ohms and this methodology is not appropriate for the third second..

Test data from TIL-914 therefore, is considered conservative and appropriate for this calculation.

Inrush Current is equal to inrush @125 VDC + Field Current (589.07 Amps + 3.11 Amps) = 592.18 Amps (See Appendix 2)

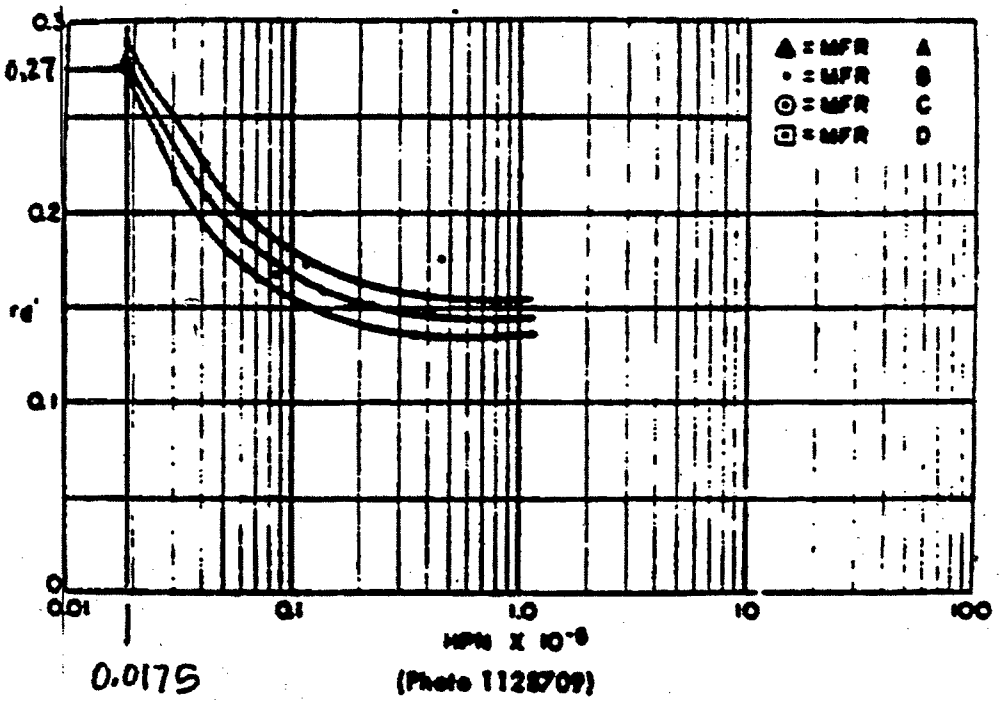
Nominal Current is equal to FLA + Field Current (169 Amps + 3.11 Amps) = 172.11 Amps (See Appendix 2)



94P-2(M) Motor One Line Resistance

GE Motor 02-184P-3B(M) Inrush Current

Starter resistor - none
125 VDC FLA=7.45Amps Field = 0.574 Amps NEMA Enclosure TENV 1 H. P 1750 RPM
H.P x Speed = 1 x 1750 = 1750 HPN 1750 / 100,000 =0.0175
From curve (Fig. 4) per unit transient effective resistance = 0.27 pu
Maximum short circuit current = 7.45 Amps / 0.27 pu = 27.5 Amps
Inrush Current is equal to Short Circuit Current + Field Current (27.5 Amps + 0.574 Amps) = 28.1 Amps
(See Appendix 2)
Nominal Current is equal to FLA + Field Current (7.45 Amps + 0.574 Amps) = 8.02 Amps (See Appendix 2)



D-c Motor

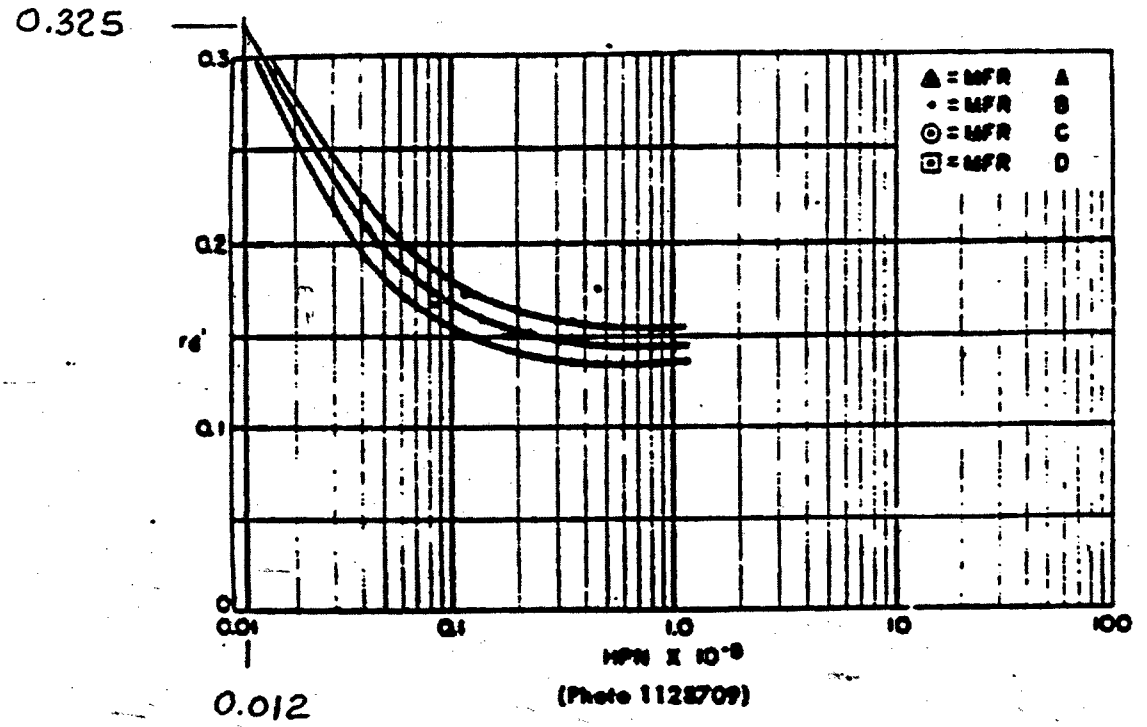
Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	115
Field winding	Shunt or compound wound

Fig. 4. Transient resistance of armature circuit in per-unit vs HPN, of machine

02-184P-3B(M) Motor Per Unit Transient Effective Resistance

GE Motor 23P-140(M) Inrush Current

Starter resistor 0-1 sec = 1.6 ohms
120 VDC FLA=3.5 Amps Field = 0 Amps NEMA Enclosure TEFC 1/3 H. P. 3450 RPM
H.P x Speed = 1/3 x 3450 = 1150 HPN 1150 / 100,000 =0.012
From curve (Fig. 4) per unit transient effective resistance ≈ 0.325 pu
Maximum short circuit current = 3.5 Amps / 0.325 pu = 10.76 Amps
Equivalent motor resistance = 120 VDC / 10.76 Amps = 11.15 ohms
Total inrush current that include starter resistance 120 VDC / (1.6 ohms + 11.15 ohms) = 9.41 Amps
Inrush Current is equal to 9.41 Amps (See Appendix 2)
Nominal Current is equal to FLA 3.5 Amps (See Appendix 2)



D-c Motor

Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	115
Field winding	Shunt or compound wound

Fig. 4. Transient resistance of armature circuit in per-unit vs HPN, of machine

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23P-140(M) Motor Per Unit Transient Effective Resistance

BALDOR Electric Co. Motor 23P-141(M) Inrush Current

Starter resistor 0-1 sec = 1.6 ohms
125 VDC FLA=10 Amps NEMA Enclosure TEFC 1 H. P. 1750 RPM
Starting Current (Locked Rotor) 114 Amps (Reference Manual B060-0182 (T16))
Equivalent motor resistance = 125 VDC / 114 Amps = 1.096 ohm
Total Inrush current that include starter resistance 125 VDC / (1.096 ohms + 1.6 ohms) = 46.36 Amps

Rated Inrush Current is equal to 46.36 Amps (See Appendix 2)
Nominal Current is equal to FLA 10 Amps (See Appendix 2)

BALDOR Electric Co. Motor 23P-150(M) Inrush Current

Starter resistor 0-1 sec = 1.6 ohms
120 VDC FLA=50 Amps NEMA Enclosure TEFC 7.5 H. P. 1800 RPM
Inrush Current 2000 Amps at rated 125 VDC (Reference Fax from Baldor Electric Co dated 7/7/99) See Appendix 8
Equivalent motor resistance = 125 VDC / 2000 Amps = 0.0625 ohm
Total Inrush current that include starter resistance 120 VDC / (0.0625 ohms + 1.6 ohms) = 72.18 Amps

Rated Inrush Current is equal to 72.18 Amps (See Appendix 2)
Nominal Current is equal to FLA 50 Amps (See Appendix 2)

125V DC Station Battery "B" Sizing & Voltage Drop
Appendix 15
HPCI MOV/PUMP Sequencing

HPCI MOV/PUMP Sequencing

- 23MOV-14 (HPCI Turbine Steam Supply Isolation Valve) opens on Lo-Lo Reactor Level (126"). 23MOV-14 is manual closure only. Therefore, during both SBO and LOOP/LOCA 23MOV-14 receives an open signal at the onset of Rx Lo-Lo signal and remains open for the duration for both events. The stroke time of 23MOV-14 is calculated based on the BWR Owners Group DC Motor Performance Methodology NEDC-32958, revision 0, in Appendix 8. The stroke time is calculated based on a BMCC bus voltage of approximately 104 Volts (for opening). The calculated value for opening is 15.2 seconds. This value has been increased by 10% to yield 16.7 seconds in the duty cycle for added margin.

- 23MOV-16 (HPCI Steam Line Isolation Valve) opens on Lo-Lo Reactor Level. During both SBO and LOCA 23MOV-16 receives an open signal. During LOOP/LOCA 23MOV-16 receives a closure signal on low reactor pressure at less than 75PSIG. In accordance with GE SAFER/GESTR-LOCA Report NEDC-31317P, Revision 2, Figure A-1b (DBA Suction Break), 75PSIG (89.7PSIA) would occur at approximately 43 seconds. The shortest duration LOCA response was used because the turbine trip causes the DC Lube Oil Pump 23P-150 to start and this results in the most amphours to be removed from the battery. Additionally, using a smaller break and tripping the turbine slightly later doesn't cause any added voltage problems with any other loads. Therefore, 43 seconds is considered conservative and appropriate. The stroke time of 23MOV-16 is calculated based on the BWR Owners Group DC Motor Performance Methodology NEDC-32958, revision 0, in Appendix 8. The stroke time is calculated based on a BMCC bus voltage of approximately 99 Volts (for opening) and 103.7 Volts (for closing). The calculated value for opening is 11.48 seconds. The calculated value for closing is 12.29 seconds. Both the opening and close times have been increased by 10% to yield 12.6 seconds (opening) and 13.5 seconds(closing) in the duty cycle for added margin. These values are within the maximum allowed stroke time of 13.5 seconds based on the Technical Requirements Manual

- 23MOV-19 (HPCI Pump Discharge Isolation Valve) opens on Lo-Lo Reactor Level. During both SBO and LOCA this valve receives an open signal. During a LOOP/LOCA this valve receives a closure signal at 43 seconds on low Reactor Pressure (see write up on 23MOV-16). The actual closure signal is from the full closed limit switch from the HPCI Turbine Stop Valve. 23MOV-19 opens approximately 1 second after receiving the turbine trip signal. The closure signal comes from the close limit switch for 23HOV-1 (HPCI Turbine Stop Valve). Based on a review of previously performed ST-4N (HPCI Quick Start) it takes 1 to 2 seconds for 23HOV-1 to close. Closure signal to 23MOV-57, 58 & 16 is directly from the low reactor pressure relays 23A-K15 or K16 whereas 23MOV-19 is off of the HPCI turbine stop valve 23HOV-1 close position switch. During an SBO, 23MOV-19 receives a closure signal when reactor Hi level is reached (see appendix 12). The stroke time of 23MOV-19 is calculated based on the BWR Owners Group DC Motor Performance Methodology NEDC-32958, revision 0, in Appendix 8. The stroke time is calculated based on a BMCC bus voltage of approximately 99 Volts (for opening) and 101 volts (for closing). The calculated value for opening is 26.07 seconds. The calculated value for closing is 23.99 seconds. Both the opening and close times have been increased by 10% to yield 28.7 seconds (opening) and 26.4 seconds (closing) in the duty cycle for added margin.

- 23MOV-25 (HPCI Pump Min Flow Bypass) opens when the HPCI Pump discharge pressure of 50PSIG has been achieved and flow is less than 550GPM. Based on a review of past ST-4N surveillance tests this takes approximately 14 seconds from the time of HPCI initiation until 23HOV-1 starts to open (see attached spreadsheet). It takes an additional 5 seconds (total of 19 seconds) to reach 50PSIG (this data was obtained from the 2/4/00, 2/14/01,2/19/01 & 6/18/02 performances of ST-4N). Once 50PSIG is reached, 23MOV-25 cycles open. During a DBA LOCA, 23MOV-25 cycles closed immediately after reaching the full open position due to reaching 750GPM and/or Turbine Trip. It takes less time (~1 second) to reach 750GPM after reaching 50PSIG than it does to fully open 23MOV-25 (~6.2 seconds). Therefore, at the completion of the open stroke (which is sealed in), the valve auto closes because 750GPM has already been reached. During an SBO, 23MOV-25 will open 19 seconds after receiving a HPCI initiation signal. 23MOV-25 will immediately close after reaching the full open position due to flow greater than 750GPM. Upon a HPCI trip, 23MOV-25 will cycle open and close. The valve cycles open because pressure is greater than 50PSIG but flow is less than 550GPM (the control circuit is lined up to open even though a turbine trip signal to close is in) and returns to close immediately after reaching full open. This will only cycle during the initial cycling HPCI. Per AOP-49, 23MOV-25 will be rendered inoperable to eliminate cycling of this MOV. The stroke time of 23MOV-25 is calculated based on the BWR Owners Group DC Motor Performance Methodology NEDC-32958, revision 0, in Appendix 8. The stroke time is calculated based on a BMCC bus voltage of approximately 108.8 Volts (for opening) and 111.8 Volts (for closing). The calculated value for opening is 5.77 seconds. The calculated value for closing is 8.18 seconds. Both the opening and close times have been increased by 10% to yield 6.3 seconds (opening) and 9.0 seconds(closing) in the duty cycle for added margin. These values are within the maximum allowed stroke time of 10 seconds based on the Technical Requirements Manual. The above response is consistent with the simulator response and actual plant testing.

- 23MOV-57 and 23MOV-58 will open at the onset of a DBA LOCA due to suppression pool swell. This is described in memorandum JTRG-02-102. However, these valves will receive a closure signal before reaching full open stroke due to Reactor Pressure reaching the low pressure setpoint of 75PSIG). These valves will close due to low reactor pressure (i.e. 75PSIG).

- 23P-150 starts on Lo-Lo Reactor Level and stops within 30 seconds of the HPCI initiation due to the main oil pump bringing system pressure above 90PSIG. This has been verified by reviewing past performed surveillances of ST-4N and ST-4P. Upon a HPCI trip this pump will restart on low lube (less than 35PSIG) because of the aux oil pump (23P-150) seal in circuit. During a DBA LOCA, this pump will start and continue to run for the duration of the duty cycle. It is unclear as to whether or not lube oil pressure would increase enough to cause 23P-150 to trip (i.e. 90PSIG). In any case, it would restart sometime after the turbine tripped. This calculation will assume that this pump will run for the entire duration of a LOCA (i.e. 2 hours). During an SBO, 23P-150 will trip during HPCI initiation (at 30 seconds after initiation). When HPCI is tripped this pump will restart and run until HPCI restarts due to the seal in logic.

- 23P-140 starts on Lo-Lo Reactor Level and remains running for the entire duty cycle for both SBO and LOCA.

- 23P-141 starts upon condenser high level. Steam is not available to the HPCI Turbine until at least 19 seconds after initiation (see 23MOV-25 for basis). Since it unknown when this pump will start and when it will stop, the calculation will start the pump at 19 seconds after HPCI initiation and run for the entire duty cycles for both LOCA and SBO.

ST-4N (HPCI Quick Start)

Date	Time to Reach 4250 GPM (less than 30 seconds)	Oil Filter Inlet Press, 23PI-302	Main Oil Pump Disch Press, 23PI-310 (105 to 110PSIG)	Aux Oil Pump 23P-150 Disch Press, 23PI-302 (83 to 95PSIG)	23HOV-1 Response Time*	23HOV-1 Opening Time**	23HOV-1 Closing Time***	HOV-1 Stoke time (Light to Light)
6/18/02	23.7 seconds	104PSIG	107PSIG	87PSIG	12.6	20.9	1.65	8.3
3/21/02	24.4 seconds	105PSIG	108PSIG	87PSIG	13.1	21.1	1.37	8.0
12/18/01	24.4 seconds	103PSIG	106PSIG	87PSIG	13.0	21.2	1.15	8.2
10/4/01	25.5 seconds	106PSIG	106PSIG	85PSIG	14.2	23.4	1.06	9.2
6/25/01	25.1 seconds	96PSIG	89PSIG	86PSIG	14.4	22.9	1.25	8.5
3/31/01	25.6 seconds	98PSIG	91PSIG	90PSIG	14.9	22.9	1.25	8.0
3/16/01	27.2 seconds	98PSIG	89PSIG	90PSIG	15.5	23.3	1.53	7.8
2/21/01	24.2 seconds			90PSIG	13.1	20.8	1.93	7.7
2/20/01	24.4 seconds	98PSIG	89PSIG	90PSIG	13.1	20.9	1.71	7.8
2/19/01	24.7 seconds	98PSIG	88PSIG	90PSIG	13.4	21.3	1.93	7.9
2/15/01	25.2 seconds							
2/14/01	23.9 seconds	97PSIG	89PSIG	90PSIG	13.1	20.7	1.71	7.6
The acceptance criteria for Main Oil Pump Disch Press was changed in 3/01								
*From start of test until dual indication is observed (i.e. red light comes on)								
** From start of test until green light goes off (I.e. full open)								
*** From the time 23A-S19 pushed to trip turbine until 23HOV-1 is full closed								

ATTACHMENT 9.8 MINOR CALCULATION CHANGE FORM

MINOR CALCULATION CHANGE FORM

Calculation No.: JAF-CALC-ELEC-02610 **Revision:** 2

Minor Calculation Change No.: DRN-03-00399

1 Purpose of Change:
Equivalent Change JE-03-024 will replace the 3 Agastat E7012 relays with Allen-Bradley 700-RTC in 4kV SWGR 71HO6

2 SSC affected:
71-62-3-1HOEBO3, 71-62-4-1HOEBO3, 71-62-5-1HOEBO3.

3 Drawings/Procedures/ Calculations affected
JAF-CALC-ELEC-02610, Rev. 2, Appendices 2, 3, 4, 5 and 9

4 Description of Change:
Revise the Component Data as shown in Appendices 2 and 5 Appendices 3, 4 and 9 will be updated on the next revision of this calculation after the installation of the Allen-Bradley 700-RTC, as the entries in Appendices 3,4 and 9 are calculated using Appendix 2 input.

5 Impact on existing calculation conclusion:
None

6 Impact on DBD's, UFSAR, Technical Specifications:
None

7 The existing calculation does/does not (circle one) have a calculation verification checklist.

Remarks: Refer to JAF-ECCF-03-00003 for additional information.
The required minimum pickup/dropout voltage is 70/40 vDC for Allen-Bradley 700-RTC Relays. The Relays will have enough voltage to energize and run during the worst event of Loss of Coolant Accident coincident with Loss of Battery Charger and SBO. Battery "B" Sizing will not be effected as a result of this change.

NOTE:
A. If UFSAR or Technical Specifications need to be revised, Minor Calculation Change Form should not be used unless it is an editorial change to the FSAR or Technical Specifications.
B. Minor Calculation Change Forms do not change the status of the Parent Calculation Revision.

	Print/Sign		
Prepared by:	Alex Barton	Alex Barton	**Date:** 6/19/03
Reviewed by: •	Steve Glover	S. Glover	**Date:** 6/19/03
Approved by	Aaric Mitchell	Aaric A. Mitchell	**Date:** 06/20/03

- Where the original calculation was design verified, the reviewer signature confirms the latest design verification is still valid.
-

4 kV SWGR 71H06 (Cont'd)

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
71H06	71-10640	RHR Pump 10P-3D (Close)	13.2 sec	13.3 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BX	1
		Breaker Charging Motor Inrush	13.3 sec	14.3 sec	N/A	N/A	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	14.3 sec	18.2 sec	N/A	N/A	N/A	14	125	N/A	VA			
71H06	71-10650	RHR Pump 10P-3C (Close)	1 sec	1.1 sec	3.5 sec	3.6 sec	6	N/A	125	N/A	Resistance	I	ESK-5BW	1
		Breaker Charging Motor Inrush	1.1 sec	2.1 sec	3.6 sec	8.5 sec	68	N/A	125	N/A	VA	I		
		Breaker Charging Motor F.L.	2.1 sec	6 sec	3.6 sec	8.5 sec	N/A	14	125	N/A	VA	I		
		RHR Pump 10P-3C (Trip)	6.2 sec	6.3 sec	8.7 sec	8.8 sec	6	N/A	125	N/A	Resistance	I		4
		RHR Pump 10P-3C (Close)	8.2 sec	8.3 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		1
		Breaker Charging Motor Inrush	8.3 sec	9.3 sec	N/A	N/A	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	9.3 sec	13.2 sec	N/A	N/A	N/A	14	125	N/A	VA	I		
71H06	71-10660	Feed to Buses 11600 & 12600 (Close)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-5BN	6
71H06	1HOEB03	Emer Bus 10600 Undervoltage, Load Shedding and Sequencing	0.1 sec	7.2 sec	0.1 sec	239 min & 7.2 sec	N/A	1.1	125	139	Resistance	I	ESK-5BT	
71H06		Continuous control	0 sec	120 min	0 sec	240 min	N/A	1.22	125	152	Resistance			

1,19 DRN-03-00399

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) For the LOCA + LOBC scenario timing is based on the load sequence included in UFSAR table 8.6-1

2) EDG B & D Tie breaker is closed when both engines reach 200 rpm.

3) RHR SW are manually started by operators after RHR Pump Start. RHR SW pumps 10P-1B & 10P-1D start at 10 min to initiate RHRSW cooling.
RHRSW pump will be started manually by the control room operator one by one, not simultaneously.
OP-13C directs to start one pump first, and then start next pump if required. According to Control Room SM, Chris Adner,
operation would not start pumps simultaneously because operator knows that 4KV motors can draw high inrush currents resulting in a high voltage drop on emergency buss.
At least 5 to 10 seconds' duration is expected between the pumps' start.
T~10 minutes is selected for the first manual start of RHRSW pump. This is the time reasonably early because no earlier time is credible for manual action.
Startup of RHRSW pumps which are to provide cooling to the RHR Heat Exchangers would not be delayed until the end time of the 2 hours' battery duty cycle period.

4) Breaker trips when one of the EDG's reach 75% of rated voltage and one of the double ended tie breakers is open with both of EDG output breakers open.

5) For the purpose of this calculation, these breakers are considered to close during the last minute of battery duty cycle as a random load for LOCA.

6) This breaker is not automatically actuated as result of the postulated scenarios

4 kV SWGR 71H06 for LOCA PICK UP & DROP OUT VOLTAGES

Unit No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
10602	71-10602(Close)	93EDG-B feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	92.97	22.97	YES	92.97	22.97	YES
	71-10602(Motor)	71-10602 Brk Charging Motor	I	GE		G080-0631	125	90	90	100.46	10.46	YES	104.86	14.86	YES
10604	K8-1EDGB02	EDG-B&D Tie Brk Closing Rel	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.73	27.98	YES	103.11	59.36	YES
	71-10604(Close)	Gen. Tie to 93EDG-B & D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	85.44	15.44	YES	85.44	15.44	YES
	71-10604(Motor)	71-10604 Brk Charging Motor	I			G080-0631	125	90	90	100.46	10.46	YES	102.61	12.61	YES
	62-1EDGB02	93EDG-B&D Output Brk Closing Rel	I	Agastat	E7012PB	A348-C008	125	100	12.5	110.97	10.97	YES	103.22	90.72	YES
	62X-1EDGB02	93EDG-B&D Output Brk Closing Rel	I	GE	12HLA11B12A	G080-0657	125	75	75	110.97	35.97	YES	103.25	28.25	YES
	K9-1EDGB02	Gen. Tie to 93EDG-B & D Trip	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	102.55	23.80	YES	103.23	59.48	YES
	71-10604(Trip)	Gen. Tie to 93EDG-B & D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	101.80	31.80	YES	101.80	31.80	YES
10610	71-10610(Close)	RHR Serv Water Pump 10P-1D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	99.98	29.98	YES	99.98	29.98	YES
	71-10610(Motor)	71-10610 Brk Charging Motor	I	GE		G080-0631	125	90	90	106.78	16.78	YES	113.04	23.04	YES
	10SOV-101D	RHR 10P-1D Motor Cooling SOV	I	ACSO Co.	8210C13	E-Mail from ASCO Dated 11/15/01	125	90	90	117.17	27.17	YES	102.80	12.80	YES
10612	71-10612(Close)	93EDG-D feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	93.61	23.61	YES	93.61	23.61	YES
	71-10612(Motor)	71-10612 Brk Charging Motor	I			G080-0631	125	90	90	100.62	10.62	YES	104.91	14.91	YES
10614	71-10614(Trip)	Bus 10400 feed to bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	105.33	35.33	YES	105.61	35.61	YES
	71-10614(Close)	Bus 10400 feed to bus 10600			AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	92.45	22.45	YES	92.45	22.45	YES
	71-10614(Motor)	71-10614 Brk Charging Motor				G080-0631	125	90	90	107.14	17.14	YES	113.11	23.11	YES
10620	71-10620(Close)	RHR Service Water Pump 10P-1B	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	98.22	28.22	YES	98.22	28.22	YES
	71-10620(Motor)	71-10620 Brk Charging Motor				G080-0631	125	90	90	114.97	24.97	YES	0.00	-90.00	NO
	10SOV-101B	RHR Pmp Mtr Cooling SOV	I	ACSO Co.	8210C13	E-Mail from ASCO Dated 11/15/01	125	90	90	117.17	27.17	YES	102.80	12.80	YES
10630	71-10630(Close)	Core Spray Pump 14P-1B	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.26	27.26	YES	97.26	27.26	YES
	71-10630(Motor)	71-10630 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.26	14.26	YES	110.23	20.23	YES
10640	Bkr 71-10640(Close)	RHR Pump 10P-3D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.45	24.45	YES	94.45	24.45	YES
	71-10640(Motor)	71-10640 Brk Charging Motor	I	GE		G080-0631	125	90	90	105.79	16.79	YES	111.10	21.10	YES
10650	71-10650(Close)	RHR Pump 10P-3C	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	87.28	17.28	YES	87.28	17.28	YES
	71-10650(Motor)	71-10650 Brk Charging Motor	I	GE		G080-0631	125	90	90	101.30	11.30	YES	102.45	12.45	YES
10660	71-10660	Feed to Buses 11600 & 12600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10612	1HOEB03	Emer. Bus 10600 Undervoltage Circuits.	I	GE	8AM17A	G080-0576	125	62.5	62.5	103.26	40.76	YES	99.38	36.88	YES
			I	GE	12HLA11B12A	G080-0657	125	75	75	103.26	28.26	YES	99.38	24.38	YES
			~~I~~	~~GE~~	~~12HGA11J52~~	~~G080-0213~~	~~125~~	~~75~~	~~12.5~~	~~103.26~~	~~28.26~~	~~YES~~	~~99.38~~	~~86.88~~	~~YES~~
			I	Allen-Bradley	700-RTC	JE-05-024	120	70	40	103.26	33.26	YES	99.38	59.38	YES
			~~I~~	~~Agastat~~	~~E7012DO~~	~~A348-C008~~	~~125~~	~~100~~	~~12.5~~	~~103.26~~	~~3.26~~	~~YES~~	~~99.38~~	~~86.88~~	~~YES~~
			I	Agastat	E7012PD	A348-C008	125	100	12.5	103.26	3.26	YES	99.38	86.88	YES
			I	GE	12HFA151AZF	G080-0233	125	75	12.5	103.26	28.26	YES	99.38	86.88	YES
			I	Brown Boveri	ITE-27N	B455-0002 & Appendix 6	125	70	70	103.26	33.26	YES	99.38	29.38	YES

DRN-03-00399

4 kV SWGR 71HO6 for SBO PICK UP & DROP OUT VOLTAGES

Unit No.	Load I.D.	Load Description	Q.A. Cat	MFG	Model No	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
10602	71-10602(Close)	93EDG-B feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	93.60	23.60	YES	93.60	23.60	YES
	71-10602(Motor)	71-10602 Brk Charging Motor	I	GE		G080-0631	125	90	90	95.34	5.34	YES	103.84	13.84	YES
	K10-1EDGB01	K10-1EDGB01EDG B Egn Failure	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.66	33.91	YES	97.93	54.18	YES
	71-10602(Trip)	4KV Swgr Bkr 71-10602 Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	99.77	29.77	YES	99.77	29.77	YES
	71-10602(Close)	EDG-B feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	91.77	21.77	YES	91.77	21.77	YES
	71-10602(Motor)	71-10602 Brk Charging Motor	I			G080-0631	125	90	90	103.45	13.45	YES	109.69	19.69	YES
10604	K8-1EDGB02	EDG-B&D Tie Brk Closing Rel	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	107.67	28.92	YES	98.00	54.25	YES
	71-10604(Close)	Gen. Tie to 93EDG-B & D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	86.28	16.28	YES	86.28	16.28	YES
	71-10604(Motor)	71-10604 Brk Charging Motor	I			G080-0631	125	90	90	103.98	13.98	YES	105.89	15.89	YES
	62-1EDGB02	93EDG-B&D Output Brk Closing Rel	I	Agastat	E7012PB	A348-C008	125	100	12.5	113.75	13.75	YES	97.90	85.40	YES
	62X-1EDGB02	93EDG-B&D Output Brk Closing Rel	I	GE	12HLA11B12A	G080-0657	125	75	75	113.75	38.75	YES	97.96	22.96	YES
	K9-1EDGB02	Gen. Tie to 93EDG-B & D (Trip)	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.78	34.03	YES	97.94	54.19	YES
	71-10604(Trip)	Gen. Tie to 93EDG-B & D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	102.20	32.20	YES	102.20	32.20	YES
10610	71-10610	RHR Serv Water Pump 10P-1D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10612	71-10612(Close)	93EDG-D feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.25	24.25	YES	94.25	24.25	YES
	71-10612(Motor)	71-10612 Brk Charging Motor	I			G080-0631	125	90	90	95.49	5.49	YES	103.89	13.89	YES
	K10-1EDGD01	93EDG-D Egn Failure	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	113.00	34.25	YES	97.95	54.20	YES
	71-10612(Trip)	93EDG-D feed to Bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	100.03	30.03	YES	100.03	30.03	YES
10614	71-10614(Trip)	Bus 10400 feed to bus 10600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	108.72	38.72	YES	108.72	38.72	YES
10620	71-10620	RHR Service Water Pump 10P-1B	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10630	71-10630	Core Spray Pump 14P-1B	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10640	71-10640	RHR Pump 10P-3D	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10650	71-10650(Close)	RHR Pump 10P-3C	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	92.58	22.58	YES	92.58	22.58	YES
	71-10650(Motor)	71-10650 Brk Charging Motor	I			G080-0631	125	90	90	102.89	12.89	YES	106.03	16.03	YES
	71-10650(Trip)	RHR Pump 10P-3C	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	108.47	38.47	YES	108.47	38.47	YES
10660	71-10660	Feed to Buses 11600 & 12600	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	N/A	N/A	N/A	N/A	N/A	N/A
10612	1HOEB03	Emer. Bus 10600 Undervoltage Circuits.	I	GE	8AM17A	G080-0576	125	62.5	62.5	112.34	49.84	YES	94.59	32.09	YES
			I	GE	12HLA11B12A	G080-0657	125	75	75	112.34	37.34	YES	94.59	19.59	YES
			I	GE	12HGA11J52	G080-0215	125	75	12.5	112.34	37.34	YES	94.59	82.09	YES
			I	Allen-Bradley	700-RTC	JE-05-024	120	70	40	112.34	42.34	YES	94.59	54.59	YES
			I	Agastat	E7017PC	A348-C008	125	100	12.5	112.34	12.34	YES	94.59	82.09	YES
			I	Agastat	E7012PD	A348-C008	125	100	12.5	112.34	12.34	YES	94.59	82.09	YES
			I	GE	12HFA151A2F	G080-0233	125	75	12.5	112.34	37.34	YES	94.59	82.09	YES
			I	Brown Boveri	ITE-27N	B455-0002 & Appendix 6	125	70	70	112.34	42.34	YES	94.59	24.59	YES

DRN-03-00399

MINOR CALCULATION CHANGE FORM

Calculation No.: JAF-CALC-ELEC-02610 **Revision:** 2

Minor Calculation Change No.: DRN-03-01072

1 Purpose of Change:
Equivalent Change JD-01-020 will replace 23MOV-14 with new GE/Sentinel Valve. Existing actuator motor will be re-used. Closing control will be revised from LS control to Torque Switch Control.

2 SSC affected:
23MOV-14

3 Drawings/Procedures/ Calculations affected
JAF-CALC-ELEC-02610, Rev. 2, Appendices 2, 4, 5, 8 and 15

4 Description of Change:
Revise the Component Data as shown in Appendices 2 , 5, 8, 15. Appendix 4 will be updated on the next revision of this calculation after the installation of the 23MOV-~~14~~ 14 as the entries in Appendix 4 are calculated using Appendix 2 input. AD 8/1/03

5 Impact on existing calculation conclusion:
None

6 Impact on DBD's, UFSAR, Technical Specifications:
None

7 The existing calculation (does) does not (circle one) have a calculation verification checklist.

Remarks: Refer to JAF-ECCF-03-00013 for additional information.
The required minimum reduced voltage for 23MOV-14 is 92.07 Vdc per JAF-CALC-HPCI-01825 Rev. 3. Valve stroke time is 11.9 sec. The 24MOV-14 will have enough voltage to open during the worst event of Loss of Coolant Accident coincident with Loss of Battery Charger and SBO.
Battery "B" Sizing will not be effected as a result of this change.

NOTE:
A. If UFSAR or Technical Specifications need to be revised, Minor Calculation Change Form should not be used unless it is an editorial change to the FSAR or Technical Specifications.
B. Minor Calculation Change Forms do not change the status of the Parent Calculation Revision.

	Print/Sign		
Prepared by:	Alex Barton	Alex Barton	**Date:** 8/04/03
Reviewed by: •	Sung Kim	Sung Kim	**Date:** 08/04/03
Approved by	Gerry Caccavale	G. Caccavale	**Date:** 8/7/03

- Where the original calculation was design verified, the reviewer signature confirms the latest design verification is still valid.
-

CALCULATION SHEET

Entergy Nuclear Northeast			
Calculation No. JAF-CALC-ELEC-02610		Revision: 2	
Subject:	71 ELECTRICAL DISTRIBUTION	Page 19 of 21	
	125 VDC STATION BATTERY "B" SIZING &	Computed by: A Barton	Date: 4/30/03
	VOLTAGE DROP	Checked by: S Kim	Date: 4/30/03

4.0 REFERENCES

4.1 Engineering data, copper and aluminum conductor electrical cables, Okonite bulletin (Appendix 8)

4.2 ECRIS, dated 3/30/99.

4.3 IEEE 485-1997, IEEE Recommended Practice for sizing Lead-Acid Batteries for Stationary applications

4.4 Gould battery data for Battery NCN-33 (Appendix 7)

4.5 Operating Procedure OP-43 125V DC Power System

4.6 NEMA Standard ICS-2-1978

4.7 EPRI Reference series, Volume 4, Wire and Cable

4.8 Tabulation of Circuit Breaker Resistance Measured Data (Appendix 10)

4.9 IEEE Std 241-1983, IEEE Recommended Practice for Electrical Power Systems in Commercial Buildings.

4.10 Report No. JAF-RPT-ELEC-03375, Revision 1, Basis for Conductor Temperatures for 125VDC Voltage Drop Calculations

4.11 JAF-CALC-ELEC-01488, Revision 4, 4KV Emergency Bus Loss of Voltage, Degraded Voltage and Time Delay Relay Uncertainty and Setpoint Calculation.

4.12 AOP-49, Revision 10, "Station Blackout"

4.13 IEEE 946-1992, IEEE Recommended Practice for the Design of DC Auxiliary Power systems for Generating Stations

4.14 JAF-CALC-RWCU-01824, Revision 4, Reduced Voltage Analysis for 12MOV-18 (Appendix 5)

4.15 JAF-CALC-HPCI-01825, Revision 2 (3) Reduced Voltage Analysis for 23MOV-14 DRN-03-01072

MCC 71BMCC-2

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
OA1	29MOV-77	Main Steam Line Drain Isol Valve	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	I	ESK-11AF	1
OA2	23MOV-14 (Open)	HPCI Turbine Steam Inlet VA Inrush	0.1 sec	1.1 sec	10 sec	11 sec	136	N/A	125	N/A	Resistance	I	ESK-11AK	2
		HPCI Turbine Steam Inlet VA F.L.	1.1 sec	12 sec	11 sec	21.9 sec	N/A	36	125	4500	VA			
		HPCI Turbine Steam Inlet Cntl Open	0.1 sec	12 sec	10 sec	21.9 sec	N/A	0.58	125	72.8	Resistance	I		
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.19	125	24.2	Resistance			
OB1	23MOV-17	HPCI Cond Storage Tk to PP	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	I	ESK-11AL	3
OC2	10MOV-67	RHR To Radwaste Inboard Isol	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	II/III	ESK-11AH	1
OD1	23P-140	HPCI Gland Seal Cond Exhstr Inrush	0.1 sec	1.1 sec	10 sec	11 sec	9.41	N/A	120	N/A	Resistance	II/III	ESK-11CB	4
		HPCI Gland Seal Cond Exhstr F.L.	1.1 sec	120 min	11 sec	240 min	N/A	3.5	120	420	VA			
		HPCI Gland Seal Cond Exhstr Control	0.1 sec	120 min	10 sec	240 min	N/A	0.49	125	61.8	Resistance	II/III		
		Continuous control	0	0.1 sec	0 sec	10 sec	N/A	0.19	125	24.2	Resistance			
OE1	23P-141	HPCI Gland Seal Cond Pmp Inrush	19 sec	20 sec	29sec	30 sec	46.36	N/A	125	N/A	Resistance	II/III	ESK-11CB	5
		HPCI Gland Seal Cond Pump F.L.	20 sec	120 min	30 sec	240 min	N/A	10	125	1250	VA	II/III		
		HPCI Gland Seal Cond Pump Control	19 sec	120 min	29sec	240 min	N/A	0.49	125	61.8	Resistance	II/III		
		Continuous control	0 sec	10 sec	0 sec	20 sec	N/A	0.19	125	24.2	Resistance			
OE2	23MOV-60	Bypass HPCI Outboard Iso VV	N/A	N/A	N/A	N/A	N/A	N/A	N/A		VA	I	ESK-11AAG	1

NOTES (Timing Sequence and Individual Load Current Justifications) cont'd on page 20

DRN-03-01072

MCC 71BMCC-2 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet VA (Open)	I	Sentinel	ROV W.O. 00270	JAF-CALC-HPCI-01825	125	92.07	92.07	93.07	1.00	YES	105.26	13.19	YES
	23MOV-14(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78.0	18	103.07	25.07	YES	102.40	84.40	YES
			I	GE	IC2800A1617B3H	See Design Input 2.18 & 2.19	120	78.0	18	103.07	25.07	YES	102.40	84.40	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	103.07	27.47	YES	102.40	78.40	YES
OD1	23P-140(M)	HPCI Gland Seal Cond Exhauster Pump	II/III	GE	5BCJ56ED56A	IEEE-946 (80% of nominal)	120	96	96	102.63	6.63	YES	109.22	13.22	YES
	23P-140(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18	103.70	25.70	YES	103.03	85.03	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	109.70	28.10	YES	103.03	93.43	YES
OE1	23P-141(M)	HPCI Gland Seal Cond. Pump	II/III	Baldor	6229D	IEEE-946 (80% of nominal)	125	100	100	104.43	4.43	YES	108.19	8.19	YES
	23P-141(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18	110.48	32.48	YES	109.20	91.20	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	110.48	34.88	YES	109.20	99.60	YES

DRN-03-01072

MCC 71BMCC-2 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet VA (Open)	I	Sentinel	ROV W.O. 00270	JAF-CALC-HPCI-01825	125	92.07	92.07	93.72	1.65	YES	106.53	14.46	YES
	23MOV-14(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	103.12	25.12	YES	103.12	85.12	YES
			I	GE	IC2800A1617B3H	See Design Input 2.18 & 2.19	120	78	18	103.12	25.12	YES	106.53	88.53	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	103.12	27.52	YES	106.53	82.53	YES
OD1	23P-140(M)	HPCI Gland Seal Cond Exhauster Pump	II/III	GE	5BCJ56ED56A	IEEE-946 (80% of nominal)	120	96	96	103.34	7.34	YES	105.93	9.93	YES
	23P-140(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	103.75	25.75	YES	103.75	85.75	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	103.75	28.15	YES	103.75	94.15	YES
OE1	23P-141(M)	HPCI Gland Seal Cond. Pump	II/III	Baldor	6229D	IEEE-946 (80% of nominal)	125	100	100	104.84	4.84	YES	104.42	4.42	YES
	23P-141(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	110.91	32.91	YES	105.54	87.54	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	110.91	35.31	YES	105.54	95.94	YES

BWROG DCM for B Battery (batch), Version 2.0.xls, Inputs, 7/28/03, 10:51 AM

Select Valve—> 23MOV-14, dynamic open with blowdown model

General Information	*Required?*	*Value*
Valve Type	yes	wedge gate
Flow type	yes	blowdown
Stroke direction	yes	open
Fluid (blowdown only)	yes	steam
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	2.500
Seat ring face ID, $D_{body-ID}$ (inches)	yes	7.079
Seat ring inner diameter, D_w (inches)	no	6.890
Globe valve stroke length, D (inches)	no	8.070
Isolation-to-wedging travel, X (percent)	yes	9.79%
Packing load, F_{pack} (lbs)	yes	2,500
Required thrust (including water inertia), F_R (lbs)	yes	19,649
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	no	2.497
Actuator overall ratio, OAR	yes	40.18
Motor gear set ratio, MGSR	yes	0.848
Actuator rated torque, τ_{rated}	yes	850
Stem factor, SF (ft-lbs/lb)	yes	0.01470
Overhauling stem factor, SF_O (ft-lbs/lb)	yes	0.01190
Voltage at MCC, V_{mcc} (volts)	yes	104.09
Cable resistance, R_{cable} (ohms)	yes	0.1515
Thermal overload resistance, R_{tol} (ohms)	yes	0.0112
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	60 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	1.000
Pullout efficiency, η_p	yes	0.40
Run efficiency, η_r	yes	0.50
Nominal motor speed (rpm), ω_{nom}	optional	1,900
Design Basis Conditions		
Differential pressure, DP (psi)	no	0
Valve pressure at full open, P_g (psig)	yes	1195
Flow rate, Q_{max} (gpm)	no	0
Fluid density, ρ (lbs/ft^3)	no	2.786
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	yes	10000
Calculated Values		
System resistance, K_{sys}	no	—
Fully open stem thrust, F_O (lbs)	yes	-3,366
Nominal motor torque, τ_{nom} (ft-lbs)	yes	74.7
Maximum motor torque (ft-lbs)	yes	18.0
Maximum adjusted motor torque (ft-lbs)	yes	24.6
Minimum motor speed (rpm)	yes	1036
Minimum instantaneous actuator capability (lbs)	yes	59,665
Minimum instantaneous margin (lbs)	yes	40,016
Maximum allowable thrust at unwedging	yes	51,174
Efficiency at minimum instantaneous capability	yes	0.400

Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

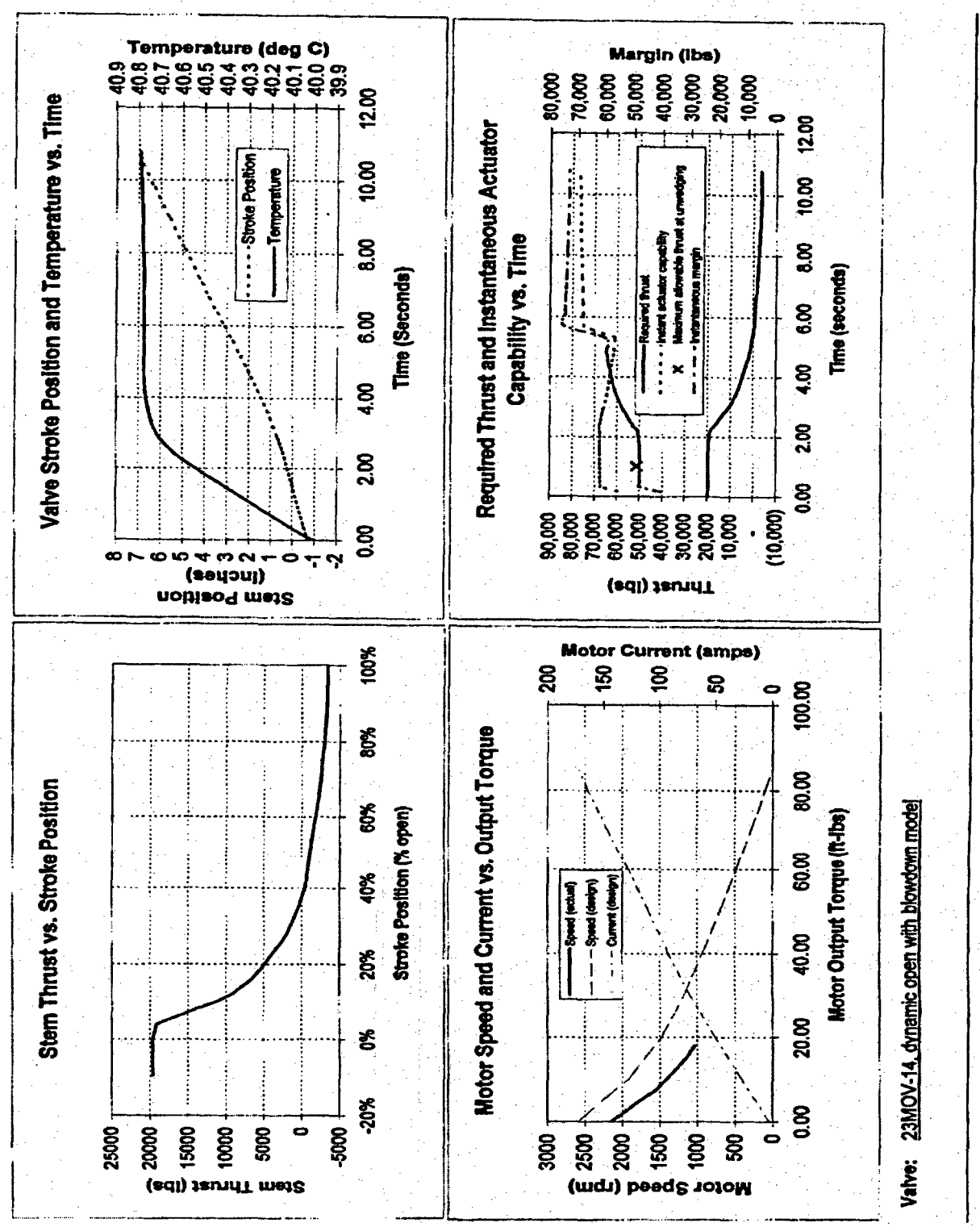
Warnings

Predicted Stroke Time (Seconds): 10.77

BWROG DCM for B Battery (batch), Version 2.0.xls, Results, 7/28/03, 10:51 AM

Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
-10%	-0.69	19649												0.00	40.0				
-9%	-0.62	19649	19649	288.84		0.400	17.97	48.33	104.09	97	24.61	1036	0.16	0.16	40.1	877	59,665	40,016	
-8%	-0.55	19649	19649	288.84	877	0.448	16.04	41.88	104.09	97	21.80	1110	0.15	0.31	40.1	990	67,352	47,703	
-7%	-0.49	19649	19649	288.84	939	0.449	15.99	41.79	104.09	97	21.74	1111	0.15	0.46	40.1	993	67,534	47,885	
-6%	-0.42	19649	19649	288.84	940	0.449	15.99	41.78	104.09	97	21.75	1111	0.15	0.61	40.2	993	67,528	47,879	
-5%	-0.35	19649	19649	288.84	940	0.449	15.99	41.78	104.09	97	21.75	1111	0.15	0.76	40.2	993	67,518	47,869	
-4%	-0.28	19649	19649	288.84	940	0.449	15.99	41.78	104.09	97	21.75	1111	0.15	0.91	40.3	992	67,508	47,859	
-3%	-0.21	19649	19649	288.84	940	0.449	15.99	41.78	104.09	97	21.76	1111	0.15	1.06	40.3	992	67,498	47,849	
-2%	-0.14	19649	19649	288.84	940	0.449	15.99	41.78	104.09	97	21.76	1111	0.15	1.21	40.3	992	67,488	47,839	
-1%	-0.07	19649	19649	288.84	940	0.449	15.99	41.78	104.09	97	21.76	1111	0.15	1.36	40.4	992	67,478	47,829	
0%	-0.01	19649	19649	288.84	940	0.449	15.99	41.78	104.09	97	21.77	1111	0.14	1.50	40.4	992	67,468	47,819	
0%	0.00	19649	19649	288.84	940	0.449	15.99	41.78	104.09	97	21.77	1111	0.02	1.51	40.4	992	67,459	47,810	
1%	0.07	19520	19585	287.90	940	0.449	15.94	41.66	104.09	97	21.69	1113	0.15	1.67	40.5	992	67,471	47,887	
2%	0.14	19392	19456	286.01	941	0.450	15.84	41.42	104.09	97	21.54	1117	0.15	1.82	40.5	992	67,494	48,038	
3%	0.21	19263	19328	284.12	945	0.450	15.73	41.17	104.09	97	21.39	1121	0.15	1.97	40.5	993	67,521	48,194	
4%	0.28	19135	19199	282.23	948	0.450	15.62	40.93	104.09	97	21.24	1125	0.15	2.13	40.6	993	67,549	48,350	
5%	0.35	18073	18604	273.48	952	0.450	15.13	39.81	104.09	98	20.54	1143	0.15	2.27	40.6	995	67,876	49,072	
6%	0.42	16509	17291	254.17	967	0.450	14.06	37.35	104.09	98	19.02	1194	0.14	2.42	40.6	999	67,956	50,666	
7%	0.50	15169	15839	232.83	1010	0.445	13.03	34.97	104.09	98	17.55	1248	0.14	2.55	40.7	991	67,443	51,605	
8%	0.57	14072	14620	214.91	1056	0.440	12.14	32.93	104.09	99	16.30	1295	0.13	2.69	40.7	985	67,022	52,401	
9%	0.64	12847	13459	197.85	1095	0.436	11.29	30.96	104.09	99	15.11	1340	0.13	2.81	40.7	979	66,592	53,132	
10%	0.71	11325	12086	177.67	1134	0.431	10.26	28.60	104.09	99	13.68	1394	0.12	2.94	40.7	971	66,046	53,960	
12%	0.85	9244	10285	151.19	1179	0.424	8.88	25.19	104.09	100	11.77	1467	0.23	3.17	40.7	960	65,320	55,035	
14%	0.99	7905	8575	126.05	1241	0.417	7.52	21.80	104.09	101	9.91	1541	0.22	3.39	40.7	950	64,636	56,061	
16%	1.13	6566	7235	106.36	1304	0.412	6.43	19.07	104.09	101	8.44	1630	0.21	3.60	40.8	942	64,093	56,857	
18%	1.27	5702	6134	90.17	1379	0.408	5.51	16.76	104.09	101	7.20	1705	0.20	3.80	40.8	936	63,650	57,516	
20%	1.42	4923	5312	78.09	1443	0.404	4.81	15.02	104.09	102	6.27	1762	0.19	3.99	40.8	931	63,307	57,995	
22%	1.56	4143	4533	66.63	1491	0.401	4.14	13.34	104.09	102	5.38	1817	0.19	4.18	40.8	925	62,956	58,423	
24%	1.70	3363	3753	55.17	1538	0.398	3.45	11.64	104.09	102	4.48	1873	0.18	4.36	40.8	920	62,590	58,837	
26%	1.84	2584	2974	43.71	1585	0.394	2.76	9.90	104.09	102	3.57	1929	0.18	4.54	40.8	915	62,212	59,238	
28%	1.98	1941	2263	33.26	1633	0.391	2.12	8.30	104.09	103	2.73	1982	0.17	4.71	40.8	909	61,857	59,595	
30%	2.12	1492	1717	25.23	1677	0.388	1.62	7.04	104.09	103	2.08	2023	0.17	4.88	40.8	905	61,579	59,863	
35%	2.48	369	930	13.68	1712	0.385	0.89	5.21	104.09	103	1.14	2083	0.41	5.29	40.8	899	61,159	60,229	
40%	2.83	-439	-35	0.42	1782	0.380	0.03	3.07	104.09	104	0.03	2153	0.40	5.69	40.8	892	74,940	74,905	
45%	3.19	-757	-598	7.12	1822	0.382	0.46	4.16	104.09	103	0.59	2117	0.40	6.09	40.8	896	75,260	74,662	
50%	3.54	-1075	-916	10.90	1791	0.384	0.71	4.77	104.09	103	0.91	2097	0.41	6.50	40.8	898	75,435	74,519	
55%	3.89	-1407	-1241	14.77	1775	0.385	0.96	5.39	104.09	103	1.23	2077	0.41	6.91	40.8	900	75,614	74,373	
60%	4.25	-1833	-1620	19.28	1758	0.386	1.24	6.10	104.09	103	1.60	2054	0.42	7.32	40.8	902	75,821	74,200	
70%	4.96	-2503	-2168	25.80	1738	0.389	1.65	7.13	104.09	103	2.13	2020	0.84	8.17	40.8	906	76,117	73,949	
80%	5.66	-2974	-2738	32.58	1709	0.391	2.08	8.19	104.09	103	2.68	1985	0.86	9.03	40.8	909	76,417	73,679	
90%	6.37	-3317	-3145	37.43	1680	0.392	2.37	8.94	104.09	103	3.07	1961	0.87	9.90	40.8	912	76,623	73,478	
100%	7.08	-3366	-3341	39.76	1659	0.393	2.52	9.29	104.09	103	3.26	1949	0.88	10.77	40.8	913	76,715	73,374	
UNW	—	—	*51174*	*752.26*	*117*	*0.383*	*48.89*	*108.00*	*104.09*	*87*	*74.74*	*138*	—	—	—	*752*	51,174	(0)	
Screen	—	—	*19649*	*288.84*	—	*0.400*	*17.97*	*172.00*	*104.09*	*76*	*32.36*	*682*	—	*27.5*	*49.2*	*669*	45,499	25,850	
wiier	—	—	*19649*	*288.84*	*933*	*0.449*	*16.00*	*41.79*	*104.09*	*97*	*22.10*	*1103*	—	*17.0*	*44.5*	*977*	66,443	46,794	

Valve: 23MOV-14, dynamic open with blowdown model



Valve: 23MOV-14, dynamic open with blowdown model

BWROG DCM for B Battery (batch), Version 2.0.xls, Output Plots, 7/28/03, 10:51 AM

JAF-CALC-ELEC-02610 Revision 2 **Appendix 15**
1 of 4

HPCI MOV/PUMP Sequencing

- 23MOV-14 (HPCI Turbine Steam Supply Isolation Valve) opens on Lo-Lo Reactor Level (126"). 23MOV-14 is manual closure only. Therefore, during both SBO and LOOP/LOCA 23MOV-14 receives an open signal at the onset of Rx Lo-Lo signal and remains open for the duration for both events. The stroke time of 23MOV-14 is calculated based on the BWR Owners Group DC Motor Performance Methodology NEDC-32958, revision 0, in Appendix 8. The stroke time is calculated based on a BMCC bus voltage of approximately 104 Volts (for opening). The calculated value for opening is 10.8 ~~13.2~~ seconds. This value has been increased by 10% to yield ~~16.7~~ 11.9 seconds in the duty cycle for added margin. DRN-03-01072

- 23MOV-16 (HPCI Steam Line Isolation Valve) opens on Lo-Lo Reactor Level. During both SBO and LOCA 23MOV-16 receives an open signal. During LOOP/LOCA 23MOV-16 receives a closure signal on low reactor pressure at less than 75PSIG. In accordance with GE SAFER/GESTR-LOCA Report NEDC-31317P, Revision 2, Figure A-1b (DBA Suction Break), 75PSIG (89.7PSIA) would occur at approximately 43 seconds. The shortest duration LOCA response was used because the turbine trip causes the DC Lube Oil Pump 23P-150 to start and this results in the most amphours to be removed from the battery. Additionally, using a smaller break and tripping the turbine slightly later doesn't cause any added voltage problems with any other loads. Therefore, 43 seconds is considered conservative and appropriate. The stroke time of 23MOV-16 is calculated based on the BWR Owners Group DC Motor Performance Methodology NEDC-32958, revision 0, in Appendix 8. The stroke time is calculated based on a BMCC bus voltage of approximately 99 Volts (for opening) and 103.7 Volts (for closing). The calculated value for opening is 11.48 seconds. The calculated value for closing is 12.29 seconds. Both the opening and close times have been increased by 10% to yield 12.6 seconds (opening) and 13.5 seconds(closing) in the duty cycle for added margin. These values are within the maximum allowed stroke time of 13.5 seconds based on the Technical Requirements Manual

- 23MOV-19 (HPCI Pump Discharge Isolation Valve) opens on Lo-Lo Reactor Level. During both SBO and LOCA this valve receives an open signal. During a LOOP/LOCA this valve receives a closure signal at 43 seconds on low Reactor Pressure (see write up on 23MOV-16). The actual closure signal is from the full closed limit switch from the HPCI Turbine Stop Valve. 23MOV-19 opens approximately 1 second after receiving the turbine trip signal. The closure signal comes from the close limit switch for 23HOV-1 (HPCI Turbine Stop Valve). Based on a review of previously performed ST-4N (HPCI Quick Start) it takes 1 to 2 seconds for 23HOV-1 to close. Closure signal to 23MOV-57, 58 & 16 is directly from the low reactor pressure relays 23A-K15 or K16 whereas 23MOV-19 is off of the HPCI turbine stop valve 23HOV-1 close position switch. During an SBO, 23MOV-19 receives a closure signal when reactor Hi level is reached (see appendix 12). The stroke time of 23MOV-19 is calculated based on the BWR Owners Group DC Motor Performance Methodology NEDC-32958, revision 0, in Appendix 8. The stroke time is calculated based on a BMCC bus voltage of approximately 99 Volts (for opening) and 101 volts (for closing). The calculated value for opening is 26.07 seconds. The calculated value for closing is 23.99 seconds. Both the opening and close times have been increased by 10% to yield 28.7 seconds (opening) and 26.4 seconds (closing) in the duty cycle for added margin.

ATTACHMENT 9.8 MINOR CALCULATION CHANGE FORM

MINOR CALCULATION CHANGE FORM

Calculation No.: JAF-CALC-ELEC-02610 **Revision:** 2

Minor Calculation Change No.: DRN-03-01866

1 Purpose of Change:
Equivalent Change JE-03-112 will replace all obsolete Square D Relays 8501KPD13 relays in EDG 93FPBD, 93ECP-B & 93ECP-D Panels. This MCC will also revised relay 8501KPD13V63 data to Appendices 5 and 8

2 SSC affected:
See Attached on Page 2

3 Drawings/Procedures/ Calculations affected
JAF-CALC-ELEC-02610, Rev. 2, Appendices 2, 4, 5 and 8

4 Description of Change:
Revise the Component Data as shown in Appendices 2 and 5. Appendices 4 will be updated on the next revision of this calculation after the installation of the Square D Relay 8501KPD13V63, as the entries in Appendix 4 is calculated using Appendix 2 input.

5 Impact on existing calculation conclusion:
None

6 Impact on DBD's, UFSAR, Technical Specifications:
None

7 The existing calculation does/does not (circle one) have a calculation verification checklist.

Remarks: *Refer to JAF-ECCF-03-00016 for additional information.*
The required minimum pickup/dropout voltage is 93.75/50 vDC for Square D 8501KPD13V63 Relays. The relays will have enough voltage to energize and run during the worst event of Loss of Coolant Accident coincident with Loss of Battery Charger and SBO. Battery "B" Sizing will not be effected as a result of this change.

NOTE:
A. If UFSAR or Technical Specifications need to be revised, Minor Calculation Change Form should not be used unless it is an editorial change to the FSAR or Technical Specifications.
B. Minor Calculation Change Forms do not change the status of the Parent Calculation Revision.

	Print/Sign		
Prepared by:	Alex Barton	Alex Barton	**Date:** 10/14/03
Reviewed by: *	Steve Glover	Steve Glover	**Date:** 10/14/03
Approved by	Gerry Caccavale	G. Hay by direction	**Date:** 10/14/03

- Where the original calculation was design verified, the reviewer signature confirms the latest design verification is still valid.
-

2. **SSC affected :**

@ Panel 93FPBD:

93-TBRX1-1EDGB13
93-TBRX2-1EDGB13
93-VSRX1-1EDGB13
93-VSRX2-1EDGB13
93-GRF-1EDGB13

@ Panel 93ECP-B:

93-TBR-1EDGB12
93-K4-1EDGB12
93-VSR-1EDGB12

@ Panel 93ECP-D:

93-TBR-1EDGD12
93-K4-1EDGD12
93-VSR-1EDGD12

DRN-03-01866

PANEL 71DC-B4

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
1	LOTC2	600V SWGR Test Cab	N/A	N/A	N/A	N/A	N/A	N/A	N/A	II/III	FE-1AH	1
2	93FPBD	Force Paralleling Cntl Pnl										
	TBRX1-1EDGB13	Start Tie Brk Control	1.85 sec	120 min	N/A	0.02	125	3	Resistance	I	ESK-11BP	
	TBRX2-1EDGB13	Start Tie Brk Permissive	1.85 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD8M-1EDGB13	EDG B & D Force Parallel	1.90 sec	120 min	N/A	0.06	125	8	Resistance	I		
	VSRX1-1EDGB13	EDG B Start Field Flashing	3.52 sec	120 min	N/A	0.02	125	3	Resistance	I		
	VSRX2-1EDGB13	EDG D Start Field Flashing	3.52 sec	120 min	N/A	0.02	125	3	Resistance	I		
	GFR-1EDGB13	EDG B & D Field Flashing	3.54 sec	6.54 sec	N/A	0.02	125	3	Resistance	I		
	TD9M-1EDGB13	EDG B & D Force Parallel	3.54 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD9X-1EDGB13	EDG B & D Force Parallel	6.54 sec	120 min	2.26	0.14	120	17	Resistance	I		
		Continuous Control	0 sec	120 min	N/A	0.151	125	19	Resistance			
7	71L26	Emer SWGR Bus 12600	(See details on Sheet 71L26)							I	FE-1AK	
8	71H06	Emer SWGR Bus 10600	(See details on Sheet 71H06)							I	FE-1AM	
11	93ECP-B	EDG "B" Ctrl & Ann										
	K1-1EDGB12	Auto Start	0.1 sec	120 min	2.26	0.14	120	N/A	Resistance	I	ESK-11BK	
	TBR-1EDGB12	Remote Start	1.8 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD6-1EDGB12	Engine Start Interlock	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD7-1EDGB12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	K4-1EDGB12	Loss of Gen Field	3.5 sec	120 min	N/A	0.02	125	3	Resistance	I		
	FFR-1EDGB12	Field Flash	3.56 sec	120 min	1.47	0.090	125	N/A	Resistance	I		
	VSR-1EDGB12	Volt Speed	3.5 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD5-1EDGB12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.06	125	8	Resistance	I	ESK-11BL	
	SOV-1B	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	SOV-2B	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	K2-1EDGB12	Gov. Booster Pump	0.2 sec	1.75 sec	2.08	0.154	125	N/A	Resistance	I		
	ESR40-1EDGB12	40 RPM Speed Relay	0.32 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	ESR200-1EDGB12	200 RPM Speed Relay	1.75 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	ESR400-1EDGB12	400 RPM Speed Relay	3.4 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	C2-1EDGB12	Fuel Oil Prime Pump	0.2 sec	120 min	2.08	0.154	125	N/A	Resistance	I	ESK-11BM	
	TD10-1EDGB12	Loss of Field	3.52 sec	3.58 sec	N/A	0.06	125	8	Resistance	I		

PANEL 71DC-B4(cont'd)

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
11	93ECP-B	EDG "B" Ctrl & Ann (Cont'd)										
(Cont'd)	TD1-1EDGB12	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.06	125	8	Resistance	I	ESK-11BM	
	ETM-1EDGB12	Run Time Indicator	0.1 sec	120 min	0.50	N/A	120	N/A	VA	I		5
	93GS-5B	EDG "B" Booster Pmp Inrush	0.3 sec	1.3 sec	40	N/A	115		Resistance	I	ESK-11BM	2,3
		EDG "B" Booster Pmp F.L.	1.3 sec	1.75 sec	N/A	9	115	1035	VA	I		
	93P-4B	EDG "B" Fuel Oil Pmp Inrush	0.3 sec	1.3 sec	6.64	N/A	120		Resistance	I	ESK-11BM	2,3
		EDG "B" Fuel Oil Pmp F.L.	1.3 sec	120 min	N/A	4.44	120	533	VA			
	ESS-1EDGB12	Speed Switch	0.32 sec	120 min	N/A	0.04	125		Resistance	I		4
	62-1EDGB12	High Circulating Current	3.58 sec	120 min	N/A	0.06	125	8	Resistance	I		
		Continuous Control	0 sec	120 min	N/A	0.15	125	19	Resistance			
	93EGP-B	Gen "B" Cont Panel										
	EDG "B" FF	EDG "B" Field Flash	3.6 sec	6.6 sec	N/A	41.14	125	5142	Resistance	I	ESK-8HE	9
	K2/VR-1EDGB25	Auto Field Flash	3.58 sec	6.6 sec	N/A	0.14	115	16	Resistance	I	1.12-41	
	TDVR-1EDGB25	Field Shutdown	3.58 sec	6.6 sec	N/A	0.06	125	8	Resistance	I	1.12-41	
	93P/S-B	P/S for EG-M Control	0 sec	120 min	N/A	0.36	125	44.6	VA	I	ESK-8HG	7
		Continuous Control	N/A	N/A	N/A	0.32	125	41	VA			8
12	93ECP-D	EDG "D" Ctrl & Ann										
	K1-1EDGD12	Auto Start	0.1 sec	120 min	2.26	0.14	120	N/A	Resistance	I	ESK-11BQ	
	TBR-1EDGD12	Remote Start	1.8 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD6-1EDGD12	Engine Start Interlock	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD7-1EDGD12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	K4-1EDGD12	Loss of Gen Field	3.5 sec	120 min	N/A	0.02	125	3	Resistance	I		
	FFR-1EDGD12	Field Flash	3.56 sec	120 min	1.41	0.14	125	N/A	Resistance	I		
	VSR-1EDGD12	Volt Speed	3.5 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD5-1EDGD12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.06	125	8	Resistance	I	ESK-11BR	
	SOV-1C	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	SOV-2C	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	K2-1EDGD12	Gov. Booster Pump	0.2 sec	1.75 sec	2.08	0.15	125	N/A	Resistance	I		
	ESR40-1EDGD12	40 RPM Speed Relay	0.32 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	ESR200-1EDGD12	200 RPM Speed Relay	1.75 sec	120 min	2.36	0.15	125	N/A	Resistance	I		
	ESR400-1EDGD12	400 RPM Speed Relay	3.4 sec	120 min	2.36	0.15	125	N/A	Resistance	I		

Entergy

125V DC STATION BATTERY "B" SIZING VOLTAGE DROP
JAF-CALC-02610 Rev. 2
LOCA w/LOOP

Appendix 4
Page 2 of 2
Computed by: A. Barton
Checked by: S. Kim

			LOCA w/LOOP							
				Time Period No.:		DRN-03-01866		PICK UP Profile		
			Period Range:	From: To:				Req'd	Available	
Panel	Load I.D.	Load Description	Start Time	Start Time : Stop Time	Inrush Current	Nominal Current	Nominal Voltage	Min. Voltage LOAD	Min. Voltage LOCA	Pick up Margin
BATTERY 71SB-2			reset						117.60	
71DC-B4										
02	93FPBD	Force Paralleling Control Panel			N/A	0.151	125	N/A	117.16	N/A
	TBRX1-1EDGB13	Start Tie Brk Cnt	1.85 sec	120 min	N/A	0.024	125	93.75	109.53	15.78
	TBRX2-1EDGB13	Start Tie Brk Permissive	1.85 sec	120 min	N/A	0.024	125	93.75	109.53	15.78
	TD8M-1EDGB13	EDG B & D Force Parallel	1.90 sec	120 min	N/A	0.064	125	100	109.51	9.51
	VSRX1-1EDGB13	EDG B Start Field Flushing	3.52 sec	120 min	N/A	0.024	125	93.75	108.67	14.92
	VSRX2-1EDGB13	EDG D Start Field Flushing	3.52 sec	120 min	N/A	0.024	125	93.75	108.67	14.92
	GFR-1EDGB13	EDG B & D Field Flashing	3.54 sec	6.54 sec	N/A	0.024	125	93.75	108.65	14.90
	TD9M-1EDGB13	EDG B & D Force Parallel	3.54 sec	120 min	N/A	0.06	125	100	108.65	8.65
	TD9X-1EDGB13	EDG B & D Force Parallel	6.54 sec	120 min	2.26	0.14	120	78.75	106.83	28.08
07	71L26	600V SWGR BUS 12600						N/A	117.16	N/A
08	71H06	4kV SWGR BUS 10600						70	117.17	N/A
11	93ECP-B	EDG "B" Ctrl & Ann. Panel			N/A	0.15	125	100	117.13	17.13
	K1-1EDGB12	Auto Start	0.1 sec	120 min	2.26	0.14	120	78.75	96.60	17.85
	TBR-1EDGB12	Remote Start	1.8 sec	120 min	N/A	0.024	125	93.75	107.76	14.01
	TD6-1EDGB12	Engine Start Interlock	1.8 sec	120 min	N/A	0.064	125	100	107.76	7.76
	TD7-1EDGB12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.064	125	100	107.76	7.76
	K4-1EDGB12	Loss of Gen Field	3.5 sec	120 min	N/A	0.024	125	93.75	106.81	13.06
	FFR-1EDGB12	Field Flash	3.56 sec	120 min	1.47	0.090	125	78.75	106.81	28.06
	VSR-1EDGB12	Volt Speed	3.5 sec	120 min	N/A	0.024	125	93.75	106.81	13.06
	TD5-1EDGB12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.064	125	100	106.04	6.04
	SOV-1B	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	90	106.02	16.02
	SOV-2B	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	90	106.03	16.03
	K2-1EDGB12	Gov. Booster Pump	0.2 sec	1.75 sec	2.08	0.154	125	62.5	106.04	43.54
	ESR40-1EDGB12	Speed Relay	0.32 sec	120 min	2.36	0.151	125	78.75	95.12	16.37
	ESR200-1EDGB12	Speed Relay	1.75 sec	120 min	2.36	0.151	125	78.75	105.23	26.48
	ESR400-1EDGB12	Speed Relay	3.4 sec	120 min	2.36	0.151	125	78.75	106.81	28.06
	C2-1EDGB12	Fuel Oil Prime Pump	0.2 sec	120 min	2.08	0.154	125	62.5	106.04	43.54
	TD10-1EDGB12	Loss of Field	3.52 sec	3.58 sec	N/A	0.064	125	100	107.37	7.37
	TD1-1EDGB12	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.064	125	100	106.04	6.04
	ETM-1EDGB12	Run Time Indicator	0.1 sec	120 min	0.50	N/A	120	N/A	N/A	N/A
	93GS-5B	Gov. Booster Pump	0.3 sec	1.75 sec	40	9.00	115	92	93.35	1.35
	93P-4B	Fuel oil pump	0.3 sec	120 min	6.64	4.44	120	96	94.93	-1.07
	ESS-1EDGB12	Speed Switch	0.32 sec	120 min	N/A	0.04	125	90	95.12	5.12
	82-1EDGB12	High Circulating Current	3.58 sec	120 min	N/A	0.06	125	100	106.98	6.98
11	93EGP-B	Gen "B" Control Panel						N/A	117.23	N/A
	EDG "B" FF	EDG "B" Field Flash	3.6 sec	6.6 sec	N/A	41.14	125	90	103.93	13.93
	K2/VR-1EDGB25	Auto Field Flash	3.58 sec	6.6 sec	N/A	0.14	115	92	106.63	16.63
	TDVR-1EDGB25	Field Shutdown	3.58 sec	6.6 sec	N/A	0.064	125	100	106.72	6.72
	93P/S-B	P/S for EG-M Control	0 sec	120 min	N/A	0.4	125	85	116.92	31.92
12	93ECP-D	EDG "D" Ctrl & Ann. Panel			N/A	0.150	125	100	117.16	17.16
	K1-1EDGD12	Auto Start	0.1 sec	120 min	2.26	0.140	120	78.75	95.74	17.85
	TBR-1EDGD12	Remote Start	1.8 sec	120 min	N/A	0.024	125	93.75	108.13	14.38
	TD6-1EDGD12	Engine Start Interlock	1.8 sec	120 min	N/A	0.064	125	100	108.13	8.13
	TD7-1EDGD12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.064	125	100	108.13	8.13
	K4-1EDGD12	Loss of Gen Field	3.5 sec	120 min	N/A	0.024	125	93.75	107.25	13.50
	FFR-1EDGD12	Field Flash	3.56 sec	120 min	1.41	0.140	125	78.75	107.25	28.50
	VSR-1EDGD12	Volt Speed	3.5 sec	120 min	N/A	0.024	125	93.75	107.25	13.50
	TD5-1EDGD12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.064	125	100	106.29	6.29
	SOV-1D	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	90	106.27	16.27
	SOV-2D	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	90	106.28	16.28
	K2-1EDGD12	Gov. Booster Pump	0.2 sec	1.75 sec	2.08	0.154	125	62.5	106.29	43.79
	ESR40-1EDGD12	Speed Relay	0.32 sec	120 min	2.36	0.151	125	78.75	97.03	18.28
	ESR200-1EDGD12	Speed Relay	1.75 sec	120 min	2.36	0.151	125	78.75	106.08	27.33
	ESR400-1EDGD12	Speed Relay	3.4 sec	120 min	2.36	0.151	125	78.75	107.25	28.50
	C2-1EDGD12	Fuel Oil Prime Pump	0.2 sec	120 min	2.08	0.154	125	62.5	106.29	43.79
	TD10-1EDGD12	Loss of Field	3.52 sec	3.58 sec	N/A	0.064	125	100	107.72	7.72
	TD1-1EDGD12	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.064	125	100	106.29	6.29
	ETM-1EDGD12	Run Time Indicator	0.1 sec	120 min	0.5	N/A	120	N/A	117.16	N/A
	93GS-5D	Gov. Booster Pump	0.3 sec	1.75 sec	40	9.00	115	92	95.22	3.22
	93P-4D	Fuel oil pump	0.3 sec	120min	6.64	4.44	120	96	96.83	0.83
	ESS-1EDGD12	Speed Switch	0.32 sec	120 min	N/A	0.040	125	90	97.02	7.02
	82-1EDGD12	High Circulating Current	3.58 sec	120 min	N/A	0.064	125	100	107.39	7.39
12	93EGP-D	Gen "D" Cont Panel						N/A	117.16	N/A
	EDG "D" FF	EDG "D" Field Flash	3.6 sec	6.6 sec	N/A	41.28	125	90	103.20	13.20
	K2/VR-1EDGD25	Auto Field Flash	3.58 sec	6.6 sec	N/A	0.136	115	92	107.39	15.39
	TDVR-1EDGD25	Field Shutdown	3.58 sec	6.6 sec	N/A	0.064	125	100	107.39	7.39
	93P/S-D	P/S for EG-M Control	0.1 sec	120 min	N/A	0.36	125	85	116.96	31.96

Entergy 125V DC STATION BATTERY "B" SIZING & VOLTAGE DROP
JAF-CALC-ELEC-02610 Rev. 2

Appendix 1
Ref Table ONLY
Computed by: A. Barton

1	2	3	4	5	6	7
Relays and Contactors Data						
Model Number	MFR	REF	Nominal Voltage	Pickup Voltage	Dropout Voltage	Q.A. Cat
7012PBL	Agastat	A348-C008	125	100.00	50.00	II/III
7012PDL	Agastat	A348-C008	125	100.00	50.00	II/III
7012PH	Agastat	A348-C008	125	100.00	50.00	II/III
E7012PB	Agastat	A348-C008	125	100.00	12.50	I
E7012PC	Agastat	A348-C008	125	100.00	12.50	I
E7012PD	Agastat	A348-C008	125	100.00	12.50	I
E7012PF	Agastat	A348-C008	125	100.00	12.50	I
E7012PH	Agastat	A348-C008	125	100.00	12.50	I
E7014PC	Agastat	A348-C008	125	100.00	12.50	I
E7014PF	Agastat	A348-C008	125	100.00	12.50	I
E7022PK	Agastat	A348-C008	125	100.00	12.50	I
EGPD003	Agastat	A348-0342	125	100.00	56.25	I
ETR14D3EC2004	Agastat	A348-0342	125	100.00	56.25	I
ETR	Agastat	A348-0342	125	100.00	56.25	I
GPD	Agastat	A348-0342	125	100.00	56.25	II/III
BFDL84S	C-H	JE-01-093	120	85.00	N/A	I
IC28001607	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	II/III
IC2800A1607D3G	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	I
IC2800A1607F3J	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	I
IC28001612	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	II/III
IC2800A1617B3H	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	I
IC2800A1607F3H	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	I
IC2800A1607F3J	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	I
IC28001617AB3H	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	I
IC28001617AB3J	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	I
IC28001617AD3G	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	I
IC2800A501AB23C	GE	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.60	9.60	I
IC28001621AM3H	GE	See Design Input 2.18 & 2.19	120	78.00	18.00	II/III
IC2800A501AB23C	GE	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.60	9.60	II/III
IC2820A100BB3J	GE	See Design Input 2.21	120	75.60	24.00	II/III
IC2820A100BB3K	GE	See Design Input 2.21	120	75.60	24.00	II/III
IC2820A200A3E	GE	E-Mail from GE 09/05/00	120	75.60	24.00	I
IC2820A200A3F	GE	E-Mail from GE 09/05/00	120	75.60	24.00	I
ITE-27N	Brown Bovery	B455-0002 & Appendix 6	125	70.00	70.00	I
12HEA61B235	GE	GE GEZ-7723 (Excerpt), App. 8	125	70.00	70.00	II/III
12HFA51A42F	GE	G080-0233	125	75.00	12.50	I
12HFA151A2F	GE	G080-0233	125	75.00	12.50	I
12HFA154E222H	GE	G080-1269	125	76.25	76.25	I
12HGA11A52F	GE	G080-0213	125	75.00	12.50	I
12HGA11J52	GE	G080-0213	125	75.00	12.50	I
12HLA11B12A	GE	G080-0657	125	75.00	75.00	I
12HMA124A2	GE	GE Fax Dated 09/30/00	125	75.00	37.50	I
CR105K000BLA	GE	Telecon with GE Dated 04/18/97	125	62.50	37.50	II/III
CR105 Coil 15D21G26	GE	Telecon with GE Dated 04/18/97	125	62.50	37.50	I
CR2810 Coil 22D135G22	GE	D1-97-114 and JE-01-093	125	78.75	43.75	I
CR2820B Series A	GE	GE Technical inquiry dated 08/08/97	125	87.50	12.50	I
CR2811A211G	GE	Telecon with GE Dated 06/10/97	125	78.75	43.75	I
CR2811A212J	GE	Telecon with GE Dated 06/10/97	125	78.75	43.75	I
CR2811 Coil 22D135G441	GE	Telecon with GE Dated 06/10/97	125	78.75	43.75	I
CR2811 Coil 22D135G641	GE	Telecon with GE Dated 06/10/97	125	78.75	43.75	I
219XXF102	S & D	S440-C016	125	100.00	100.00	I
8501KPD13V63	Square D	S345-C006 & App. 8	125	93.75	50.00	I
SAM17A	GE	G080-0576	125	62.50	62.50	I

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PANEL 71DC-B4 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
12	93ECP-D	EDG "D" Ctrl & Ann													
	K1-1EDGD12	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	95.74	16.99	YES	96.34	52.59	YES
	TBR-1EDGD12	Remote Start	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	108.13	14.38	YES	103.85	53.85	YES
	TD6-1EDGD12	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	108.13	8.13	YES	103.85	91.35	YES
	TD7-1EDGD12	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	108.13	8.13	YES	103.85	91.35	YES
	K4-1EDGD12	Loss of Gen Field	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	107.25	13.50	YES	103.85	53.85	YES
	FFR-1EDGD12	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	107.25	28.50	YES	103.28	59.53	YES
	VSR-1EDGD12	Volt Speed	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	107.25	13.50	YES	103.85	53.85	YES
	TD5-1EDGD12	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	106.29	6.29	YES	97.03	84.53	YES
	SOV-1D	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	106.27	16.27	YES	97.01	7.01	YES
	SOV-2D	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	106.28	16.28	YES	97.01	7.01	YES
	K2-1EDGD12	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	106.29	43.79	YES	97.03	59.53	YES
	ESR40-1EDGD12	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	97.03	18.28	YES	97.22	53.47	YES
	ESR200-1EDGD12	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.08	27.33	YES	103.85	60.10	YES
	ESR400-1EDGD12	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	107.25	28.50	YES	103.85	60.10	YES
	C2-1EDGD12	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	106.29	43.79	YES	97.03	59.53	YES
	TD10-1EDGD12	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.72	7.72	YES	107.39	94.89	YES
	TD1-1EDGD12	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	106.29	6.29	YES	97.03	84.53	YES
	93GS-5D	EDG "D" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	95.22	3.22	YES	105.54	N/A	N/A
	93P-4D	EDG "D" Fuel Oil Pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	96.83	0.83	YES	103.66	N/A	N/A
	ESS-1EDGD12	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	97.02	7.02	YES	97.21	7.21	YES
	62-1EDGD12	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.39	7.39	YES	103.85	91.35	YES
	93EGP-D	Gen "D" Cont Panel													
	EDG "D" FF	EDG "D" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27/00	125	90	90	103.20	13.20	YES	105.01	15.01	YES
	K2/VR-1EDGD25	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	107.39	15.39	YES	103.20	11.20	YES
	TDVR-1EDGD25	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	107.39	7.39	YES	103.20	90.70	YES
	93P/S-D	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	100-370	85	85	116.98	31.98	YES	96.82	11.82	YES

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PANEL 71DC-B4 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component Nominal Voltage	Component Pickup Voltage	Component Dropout Voltage	LOCA Pickup Minimum Voltage	LOCA Pickup Margin	LOCA Pickup Acceptable	LOCA Dropout Minimum Voltage	LOCA Dropout Margin	LOCA Dropout Acceptabl
02	93FPBD	Force Paralleling Cntl Pnl													
	TBRX1-1EDGB13	Start Tie Brk Control	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	109.53	15.78	YES	104.82	54.82	YES
	TBRX2-1EDGB13	Start Tie Brk Permissive	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	109.53	15.78	YES	104.82	54.82	YES
	TD8M-1EDGB13	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	109.51	9.51	YES	104.82	92.32	YES
	VSRX1-1EDGB13	EDG A Start Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	108.67	14.92	YES	104.82	54.82	YES
	VSRX2-1EDGB13	EDG C Start Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	108.67	14.92	YES	104.82	54.82	YES
	GFR-1EDGB13	EDG A & C Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	108.65	14.90	YES	104.83	54.83	YES
	TD9M-1EDGB13	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	108.65	8.65	YES	104.83	92.33	YES
	TD9X-1EDGB13	EDG A & C Force Parallel	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.83	28.08	YES	107.89	64.14	YES
07	71L26	Panel 71L26 Close	I	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.16	27.16	YES	93.05	3.05	YES
08	71HO6	Panel 71HO6 Close	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.17	47.17	YES	103.00	33.00	YES
	71HO6	Panel 71HO6 Trip	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.17	47.17	YES	103.00	33.00	YES
11	93ECP-B	EDG "B" Ctrl & Ann													
	K1-1EDGB12	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	96.60	17.85	YES	94.52	50.77	YES
	TBR-1EDGB12	Remote Start	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	107.76	14.01	YES	103.50	53.50	YES
	TD6-1EDGB12	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.76	7.76	YES	103.50	91.00	YES
	TD7-1EDGB12	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.76	7.76	YES	103.50	91.00	YES
	K4-1EDGB12	Loss of Gen Field	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	106.81	13.06	YES	103.50	53.50	YES
	FFR-1EDGB12	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.81	28.06	YES	103.46	59.71	YES
	VSR-1EDGB12	Volt Speed	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	106.81	13.06	YES	103.50	53.50	YES
	TD5-1EDGB12	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	106.04	6.04	YES	95.12	82.62	YES
	SOV-1B	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	106.02	16.02	YES	95.11	5.11	YES
	SOV-2B	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	106.03	16.03	YES	95.11	5.11	YES
	K2-1EDGB12	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	106.04	43.54	YES	95.12	57.62	YES
	ESR40-1EDGB12	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	95.12	16.37	YES	95.39	51.64	YES
	ESR200-1EDGB12	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	105.23	26.48	YES	103.50	59.75	YES
	ESR400-1EDGB12	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	106.81	28.06	YES	103.50	59.75	YES
	C2-1EDGB12	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	106.04	43.54	YES	95.12	57.62	YES
	TD10-1EDGB12	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	107.37	7.37	YES	106.98	94.48	YES
	TD1-1EDGB12	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	106.04	6.04	YES	95.12	82.62	YES
	93GS-5B	EDG "A" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	93.35	1.35	YES	104.69	N/A	N/A
	93P-4B	EDG "A" Fuel oil pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	94.93	-1.07	NO	103.31	N/A	N/A
	ESS-1EDGB12	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	95.12	5.12	YES	95.38	5.38	YES
	62-1EDGB12	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	106.98	6.98	YES	103.50	91.00	YES
	93EGP-B	Gen "B" Cont Panel													
	EDG "B" FF	EDG "B" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27/00	125	90	90	103.93	13.93	YES	105.71	15.71	YES
	K2/VR-1EDGB25	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	108.63	16.63	YES	103.93	11.93	YES
	TDVR-1EDGB25	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	108.72	8.72	YES	103.93	91.43	YES
	93PS-B	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	100-370	85	85	116.92	31.92	YES	94.86	9.86	YES

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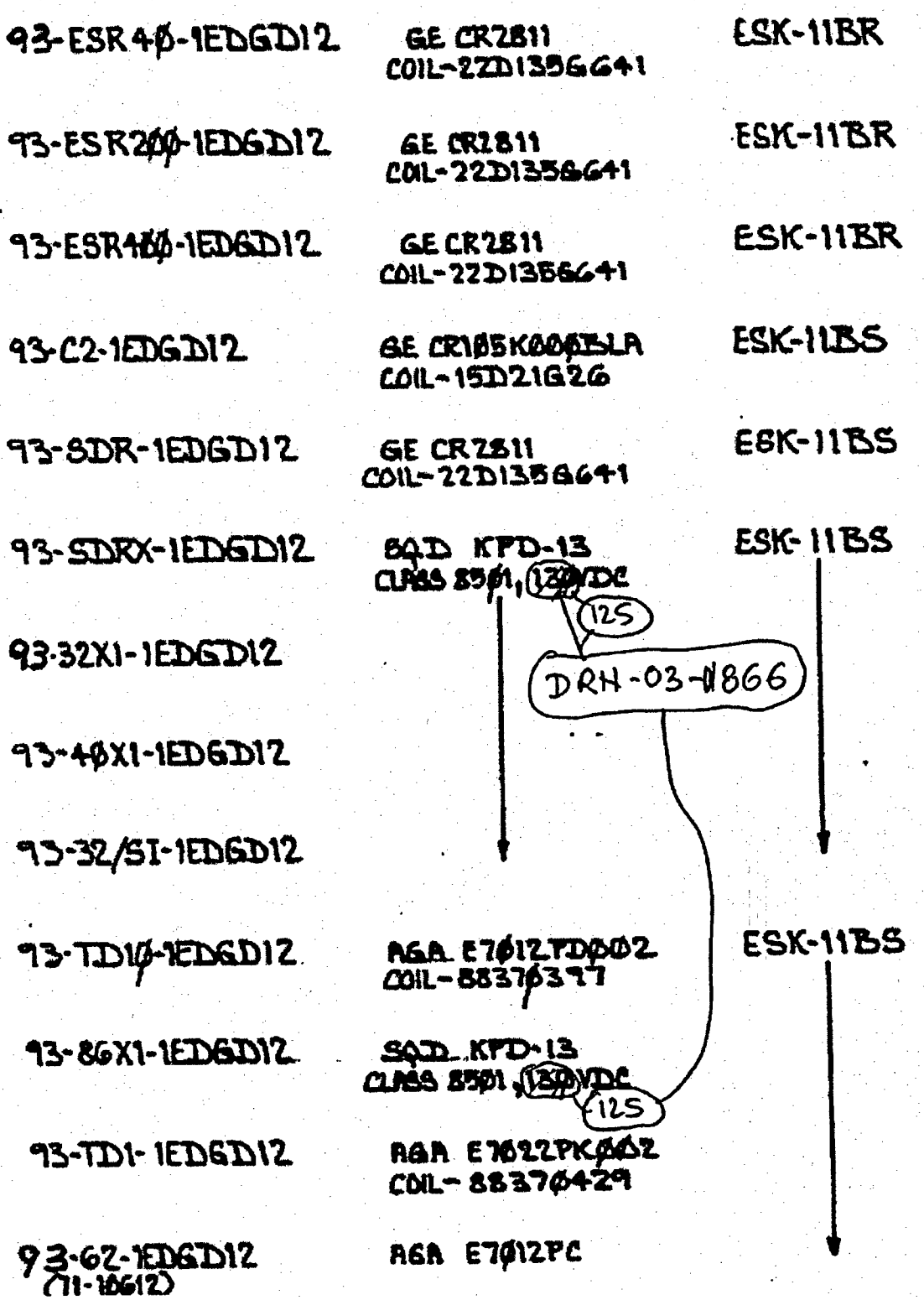
PANEL 71DC-B4 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptabl
02	93FPBD	Force Paralleling Cntl Pnl								109.46			101.63		
	TBRX1	Start Tie Brk Control	1	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	109.46	15.71	YES	101.63	51.63	YES
	TBRX2	Start Tie Brk Permissive	1	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	109.46	15.71	YES	101.63	51.63	YES
	TD8M	EDG A & C Force Parallel	1	Agastat	E7014PC	A348-C008	125	100	12.5	109.46	9.46	YES	101.63	89.13	YES
	VSRX1	EDG A Start Field Flashing	1	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	109.46	15.71	YES	101.63	51.63	YES
	VSRX2	EDG C Start Field Flashing	1	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	109.46	15.71	YES	101.63	51.63	YES
	GRF	EDG A & C Field Flashing	1	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	109.46	15.71	YES	101.63	51.63	YES
	TD9M	EDG A & C Force Parallel	1	Agastat	E7014PC	A348-C008	125	100	12.5	109.46	9.46	YES	101.63	89.13	YES
	TD9X	EDG A & C Force Parallel	1	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	109.46	30.71	YES	101.63	57.88	YES
07	71L26	Panel 71L26 Close	1	GE	AK-2A-25-1	GE FAX 5/2/1997	125	90	90	117.19	90.00	YES	95.34	90.00	YES
08	71HO6	Panel 71HO6 Close	1	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.22	47.22	YES	98.04	90.00	YES
	71HO6	Panel 71HO6 Trip	1	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.22	47.22	YES	98.04	90.00	YES
11	93ECP-B	EDG "B" Ctrl & Ann								112.81			98.93		
	K1	Auto Start	1	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	TBR	Remote Start	1	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	112.81	19.06	YES	98.93	48.93	YES
	TD6	Engine Start Interlock	1	Agastat	E7012PD	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	TD7	Engine Start Raw Wtr	1	Agastat	E7012PD	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	K4	Loss of Gen Field	1	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	112.81	19.06	YES	98.93	48.93	YES
	FFR	Field Flash	1	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	VSR	Volt Speed	1	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	112.81	19.06	YES	98.93	48.93	YES
	TD5	Diesel Fail to Start	1	Agastat	E7014PC	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	SOV-1A	Air Start Right Solenoid	1	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	112.81	22.81	YES	98.93	8.93	YES
	SOV-2A	Air Start Left Solenoid	1	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	112.81	22.81	YES	98.93	8.93	YES
	K2	Gov. Booster Pump Relay	1	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	112.81	50.31	YES	98.93	61.43	YES
	ESP40	40 RPM Speed Relay	1	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	ESP200	200 RPM Speed Relay	1	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	ESP400	400 RPM Speed Relay	1	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.81	34.06	YES	98.93	55.18	YES
	C2	Fuel Oil Prime Pump Relay	1	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	112.81	50.31	YES	98.93	61.43	YES
	TD10	Loss of Field	1	Agastat	E7012PD	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	TD1	Gov. Solenoid TD	1	Agastat	E7022PK	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	93GS-5B	EDG "A" Gov Booster Pump	1	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	97.08	5.08	YES	105.07	13.07	YES
	93P-4B	EDG "A" Fuel oil pump	1	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	98.73	2.73	YES	100.38	4.38	YES
	ESS	Speed Switch	1	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	112.81	22.81	YES	98.93	8.93	YES
	62-	High Circulating Current	1	Agastat	E7012PD	A348-C008	125	100	12.5	112.81	12.81	YES	98.93	86.43	YES
	93EGP-B	Gen "B" Cont Panel													
	Field Flash	EDG "B" Field Flash	1	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27/00	125	90	90	108.93	18.93	YES	108.93	18.93	YES
	K2/VR	Auto Field Flash	1	W	MD120	Instruction Leaflet 15-800-M	115	92	92	108.93	16.93	YES	108.93	16.93	YES
	TDVR	Field Shutdown	1	Agastat	E7012PC	A348-C008	125	100	12.5	108.93	8.93	YES	108.93	96.43	YES
	93P/S-B	P/S for EG-M Control	1	Lambda	JWS-150-48/A	EC JE-00-115	100-370	85	85	109.20	24.20	YES	0.41	-84.59	NO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93-ESR400-1EDGD12
GE CR2811
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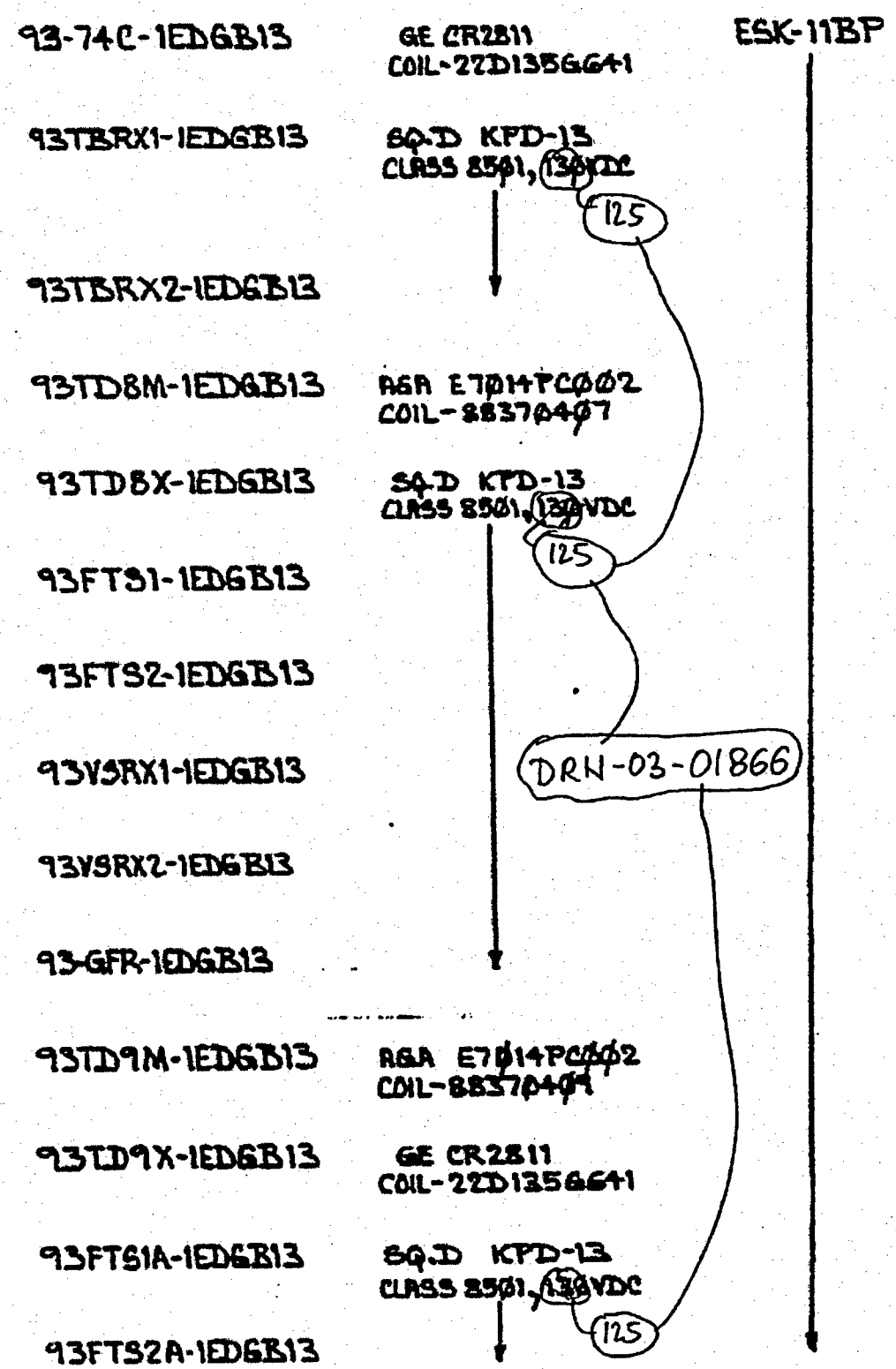
ESK-11BR
93-C2-1EDGD12
GE CR105K00GBLA
COIL-15D21G26
ESK-11BS
93-SDR-1EDGD12
GE CR2811
COIL-22D1356G41
ESK-11BS
93-SDRX-1EDGD12
SQD KPD-13
CLASS 8501, 120VDC
125
ESK-11BS
93-32X1-1EDGD12
DRN-03-1866
93-40X1-1EDGD12
93-32/SI-1EDGD12
93-TD10-1EDGD12
AGA E7012TD002
COIL-8837397
ESK-11BS
93-86X1-1EDGD12
SQD KPD-13
CLASS 8501, 120VDC
125
93-TD1-1EDGD12
AGA E7022PK002
COIL-8837429
93-62-1EDGD12
(11-1062)
AGA E7012PC

93-AR1-1EDGD12 THRU 93-AR18-1EDGD12	SQ.D KPD-13 CLASS 8501, 125VDC	ESK-11BT
93-T4-1EDGD12	SQ.D KPD-13 CLASS 8501, 125VDC	ESK-11BQ
93-ISX-1EDGD12	GE 12HFA151A2H	ESK-11BQ
93-K1-1EDGD12	GE CR2811A257AA COIL-22D1356G41 COIL-22D1210G41	ESK-11BQ
93-TBR-1EDGD12	SQ.D KPD-13 CLASS 8501, 125VDC	ESK-11BQ
93-TD6-1EDGD12	AGA E7B12FD002 COIL-8837B399	ESK-11BQ
93-TD7-1EDGD12	AGA E7D12FD002 COIL-8837B400	ESK-11BQ
93-K4-1EDGD12	SQ.D KPD-13 CLASS 8501, 125VDC	ESK-11BQ
93-FFR-1EDGD12	GE CR2811 COIL-22D1356G41	ESK-11BQ
93-VSR-1EDGD12	SQ.D KPD-13 CLASS 8501, 125VDC	ESK-11BQ
93-K3-1EDGD12	GE CR2811A257AA COIL-22D1356G41 COIL-22D1210G41	ESK-11BR
93-TD5-1EDGD12	AGA E7D14FC002 COIL-8837B411	ESK-11BR
93-K2-1EDGD12	GE CR105K0002BLA COIL-15D216G26	ESK-11BR

DRN-03-01866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COIL-22D135GG41
ESK-11BP
93TBRX1-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
125
93TBRX2-1EDGB13
93TD8M-1EDGB13
AGA E7014PC002
COIL-8837047
93TD8X-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
125
93FTS1-1EDGB13
93FTS2-1EDGB13
93VSRX1-1EDGB13
DRN-03-01866
93VSRX2-1EDGB13
93-GFR-1EDGB13
93TD9M-1EDGB13
AGA E7014PC002
COIL-8837047
93TD9X-1EDGB13
GE CR2811
COIL-22D135GG41
93FTS1A-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
125
93FTS2A-1EDGB13

MINOR CALCULATION CHANGE FORM (Tracked via DRN in MERLIN)

Calculation No.: JAF-CALC-ELEC-02610	**Revision: 2**
Calculation Title: **125V DC Battery "B" Sizing and Voltage Drop**	**Indicate Status of Minor Calculation Change: ~ Prel; ~ Pend; ~As-Built**
MERLIN DRN No. or Minor Calculation Change No.: DRN-04-06672	
Modification No./Task No./ER No. N/A	
Computer Code Used ☐ Yes ☒ No. If "Yes", Code:	

1 Purpose of Change:	**See Attached on Page 2**
2 SSC affected:	**See Attached on Page 2**
3 Design Input Documents not used in parent Calculation:	**N/A**
4 Drawings/Procedures/ Calculations / other Documents affected	**JAF-CALC-ELEC-02610, Rev. 2, Appendices 2, 4, 5 and 15**
5 Description of Change:	**See Attached on Page 2**
6 Impact on existing calculation conclusion:	**None**
7 Impact on DBD's, UFSAR, Technical Specifications:	**None**

8. The existing calculation does/does not (circle one) have a calculation verification checklist.

Remarks: For 23MOV-25 HPCI minimum flow bypass valve added loading beyond 30 minutes for SBO per AOP-49 Refer to CR-JAF-2004-03615 for additional information.

NOTE:
A. If UFSAR or Technical Specifications need to be revised, Minor Calculation Change Form should not be used unless it is an editorial change to the UFSAR or Technical Specifications.
B. Minor Calculation Change Forms do not change the status of the Parent Calculation Revision.

	Print/Sign		Date:
Prepared by:	**Alex Barton** / Alex Barton		**Date:** 11/09/04
Reviewed by: *	**Sing Kim** / Sing Kim		**Date:** 11/09/04
Approved by	**Daniel Ruddy** / Daniel Ruddy		**Date:** 11/18/04

* Where the original calculation was design verified, the reviewer signature confirms the latest design verification is still valid.

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1. **Purpose of Change :**

   As an Extent of Condition associated with CR-JAF-2004-01104 Corrective Action 3, it was discovered an anomaly exists within JAF-CALC-ELEC-02610 Revision 2, Revision Summary (Revision 2) page 2 item 6 which states "For 23MOV-25 HPCI minimum flow bypass valve removed loading beyond 30 minutes for SBO per AOP-49 Revision." The current revision of AOP-49 (Revision 11) does not provide guidance on removing 23MOV-25 from service. .

2. **SSC affected :**

   @ MCC 71BMCC-4

   23MOV-25

5 **Description of Change**

Revise the Component Data for 23MOV-25 as shown in Appendices 2. Appendices 4 and 5 will be updated on the next revision of this calculation, as the entries in Appendix 4 and 5 are calculated using Appendix 2 input.

DRN-04-06672

MCC 71BMCC-4

Compt No.	Load I.D.	Load Description	LOCA w/ LOBC Start Time	LOCA w/ LOBC Stop Time	SBO Start Time	SBO Stop Time	Rated Inrush Current (A)	Nominal Current (A)	Nominal Voltage (V)	Normal VA Rating	Load Type	QA Cat.	Drawing	Notes
OA2	23MOV-24	HPCI-RCIC Return Cond Tk	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	VA	II/III	ESK-11AN	1,8
OB1	23MOV-25 (Open)	HPCI Min Flow Bypass Inrush	19 sec	20 sec	29 sec	30 sec	82	N/A	125	N/A	Resistance	I	ESK-11AN	2
		HPCI Min Flow Bypass F.L.	20 sec	29 sec	30 sec	39 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Control	19 sec	29 sec	29 sec	39 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Close)	HPCI Min Flow Bypass Inrush	29 sec	30 sec	39 sec	40 sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass F.L.	30 sec	38 sec	40 sec	48 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Seating LRA	38 sec	39 sec	48 sec	49 sec	41	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass Control	29 sec	39 sec	39 sec	49 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Open)	HPCI Min Flow Bypass Inrush	N/A	N/A	4 min	4 min & 1sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass F.L.	N/A	N/A	4 min & 1sec	4 min & 10 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Control	N/A	N/A	4 min	4 min & 10 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Close)	HPCI Min Flow Bypass Inrush	N/A	N/A	4 min & 10 sec	4 min & 11sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass-Close	N/A	N/A	4 min & 11sec	4 min & 19 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Seating LRA	N/A	N/A	4 min & 19 sec	4 min & 20 sec	41	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass Control	N/A	N/A	4 min & 10 sec	4 min & 20 sec	N/A	0.62	125	78	Resistance			
	23MOV-25 (Open)	HPCI Min Flow Bypass Inrush	N/A	N/A	35 min & 19 sec	35 min & 20 sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass F.L.	N/A	N/A	35 min & 20 sec	35 min & 29 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Control	N/A	N/A	35 min & 19 sec	35 min & 29 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Close)	HPCI Min Flow Bypass Inrush	N/A	N/A	35 min & 29 sec	35 min & 30 sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass-Close	N/A	N/A	35 min & 30 sec	35 min & 38 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Seating LR	N/A	N/A	35 min & 38 sec	39 min & 39 sec	41	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass Control	N/A	N/A	35 min & 29 sec	39 min & 39 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Open)	HPCI Min Flow Bypass Inrush	N/A	N/A	40 min	40 min & 1 sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass F.L.	N/A	N/A	40 min & 1 sec	40 min & 10 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Control	N/A	N/A	40 min	40 min & 10 sec	N/A	0.62	125	78.1	Resistance			
	23MOV-25 (Close)	HPCI Min Flow Bypass Inrush	N/A	N/A	40 min & 10 sec	40 min &11 sec	82	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass-Close	N/A	N/A	40 min &11 sec	40 min & 19 sec	N/A	14.5	125	1812.5	VA			
		HPCI Min Flow Bypass Seating LR	N/A	N/A	40 min & 19 sec	40 min & 20 sec	41	N/A	125	N/A	Resistance			
		HPCI Min Flow Bypass Control	N/A	N/A	40 min & 10 sec	40 min & 20 sec	N/A	0.62	125	78	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.24	125	30	Resistance			
OB2	12MOV-18 (Close)	Reactor Wtr Cleanup Inrush	0.1 sec	1.1 sec	1 sec	2 sec	112.2	N/A	125	N/A	Resistance	I	ESK-11AD	3
		Reactor Wtr Cleanup F.L.	1.1 sec	19.1 sec	2 sec	20 sec	N/A	26	125	3250	VA			
		Reactor Wtr Cleanup Seating LRA	19.1 sec	20.1 sec	20 sec	21 sec	56.1	N/A	125	N/A	Resistance			
		Reactor Wtr Cleanup Control	0.1 sec	20.1 sec	1 sec	21 sec	N/A	0.62	125	78	Resistance			
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.24	125	30	Resistance			

- 23MOV-25 (HPCI Pump Min Flow Bypass) opens when the HPCI Pump discharge pressure of 50PSIG has been achieved and flow is less than 550GPM. Based on a review of past ST-4N surveillance tests this takes approximately 14 seconds from the time of HPCI initiation until 23HOV-1 starts to open (see attached spreadsheet). It takes an additional 5 seconds (total of 19 seconds) to reach 50PSIG (this data was obtained from the 2/4/00, 2/14/01,2/19/01 & 6/18/02 performances of ST-4N). Once 50PSIG is reached, 23MOV-25 cycles open. During a DBA LOCA, 23MOV-25 cycles closed immediately after reaching the full open position due to reaching 750GPM and/or Turbine Trip. It takes less time (~1 second) to reach 750GPM after reaching 50PSIG than it does to fully open 23MOV-25 (~6.2 seconds). Therefore, at the completion of the open stroke (which is sealed in), the valve auto closes because 750GPM has already been reached. During an SBO, 23MOV-25 will open 19 seconds after receiving a HPCI initiation signal. 23MOV-25 will immediately close after reaching the full open position due to flow greater than 750GPM. Upon a HPCI trip, 23MOV-25 will cycle open and close. The valve cycles open because pressure is greater than 50PSIG but flow is less than 550GPM (the control circuit is lined up to open even though a turbine trip signal to close is in) and returns to close immediately after reaching full open. This will only cycle during the initial cycling of HPCI. Per AOP-49, 23MOV-25 will be rendered inoperable to eliminate cycling of this MOV. The stroke time of 23MOV-25 is calculated based on the BWR Owners Group DC Motor Performance Methodology NEDC-32958, revision 0, in Appendix 8. The stroke time is calculated based on a BMCC bus voltage of approximately 108.8 Volts (for opening) and 111.8 Volts (for closing). The calculated value for opening is 5.77 seconds. The calculated value for closing is 8.18 seconds. Both the opening and close times have been increased by 10% to yield 6.3 seconds (opening) and 9.0 seconds(closing) in the duty cycle for added margin. These values are within the maximum allowed stroke time of 10 seconds based on the Technical Requirements Manual. The above response is consistent with the simulator response and actual plant testing.

DRN-04-06672

- 23MOV-57 and 23MOV-58 will open at the onset of a DBA LOCA due to suppression pool swell. This is described in memorandum JTRG-02-102. However, these valves will receive a closure signal before reaching full open stroke due to Reactor Pressure reaching the low pressure setpoint of 75PSIG). These valves will close due to low reactor pressure (i.e. 75PSIG).

- 23P-150 starts on Lo-Lo Reactor Level and stops within 30 seconds of the HPCI initiation due to the main oil pump bringing system pressure above 90PSIG. This has been verified by reviewing past performed surveillances of ST-4N and ST-4P. Upon a HPCI trip this pump will restart on low lube (less than 35PSIG) because of the aux oil pump (23P-150) seal in circuit. During a DBA LOCA, this pump will start and continue to run for the duration of the duty cycle. It is unclear as to whether or not lube oil pressure would increase enough to cause 23P-150 to trip (i.e. 90PSIG). In any case, it would restart sometime after the turbine tripped. This calculation will assume that this pump will run for the entire duration of a LOCA (i.e. 2 hours). During an SBO, 23P-150 will trip during HPCI initiation (at 30 seconds after initiation). When HPCI is tripped this pump will restart and run until HPCI restarts due to the seal in logic.

- 23P-140 starts on Lo-Lo Reactor Level and remains running for the entire duty cycle for both SBO and LOCA.

MINOR CALCULATION CHANGE FORM (Tracked via DRN in MERLIN)

Page 1 of 7

Calculation No.: JAF-CALC-ELEC-02610	**Revision: 2**
Calculation Title: **125VDC Station Battery "B" Sizing & Voltage Drop**	**Indicate Status of Minor Calculation Change: ~ Prel; ~ Pend; X As-Built**
MERLIN DRN No. or Minor Calculation Change No.: DRN-05-~~00305~~ 00912 A.B 3/8/05	
Modification No./Task No./ER No. JD-01-020	
Computer Code Used ☐ **Yes** ☒ **No.** **If "Yes", Code:**	

1 Purpose of Change:	**See Attached on Page 2.**
2 SSC affected:	**See Attached on Page 2.**
3 Design Input Documents not used in parent Calculation:	**N/A**
4 Drawings/Procedures/ Calculations / other Documents affected	**JAF-CALC-ELEC-02610, Rev. 2, Appendices 1, 4 and 5**
5 Description of Change:	**See Attached on Page 2.**
6 Impact on existing calculation conclusion:	**None**
7 Impact on DBD's, UFSAR, Technical Specifications:	**None**
8. The existing calculation does / does not (circle one) have a calculation verification checklist.	
Remarks: See Attached on Page 2 and MCC JAF-CALC-ELEC-02610, DRN-03-01072.	

NOTE:
A. If UFSAR or Technical Specifications need to be revised, Minor Calculation Change Form should not be used unless it is an editorial change to the UFSAR or Technical Specifications.
B. Minor Calculation Change Forms do not change the status of the Parent Calculation Revision.

	Print/Sign		Date:
Prepared by:	**Alex Barton** Alex Barton		**Date:** 2/25/05
Reviewed by: *	David E. Burch by direction of Brian Marks David E. Burch		**Date:** 2/26/05
Approved by	J. Abisamra		**Date:** 2/26/05

* Where the original calculation was design verified, the reviewer signature confirms the latest design verification is still valid.

This IS a Quality Record -

1. **Purpose of Change :**

Equivalent Change JD-01-020 ECN-006 will rotate 23MOV-14 with new GE/Sentinel Valve Actuator and Motor approx 180 Degree from original valve position. Existing Power cables jumper length will be increased by 1 feet per Electrical Installer as built data. Power jumpers cable from JB-MOV to 23MOV-14 will be changed from 2/C#8 to 3/C#8. All Control Cables length will be increased by 3 feet per Electrical Installer data

2. **SSC affected :**

23MOV-14

5 Description of Change

Revise the Component Data for 23MOV-14 as shown in Appendix 1 cable data. Appendix 4 (Detailed Results) and Appendix 5 (Components Minimum Voltage) will be revised too, as the entries in Appendix 4 and 5 are calculated using Appendix 1 input.

Remarks:

This MCC DRN- 05-00305 will revise minimum 23MOV-14 inrush voltage at motor terminal from 93.07 VDC to 92.69 VDC in LOCA scenario.
This MCC DRN- 05-00305 will revise minimum 23MOV-14 running voltage at motor terminal from 105.27 VDC to 105.07 VDC in LOCA scenario.

This MCC DRN- 05-00305 will revise minimum 23MOV-14 inrush voltage at motor terminal from 93.72 VDC to 93.34 VDC in SBO scenario.
This MCC DRN- 05-00305 will revise minimum 23MOV-14 running voltage at motor terminal from 106.53 VDC to 106.34 VDC in SBO scenario.
LOCA scenario is worse.

The minimum battery voltage from the voltage drop study using IEEE-485 methodology was identified (109.65 VDC for LOCA and 109.86 VDC for SBO) in Rev 2.
The minimum battery voltage will not be effected as of this change

Battery "B" Sizing will not be effected as of this change.

Revision of calculation JAF_CALC-HPCI-01815, Rev. 3 "Reduced Voltage Analysis for 23MOV-14 is not required at this time since minimum motor terminal voltage used in the calculation JAF_CALC-HPCI-01815, Rev.3 is 92.07 in LOCA scenario.

Entergy 125V DC STATION BATTERY "B" SIZING & VOLTAGE DROP
JAF-CALC-ELEC-02610 Rev. 2

Appendix 1
Page 1 of 40
Computed by: A. Barton
Checked by: S. Kim

CABLE & WIRE DATA

Cable mark Number	Conductors per cable	Wire Size	Type	Nominal DC Resistance in Ohms per 1000' (@25° C)	(@40° C)	(@50° C)	(@90° C)
NFE-02	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-05	2	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NFE-08	2	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFE-09	3	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFE-13	3	4 AWG	Cu	0.2690	0.2845	0.2949	0.3364
NFE-21	3	1/0 AWG	Al	0.1680	0.1780	0.1846	0.2111
NFE-22	3	3/0 AWG	Al	0.1050	0.1112	0.1154	0.1320
NFE-23	3	4/0 AWG	Al	0.0836	0.0886	0.0919	0.1051
NFE-24	3	350MCM	Al	0.0505	0.0535	0.0555	0.0635
NFE-25	3	500MCM	Al	0.0354	0.0375	0.0389	0.0445
NFE-26	3	750MCM	Al	0.0236	0.0250	0.0259	0.0297
NFE-30	3	350MCM	Cu	0.0320	0.0338	0.0351	0.0400
NFE-55	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-61	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-62	3	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-63	5	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-64	7	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-65	9	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-66	12	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFE-67	1	500MCM	Cu	0.0222	0.0235	0.0243	0.0278
NFE-68	1	500MCM	Cu	0.0222	0.0235	0.0243	0.0278
NFF-09	4	4 AWG	Cu	0.2690	0.2845	0.2949	0.3364
NFF-15	12	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NFF-16	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-18	2	4 AWG	Cu	0.2690	0.2845	0.2949	0.3364
NFF-21	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-22	3	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-24	5	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-25	7	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-26	9	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-27	12	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFF-28	2	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFF-30	1	2 AWG	Cu	0.1690	0.1788	0.1853	0.2113
NFF-31	2	6 AWG	Cu	0.4270	0.4517	0.4681	0.5340
NFF-32	4	6 AWG	Cu	0.4270	0.4517	0.4681	0.5340
NFF-33	2	4 AWG	Cu	0.2690	0.2845	0.2949	0.3364
NFF-34	1	4/0 AWG	Al	0.0836	0.0886	0.0919	0.1051
NFF-35	12	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NFF-48	4	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NFF-51	1	750MCM	Al	0.0236	0.0250	0.0259	0.0297
NFF-64	2	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFF-89	4	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NFF-90	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-50	7	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-51	9	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-52	12	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-28	12	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-04	1	500MCM	Cu	0.0222	0.0235	0.0243	0.0278
NGG-14	3	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NGG-30	2	2 AWG	Cu	0.1690	0.1788	0.1853	0.2113
NGG-31	3	2 AWG	Cu	0.1690	0.1788	0.1853	0.2113
NGG-33	3	6 AWG	Cu	0.4270	0.4517	0.4681	0.5340
NGG-34	3	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
NGG-37	2	10 AWG	Cu	1.0800	1.1424	1.1840	1.3505
NGG-47	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-48	3	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-49	5	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-50	7	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGG-51	9	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGH-03	6	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGH-08	2	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NGH-13	3	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491
SIS-14	1	14 AWG	Cu	2.7300	2.8878	2.9930	3.4138
SIS-12	1	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508

DRN-05-00~~365~~ 912

125V DC 71BMCC-2 React Bldg MCC

Compt No.	LOAD	CABLE NUMBER	CABLE MARK NO.	CABLE LENGTH (feet)	NO OF CABLE	COND PER CABLE	Twisting Multiplier	R/1000 (ohms) @ 50° C	R tot (ohms) @ 50° C	Drawing
OA2	23MOV-14									SE-10AF
	70 Amp Breaker (ohms)								0.0040	PEDB
	Armature (A1)	1HPIBBK037	NFE-22	90	1	3	1.04	0.1154	0.0108	
	Armature (A2)	1HPIBBK037	NFE-22	90	1	3	1.04	0.1154	0.0108	
	Series (S1)	1HPIBBK037	NFE-22	90	1	3	1.04	0.1154	0.0108	
	Series (S2)	1HPIBBK005	NFF-33	120	1	2 (1sp)	1.00	0.2949	0.0354	
	JB - MOV (Arm.and Series)	Unscheduled	NGH-13	11	2	3 (1sp)	1.04	0.7444	0.0341	
	OL Heater @ 55° C		K21.3B					0.0072	0.0072	PEDB
	Total Res.								* 0.1131	
	23MOV-14 Control (Open)									SE-10AF
	70 Amp Breaker (ohms)								0.0040	PEDB
		1HPIBBC001	NFF-24	120	1	5	1.04	1.8857	0.4707	
		1HPIBBC002	NGH-03	18	1	5	1.04	1.8857	0.0706	
		1HPIBBC003	NFE-64	625	1	7	1.04	1.8857	2.4514	
		1HPIBBC004	NFF-21	145	1	2	1.00	1.8857	0.5469	
	Total Res.								* 3.5435	
OB1	23MOV-17									SE-10AH
	15 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1HPIBBK010	NFF-21	260	1	2	1.00	1.8857	0.4903	
		1HPIBBK039	NFF-31	250	1	2	1.00	0.4681	0.1170	
	Armature (A2)	1HPIBBK010	NFF-21	260	1	2	1.00	1.8857	0.4903	
		1HPIBBK039	NFF-31	250	1	2	1.00	0.4681	0.1170	
	Series (S1)	1HPIBBK011	NFF-21	260	1	2	1.00	1.8857	0.4903	
		1HPIBBK040	NFF-31	250	1	2	1.00	0.4681	0.1170	
	Series (S2)	1HPIBBK011	NFF-21	260	1	2	1.00	1.8857	0.4903	
		1HPIBBK040	NFF-31	250	1	2	1.00	0.4681	0.1170	
	OL Heater @ 55° C		K6.42A					0.0643	0.0643	PEDB
	Total Res.								* 0.4522	

* Total resistance of the circuit path for this load

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125V DC STATION BATTERY "B" SIZING VOLTAGE DROP
JAF-CALC-02610 Rev. 2
LOCA w/LOOP

Computed by: A. Barton
Checked by: S. Kim

			LOCA w/LOOP		Load Voltage & Current						40 RPM			
			Time Period No.:		2		3		4		5		6		7	
			Period Range:	From:	00:00:00.10 -		00:00:00.20 -		00:00:00.21 -		00:00:00.30 -		00:00:00.32 -		00:00:01.00 -	
				To:	00:00:00.20		00:00:00.21		00:00:00.30		00:00:00.32		00:00:01.00		00:00:01.10	
				Start Time:	0.1 sec		0.2 sec		0.21 sec		0.3 sec		0.32 sec		1 sec	
Panel	Load I.D.	Load Description	Start Time	Stop Time	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current
BATTERY 71SB-2			reset		110.15	911.76	110.22	902.07	110.20	905.38	109.68	976.57	109.66	979.67	109.65	980.58
71BCB-2B					107.46	911.76	107.58	902.07	107.52	905.38	106.80	976.57	106.77	979.67	106.76	980.58
71BMCC-2					104.78	110.67	104.88	110.77	104.85	110.74	104.14	109.99	104.11	109.96	104.10	109.95
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet Valve	0.1 sec	16.8 sec	93.30	101.52	93.39	101.61	93.36	101.58	92.73	100.89	92.70	100.86	92.69	100.85
	23MOV-14(Control)	HPCI Turbine Steam Inlet VA Contrc	0.1 sec	16.8 sec	103.08	0.48	103.18	0.48	103.15	0.48	102.45	0.48	102.42	0.48	102.41	0.48
OD1	23P-140(M)	HPCI Gland Seal Cond Exhstr Pump	0.1 sec	120 min	103.32	8.10	103.41	8.11	103.38	8.11	102.68	8.05	102.65	8.05	102.64	8.05
	23P-140(Control)	23P-140 Control	0.1 sec	120 min	103.72	0.41	103.81	0.41	103.78	0.41	103.08	0.41	103.05	0.41	103.04	0.41
OE1	23P-141(M)	HPCI Gland Seal Cond Pump	19 sec	120 min												
	23P-141(Control)	23P-141 Control	19 sec	120 min	104.36	0.16	104.45	0.16	104.42	0.16	103.72	0.16	103.69	0.16	103.68	0.16

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DRN-05-00305

			LOCA w/LOOP		Load Voltage & Current		& Current				Load Voltage & Current					
			Time Period No.:		8		9		15		18		19		20	
			Period Range:	From:	00:00:01.10 -		00:00:01.20 -		00:00:01.85 -		00:00:02.10 -		00:00:03.00 -		00:00:03.10 -	
				To:	00:00:01.20		00:00:01.21		00:00:01.90		00:00:03.00		00:00:03.10		00:00:03.40	
				Start Time:	1.1 sec		1.2 sec		1.85 sec		2.1 sec		3 sec		3.1 sec	
Panel	Load I.D.	Load Description	Start Time	Stop Time	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current
BATTERY 71SB-2			reset		113.27	603.23	113.27	603.23	114.18	528.32	113.23	607.14	112.93	632.04	113.80	558.52
71BCB-2B					111.49	603.23	111.49	603.23	112.62	528.32	111.44	607.14	111.07	632.04	112.15	558.52
71BMCC-2					110.34	47.58	110.34	47.58	111.48	47.08	110.29	47.61	109.91	47.78	111.01	47.29
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet Valve	0.1 sec	16.8 sec	105.62	42.65	105.52	42.65	106.71	42.17	105.46	42.67	105.07	42.83	106.22	42.37
	23MOV-14(Control)	HPCI Turbine Steam Inlet VA Contrc	0.1 sec	16.8 sec	108.55	0.51	108.65	0.51	109.67	0.51	108.49	0.51	108.13	0.50	109.21	0.51
OD1	23P-140(M)	HPCI Gland Seal Cond Exhstr Pump	0.1 sec	120 min	109.65	3.83	109.65	3.83	110.79	3.79	109.59	3.83	109.22	3.85	110.32	3.81
	23P-140(Control)	23P-140 Control	0.1 sec	120 min	109.22	0.43	109.22	0.43	110.35	0.44	109.16	0.43	108.80	0.43	109.88	0.43
OE1	23P-141(M)	HPCI Gland Seal Cond Pump	19 sec	120 min												
	23P-141(Control)	23P-141 Control	19 sec	120 min	109.90	0.17	109.90	0.17	111.03	0.17	109.84	0.17	109.47	0.17	110.56	0.17

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125V DC STATION BATTERY "B" SIZING VOLTAGE DROP
JAF-CALC-02610 Rev. 2
SBO

Appendix 4
Page 1 of 2
Computed by: A. Barton
Checked by: S. Kim

			Period Range:	Time Period No. :	35		36		37		38		39		40		41		42	
				From :	00:00:09.90 -		00:00:10.80 -		00:00:10.70 -		00:00:10.80 -		00:00:11.00 -		00:00:14.70 -		00:00:17.00 -		00:00:18.00 -	
				To:	00:00:10.80		00:00:10.79		00:00:10.80		00:00:11.00		00:00:14.70		00:00:17.00		00:00:18.00		00:00:19.00	
				Start Time :	9.9 sec		10 sec		10.7 sec		10.8 sec		11 sec		14.7 sec		17 sec		18 sec	
Panel	Load I.D.	Load Description	Start Time	Stop Time	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current
BATTERY 71SB-2			reset		116.00	346.36	110.18	907.42	110.18	907.22	110.98	842.45	115.02	464.98	115.22	448.30	113.80	550.98	113.91	549.21
71BMCC-2					114.96	0.53	104.83	110.71	104.83	110.72	105.79	111.73	112.52	46.83	112.78	46.52	111.12	47.24	111.15	47.23
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet Valve	10 sec	26.7 sec			93.34	101.56	93.34	101.56	94.20	102.49	107.80	41.74	108.07	41.84	108.34	42.32	108.37	42.31
	23MOV-14(Control)	23MOV-14 Control	10 sec	26.7 sec	114.34	0.18	103.12	0.48	103.13	0.48	104.07	0.48	110.69	0.52	110.95	0.52	109.32	0.51	109.34	0.51
OD1	23P-140(M)	HPCI Gland Seal Cond Exhaust Pump	10 sec	240 min			103.36	8.11	103.36	8.11	104.31	8.18	111.84	3.76	112.10	3.75	110.43	3.80	110.46	3.80
	23P-140(Control)	23P-140 Control	10 sec	240 min	114.50	0.18	103.76	0.41	103.76	0.41	104.71	0.41	111.36	0.44	111.63	0.44	109.99	0.44	110.02	0.44
OE1	23P-141(M)	HPCI Gland Seal Cond Pump	29sec	240 min																
OE1	23P-141(Control)	23P-141 Control	29sec	240 min	114.50	0.18	104.40	0.18	104.40	0.18	105.36	0.18	112.06	0.17	112.32	0.17	110.67	0.17	110.70	0.17

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125V DC STATION BATTERY "B" SIZING VOLTAGE DROP
JAF-CALC-02610 Rev. 2
SBO

Appendix 4
Page 2 of 2
Computed by: A. Barton
Checked by: S. Kim

			Period Range:	Time Period No. :	Load Voltage & Current									
					43		44		45		46		47	
				From :	00:00:19.80 -		00:00:20.80 -		00:00:21.80 -		00:00:22.60 -		00:00:26.70 -	
				To:	00:00:20.80		00:00:21.80		00:00:22.80		00:00:26.70		00:00:29.90	
				Start Time :	19 sec		20 sec		21 sec		22.6 sec		26.7 sec	
Panel	Load I.D.	Load Description	Start Time	Stop Time	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current	Voltage	Current
BATTERY 71SB-2			reset		114.46	507.40	114.18	526.61	114.88	475.31	115.35	451.96	115.67	389.39
71BMCC-2					111.82	46.93	111.48	47.06	112.35	46.70	112.95	46.45	114.41	4.49
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet Valve	10 sec	26.7 sec	107.07	42.03	106.71	42.17	107.62	41.81	108.25	41.57		
	23MOV-14(Control)	23MOV-14 Control	10 sec	26.7 sec	110.01	0.51	109.67	0.51	110.53	0.51	111.12	0.52	113.79	0.18
OD1	23P-140(M)	HPCI Gland Seal Cond Exhaust Pump	10 sec	240 min	111.14	3.78	110.79	3.79	111.67	3.76	112.27	3.74	113.74	3.69
	23P-140(Control)	23P-140 Control	10 sec	240 min	110.69	0.44	110.34	0.44	111.21	0.44	111.80	0.44	113.25	0.45
OE1	23P-141(M)	HPCI Gland Seal Cond Pump	29sec	240 min										
OE1	23P-141(Control)	23P-141 Control	29sec	240 min	111.37	0.17	111.02	0.17	111.90	0.17	112.49	0.17	113.95	0.16

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DRN-05-00365

MCC 71BMCC-2 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			LOCA Pickup			LOCA Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet VA (Open)	I	Anchor	W8622455	JAF-CALC-HPCI-01825	125	87.97	87.97	92.69	4.73	YES	105.07	17.10	YES
	23MOV-14(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78.0	18	103.08	25.08	YES	102.41	84.41	YES
			I	GE	IC2800A1617B3H	See Design Input 2.18 & 2.19	120	78.0	18	103.08	25.08	YES	102.41	84.41	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	103.08	27.48	YES	102.41	78.41	YES
OD1	23P-140(M)	HPCI Gland Seal Cond Exhauster Pump	II/III	GE	5BCJ56ED56A	IEEE-946 (80% of nominal)	120	96	96	102.64	6.64	YES	109.22	13.22	YES
	23P-140(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18	103.72	25.72	YES	103.04	85.04	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	103.72	28.12	YES	103.04	93.44	YES
OE1	23P-141(M)	HPCI Gland Seal Cond. Pump	II/III	Baldor	6229D	IEEE-946 (80% of nominal)	125	100	100	104.43	4.43	YES	108.19	8.19	YES
	23P-141(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78.0	18	110.48	32.48	YES	109.20	91.20	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	110.48	34.88	YES	109.20	99.60	YES

MCC 71BMCC-2 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Reference	Component			SBO Pickup			SBO Dropout		
							Nominal Voltage	Pickup Voltage	Dropout Voltage	Minimum Voltage	Margin	Pickup Acceptable	Minimum Voltage	Margin	Dropout Acceptable
OA2	23MOV-14(Open)	HPCI Turbine Steam Inlet VA (Open)	I	Anchor	W8622455	JAF-CALC-HPCI-01825	125	87.97	87.97	93.34	5.37	YES	106.34	18.37	YES
	23MOV-14(Control)		I	GE	IC2800A1607D3G	See Design Input 2.18 & 2.19	120	78	18	103.12	25.12	YES	103.13	85.13	YES
			I	GE	IC2800A1617B3H	See Design Input 2.18 & 2.19	120	78	18	103.12	25.12	YES	106.34	88.34	YES
			I	GE	IC2820A200A3F	E-Mail from GE 09/05/00	120	75.6	24	103.12	27.52	YES	106.34	82.34	YES
OD1	23P-140(M)	HPCI Gland Seal Cond Exhauster Pump	II/III	GE	5BCJ56ED56A	IEEE-946 (80% of nominal)	120	96	96	103.36	7.36	YES	105.93	9.93	YES
	23P-140(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	103.76	25.76	YES	103.76	85.76	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	103.76	28.16	YES	103.76	94.16	YES
OE1	23P-141(M)	HPCI Gland Seal Cond. Pump	II/III	Baldor	6229D	IEEE-946 (80% of nominal)	125	100	100	104.84	4.84	YES	104.42	4.42	YES
	23P-141(Control)		II/III	GE	IC2800A1607F3J	See Design Input 2.18 & 2.19	120	78	18	110.91	32.91	YES	105.54	87.54	YES
			II/III	GE	IC2800A501AB23C	See Design Input 2.20 & E-Mail from GE 12/19/01	120	75.6	9.6	110.91	35.31	YES	105.54	95.94	YES