Enclosure 1 to JAFP-05-0179
Entergy Nuclear Operations, Inc. – FitzPatrick
Docket No. 50-333

Calculation JAF-CALC-ELEC-02609
"125VDC "A" Station Battery Sizing & Voltage Drop" revision 2

CALCULATION COVER PAGE

☐ IP-2 ☐ IP-3 ☒ JAF ☐ PNPS			
Calculation No. JAF-CALC-ELEC-02609	Revision 2	Sheet 1 of 1	
Title: 125VDC "A" Station Battery Sizing & Voltage Drop		Status: ☐ Preliminary ~~☒ Pending~~ ☒ As-Built ☐ Void ☐ Superceded AB 11-17-05	
☒ QR ☐ NQR			
Discipline: Electrical	Design Basis Calculation? ☒ Yes ☐ No		
This calculation supercedes calculation: none			
Modification No./Task No/ER No: JD-01-106			
Software Used? ☐ Yes ☒ No (If Yes, include Computer Run Summary Sheet)			
System No./Name: 071 Component No./Name: 71SB-1 Attached additional pages if necessary)			
Print / Sign			
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Approver Tom Savory T Savory N/A	Date: 6/10/02		

CALCULATION SUMMARY PAGE

Calculation No. JAF-CALC-ELEC-02609 Revision No. 2

CALCULATION OBJECTIVE: (1) To establish aging and design margin for the "A" Station Battery from the voltage drop and sizing calculation. (2) To establish testing profile and acceptance criteria for "A" Station Battery discharge testing to satisfy Technical Specifications.
CONCLUSIONS: See Attached
ASSUMPTIONS: Assumptions are listed in the body of the calculation. Assumptions that need follow-up verification are indentified in section 2 of the calculation and are identified with an ACT item.
DESIGN INPUT DOCUMENTS: See Attached
AFFECTED DOCUMENTS: MST-71.20, MST-71.26 and Tab III of DBD-071. ACT-02-65690 has been initiated to follow initiation of change documentation
METHODOLOGY: See Attached

RECORD OF REVISIONS

Calculation Number: JAF-CALC-ELEC-02609

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

CALCULATION SHEET

Entergy Nuclear Northeast		
Calculation No. JAF-CALC-ELEC-02609	Revision: 2	
Subject: 71 ELECTRICAL DISTRIBUTION	Page 1 of 21	
125 VDC STATION BATTERY A SIZING &	Computed by: A Barton	Date: 6/10/02
VOLTAGE DROP	Checked by: B Marks	Date: 6/10/02

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Revision Summary

Revision 1

1) Resistances for containment cables were changed to 90°C and external to the Reactor Building to 40°C.
2) Breaker resistances were added to Appendix 1.
3) All Appendix pages were revised therefore; no revision bars are used.
4) Plant changes, in cables, were reviewed (Reference 4.2) and appropriate changes made to Appendix 1.
5) Incorporated the following SSFI Items:

SSFI 125VDC-97-04
SSFI 125VDC-97-12

6) Incorporated the following ACTS:

ACT-98-35189 (Conductor Temperatures & most limiting ADS cable length)
ACT-98-35193 (Misapplication of EQ voltage criteria)
ACT-98-30907 (SSFI-97-10 & 11)
ACT-98-37362 (Describe Scenario)
ACT-99-43846 (SWGR Trip & Close Coil Voltage Drop)
ACT-99-45065 (Minimum Voltage for Sizing Calculation not Conservative)
ACT-99-45260 (Address Minimum Voltage @ 13P-3 and 13P-4)
ACT-99-45320 (SSFE RFI #039 items 1,3,4,5 & 6)
ACT-99-45925 (Inrush Currents for MOVs)
ACT-00-47130 (Oscillograph Replacement MOD F1-88-224)

7) This calculation incorporates the Battery sizing calculation previously located in JAF-CALC-ELEC-2547 (appendix 9).

Revision 2

1) Incorporate ACT-00-47872 (Backup SCRAM Solenoids), Addendum 0A

2) Incorporate addendum 1C for Design Change JD-01-106 (ESW Pump Motor Breaker Control Cable)

3) Revised SBO timing for initiation of Lo-Lo level based on PTE-96-002 (9/16/96 event at JAF)

4) Incorporated Addendum 0B (SRV Electric Lift Design Change M1-97-070)

5) Added electric lifting of 2 SRVs in SBO based on PTE-96-002 (9/16/96 event at JAF)

6) Incorporated Addendum 1A (EDG EGM Power Supply Design Change JE-00-115)

7) Incorporated Addendum 1B (Added RHR SW Pump Motor Breakers to LOCA profile per DER-01-03565)

8) Incorporated JAF-ICD-ELEC-04224 (UPS loading)

9) Revised minimum required voltage to Topaz Inverters 13INV-152 to 101.5VDC

10) Revised continuous control to eliminate having it in the calc twice

11) Control loads for pumps and MOVs were added

12) Stroke times for RCIC MOVs were increased based on BWROG Methodology per NEDC-32958 and Engineering Judgment

13) Used actual loading measurements for RCIC Inverter 13INV-152, Feedwater Inverter 06INV-1A, RHRSW Motor Cooling Water Return Solenoids 10SOV-101A & C, and the EDG EGM power supplies 93P/S-A & C.

14) Explanation and source of data for MOV Inrush Currents

15) Revise minimum design battery electrolyte temperature from 60°F to 65°F per JENG-01-0038, M1-89-064, Calculation 01-009 and Addendum 1D to this calculation.

16) Revised Battery Sizing Calculation based on a new minimum required battery voltage.

17) Revised starting of 31P-7A (RFPT Emergency Lube Oil Pump). The starting of this pump was moved conservatively to 15 second start for LOCA and 18 second start for SBO. Previous revision was not conservative and not appropriate based on

actual plant response.

18) 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.

19) Add a closure of 1 RBC Pump Motor breaker. This breaker will automatically be demanded to close upon loss of AC power.

20) Added EHC Loading for a turbine trip.

21) Added a generator trip due to either anti-motoring or reverse power.

22) Revised undervoltage trip circuit for H03 to initiate at 0.1 seconds from 3 seconds

23) Revised tripping of recirc MG set exciter breaker to trip at 17 seconds. This is consistent with OP-27.

24) Added closure of 13MOV-16 and 13MOV-21 during LOCA due to reaching 75PSIG.

25) Added 13MOV-30 for assisting in reactor level control in SBO.

26) Added actual emergency lighting loads per field measurement.

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 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 "A" 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 have a capacity greater than 80% and must be able to function with an electrolyte temperature as low as 65°F. This accounts for the 8% temperature margin and 25% aging margin.

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 nominal 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. The design margin will be "back" calculated. 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 18) 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 2.13.

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

and an 8% temperature correction factor. 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 "A" Station Battery is 60.

1.3.5 Minimum voltage values for a component in most cases is 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 MOVs. 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, the 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 2 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. The UPS MG Set is fed from the ac source.

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 RCIC MOV timing 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 MOVs. The best available information was used. The following work request numbers (i.e. VOTES test) was used for the locked rotor currents in Appendix 8:

13MOV-16	WR-96-05501-25
13MOV-30	WR-00-01537-00
13MOV-21	WR-97-03237-00
13MOV-27	WR-91-87529-00
13MOV-131	WR-96-02083-07
13MOV-132	WR-97-03239-01

2.5 Stroke times for 13MOV-21, 13MOV-27, 13MOV-131, 13MOV-132, 38MOV-VB1 were developed from BWROG DC MOV Methodology (Reference 4.21). The stroke times were increased by 10% for margin and 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 BMCC-1 voltage was assumed to be 107VDC for the entire stroke for valves off this bus. The BMCC-3 voltage was assumed to be 104VDC for the entire stroke for valves off this bus. The assumed voltage for 38MOV-VB1 was assumed to be 87VDC at 71DC-A3 to yield approximately 80VDC at the MOV.

2.6 From JAF-ICD-ELEC-04224 Table 1 the maximum UPS DC Motor Armature Inrush Current was 155Amps at 129 VDC and was achieved at 1.75 seconds after loss of AC power. Continuous current was 80Amps @ 129VDC. Steady state conditions were considered fully reached at 4.3 seconds. However, since the current was at 78 Amps at 4.0 second, the inrush will be considered to be cleared at 4.0 seconds based on results in Table 1 of JAF-ICD-ELEC-04224. From the test results documented in JAF-ICD-ELEC-04224 (WR-00-01142-00) the AC Motor drive current was at approximately 76Amps. Based on AC motor currents recorded in revision 1 of this calculation, the UPS is considered fully loaded during the test performed in JAF-ICD-ELEC-04224. Typical AC motor readings are approximately 72Amps. There was an anomaly

observed in JAF-ICD-ELEC-04224 in that the AC Generator output current recorded was less than actual (i.e. potentially indicating the UPS generator was not under its normal full load). In reviewing the work package with the individuals taking the data, it was acknowledged that the generator output readings were not correct because of the meter increments. There are 6 divisions on the meter and the first division is 25Amps. That would bring the actual readings from 20/25Amps to approximately 40/45Amps. This is consistent with the AC Motor readings of 76/80/76Amps and is consistent with reading taken in Appendix 12 of revision 1 to this calculation. Since the UPS was considered fully loaded when the readings were taken, the 155Amp and 80Amp values are considered appropriate.

2.7 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.

2.8 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).

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

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

2.11 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).

2.12 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.

2.13 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.

2.14 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.

2.15 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. 4.18).

2.16 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.

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

2.18 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.

2.19 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.

2.20 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).

2.21 Walkdown data for the "A" and "B" RFPT Emergency Lube Oil Pump MCCs are attached in Appendix 8. There is some missing/incorrect information for the relay part numbers on the "A" Pump MCC. The "B" Pump MCC has the most accurate information. This data will be used for 71BCB-2A-D01 which is the MCC for 31P-7A(M).

2.22 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).

2.23 For GE IC2820-A100 series General Purpose Relays, the pickup and dropout voltages are based on tech manual G080-0702. Pickup is 63% of rated voltage. Dropout is 10% of the pickup value. 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 (0.10 x 75.6) 8vdc.

2.24 ACT Item 02-65671 has been initiated to verify that all the Emergency Lights were lit when the current readings were taken. These values were used for the emergency lighting load.

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) and Station Blackout (SBO) for four (4) hours. 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-1A.

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 critical component not meeting the manufacturers' requirement is identified in Appendix 5 and is evaluated for impact in Appendix 6.

The following components failed to meet the manufacturers' voltage requirements during the LOCA and/or SBO scenarios:

- The Reactor Recirculation Pump MG set emergency DC lube oil pump 02-184P- 3A(M) (LOCA & SBO)
- The Condenser Vacuum Breaker Valve - 38MOV-VB1 (SBO).
- 71-11316 breaker closing for 15P-2A RBCLC Pump (LOCA & SBO)

3.1.2. Since all safety-related loads do not drop below the minimum voltage requirements as shown in Appendix 5, the minimum battery voltage was determined based on available margin between the battery voltage and pickups/dropouts using the methodology in section 1.3.7. For LOCA, a minimum battery voltage of 112.2VDC (1.87VPC) was evaluated against all loads to ensure operability. For SBO a minimum Battery voltage of 111.6VDC (1.86VPC) 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 112.2VDC minimum voltage for LOCA and 111.6 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 Appendix 6 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 1.5% design margin for LOCA. For SBO there is 8% temperature margin, 25% aging margin, and 22% design margin.

3.1.4. The load profile for the 71SB-1 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 112.2V (level 1 Acceptance Criteria). During MST-71.26 battery terminal voltage shall not drop below 112.2V during the first 2 hours (level 1 Acceptance Criteria). Once 2 hours has passed in MST-71.26, the test shall continue until 112.2V has been reached. 493AMPS is the 3 Hour Rate at 1.87 Volts per cell (112.2V).

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	737.56	441.05	NA	NA
Test Current for Service Test (Currently MST-71.20)	750	450	NA	NA
Test Current for Modified Performance Test (Currently MST- 71.26)	750*	493**	493**	

*Do not temperature correct the 1st Minute of MST-71.26.

**Do not temperature correct below 60°F. The Modified Performance Test cannot be performed with electrolyte temperatures below 60°F.

3.1.5. The MOV degraded voltage calculations were reviewed to determine the impact on those calculations based on the results of this calculation. The results of this calculation do not invalidate the results of the MOV degraded voltage calculations. The results of this calculation are conservative compared to the design inputs used for the MOV degrade voltage calculations (ref. 4.14, 4.15, 4.16, 4.17).

3.1.6. Open Items

1) Obtain concurrence in writing by those responsible for the development of accident scenarios that the load scenario in appendix 11 accurately reflects timing and loads imposed by a LOCA in conjunction with a loss of off site power and the battery charger unavailable for 2 hours (ACTS-00-53585).

2) Review JAF-CALC-ELEC-2547 to determine status and portions that have been included in JAF-CALC-ELEC-02609 that are no longer valid in JAF-CALC-ELEC-2547 (e.g. battery sizing, 2547 charger sizing is valid). (ACTS-00-53589)

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

4) ACT-02-65671 has been initiated to verify emergency lighting load

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 NYPA 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 8, "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-RCIC-01955, Revision 2, Reduced Voltage Analysis for 13MOV-21 (Appendix 5)

4.15 JAF-CALC-RCIC-01993, Revision 0, Reduced Voltage Analysis for 13MOV-131 (Appendix 5)

4.16 JAF-CALC-RCIC-03171, Revision 0, Reduced Voltage Analysis for 13MOV-132 (Appendix 5)

4.17 JAF-CALC-RCIC-03187, Revision 0, Reduced Voltage Analysis for 13MOV-27 (Appendix 5)

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

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

4.20 JAF-ICD-ELEC-04224, Revision 0, (WR-00-01142-00), UPS DC Motor readings in R14

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

4.22 JAF-CALC-RCIC-03074, Revision 0, Reduced Voltage Analysis for 13MOV-16 (Appendix 5)

5.0 APPENDICES

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125V DC Station Battery "A" 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-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-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
NFF-91	3	12 AWG	Cu	1.7200	1.8194	1.8857	2.1508
NFY-28	12	12 AWG	Cu	1.7200	0.4517	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
SIS-14	1	14 AWG	Cu	2.7300	2.8878	2.9930	3.4138
SIS-12	1	12AWG	Cu	1.7200	1.8194	1.8857	2.1508
SIS-8	1	8 AWG	Cu	0.6790	0.7182	0.7444	0.8491

Battery Control Board 71BCB-2A

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-1 Battery A (@Battery Rooms)	1STBARL001 1STBARL002 Interier Jumpers*** Shunt Resistance***	NFE-25 NFE-25	105 90	1 1	3 3	1.04 1.04	0.0375 0.0375	0.0014 0.0012 0.000488 0.000033 * 0.00306	SE-10A
A02	71LPERDC1 Emer Lgt Pnl 25 Amp Breaker (ohms) (@Reactor Building)	1ELTANK015**	NFF-30	630	2	1	1.00	0.1852813	0.00800 0.23345 * 0.2415	SE-9PF PEDB
A03	71LPERDC2 Emer Lgt Pnl 15 Amp Breaker (ohms) (@Reactor Building)	1ELTANK016**	NFF-28	720	2	2	1.00	0.7444	0.01000 0.5360 * 0.5460	SE-9PF PEDB
A04	71DC-A4 DG Rm Dist Cab 225 Amp Breaker (ohms) (@EDG Buildng)	1SCBARK001	NFE-24	726	1	3	1.04	0.0534929	0.0004 0.0606 * 0.0610	SE-10AV PEDB
A05	71LPEADC1 Emer Lgt Pnl 25 Amp Breaker (ohms) (@Administration Building)	1ELTANK001	NFF-28	485	2	2	1.00	0.7182	0.00800 0.3484 * 0.3564	SE-9PE
A06	71BMCC-3 React Bldg MCC 30 Amp Breaker (ohms) (@Reactor Building)	1DMSARK002**	NFF-34	675	2	1	1.00	0.0918576	0.0060 0.1240 * 0.1300	ECRIS 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.
*** Interier Jumpers Resistance was obtained from typical readings recorded in WRs 95-04978-00, 95-07560-00, 96-05156-00 and 97-06984-00

Battery Control Board 71BCB-2A(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
A07	71LPESWDC1 Emer Lgt Pnl 25 Amp Breaker (ohms) (@Radwaste Building)	1ELTANK014	NFF-33	500	1	2	1.00	0.2845491	0.0100 0.2845 * 0.2945	SE-9PD PEDB
B02	71DC-A1 RR Dist Cab 100 Amp Breaker (ohms) (@Relay Room)	1SCBARK002	NFF-30	140	2	1	1.00	0.1787688	0.0010 0.0501 * 0.0511	SE-10G PEDB
B03	71DC-A2 RR Dist Cab 100 Amp Breaker (ohms) (@Relay Room)	1SCBARK004	NFF-30	172	2	1	1.00	0.1788	0.00100 0.0615 * 0.0625	SE-10J PEDB
B04	71DC-A3 RR Dist Cab 100 Amp Breaker (ohms) (@Relay Room)	1SCBARK006	NGG-31	70	1	3(1sp)	1.04	0.1788	0.0010 0.0260 * 0.0270	SE-10L PEDB
B05	71BMCC-1 React Bldg MCC 225 Amp Breaker (ohms) (@Reactor Building)	1DMSARK003** 1DMSARK001**	NFF-51 NFF-34	650 690	1 1	1 2	1.00 1.00	0.0259 0.0919	0.00040 0.0169 0.0317 * 0.0489	ECRIS PEDB
B06	71LPE1 Emer Lgt Pnl 15 Amp Breaker (ohms) (@Administration Building)	1ELTANK012	NFF-28	137	1	2	1.00	0.7182486	0.0100 0.1968 * 0.2068	SE-9PD 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.

Battery Control Board 71BCB-2A(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	71DC-A5 RR Dist Cab									SE-10BC
	100 Amp Breaker (ohms)								0.00100	PEDB
	(@Relay Room)	1SCBARK005	NFF-30	250	2	1	1.00	0.1788	0.0894	
								*	0.0904	
C03	71UPS-1									SE-9PL
	600 Amp Breaker (ohms)								0.00014	
	(@Electric Swgr Bay)	1UPSNNL003	NFE-25	457	1	3(1sp)	1.04	0.0375	0.0356	
								*	0.0358	
D01	31P-7A RFPT Oil Pump									SE-10C
	100 Amp Breaker (ohms)								0.0010	PEDB
	(@Turbine Building)	1RFPANL001	NFE-21	245	1	3	1.04	0.1780	0.0907	
								*	0.0917	
	31P-7A Emerg, Oil Pmp Cntl	1RFPANC237	NFE-24	325	1	5	1.04	0.0535	0.0362	
	(@Turbine Building)	1RFPANC238	NFE-26	180	1	9	1.04	0.0250	0.0094	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	0.1158	
D02	94P-13 Seal Oil Pump									SE-10F
	125 Amp Breaker (ohms)								0.00100	PEDB
	(@Turbine Building)	1GSONNL001	NFE-24	887	1	3	1.04	0.0535	0.0987	
								*	0.0997	
	94P-13 Seal Oil Pmp Cntl	1GSONNC108	NFF-25	205	1	7	1.04	1.8194	0.7758	
	(@Turbine Building)	1GSONNC107	NFF-21	350	1	2	1.00	1.8194	1.2736	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	2.1196	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-A1

Compt No.	LOAD	CABLE NUMBER	CABLE MARK	CABLE LENGTH	NO. OF CABLE	COND PER	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
02	Unit & NSS XFMR Backup Prot									FE-3CE
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Control Room)	1UPRNNC063	NFF-21	80	1	2	1.00	1.8194	0.2911	
	Jumper cable from RU-2 to RU-1	Unscheduled	NFF-27	10	1	12	1.04	1.8194	0.0378	
								*	0.3390	
05	71DTR Digital Transient Recorder									FE-3HM
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1OSCNNC001	NFF-21	105	1	2	1.00	1.8194	0.3821	
		1OSCNNC031	NFF-21	65	1	2	1.00	1.8194	0.2365	
								*	0.6286	
06	UV Trip bus A Pnl RL-5									FE-3DN
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1ZLCNNC013	NFF-16	100	1	2	1.00	1.8194	0.3639	
	Jumper cable from RL-5 to RL-3	Unscheduled	NFF-27	30	1	12	1.04	1.8194	0.1135	
								*	0.4874	
12	71PCB-10052 Alt Failure									FE-3BN
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Relay Room)	1YL1NNC013	NFF-33	145	1	2	1.00	0.2845	0.0825	
		1YL1NNC026	NFE-63	75	1	5	1.04	1.8194	0.2838	
	Jumper cable from RU-4 to RU-3	Unscheduled	NFF-27	15	1	12	1.04	1.8194	0.0568	
	Jumper cable from RU-3 to RU-2	Unscheduled	NFF-27	15	1	12	1.04	1.8194	0.0568	
								*	0.4839	
14	345KV Bkr '71PCB-10042 trip									FE-2AG
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Yard)	1YL2NNC012	NFF-33	75	1	2	1.00	0.2845	0.0427	
		1YL2NNC009	NFF-89	1155	1	4	1.04	0.7182	0.8628	
		1YL2NNC061	NFF-89	1150	1	4	1.04	0.7182	0.8590	
		1YL2NNC013	NFF-35	145	1	12	1.04	1.1424	0.3446	
								*	1.2521	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-A1(Cont'd)

Compt No.	LOAD	CABLE NUMBER	CABLE MARK	CABLE LENGTH	NO. OF CABLE	COND PER	Twisting Multiplier	R/1000' (ohms) @ 40° C	R tot (ohms) @ 40° C	Drawing
19	71PCB-10042 Alt Failure									FE-3BN
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Relay Room)	1YL2NNC034	NFF-33	80	1	2	1.00	0.2845	0.0455	
		1YL2NNC056	NFE-61	110	1	2	1.00	1.8194	0.4003	
	Jumper cable from RU-4 to RU-3	Unscheduled	NFF-27	15	1	12	1.04	1.8194	0.0568	
	Jumper cable from RU-3 to RU-2	Unscheduled	NFF-27	15	1	12	1.04	1.8194	0.0568	
								*	0.5633	
21	345kV Bkr 71PCB-10052 trip									FE-2AH
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Yard)	1YL1NNC037	NFF-33	74	1	2	1.00	0.2845	0.0421	
		1YL1NNC078	NFF-09	1005	1	4	1.04	0.2845	0.5948	
		1YL1NNC019	NFF-35	85	1	12	1.04	1.1424	0.2020	
								*	0.8429	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-A2

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	Reac.Prot.Trip "A" B.U. Scram									SE-10A
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Reactor Building)	1RPSAIC004**	NFF-21	80	1	2	1.00	1.8857	0.3017	
		1RPSAMC001**	NFF-21	465	1	2	1.00	1.8857	1.7537	
		1RPSAMC002**	NFF-21	50	1	2	1.00	1.8857	0.1886	
	* 03SOV-140A							*	2.2540	
03	Core Spray Channel "A"									FE-3FT
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1CSPARC151	NFF-21	50	1	2	1	1.8194	0.1819	
								*	0.1919	
04	RHR Channel "A"									FE-3DC
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1RHRARC332	NFF-21	50	1	2	1	1.8194	0.1819	
								*	0.1919	
08	RFPT 31FPD-5A Trip									FE-3FD
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Turbine Building)	1RFPANC146	NFF-21	87	1	2	1.00	1.8194	0.3166	
		1RFPANC151	NFF-22	130	1	3	1.04	1.8194	0.4920	
		1RFPANC241	NFF-21	87	1	2	1.00	1.8194	0.3166	
		1RFPANC239	NFF-24	800	1	5	1.04	1.8194	3.0275	
		Unscheduled	NFF-21	20	1	2	1.00	1.8194	0.0728	
	* 31SOV-12A							*	4.2354	
09	Panel 09-30 (RCIC)									FE-3FW
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1CICARC051	NFF-21	50	1	2	1.00	1.8194	0.1819	
								*	0.1919	

* 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 90° C due to cables entering containment

125V DC Power Panel 71DC-A2(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	Panel 09-04 (HPCI & RCIC)									FE-3BH
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Reactor Building)	1CICARC050**	NFF-21	60	1	2	1.00	1.8857	0.2263	
								*	0.2363	
		1CICARC052**	NFF-22	145	1	3	1.04	1.8857	0.5687	
		1CICARCO53**	NFF-24	650	1	5	1.04	1.8857	2.5495	
		1CICARC131**	NFF-21	55	1	2	1.00	1.8857	0.2074	
	* 13SOV-12							*	3.5619	
11	RWR MG Set A Emer									FE-10AZ
	Lube Oil Pmp 02-184P-3A(M)									
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Reactor Building)	1RWRANK043**	NFF-28	400	1	2	1.00	0.7444	0.5955	
		1RWRANK044**	NFF-28	88	1	2	1.00	0.7444	0.1310	
								*	0.7365	
14	RCIC Steam leak detection									FE-3CR
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Reactor Building)	1LKDARC002**	NFF-21	220	1	2	1.00	1.8194	0.8005	
								*	0.8105	
16	RCIC Valve Trip Sol 13TS-1									FE-3FW
	20 Amp Breaker (ohms)								0.0100	
	(@Reactor Building)	1CICARC088**	NFF-28	33	1	2	1.00	0.7444	0.0491	
		1CICARC067**	NFF-21	150	1	2	1.00	1.8857	0.5657	
		1CICARC190**	NGG-34	640	1	3	1.04	0.7444	0.9910	
								*	1.6158	

* 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-A2(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
18	RWR MG Set A Exiter Fld CB									FE-3CB
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Reactor Building)	1RWRANC049**	NFF-28	425	1	2	1	0.7444	0.6328	
		Unscheduled**	SIS-14	10	2	1	1.00	2.9930	0.0599	
								*	0.6966	
19	To 71L25 Bus 12510 (ESW)									SE-9CE
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Electric Swgr Bay)	1L2EARK005****	NGG-30	496	1	2	1.00	0.1788	0.1773	
								*	0.1813	
22	ADS System Panel 9-45									FE-3FV
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Relay Room)	1ADSARC001	NFF-31	80	1	2	1	0.4681	0.0749	
								*	0.0789	
	ADS System Logic (9-45)									
		1ADSARC043	NFF-24	70	1	5	1.04	1.8194	0.2649	
		1ADSARC700	NFF-25	85	1	7	1.04	1.8194	0.3217	
								*	0.5866	
	ADS System 6 SOV Load									FE-3FV
	(@Reactor Building)	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	5	1.04	2.1508	0.0671	
								*	3.3422	

* 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 90° C due to cables entering containment
**** Actual cable length was verifyed by walkdown

125V DC Power Panel 71DC-A2(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
22 (Cont'd)	02SOV-71E1									FE-3FV
		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	5	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	
								*	3.9014	
	02SOV-71K1	1ADSARC058***	NFF-21	40	1	2	1.00	2.1508	0.1721	
		Unscheduled***	NFF-21	10	1	2	1.00	2.1508	0.0430	
								*	3.5573	
	02SOV-71L1	1ADSARC058***	NFF-21	82	1	2	1.00	2.1508	0.3527	
		Unscheduled***	NFF-21	10	1	2	1.00	2.1508	0.0430	
								*	3.7379	

* 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 90° C due to cables entering containment

125V DC Power panel 71DC-A3

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	09-ESSS1-EP SRV Electric Lift									FE-3AAQ
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1SCBARC002	NGG-47	157	1	2	1.00	1.8194	0.5713	
								*	0.5813	
06	ESW Lockout Matrix CKT 1ESWA04									FE-3FF
	20 Amp Breaker (ohms)								0.0100	
	(@Relay Room)	1ESWARC125	NFF-21	125	1	2	1	1.8194	0.4549	
								*	0.4649	
07	Standby Gas Treatment									FE-3FH
	20 Amp Breaker (ohms)								0.0100	
	(@Relay Room)	1SGTARC010	NFF-21	130	1	2	1.00	1.8194	0.4730	
								*	0.4830	
9	Main Turbine EHC Panel									FE-2AE
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1TEHNNK220	NFF-31	180	1	2	1.00	0.4517	0.1626	
		1TEHNNK211	NFF-16	180	1	2	1.00	1.8194	0.6550	
	Jumper cable from RU-2 to RU-4	Unscheduled	NFF-27	20	1	12	1.04	1.8194	0.0757	
		1TEHNNK229	NFF-21	125	1	2	1.00	1.8194	0.4549	
								*	1.3581	
10	Main Turbine Master Trip									FE-3FD
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1TEHNNC227	NFF-21	150	1	2	1.00	1.8194	0.5458	
		1TEHNNC228	NFF-16	80	1	2	1.00	1.8194	0.2911	
								*	0.8469	
13	38M0V-VB1 Cond Vac									SE-10AX
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Turbine Building)	1VACANK018	NFF-21	340	1	2	1.00	1.8194	1.2372	
	Allen Bradlay Heater	N-25							0.0550	PEDB
	Total Res.							*	1.3022	

* Total resistance of the circuit path for this load

125V DC Power panel 71DC-A3(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
20	71HO1 4160V SWGR Bus 10100 40 Amp Breaker (ohms) (@Electric Swgr Bay)	1HONANK001	NFF-31	435	1	2	1.00	0.4517 *	0.0040 0.3930 0.3970	SE-8A PEDB
22	71H03 4160V SWGR Bus 10300 40 Amp Breaker (ohms) (@Electric Swgr Bay)	1HONCNK001	NFF-33	445	1	2	1.00	0.2845 *	0.0040 0.2532 0.2572	SE-8P PEDB
23	71L13 600V SWGR Bus 11300 40 Amp Breaker (ohms) (@Reactor Building)	1L1NANK002**	NFF-28	460	1	2	1.00	0.7444 *	0.0040 0.6849 0.6889	SE-9CD PEDB
24	71H07 4160V SWGR Bus 10700 40 Amp Breaker (ohms) (@Electric Swgr Bay)	1HONENK001	NFF-33	473	1	2	1.00	0.2845 *	0.0040 0.2692 0.2732	SE-8Z 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-A4

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
02	93FPAC Emer Diesel Cont. Pnl									FE-14A
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@EDG Building)	1EDGARK001	NFF-21	80	1	2	1	1.819	0.2911	
	93FPAC Force Paralleling Panel Loads Cables:							*	0.3011	
	TBRX1	1EDGARC068	NFF-22	135	1	3	1.04	1.8194	0.5109	
	TBRX2	1EDGCRC068	NFF-22	165	1	3	1.04	1.8194	0.6244	
	TD8M	1EDGARC029	NFF-24	135	1	5	1.04	1.8194	0.5109	
4	Main Gen. Excitation Panel EP									FE-2AF
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Turbine Building)	1EXCNNC004	NFE-05	250	1	2	1.00	1.1424	0.5712	
		1EXCNNC006	NFF-26	595	1	9	1.04	1.8194	2.2517	
		1EXCNNC007	NFF-25	164	1	7	1.04	1.8194	0.6206	
		Unscheduled	SIS-12	10	1	2	1.00	1.8194	0.0364	
								*	3.4900	
08	71H05 4160V SWGR Bus									SE-8AL
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Electric Bay)	1HOEARK001	NFF-33	50	1	2	1.00	0.2845	0.0285	
								*	0.0325	
11	Panel 93ECP-A									FE-14A
	100 Amp Breaker (ohms)								0.0010	PEDB
	(@EDG Building)	1EDGARK024	NFF-28	155	1	2	1.00	0.7182	0.2227	
	93ECP-A Emergency Diesel Generator Engine Control Panel Loads Cables:							*	0.2237	
	K1	1EDGARC016	NFF-25	875	1	7	1.04	1.8194	3.3113	
		1EDGARC024	NFF-21	160	1	2	1.00	1.8194	0.5822	
								*	3.8936	
	FFR	1EDGARC019	NFF-21	145	1	2	1.00	1.8194	0.5276	
	SOV-1A	Unscheduled	SIS-14	40	1	2	1.00	2.8878	0.2310	
	SOV-2A	Unscheduled	SIS-14	25	1	2	1.00	2.8878	0.1444	
	ESS-A	Unscheduled	SIS-14	35	1	2	1.00	2.8878	0.2021	
	93GS-5A Gov Booster Pmp	Unscheduled	SIS-12	15	1	2	1.00	1.8194	0.0546	
	93P-4A Fuel Oil Pmp	Unscheduled	SIS-12	10	1	2	1.00	1.8194	0.0364	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-A4(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
11 (Cont'd	93EGP-A Emergency Diesel Generator A Control Panel Load Cables:									
	93EDG- A Field Flash	1EDGARK044	NFF-30	90	2	1	1.00	0.1788	0.0322	
								*	0.0332	
	93EDG- A Field Flash	Limiting Resistor							2.5000	
	Rectifier Asembly	Silicon Rectifier CR56 (P/N 1N3296)							0.0055	
		1EDGARL008	NFF-34	71	2	1	1.00	0.0886	0.0126	
	Field Flash Resistance								0.4910	1.12-23
								*	3.0423	
	93P/S-A	1EDGARC064	NFF-21	150	1	2	1.00	1.8194	0.5458	
12	Panel 93ECP-C									FE-14C
	100 Amp Breaker (ohms)								0.0010	PEDB
	(@EDG Building)	1EDGCRK028	NFF-28	125	1	2	1.00	0.7182	0.1796	
	93ECP-C Emergency Diesel Generator Engine Control Panel Loads Cables:							*	0.1806	
	K1	1EDGCRC016	NFF-25	875	1	7	1.04	1.8194	3.3113	
		1EDGCRC024	NFF-21	160	1	2	1.00	1.8194	0.5822	
								*	3.8936	
	FFR	1EDGCRC019	NFF-21	120	1	2	1.00	1.8194	0.4367	
	SOV-1C	Unscheduled	SIS-14	40	1	2	1.00	2.8878	0.2310	
	SOV-2C	Unscheduled	SIS-14	25	1	2	1.00	2.8878	0.1444	
	ESS-C	Unscheduled	SIS-14	35	1	2	1.00	2.8878	0.2021	
	93GS-5C Gov Booster Pmp	Unscheduled	SIS-12	15	1	2	1.00	1.8194	0.0546	
	93P-4C Fuel Oil Pmp	Unscheduled	SIS-12	10	1	2	1.00	1.8194	0.0364	
	93EGP-C Emergency Diesel Generator A Control Panel Load Cables:									
	93EDG- C Field Flash	1EDGCRK044	NFF-30	40	2	1	1.00	0.1788	0.0143	
								*	0.0153	
	93EDG- C Field Flash	Limiting Resistor							2.5000	
	Rectifier Asembly	Silicon Rectifier CR56 (P/N 1N3296)							0.0055	
		1EDGCRL008	NFF-34	71	2	1	1.00	0.0886	0.0126	
	Field Flash Resistance								0.4910	
								*	3.0244	
	93P/S-C	1EDGCRC064	NFF-21	130	1	2	1.00	1.8194	0.4730	

* Total resistance of the circuit path for this load

125V DC Power Panel 71DC-A5

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	ECCS Cab. 09-95 Pwr									FE-3TC
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1SCBARC001	NFE-08	90	1	2	1.00	0.7182	0.1293	
								*	0.1393	
02	Feedwater Inverter 06INV-1A									FE-3TC
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Control Room)	1FWCNNC010	NFF-21	240	1	2	1.00	1.8194	0.8733	
								*	0.8833	
05	Ch "A" HPCI Relay Pnl 09-32									FE-3MS
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1HPIAYC133	NFE-05	70	1	2	1.00	1.1424	0.1599	
								*	0.1699	
06	RB CCW Cont Isol Valves									FE-3EX
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Reactor Building)	1RBCARC700**	NFE-55	149	1	2	1.00	1.8857	0.5619	
		1RBCARC706**	NGG-50	368	1	7	1.04	1.8857	1.4434	
		1RBCARC711**	NFE-55	72	1	2	1.00	1.8857	0.2715	
	* 15SOV-130A							*	2.2869	
07	Alternate Rod Insertion Sys.									FE-3EAA
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Reactor Building)	1ARIARC001**	NGG-47	28	1	2	1.00	1.8857	0.1056	
		1ARICNC001**	NGG-49	20	1	5	1.04	1.8857	0.0784	
	Panel 09ARI-2							*	0.1940	
		1ARICNC007**	NGG-49	430	1	5	1.04	1.8857	1.6866	
		1ARICNC008**	NGG-49	100	1	5	1.04	1.8857	0.3922	
	03SOV-201							*	2.0788	
09	27MAP Mon Anal Pnl									FE-3SF
	20 Amp Breaker (ohms)								0.0100	PEDB
	(@Relay Room)	1HPIARC146	NGG-47	90	1	2	1.0000	1.8194	0.3275	
								*	0.3375	
18	71INV-1A Instr. Inv Pnl									SE-3SAC
	40 Amp Breaker (ohms)								0.0040	PEDB
	(@Relay Room)	1PCPARC189	NGG-34	120	1	3(1sp)	1.04	0.7182	0.1793	
								*	0.1833	

* 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-1 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	13MOV-16									SE-10T
	15 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1CICARK004	NFF-21	160	1	2	1.00	1.8857	0.3017	
	Armature (A1)	1CICARK036	NFF-31	250	1	2	1.00	0.4681	0.1170	
	Armature (A2)	1CICARK004	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A2)	1CICARK036	NFF-31	250	1	2	1.00	0.4681	0.1170	
	Series (S1)	1CICARK005	NFF-21	160	1	2	1.00	1.8857	0.3017	
	Series (S1)	1CICARK037	NFF-31	160	1	2	1.00	0.4681	0.0749	
	Series (S2)	1CICARK005	NFF-21	160	1	2	1.00	1.8857	0.3017	
	Series (S2)	1CICARK037	NFF-31	160	1	2	1.00	0.4681	0.0749	
	JB - MOV (Arm.and Series)	Unscheduled	NFF-33	15	2	3	1.04	0.2949	0.0044	
	Heater		K21.3B						0.0072	PEDB
	Total Res.							*	0.3194	
	13MOV-16 Control									SE-10T
	15 Amp Breaker (ohms)								0.0100	PEDB
		1CICARC001	NFF-25	150	1	7	1.04	1.8857	0.5883	
		1CICARC003	NFF-26	485	1	9	1.04	1.8857	1.9023	
		1CICARC004	NFF-24	120	1	5	1.04	1.8857	0.4707	
	Total Res.							*	2.9713	
OB2	13MOV-21									SE-10W
	20 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1CICARK016	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A1)	1CICARK017	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A2)	1CICARK016	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A2)	1CICARK017	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Series (S1)	1CICARK041	NFF-31	110	1	2	1.00	0.4681	0.0515	
	Series (S2)	1CICARK041	NFF-31	110	1	2	1.00	0.4681	0.0515	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-08	10	2	2	1.00	0.7444	0.0074	
	Heater		K178B						0.0089	PEDB
	Total Res.							*	0.4063	

* Total resistance of the circuit path for this load

125V DC 71BMCC-1 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 (Cont'd)	13MOV-21 Control									SE-10W
	20 Amp Breaker (ohms)								0.0100	PEDB
		1CICARC017	NFF-25	120	1	7	1.04	1.8857	0.4707	
		1CICARC019	NFF-25	120	1	7	1.04	1.8857	0.4707	
		1CICARC020	NFF-25	120	1	7	1.04	1.8857	0.4707	
	Total Res.							*	1.4220	
OC1	13MOV-27									SE-10X
	15 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1CICARK028	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A1)	1CICARK047	NFF-28	100	1	2	1.00	0.7444	0.0744	
	Armature (A2)	1CICARK028	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A2)	1CICARK047	NFF-28	100	1	2	1.00	0.7444	0.0744	
	Series (S1)	1CICARK029	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Series (S1)	1CICARK042	NFF-28	100	1	2	1.00	0.7444	0.0744	
	Series (S2)	1CICARK029	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Series (S2)	1CICARK042	NFF-28	100	1	2	1.00	0.7444	0.0744	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-08	10	2	2	1.00	0.7444	0.0074	
	Heater		K260B						0.0050	PEDB
	Total Res.							*	0.2752	
	13MOV-27 Control									SE-10X
	15 Amp Breaker (ohms)								0.0100	PEDB
		1CICARC031	NFF-25	110	1	7	1.04	1.8857	0.4314	
		1CICARC033	NFF-26	187	1	9	1.04	1.8857	0.7335	
		1CICARC174	NFF-26	453	1	9	1.04	1.8857	1.7768	
		1CICARC034	NFF-24	120	1	5	1.04	1.8857	0.4707	
		1CICARC020	NFF-21	650	1	2	1.00	1.8857	2.4514	
	Total Res.							*	5.8738	

* Total resistance of the circuit path for this load

125V DC 71BMCC-1 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	13MOV-30									SE-10Y
	20 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1CICARK019	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A1)	1CICARK020	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A2)	1CICARK019	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Armature (A2)	1CICARK020	NFF-21	135	1	2	1.00	1.8857	0.2546	
	Series (S1)	1CICARK043	NFF-31	110	1	2	1.00	0.4681	0.0515	
	Series (S2)	1CICARK043	NFF-31	110	1	2	1.00	0.4681	0.0515	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-08	10	2	2	1.00	0.7444	0.0074	
	Heater		K14.8B						0.0150	PEDB
	Total Res.							*	0.4123	
	13MOV-30 Control									SE-10Y
	20 Amp Breaker (ohms)								0.0100	PEDB
		1CICARC021	NFF-25	120	1	7	1.04	1.8857	0.4707	
		1CICARC023	NFF-25	212	1	7	1.04	1.8857	0.8315	
		1CICARC171	NFF-25	488	1	7	1.04	1.8857	1.9141	
		1CICARC024	NFF-21	150	1	2	1.00	1.8857	0.5657	
	Total Res.							*	3.7920	

* Total resistance of the circuit path for this load

125V DC 71BMCC-1 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	13P-3 40 Amp Breaker (ohms)									SE-10AD PEDB
									0.0040	
		1CICARK034	NFF-32	115	1	4	1.04	0.4681	0.1120	
								*	0.1160	
	13P-3 Control 40 Amp Breaker (ohms)									SE-10AD PEDB
									0.0040	
		1CICARC040	NFF-25	685	1	7	1.04	1.8857	2.6868	
		1CICARC042	NFF-21	150	1	2	1.00	1.8857	0.5657	
								*	3.2565	
OE2	13P-4 40 Amp Breaker (ohms)									SE-10AE PEDB
									0.0040	
		1CICARK035	NFF-32	120	1	4	1.04	0.4681	0.1168	
								*	0.1208	
	13P-4 Control 40 Amp Breaker (ohms)									SE-10AE PEDB
									0.0040	
		1CICARC045	NFF-25	685	1	7	1.04	1.8857	2.6868	
		1CICARC047	NFF-21	150	1	2	1.00	1.8857	0.5657	
								*	3.2565	

* Total resistance of the circuit path for this load

125V DC 71BMCC-3 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	13MOV-131									SE-10AB
	15 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1CICARK007	NFF-21	140	1	2	1.00	1.8857	0.2640	
	Armature (A1)	1CICARK008	NFF-21	140	1	2	1.00	1.8857	0.2640	
	Armature (A2)	1CICARK007	NFF-21	140	1	2	1.00	1.8857	0.2640	
	Armature (A2)	1CICARK008	NFF-21	140	1	2	1.00	1.8857	0.2640	
	Series (S1)	1CICARK045	NFF-31	125	1	2	1.00	0.4681	0.0585	
	Series (S2)	1CICARK045	NFF-31	125	1	2	1.00	0.4681	0.0585	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-08	10	2	2	1.00	0.7444	0.0074	
	Heater		K178B						0.0089	PEDB
								*	0.4297	
	13MOV-131 Control									SE-10AB
	15 Amp Breaker (ohms)								0.0100	PEDB
		1CICARC005	NFF-25	75	1	7	1.04	1.8857	0.2942	
		1CICARC034	NFF-25	633	1	5	1.04	1.8857	2.4828	
		1CICARC008	NFF-21	140	1	2	1.00	1.8857	0.5280	
	Total Res.							*	3.3150	

* Total resistance of the circuit path for this load

125V DC 71BMCC-3 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	13MOV-132									SE-10AC
	15 Amp Breaker (ohms)								0.0100	PEDB
	Armature (A1)	1CICARK031	NFF-21	110	1	2	1.00	1.8857	0.2074	
	Armature (A1)	1CICARK032	NFF-21	110	1	2	1.00	1.8857	0.2074	
	Armature (A2)	1CICARK031	NFF-21	110	1	2	1.00	1.8857	0.2074	
	Armature (A2)	1CICARK032	NFF-21	110	1	2	1.00	1.8857	0.2074	
	Series (S1)	1CICARK046	NFF-28	120	1	2	1.00	0.7444	0.0893	
	Series (S2)	1CICARK046	NFF-28	120	1	2	1.00	0.7444	0.0893	
	JB - MOV (Arm.and Series)	Unscheduled	NFE-05	10	2	2	1.00	1.1840	0.0118	
	Heater		K178B						0.0089	PEDB
	Total Resistance							*	0.4524	
	13MOV-132 Control									SE-10AC
	15 Amp Breaker (ohms)								0.0100	PEDB
		1CICARC036	NFF-25	100	1	7	1.04	1.8857	0.3922	
		1CICARC038	NFF-25	179	1	5	1.04	1.8857	0.7021	
		1CICARC175	NFF-25	553	1	5	1.04	1.8857	2.1690	
		1CICARC039	NFF-21	150	1	2	1.00	1.8857	0.5657	
	Total Res.							*	3.8390	

* Total resistance of the circuit path for this load

125V DC Power Panel 71HO1

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 71-10102	4160V Transf 71T-4X	1HONANC002	NFF-27	440	1	12	1.04	1.8194	1.6651	SE-8A
	(Trip)	1HONANC003	NFF-24	115	1	5	1.04	1.8194	0.4352	
	Jumper cable from RU-4 to RU-2	Unscheduled	NFF-27	15	1	12	1.04	1.8194	0.0568	
		Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	2.2553	
4kV Bkr 71-10110	React Recirc Pmp 02-2P-1A	1RWRANC082	NFE-62	530	1	3	1.04	1.8194	2.0057	SE-8C
	(Trip)	1RWRANC703	NGG-48	215	1	3	1.04	1.8194	0.8136	
	(For LOCA)	Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	2.8829	
	React Recirc Pmp 02-2P-1A	Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	
	(Trip)	Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
	(For SBO)							*	0.0635	
4kV Bkr 71-10112	Res Supply from 71T-2X	1HONANC012	NFF-27	435	1	12	1.04	1.8194	1.6462	SE-8B
	(Trip)	1HONANC013	NFF-24	115	1	5	1.04	1.8194	0.4352	
		Unscheduled	SIS-12	10	2	2	1.00	1.8194	0.0364	
		1HONANC037	NFF-21	75	1	2	1.00	1.8194	0.2729	
		1HONANC018	NFF-21	55	1	2	1.00	1.8194	0.2001	
		Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	2.654	
Ckt # 1HONA03	4KV Bus 10100 UV	1HONANC006	NFF-24	460	1	5	1.04	1.8194	1.7408	SE-8A
		Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	1.804	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H03

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 71-10302	4160V Transf 71T-4Y	1HONCNC002	NFF-27	440	1	12	1.04	1.8194	1.6651	SE-8G
	(Trip)	1HONCNC003	NFF-24	93	1	5	1.04	1.8194	0.3519	
	Jumper cable from RU-4 to RU-2	Unscheduled	NFF-27	15	1	12	1.04	1.8194	0.0568	
		Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.058	
								*	2.1402	
4kV Bkr 71-10304	4160V Bus 10500 (Trip)	1HONCNC013	NFF-24	275	1	5	1.04	1.8194	1.0407	SE-8AD
	(Trip)	Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	14	2	1	1.00	2.8878	0.0809	
								*	1.1331	
	4160V Bus 10500	1HONCNC012	NFF-27	450	1	12	1.04	1.8194	1.7030	
	(Close)	1HONCNC013	NFF-24	275	1	5	1.04	1.8194	1.0407	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	20	1	1	1.00	2.8878	0.0578	
		Unscheduled	SIS-14	13	2	1	1.00	2.8878	0.0751	
								*	2.8880	
	71-10304 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 71-10310	Cond Pmp 33P-8A	Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	SE-8L
	(Trip)	Unscheduled	SIS-14	15	2	1	1.00	2.8878	0.0866	
								*	0.1010	
	86U-1CNDA02 UV Aux Rly	1CNDANC002	NFF-27	440	1	12	1.04	1.8194	1.6651	
		Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	1.7373	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H03 (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 Brk 71-10312	4160V Transf 71T-3Y (Alt) (Trip)	1HONCNC023	NFF-24	440	1	5	1.04	1.8194	1.6651	SE-8H
		1HONCNC037	NFF-21	75	1	2	1.00	1.8194	0.2729	
		Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	2.0448	
	4160V Transf 71T-4Y (Close)	1HONCNC022	NFF-27	440	1	12	1.04	1.8194	1.6651	
		1HONCNC039	NFF-24	160	1	5	1.04	1.8194	0.6055	
		1HONCNC038	NFF-21	550	1	2	1.00	1.8194	2.0014	
		Unscheduled	SIS-8	33	1	1	1.00	0.7182	0.0237	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	4.3246	
	71-10302 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	0.029	
								*	0.0432	
4kV Bkr 71-10320	SWP 46P-1A (Trip)	Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	SE-8M
		Unscheduled	SIS-14	15	2	1	1.00	2.8878	0.0866	
								*	0.0981	
	86U-1SWSA01 UV Aux Rly	1SWSANC002	NFF-27	435	1	12	1.04	1.8194	1.6462	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	1.7155	
4kV Bkr 71-10330	Circ Water Pmp 36P-1A (Trip)	Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	SE-8J
		Unscheduled	SIS-14	18	2	1	1.00	2.8878	0.1040	
								*	0.1126	
4kV Bkr 71-10340	Aux Feed to 600V Buses (Trip)	Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	SE-8P
		Unscheduled	SIS-14	10	2	1	1.00	2.8878	0.0578	
								*	0.0635	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H03 (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 71-10350	Cond Booster Pmp 33P-9A	Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	SE-8K
	(Trip)	Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	0.1096	
	86U-1CNDA01 UV Aux Rly	1CNDANC012	NFF-27	450	1	12	1.04	1.8194	1.7030	
		Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	1.8126	
4kV Bkr 71-10360	Clsd Loop Clg Wtr Pmp 37P-2	Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	SE-8N
	(Trip)	Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0490	
	86U-1TBCA01 UV Aux Rly	1TBCANC002	NFF-27	450	1	12	1.04	1.8194	1.7030	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	1.8155	
Ckt # 1HONA03	4KV Bus 10300 UV	1HONCNC008	NFF-24	469	1	5	1.04	1.8194	1.7749	SE-8P
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	12	2	1	1.00	2.8878	0.0693	
								*	1.856	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H05

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 71-10502	Ctrl Supply 93EDG-A Close	1EDGARC011	NFF-27	655	1	12	1.04	1.8194	2.4788	SE-8AH
		1EDGARC164	NFE-63	145	1	5	1.04	1.8194	0.5487	
		Unscheduled	SIS-8	16	2	1	1.00	0.7182	0.0230	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	3.1140	
	71-10502 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	
	K10-1EDGA001 EDG A Failure Trip Relay	1EDGARC012	NFF-27	69	1	12	1.04	1.8194	0.2611	
		1EDGARC030	NFF-24	140	1	5	1.04	1.8194	0.5298	
		Unscheduled	SIS-8	16	2	1	1.00	0.7182	0.0230	
		Unscheduled	SIS-14	8	2	1	1.00	2.8878	0.0462	
								*	0.8601	
	Ctrl Supply 93EDG-A Trip	1EDGARC012	NFF-27	69	1	12	1.04	1.8194	0.2611	
		1EDGARC030	NFF-24	140	1	5	1.04	1.8194	0.5298	
		1EDGARC164	NFE-63	145	1	5	1.04	1.8194	0.5487	
		Unscheduled	SIS-8	16	2	1	1.00	0.7182	0.0230	
		Unscheduled	SIS-14	8	2	1	1.00	2.8878	0.0462	
								*	1.4089	
4kV Bkr 71-10510	RHR SWP 10P-1C Close	1RHRCRC002	NFF-26	625	1	9	1.04	1.8194	2.3652	SE-8AW
		Unscheduled	SIS-8	22	2	1	1.00	0.7182	0.0316	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	2.4604	
	71-10510 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 10SOV-101C	1RHRCRC247	NFF-91	230	1	9	1.04	1.8194	0.8704	
		Unscheduled	SIS-8	22	2	1	1.00	0.7182	0.0316	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	0.9655	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H05 (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 71-10512	Ctrl Supply 93EDG-C Close	1EDGCRC011	NFF-27	655	1	12	1.04	1.8194	2.4788	SE-8AJ
		1EDGCRC166	NFE-63	120	1	5	1.04	1.8194	0.4541	
		Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	3.0137	
	71-10512 Brk Charging Motor	Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0461	
	K10-1EDGC001 EDG C Failure Trip Relay	1EDGCRC012	NFF-27	50	1	12	1.04	1.8194	0.1892	
		1EDGCRC030	NFF-24	120	1	5	1.04	1.8194	0.4541	
		Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.6895	
	Ctrl Supply 93EDG-C Trip	1EDGCRC012	NFF-27	50	1	12	1.04	1.8194	0.1892	
		1EDGCRC030	NFF-24	120	1	5	1.04	1.8194	0.4541	
		1EDGCRC166	NFE-63	120	1	5	1.04	1.8194	0.4541	
		Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	1.1436	
4kV Bkr 71-10514	Tie to Bus 10300 Trip	Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	SE-8AG
		Unscheduled	SIS-14	8	2	1	1.00	2.8878	0.0462	
								*	0.0606	
	Tie to Bus 10300 Close	1HOEARC002	NFF-27	680	1	12	1.04	1.8194	2.5734	
		1HOEARC003	NFF-21	280	1	2	1.00	1.8194	1.0189	
		Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	3.6355	
	71-10512 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 71H05 (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 71-10520	RHR SWP 10P-1A Close	1RHRARC002	NFF-26	640	1	9	1.04	1.8194	2.4220	SE-8AN
		Unscheduled	SIS-8	20	2	1	1.00	0.7182	0.0287	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	2.5143	
	71-10520 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 SOV-10SOV-101A	1RHRARC247	NFF-91	230	1	3	1.04	1.8194	0.8704	
		Unscheduled	SIS-8	20	2	1	1.00	0.7182	0.0287	
		Unscheduled	SIS-14	11	2	1	1.00	2.8878	0.0635	
								*	0.9627	
4kV Bkr 71-10530	Core Spray Pmp Close	1CSPARC002	NFF-27	715	1	12	1.04	1.8194	2.7058	SE-8AM
		1CSPARC004	NFF-21	56	1	2	1.00	1.8194	0.2038	
		Unscheduled	SIS-8	18	2	1	1.00	0.7182	0.0259	
		Unscheduled	SIS-14	13	2	1	1.00	2.8878	0.0751	
								*	3.0106	
	71-10530 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 71-10540	RHR Pmp 10P-3B Close	1RHRCRC012	NFF-27	675	1	12	1.04	1.8194	2.5545	SE-8BA
		1RHRCRC014	NFF-24	150	1	5	1.04	1.8194	0.5677	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	15	2	1	1.00	2.8878	0.0866	
								*	3.2203	
	71-10540 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 71H05 (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 71-10550	RHR Pmp 10P-3A Close	1RHRARC012	NFF-27	660	1	12	1.04	1.8194	2.4977	SE-8AY
		1RHRARC014	NFF-24	150	1	5	1.04	1.8194	0.5677	
		Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	
		Unscheduled	SIS-14	17	2	1	1.00	2.8878	0.0982	
								*	3.1722	
	71-10550 Brk Charging Motor	Unscheduled	SIS-8	6	2	1	1.00	0.7182	0.0086	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.0375	
	RHR Pmp 10P-3A 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	
4kV Bkr 71-10504	K8-1EDGA002 EDG-A&C	1EDGARC039	NFF-26	70	1	9	1.04	1.8194	0.2649	SE-8AK
	Tie Brk Closing Rel	Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.3139	
	93EDG Tie A & C Close	1EDGARC036	NFF-26	600	1	9	1.04	1.8194	2.2706	
		1EDGARC037	NFF-24	140	1	5	1.04	1.8194	0.5298	
		1EDGARC038	NFF-24	126	1	5	1.04	1.8194	0.4768	
		1EDGARC039	NFF-26	70	1	9	1.04	1.8194	0.2649	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	3.5912	
	71-10504 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	
	62 & 62X-1EDGA02 EDG-A&C	Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
	Output Brk Closing	Unscheduled	SIS-14	19	2	1	1.00	2.8878	0.1097	
	Interlock Relays							*	0.1298	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H05 (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 71-10504 (cont'd)	K9-1EDGA02 EDG A & C Tie Brk Trip Relay	1EDGARC037	NFF-24	140	1	5	1.04	1.8194	0.5298	SE-8AK
		1EDGARC039	NFF-26	70	1	9	1.04	1.8194	0.2649	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	5	2	1	1.00	2.8878	0.0289	
								*	0.8437	
	93EDG Tie A & C Trip	1EDGARC039	NFF-26	70	1	9	1.04	1.8194	0.2649	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	17	2	1	1.00	2.8878	0.0982	
								*	0.3832	
Ckt # 1HOEA03	Emergency Bus 10500 Undervoltage, Load Shedding and Sequencing	1EDGARC175	NGG-50	70	1	7	1.04	1.8194	0.2649	SE-8AK
		1HOEARC014	NFF-21	691	1	2	1.00	1.8194	2.5144	
		1HOEARC014	NFF-21	160	1	2	1.00	1.8194	0.5822	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	20	1	1	1.00	2.8878	0.0578	
		Unscheduled	SIS-14	6	2	1	1.00	2.8878	0.0347	
								*	3.3616	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H07

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 71-10702	4160V Transf 71T-4Y	1HONENC002	NFF-27	480	1	12	1.04	1.8194	1.8165	SE-8Y
	(Trip)	1HONENC003	NFF-24	105	1	5	1.04	1.8194	0.3974	
	Jumper cable from RU-4 to RU-2	Unscheduled	NFF-27	15	1	12	1.04	1.8194	0.0568	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	12	2	1	1.00	2.8878	0.069	
								*	2.3514	
4kV Bkr 71-10710	Cond PP 33P-8C (52TC)	Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	SE-8AA
	(Trip)	Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	0.1096	
	86U-1CNDC02 UV Aux Rly	1CNDCNC002	NFF-27	455	1	12	1.04	1.8194	1.7219	
		Unscheduled	SIS-8	18	2	1	1.00	0.7182	0.0259	
		Unscheduled	SIS-14	25	2	1	1.00	2.8878	0.1444	
								*	1.8921	
4kV Bkr 71-10720	SWP 46P-1C (52TC)	Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	SE-8AC
	(Trip)	Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	0.1096	
	86U-1SWSC01 UV Aux Rly	1SWSCNC002	NFF-27	451	1	12	1.04	1.8194	1.7068	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	1.8107	
4kV Bkr 71-10730	CWP 36P-1C (52TC)	Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	SE-8Z
	(Trip)	Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	0.1039	
4kV Bkr 71-10740	CBP 33P-9C (52TC)	Unscheduled	SIS-8	10	2	1	1.00	0.7182	0.0144	SE-8AB
	(Trip)	Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	0.1068	
	86U-1CNDC01 UV Aux Rly	1CNDCNC012	NFF-27	455	1	12	1.04	1.8194	1.7219	
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	1.8258	

* Total resistance of the circuit path for this load

125V DC Power Panel 71H07(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 71-10750	Clsd Loop Clg Water PP (Trip)	Unscheduled	SIS-8	12	2	1	1.00	0.7182	0.0172	SE-8AF
		Unscheduled	SIS-14	16	2	1	1.00	2.8878	0.0924	
								*	0.1096	
	86U-1TBCC01 UV Aux Rly	1TBCCNC002	NFF-27	460	1	12	1.04	1.8194	1.7408	
		Unscheduled	SIS-8	14	2	1	1.00	0.7182	0.0201	
		Unscheduled	SIS-14	20	2	1	1.00	2.8878	0.1155	
								*	1.8764	
Ckt # 1HONE02	4KV Bus 10700 UV	1HONENC002	NFF-27	480	1	12	1.04	1.8194	1.8165	SE-8Y
		Unscheduled	SIS-8	8	2	1	1.00	0.7182	0.0115	
		Unscheduled	SIS-14	12	2	1	1.00	2.8878	0.0693	
								*	1.897	

* Total resistance of the circuit path for this load

125V DC Power Panel 71L13

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 71-11316 (@Reactor Building)	RB Clg PP 15P-2A Relay 52X Energize	1RBCANC101	NFF-26	410	1	9	1.04	1.8857	1.6081	SE-9B
		1RBCANC104	NFF-21	107	1	2	1.00	1.8194	0.3894	SE-9B
		Unscheduled	SIS-8	5	2	1	1.00	0.7444	0.0074	1.42-164
		Unscheduled	SIS-14	12	2	1	1.00	1.8857	0.0453	1.42-164
								*	2.0502	
	Bkr 71-11316 Closing Coil 52CC	Unscheduled	SIS-8	5	2	1	1.00	0.744414	0.0074	1.42-164
		Unscheduled	SIS-14	12	2	1	1.00	1.8857	0.0453	
								*	0.0527	
	RB Clg PP 15P-2A Close							*	0.0514	

* Total resistance of the circuit path for this load

125V DC Power Panel 71L25

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 71-12510 (@Electric Bay)	ESW Pmp 46P-2A	1ESWARC102	NFF-24	410	1	5	1.04	1.8194	1.5516	SE-9AB
	Relay 52X Energize	1ESWARC131	NFF-24	110	1	5	1.04	1.8194	0.4163	FE-3AC
		Unscheduled	SIS-8	4	2	1	1.00	0.7182	0.0057	1.42-6
		Unscheduled	SIS-14	4	2	1	1.00	2.8878	0.0231	1.42-6
								*	1.9967	
	Bkr 71-12510 Closing	Unscheduled	SIS-8	4	2	1	1.00	0.718249	0.0057	1.42-6
	Coil 52CC	Unscheduled	SIS-14	4	2	1	1.00	2.8878	0.0231	
								*	0.0288	
	ESW Pmp 46P-2A Close							*	0.0284	

* Total resistance of the circuit path for this load

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

General Notes

1) 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 Drywell High Pressure and Reactor Low Level Circuits thru relay starting time is equal to 0.1 sec.
For SBO: 0 Sec loads for is all continuous control loads being 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 (32-1UPRN05). If the reverse power relay didn't pickup, the anti motoring circuit would pickup due to the turbine trip. In either case, this would cause the 345KV breakers to trip. The fuse 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. Also, it would be anticipated that a generator reverse power would occur. This circuit 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, 71-10102, and 71-10302 to trip. Again since it is unknown when this will occur except that it will occur within the first minute, these trips will start at 0.1 second and continue for 1 minute.

2) 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 A will be placed in OFF commencing within 30 minutes of the station blackout per AOP-49 "Station Blackout". It is assumed that this action will be completed within 60 minutes of SBO. Panel 71LPERDC1 will be ON for the 4 hour of SBO event.

3) The SRV's do not operate during the operation of HPCI with a low reactor water level. They are used in conjunction with LPCI or Core Spray as a backup to HPCI. The system is automatic for small breaks with LPCI and Core Spray systems. (FSAR Sections 4.4.4. 6.4.2, 6.5.2.3, 7.4.3.3.1, 7.3.3.3).

4) 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.

5) All 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

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

7) 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).

8) All 600V breakers except as noted do not require operation during LOCA and SBO. For constant load requirements see panel 71BCB-2A

9) The load for various panels and relay logics is obtained from the referenced drawings by adding all component loads.

10) Continuous Control data was obtained from associated ESK's and vendor manuals.

11) 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, 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.

PANEL 71BCB-2A

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	71LPERDC1	Emerg Lighting Panel	0.1st sec	7.2nd sec	0.1st sec	240 min	N/A	17.98	120	2157	Resistance	II/III	FE-1AH	1
A03	71LPERDC2	Emerg Lighting Panel	0.1st sec	7.2nd sec	0.1st sec	60 min	N/A	10.16	120	1220	Resistance	II/III	FE-1AH	2
A04	71DC-A4	Emer Diesel Gen Dist Cabinet	(See details on Sheet Panel A4)									I	FE-1AH	
A05	71LPEADC1	Emerg Lighting Panel	0.1st sec	7.2nd sec	0.1st sec	60 min	N/A	19.72	120	2366	Resistance	II/III	FE-1AH	3
A06	71BMCC-3	RB Motor Control Center	(See details on Sheet BMCC-3)										FE-1AJ	
A07	71LPESWDC1	Emerg Lighting Panel	0.1st sec	7.2nd sec	0.1st sec	60 min	N/A	7.46	120	895	Resistance	II/III	FE-1AH	4
B02	71DC-A1	Relay Room Dist Cabinet	(See details on Sheet Panel A1)										FE-1AK	
B03	71DC-A2	Relay Room Dist Cabinet	(See details on Sheet Panel A2)										FE-1AL	
B04	71DC-A3	Relay Room Dist Cabinet	(See details on Sheet Panel A3)										FE-1AN	
B05	71BMCC-1	RB Motor Control Center	(See details on Sheet BMCC-1)										FE-1AJ	
B06	71LPE1	Emerg Lighting Panel	0.1st sec	7.2nd sec	0.1st sec	60 min	N/A	11.78	120	1414	Resistance	II/III	FE-1AH	5
C01	71DC-A5	Relay Room Dist Cabinet	(See details on Sheet Panel A5)											
C03	71UPS-1	Uninterruptible MMG Dist Pnl	0.1st sec	120 min	0.1st sec	90 min	155.00	80.00	129	10320	VA	II/III	1.15-10	6
D01	31P-7A(M)	RFPT Emerg Oil Pump Mtr	15th sec	120 min	17th sec	60 min	146	59.38	125	7423	VA	II/III	ESK-11B	7
		RFPT Emerg Oil Control	15th sec	120 min	17th sec	60 min	N/A	1.33	120	160	Resistance			
		Continuous control	0 sec	15th sec	60 min	240 min	N/A	0.26	125					
D02	94P-13(M)	Gen Emerg Seal Oil Pump	0.1st sec	120 min	0.1st sec	60 min	179	72.15	120	8658	VA	II/III	ESK-11A	8
		Gen Emerg Seal Oil Pmp Cntl	0.1st sec	120 min	0.1st sec	60 min	N/A	1.44	120	172	Resistance			
		Continuous control	0 sec	0.1st sec	60 min	240 min	N/A	0.19	125					
N/A	Continuous	Continuous control	0 sec	120 min	0 sec	240 min	N/A	40.00	132	5280	Resistance	N/A		

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

PANEL 71BCB-2A (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Loading data for this panel was obtained from WR-02-00137-00.
The total load is 128.40 VDC x 16.80 Amps / 120VDC = 17.98 Amps total.
2) Loading data for this panel was obtained from WR-02-00138-00.
The total load is 123.20 VDC x 9.90 Amps / 120VDC = 10.16 Amps total.
3) Loading data for this panel was obtained from WR-02-00133-00.
The total load is 119.5 VDC x 19.80 Amps / 120VDC = 19.72 Amps total.
4) Loading data for this panel was obtained from WR-02-00132-00. All lights were verified to be on.
The total load is 129.7 VDC x 6.9 Amps / 120VDC = 7.46 Amps total.
5) Loading data for this panel was obtained from WR-02-00132-00. All lights were verified to be on.
The total load is 129.7 VDC x 10.90 Amps / 120VDC = 11.78 Amps total.
6) See Design Input 2.5 and JAF-ICD-ELEC-04224 for basis of full load and inrush duration (4 seconds) current for this UPS M-G Set motor.
Upon loss of AC power, the M-G set will transfer to DC power while the fly wheel attempts to keep the M-G set near rated speed.
Operators are required to disconnect this load from the DC power supply after 1 hour into SBO per AOP-49 "Station Blackout".
Therefore, for SBO it is assumed that this action will be completed within 90 minutes. In the case of LOCA/LOBC no assumption is credited.
It is assumed that the UPS operates on the battery for the 2 hour of LOCA event.
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 assumed to be 250% of FLA . This is consistent with NEMA ICS-2. Appendix 14 provides technical justification inrush duration (2 seconds) and for demonstrating that 250% of FLA is appropriate.
Pump No. 31P-7A Timing Sequence Justification: The pump starts on low lube oil pressure (31PS-6A 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.
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 A will be placed in OFF commencing within 30 minutes of the station blackout per AOP-49 "Station Blackout".
It is assumed that this action will be completed within 60 minutes of SBO. In the case of LOCA/LOBC this load is considered energized for the entire duration of LOCA
8) 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 assumed to be 250% of FLA . This is consistent with NEMA ICS-2. Appendix 14 provides technical justification inrush duration (4 seconds) and for demonstrating that 250% of FLA is appropriate.
Pump No. 94P-13 Timing Sequence Justification: The pump starts on low seal oil pressure (94PS-63P7 closes on seal oil pressure decreasing at 95 psig).
Normally the AC powered Seal Oil pump maintains the pressure. Loss of AC power to the AC Seal Oil 94P-11 will cause seal oil pressure to rapidly drop below the setpoint of 95 PSIG for starting ESOP. Therefore, this pump is conservatively assumed to start immediately. Circuit breakers at Battery Control Board A will be placed in OFF commencing within 30 minutes of the station blackout per AOP-49 "Station Blackout"SBO. It is assumed that this action will be completed within 60 minutes of SBO.
In the case of LOCA/LOBC this load is considered energized for the entire duration of LOCA

PANEL 71DC-A1

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
02	1UPRN07	Unit & NSS Transf BU Prot	0.1 sec	1 min	0.1 sec	1 min	N/A	10.77	125	1346	Resistance	II/III	ESK-8CA	1
03	71T-2	RSS Transf Differential Prot.	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8CE	2
04	71T-3	RSS Transf Differential Prot.	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8CF	2
05	71DTR	Digital Transient Recorder	0 sec	120 min	0 sec	240 min	6	1.00	125	125	VA	II/III	ESK-8KA	3
06	71RL-5	115kV Line 4 Sta UV Trip Bus A	3rd sec	3.1st sec	3rd sec	3.1st sec	N/A	5.50	120	N/A	Resistance	II/III	ESK-8FM	4
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.10	125		Resistance			
07	BRK-10022	115kV Bkr Trip Coil # 2 Cntrl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FP	2
08	BRK-10012	115kV Bkr Trip Coil # 2 Cntrl	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FG	2
09	71EDSC-10015	71T-3 High Side Disc Cntrl Pwr	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FL	2
10	FITZ #3	115kV Prot Relaying	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8FA	2
11	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-8FE	2
12	71PCB-10052	345kV Bkr Alt. 1 Failure	0.1 sec	1 min	0.1 sec	1 min	N/A	0.03	125	N/A	Resistance	II/III	ESK-8EM	5
13	71MOD-10041	345kV Bkr Disconnect	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8EG	2
14	71PCB-10042	345kV Bkr Cont/Trip Coil	0.1st sec	0.2nd sec	0.1st sec	0.2nd sec	15	N/A	125	N/A	Resistance	II/III	ESK-8EC	6
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.03	125		Resistance			
16	FITZ-EDIC #1	Transfer Trip Transmit Line	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8ES	2
17	FITZ-EDIC #1	Transfer Trip Receive Line	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8ER	2
18	71MOD-10043	345kV Bkr Disconnect	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8EG	2
19	71PCB-10042	345kV Bkr Alt. 1 Failure	0.1 sec	1 min	0.1 sec	1 min	N/A	0.03	125	N/A	Resistance	II/III	ESK-8EE	5
20	FITZ-EDIC #1	Alt I Prot Relaying	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8EJ	2
21	71PCB-10052	345kV Bkr Cont/Trip Coil	0.1st sec	0.2nd sec	0.1st sec	0.2nd sec	15	N/A	125	N/A	Resistance	II/III	ESK-8EK	6
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.03	125		Resistance			
24	PNL 71RH-10	345kV Alt 2 Prot Relaying	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8EY	2

NOTES: (Timing Sequence and Individual Load Current Justifications) cont'd on page 5

PANEL 71DC-A1 (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) It would be anticipated that a generator reverse power would occur (circuit32-1UPRN05), which would cause the 345KV breakers to trip. This circuit includes 12GGP relay (0.13 ohm seal-in), 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 11.61 ohms (10.76 Amps 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 0.1 seconds and continue for 1 minute.
2) 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-2A
3) The load current for the 71DTR panel was obtained from Manufacturer's Data (see Appendix 8). The intended function of this device is to indicate/record electrical transients, The load is 125W/125VDC = 1 Amp. On start-up the system may experience surges of 5 or 6 Amps.
4) After 3 seconds of sutained undervoltage on the 115 KV bus, an HEA relay is energized to trip selected loads.
5) Relay 62Z2-1YL1N14 (See ESK-8EM) or 62Z2-1YL2N11 (See ESK-8EE) energized for 2 cycles only. 345 kV breaker 71-10042 or 71-10052 will be de-energized before relay pick up. 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 0.1 seconds and continue for 1 minute.
   Relay type is NAA special with coil resistance of 3650 ohms. The total load is 125 V DC / 3650 ohm = 0.03 Amps
6) The primary protection on this breaker will trip the breaker in the first second of the event.

PANEL 71DC-A2

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	03SOV-140A	RPS Trip "A" B.U. SCRAM	0.1st sec	120 min	0.1st sec	240 min	N/A	0.22	125	27.7	Resistance	I	1.67-91	
2	PANEL 09-41	Main Steam Isol VV's Plt Sol's	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	1.70-101	1
3	PANEL 09-46	Core Spray Channel A Logic	0 sec	120 min	N/A	N/A	N/A	1.27	125	159	Resistance	I	1.64-29	3, 4
		Continuous control	N/A	N/A	N/A	N/A	N/A	0.03	125		Resistance			
4	PANEL 09-32	RHR Channel A Logic	0 sec	120 min	N/A	N/A	N/A	3.20	125	400	Resistance	I	1.65-121	3, 4
		Continuous control	N/A	N/A	N/A	N/A	N/A	0.13	125		Resistance			
5	PANEL 09-03	Valve Pos Indicators	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	I	1.65-121	5
6	PANEL 09-13	Incore Probe Sys Shear Valves	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	I	1.66-30	5
7	LOTC3	600V SWGR Test Cab	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III		5
8	AR-2 (31FPD-5A)	RFPT Turb 31F Trip & Reset	0.1st sec	120 min	0.1st sec	240 min	N/A	0.97	125	N/A	Resistance	II/III	ESK-9AA	2, 6
		Continuous control	0 sec	0.1st sec	0 sec	0.1st sec	N/A	0.17	125		Resistance			
9	PANEL 09-30	Relay Cabinet CH A RCIC Panel	0 sec	120 min	0 sec	240 min	N/A	1.47	125	N/A	Resistance	I	1.61-154	2
		Power Supply 13TU-3-12	0 sec	120 min	0 sec	240 min	N/A	1.15	125	144.265	VA	I	1.61-154	7
		Continuous control	N/A	N/A	N/A	N/A	N/A	1.18	125		Resistance			
10	PANEL 09-04	RCIC & HPCI Misc. Loads	0 sec	120 min	0 sec	240 min	N/A	1.04	125	130	VA	M	1.61-154	2
		13INV-152 Invertor	0 sec	120 min	0 sec	240 min	N/A	1.51	125	188.6	VA	M	1.61-154	8
		13SOV-12	0.1st sec	120 min	0.1st sec	240 min	N/A	0.14	125	17.4	Resistance	I/M	ESK-11AAN	9
		Continuous control	N/A	N/A	N/A	N/A	N/A	0.29	131.1		Resistance			
11	02-184P-3A(M)	RWR MG Set A Emerg.Oil Pmp	6th sec	120 min	6th sec	60 min	37.8	8.02	125	1003	VA	II/III	ESK-11CA	10
		RWR MG Set A Emerg.Oil Pmp Cnt	6th sec	120 min	6th sec	60 min	2.1	0.42	125	53	Resistance	II/III		
		Continuous control	0 sec	6th sec	0 sec	240 min	N/A	0.08	132		Resistance			
12	09-06 (31FPD-5A)	RFPT Test & Low Vac Reset	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-9AB	5
13	AR-2 (31FPD-5A)	RFPT Motor Speed Changer	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	VA	II/III	ESK-9AE	5
14	PANEL 09-21	13INV-801A Steam Leak Det	0 sec	120 min	0 sec	240 min	N/A	1.0	125	129.4	VA	I	1.85-12	2,11
		Continuous control	N/A	N/A	N/A	N/A	N/A	1.0	125	129.4	VA			
15	CAB FPS300 (FPR	Fire Prot Control Ckts	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	M	ESK-11DK	5
16	09-30 (13TS-1)	RCIC Valve Trip Sol	0.1st sec	120 min	30 min.	240 min	N/A	0.14	125	18	Resistance	M	1.61-155	12
17	02-184-1B(BKR)	Reac Recir M/G Set B Alt Trip	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	1.62-150	5

NOTES: (Timing Sequence and Individual Load Current Justifications) cont'd on page 8

PANEL 71DC-A2 (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
18	02-184-1A(BKR)	Reac Recir M/G Set A Trip	17th sec	18th sec	17th sec	18th sec	2.02	N/A	125	N/A	Resistance	II/III	1.62-150	13
19	71L25	600V SWGR Emer Bus 12500	(See details on Sheet Panel L25)									I		
20	71L15	600V SWGR Emer Bus 11500	(See details on Sheet Panel L15)											
21	76DS-3	Fire Prot CO2 Sys	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	M	ESK-10BX	5
22	09-45 (SRV'S)	ADS Logic	0.1st sec	120 min	N/A	N/A	N/A	0.91	125	114	Resistance	I	1.83-38	14
		6 ADS SOV Load	2nd min	60 min.	N/A	N/A	N/A	6.89	125	861	Resistance	I	1.83-37	15
		02SOV-71E1	2nd min	60 min.	N/A	N/A	N/A	1.14	125	143	Resistance	I	1.83-39	15
		02SOV-71K1	N/A	N/A	3rd sec	240 min	N/A	1.14	125	143	Resistance	I	1.83-39	16
		02SOV-71L1	N/A	N/A	3rd sec	240 min	N/A	1.14	125	143	Resistance	I	1.83-39	16
		Continuous control	0 sec	2nd min	0 sec	240 min	N/A	2.33	125	291	Resistance			
			60 min.	120 min	N/A	N/A								
23	RH-1 (EDIC #1)	345kV Transfer Trip Xmtr	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8ES	5
24	71T-1A	Main Xfmr 1A Ann Ckt	0 sec	120 min	0 sec	240 min	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8CA	5

NOTES: (Timing Sequence and Individual Load Current Justifications) cont'd on page 8

PANEL 71DC-A2 (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) 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.

2) This load is considered energized for the entire duration of LOCA and/or SBO

3) This load is considered energized for the entire duration of LOCA

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

5) 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-2A

6) This circuit includes 74-1RFPA05 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.

7) Loading and Continuous Control data for the 13TU-3-12 Lambda Model JWS-150-48/A was obtained from WR-01-12104-00. Loading data was increased by 10%

8) Loading and Continuous Control data for the 13INV-152 Topaz Model 125-GW-125-60-115 was obtained from WR-01-11000-00. Loading data was increased by 10%

9) The solenoid is rated 17.4 watts (Ref. PEDB) and is expected to operate as a random load for LOCA and SBO Events. This load is considered energized for the entire duration of LOCA and SBO.

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 500% of FLA with duration of 1 sec.
Appendix 14 validates that 500% is conservative.
Pump No.02-184P-3A timing Sequence Justification: The pump starts on low pressure after a six second time delay. This pump is a not a shaft oil driven pump (M-G set). See ESK-11CA and GE instruction Manual GEK-16631 pgs. 2-23.
Procedure No. AOP-49 "Station Blackout" requires commencing to shed this load at 30 minutes after SBO initiation. It is assumed that it will completed within 60 minutes.

11) Loading and Continuous Control data for the 13INV-801A Topaz Model 125-GW-125-60 was obtained from WR-02-00416- 00. Data was increased by 10%

12) The solenoid is rated 18 watts and is expected to operate as a random load for LOCA and SBO Events. This load is considered energized for the entire duration of LOCA and 30 min thru 240 min duration for the SBO. This conservatively is considered a random load. It is assumed to occur after 30 minutes because RCIC will be manually controlled per AOP-49 and Operations will not manually trip RCIC within 30 minutes. This load is conservatively assumed for the remaining duration.

13) 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.

14) Some of the ADS logic relays energize at the start of LOCA. Others energize after either on ECCS pum 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.

15) 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.

16) Based on PTE-96-002 (turbine trip w/momentary loss of all AC) 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. These two have the lowest electric lift setpoint at the 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)).

PANEL 71DC-A3

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	PNL 09ECCS1-EP	SRV Electric Lift Cabinet	0.1st sec	120 min	N/A	N/A	N/A	1.24	125	155	VA	I	ESK-11AAQ	1
			N/A	N/A	0 sec	240 min	N/A	1.91	125	239	VA			2
2	PNL 09AR-4A	Vibration Detection Alarm	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-11V	3
3	38SOV-113	Cond Isol Valve	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-11AA	3
5	94HSC	H2 Stator Cooling Panel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	1.11-261	3
6	1ESWA04	ESW Lockout Matrix	2nd sec	120 min	2nd sec	240 min	2.90	0.41	120	50	Resistance	I	ESK-11AC	4
		Continuous Control	0 sec	2nd sec	0 sec	2nd sec	N/A	0.09	125	11	Resistance			
7	PNL 09AR-6A	Standby Gas Treat Cont A	0.1st sec	120 min	0.1 sec	240 min	6.78	1.62	125	N/A	Resistance	II/III	ESK-11AJ	5
		Continuous Control	N/A	N/A	N/A	N/A	N/A	0.31	125	39	Resistance			
8	HWC	H2 Water Cooling Panel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	1.51-306	3
9	94EHC	Main Turbine EHC Panel	0.1st sec	120 min	0.1st sec	240 min	N/A	0.9563	125	119.5	Resistance	II/III	1.11-491	6
10	94-1TEHN05	Main Turb.Master Trip	0.1st sec	120 min	0.1st sec	240 min	0.64	0.13	125	15.6	Resistance	II/III	ESK-9E	6
11	76FPRC	Fire Prot Relay Cabinet	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-11DA	3
12	31NRVs	Extraction Steam Valves	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-11AAE	3, 6
13	38MOV-VB1	Cond Vac Bkr Valve	N/A	N/A	2nd min	3rd min 48 sec	29	6.00	125	750	VA	II/III	ESK-11AB	8
		Cond Vac Bkr Valve Cntl	N/A	N/A	2nd min	3rd min 48 sec	0.66	0.66	125	83	Resistance	II/III		
		Continuous Control & Htr	0 sec	120 min	0 sec	240 min	N/A	0.54	125	68	Resistance			
15	PNLS 09-8,7	Misc Ind Lights	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-11S	3
16	71RU-1	Unit & NSS Xfmr Prot	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-8CG	3
17	71L43	600V SWGR Bus 14300	(See details on Sheet Panel L43)									II/III	FE-1AJ	
18	71HOTC-1	4160V Bkr Test Cubicles	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III		3
19	71L33	600V SWGR Bus 13300	(See details on Sheet Panel L33)									II/III	FE-1AK	
20	Panel HO1	4160V SWGR Bus 10100	(See details on Sheet Panel HO1)									II/III	FE-1AM	
21	71L23	600V SWGR Bus 12300	(See details on Sheet Panel L23)									II/III	FE-1AM	
22	Panel HO3	4160V SWGR Bus 10300	(See details on Sheet Panel HO3)									II/III	FE-1AM	
23	71L13	600V SWGR Bus 11300	(See details on Sheet Panel L13)									II/III	FE-1AK	
24	Panel HO7	4160V SWGR Bus 10700	(See details on Sheet Panel HO7)									II/III	FE-1AM	

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

PANEL 71DC-A3 (Cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) This is the maximum continuous control load that would be expected during a LOCA/LOOP per JAF-ECCF-241. No SRVs are actuated by the electric lift circuit during a LOCA.

2) This includes the continuous control load for LOCA/LOOP plus the logic relays for electrical lifting of all 11 SRVs per JAF-ECCF-241. Although this calculation only requires 2 SRVs electrically lifting for SBO (see Appendix 12), we have conservatively included the electric lift logic for all 11 SRVs.

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

4) 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 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 reachi 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 contir 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).

5) 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).

6) Per FSAR Sections 8.6.5 and 8.11.1 all normal and reserve power is lost (including 115Kv and in house power) concurrent with the LOCA or SBO. With a simultaneous loss of house power there will be an immediate loss of power to the EHC pumps, Stator water cooling pumps and the Circulating water pumps. Therefore, there will be a turbine trip on either loss of EHC pressure, loss of stator water cooling, loss of condenser vacuum or due to a generator trip on reverse power. For breaker 9 we will conservatively consider 12 KT type relays (mercury wetted) for the above functions (9600 ohms each) and MTS (Mechanical Trip Solenoid) ASCO # 106S141 Sol with Inrush and Holding 0.8 Amps (1.11-408 Sh.2). Breaker 10 has 1 CR2810 relay. Since it is unknown when this would occur, this load will conservatively start at 0.1 seconds and remain for the entire duration for LOCA and/or SBO event. Source of loading can be found in Appendix 8.

7) Extraction steam NRVs close because the main turbine extraction steam dump valves vent air from actuators. No electrical loading changes.

8) Both the FLA. and LRC for these motor was obtained from Appendix 8.
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-VB1 is opened after the 2 nd minute of SBO. 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 2nd minute into on SBO. Has approximattely 49 second stroke time at 125 VDC.
Open stroke time for the Battery degraded voltage (97.7 sec + 10% = 108 sec) was obtaited from BWR Owners Group DC Motor Performance methodology NEDC-32958 Rev. 0

PANEL 71DC-A4

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	LOTC1	600V SWGR Test Cab	N/A	N/A	N/A	N/A	N/A			II/III	FE-1AH	1
2	93FPAC	Force Paralleling Cntl Pnl	1.85th sec	120 min	N/A	0.14	120	N/A	Resistance	I		
	TBRX1	Start Tie Brk Control	1.85th sec	120 min	N/A	0.02	130	3	Resistance	I	ESK-11BE	
	TBRX2	Start Tie Brk Permissive	1.85th sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD8M	EDG A & C Force Parallel	1.90th sec	120 min	N/A	0.06	125	8	Resistance	I		
	VSRX1	EDG A Start Field Flashing	3.52th sec	120 min	N/A	0.02	130	3	Resistance	I		
	VSRX2	EDG C Start Field Flashing	3.52th sec	120 min	N/A	0.02	130	3	Resistance	I		
	GFR	EDG A & C Field Flashing	3.54th sec	6.6th sec	N/A	0.02	130	3	Resistance	I		
	TD9M	EDG A & C Force Parallel	3.54th sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD9X	EDG A & C Force Parallel	6.54th sec	120 min	2.26	0.14	120	N/A	Resistance	I		
		Continuous Control	0 sec	1.85th sec	N/A	0.094	125	11.75	Resistance			
3	HOTC3	4160V Bkr Test	N/A	N/A	N/A	N/A	N/A			II/III	FE-1AH	1
4	M/G EX	Main Gen Excitation	0.1 sec	1 min	2.61	0.44	125		Resistance	II/III	ESK-8DB	5
		Continuous Control	0 sec	120 min	N/A	0.44	125	55	Resistance			
8	Panel HO5	4160V Emerg SWGR Bus	(See details on Sheet Panel HO5)							I	FE-1AM	
11	93ECP-A	EDG "A" Ctrl & Ann	0.1st sec	120 min	N/A	0.08	120	10	Resistance	I		
	K1	Auto Start	0.1st sec	120 min	2.26	0.15	120	N/A	Resistance	I	ESK-11BA	
	TBR	Tie Breaker	1.8rd sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD6	Engine Start Interlock	1.8rd sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD7	Engine Start Raw Wtr	1.8rd sec	120 min	N/A	0.06	125	8	Resistance	I		
	K4	Loss of Gen Field	3.5th sec	120 min	N/A	0.02	130	3	Resistance	I		
	FFR	Field Flash	3.56th sec	120 min	1.41	0.14	125	N/A	Resistance	I		
	VSR	Volt Speed	3.5th sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD5	Diesel Fail to Start	0.2nd sec	1.75th sec	N/A	0.06	125	8	Resistance	I	ESK-11BB	
	SOV-1A	Air Start Right Solenoid	0.2nd sec	1.75th sec	N/A	0.104	125	13	Resistance	I		10
	SOV-2A	Air Start Left Solenoid	0.2nd sec	1.75th sec	N/A	0.104	125	13	Resistance	I		10
	K2	Gov. Booster Pump	0.2nd sec	1.75th sec	2.10	0.15	125	N/A	Resistance	I		
	ESR40	40 RPM Speed Relay	0.32nd sec	120 min	2.26	0.15	120	N/A	Resistance	I		
	ESR200	200 RPM Speed Relay	1.75th sec	120 min	2.26	0.14	125	N/A	Resistance			
	ESR400	400 RPM Speed Relay	3.4th sec	120 min	2.26	0.14	125	N/A	Resistance	I		
	C2	Fuel Oil Prime Pump	0.2nd sec	120 min	2.10	0.15	125	N/A	Resistance	I	ESK-11BC	
	TD10	Loss of Field	3.52nd sec	3.58th sec	N/A	0.06	125	8	Resistance	I		
	TD1	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.06	125	8	Resistance	I		
	ETM	Run Time Indicator	0.2st sec	120 min	0.50	N/A	120	N/A	VA	I		11
	93GS-5A	EDG Gov Booster Pump	0.3rd sec	1.75th sec	40.00	9.00	115	1035	VA	I		2,3
	93P-4A	EDG "A" Fuel Oil pump	0.3rd sec	120 min	6.64	4.44	120	533	VA	I		2,3
	ESS	Speed Switch	0.32nd sec	120 min	N/A	0.04	125		Resistance	I		4
	62-	High Circulating Current	3.58th sec	120 min	N/A	0.06	125	8	Resistance	I		
		Continuous Control	0 sec	0.1st sec	N/A	0.15	125	12.41	Resistance			

PANEL 71DC-A4 (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	93EGP-A	Gen "A" Cont Panel	3.6th sec	120 min	N/A	0	125		Resistance	I	ESK-8HE	
(cont'd)	Field Flash	EDG "A" Field Flash	3.6th sec	6.6th sec	N/A	41.09	125	5136	Resistance	I	ESK-8HE	9
	K2/VR	Auto Field Flash	3.58th sec	6.6th sec	N/A	0.14	115	16	Resistance	I	1.12-41	
	TDVR	Field Shutdown	3.58th sec	6.6th sec	N/A	0.06	125	8	Resistance	I	1.12-41	
	93P/S-A	P/S for EG-M Control	0 sec	120 min	N/A	0.31	125	39.28	VA	I	ESK-8HF	7
		Continuous Control	N/A	N/A	N/A	0.31	125	38.89	Resistance			
12	93ECP-C	EDG "C" Ctrl & Ann	0.1st sec	120 min	N/A	0.08	120	10	Resistance	I		
	K1	Auto Start	0.1st sec	120 min	2.26	0.15	120	N/A	Resistance	I	ESK-11BF	
	TBR	Tie Breaker	1.8rd sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD6	Engine Start Interlock	1.8rd sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD7	Engine Start Raw Wtr	1.8rd sec	120 min	N/A	0.06	125	8	Resistance	I		
	K4	Loss of Gen Field	3.5th sec	120 min	N/A	0.02	130	3	Resistance	I		
	FFR	Field Flash	3.56th sec	120 min	1.41	0.14	125	N/A	Resistance	I		
	VSR	Volt Speed	3.5th sec	120 min	N/A	0.02	130	3	Resistance	I		
	TD5	Diesel Fail to Start	0.2nd sec	1.75th sec	N/A	0.06	125	8	Resistance	I	ESK-11BG	
	SOV-1C	Air Start Right Solenoid	0.2nd sec	1.75th sec	N/A	0.104	125	13	Resistance	I		10
	SOV-2C	Air Start Left Solenoid	0.2nd sec	1.75th sec	N/A	0.104	125	13	Resistance	I		10
	K2	Gov. Booster Pump	0.2nd sec	1.75th sec	2.1	0.15	125	N/A	Resistance	I		
	ESR40	40 RPM Speed Relay	0.32nd sec	120 min	2.26	0.15	120	N/A	Resistance	I		
	ESR200	200 RPM Speed Relay	1.75th sec	120 min	2.26	0.14	125	N/A	Resistance	I		
	ESR400	400 RPM Speed Relay	3.4th sec	120 min	2.26	0.14	125	N/A	Resistance	I		
	C2	Fuel Oil Prime Pump	0.2nd sec	120 min	2.1	0.15	125	N/A	Resistance	I	ESK-11BH	
	TD10	Loss of Field	3.52nd sec	3.58th sec	N/A	0.06	125	8	Resistance	I		
	TD1	Gov. Solenoid TD	0.2nd sec	120 min	N/A	0.06	125	8	Resistance	I		
	ETM	Run Time Indicator	0.2st sec	120 min	0.5	N/A	120	N/A	VA	I		11
	93GS-5C	EDG Gov Booster Pump	0.3rd sec	1.75th sec	40	9.00	115	1035	VA	I		2,3
	93P-4C	EDG "C" Fuel Oil pump	0.3rd sec	120 min	6.64	4.44	120	533	VA	I		2,3
	ESS	Speed Switch	0.32nd sec	120 min	N/A	0.04	125		Resistance	I		4
	62-	High Circulating Current	3.58th sec	120 min	N/A	0.06	125	8	Resistance	I		
		Continuous Control	0 sec	0.1st sec	N/A	0.15	125	N/A	Resistance			
	93EGP-C	Gen "C" Cont Panel	3.6th sec	120 min	N/A	0.00	125		Resistance	I	ESK-8HE	
	Field Flash	EDG "C" Field Flash	3.6th sec	6.6th sec	N/A	41.33	125	5166	Resistance	I	ESK-8HE	9
	K2/VR	Auto Field Flash	3.58th sec	6.6th sec	N/A	0.14	115	16	Resistance	I	1.12-41	
	TDVR	Field Shutdown	3.58th sec	6.6th sec	N/A	0.06	125	8	Resistance	I	1.12-41	
	93P/S-C	P/S for EG-M Control	0 sec	120 min	N/A	0.36	125	44.53	VA	I	ESK-8HF	8
		Continuous Control	N/A	N/A	N/A	0.32	125	40.48	Resistance			

PANEL 71DC-A4 (Cont'd)

Compt No.	Load I.D.	Load Description	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	LOTC1	600V SWGR Test Cab	N/A	N/A	N/A	N/A	N/A		Resistance	II/III	FE-1AH	1
2	93FPAC	Force Paralleling Cntl Pnl	4.35th sec	240 min	N/A	2.28	120	273.6	Resistance	I	ESK-11BE	
		Continuous Control	0 sec	4.35th sec	N/A	0.09	125	11.75	Resistance			
3	HOTC3	4160V Bkr Test	N/A	N/A	N/A	N/A	N/A		Resistance	II/III	FE-1AH	1
4	M/G EX	Main Gen Excitation	0.1 sec	1 min	2.61	0.44	125		Resistance	II/III	ESK-8DB	5
		Continuous Control	0 sec	120 min	N/A	0.44	125	55	Resistance			
8	Panel HO5	4160V Emerg SWGR Bus	(See details on Sheet Panel HO5)						Resistance	I	FE-1AM	
11	93ECP-A	EDG "A" Ctrl & Ann	2.5th sec	240 min	N/A	4.61	120	553.2	Resistance	I	ESK-11BA	6
		93GS-5A	2.8th sec	4.2 sec	40	9.00	115	1035	VA	I	ESK-11BC	2,3
		EDG "A" Gov Booster Pump	239min	239min & 2 sec	40	9.00	115	1035	VA			
		93P-4A"A" Fuel oil pump	2.8th sec	240 min	6	3.80	120	456	VA	I	ESK-11BC	2,3
		Continuous Control	0 sec	2.5th sec	N/A	0.15	132	19.8	Resistance			
	93EGP-A	EDG "A" Field Flash	6.1st sec	9.1sec	N/A	41.09	125	5136.0	Resistance	I	ESK-8HE	6, 9
			239min & 3.6sec	239min & 6.6sec	N/A	41.09	125	5136.0				
	93P/S-A	P/S for EG-M Control	0 sec	240 min	N/A	0.31	125	39.3	VA	I	ESK-8HF	
		Continuous Control	N/A	N/A	N/A	0.31	125	38.9	Resistance			
12	93ECP-C	EDG "C" Ctrl & Ann	2.5 sec	240 min	N/A	4.61	120	553.2	Resistance	I	ESK-11BF	6
		93GS-5C	2.8th sec	4.2 sec	40	9.00	115	1035	VA	I	ESK-11BH	2,3
		EDG "C" Gov Booster Pump	N/A	N/A	40	9.00	115	1035				
		93P-4C "C" Fuel oil pump	2.8th sec	240 min	6	3.80	120	456	VA	I	ESK-11BH	2,3
		Continuous Control	0 sec	2.5 sec	N/A	0.15	125	18.8	Resistance			
	93EGP-C	EDG "C" Field Flash	6.1st sec	9.1 sec	N/A	41.33	125	5166.4	Resistance	I	ESK-8HE	6, 9
	93P/S-C	P/S for EG-M Control	0 sec	240 min	N/A	0.36	125	44.5	VA	I	ESK-8HF	8
		Continuous Control	N/A	N/A	N/A	0.32	125	40.5	Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications) cont'd on page 14

PANEL 71DC-A4 (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-11BA & ESK-11BF).

3) Both the FLA and LRC for these motors were obtained from Appendix 8.
Pump Nos. 93P-4A & C automatically start on loss of AC power or
low reactor water level and high dry well pressure and continue throughout EDG operation.
Pump Nos. 93GS-5A/C 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) 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 0.1 seconds and continue for 1 minute. Generator Trip 41TC resistance is equial 57.6 ohms (See Appendix 8).
Since the generator has tripped field flash will not occur.
Continuous Control data for the this circuit obtained from WR-99-04999-03. Loading data was increased by 10% for margin & conservatism

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-A Lambda Model JWS-150-48/A was obtained from WR-01-10534-00. Loading data was increased by 10% for margin & cons

8) Continuous Control data for the 93P/S-C Lambda Model JWS-150-48/A was obtained from WR-99-06447-00. Loading data was increased by 10% for margin & cons

9) The generator field resistance is 0.491ohms (see drawing 1.12-23). The field flashing blocking diode 1N3296 has an ohmic value of 5.5mohms.
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.

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

PANEL 71DC-A5

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	09-95	ECCS Cab Power (ATTS)	0 sec	7.2nd sec.	0 sec	240 min	N/A	6.15	125	769	VA	I	1.60-16	1
2	06-INV-1A	Feedwater Inverter A	0 sec	120 min	0 sec	240 min	N/A	1.07	125	133.6	VA	M	1.75-70	7
		Continuous Control	N/A	N/A	N/A	N/A	N/A	0.97	125	121	VA			
3	71RU-2	Fast Transfer Blocking Ckt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-5J	2
4	76FPRC	Cardox Cont Ckt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-11DJ	2
5	09-32	HPCI Relay Logic	0 sec	120 min	0 sec	240 min	N/A	0.22	125	27.8	Resistance	I	1.61-141	8
		Continuous Control	0 sec	120 min	0 sec	240 min	N/A	0.07	132	9	Resistance			
6	PNL 09-75	RB CCW Cont Isol Valves	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-6KT	3
7	09ARI-2	CRD ARI Isolation Rly Pnl	0 sec	120 min	10 sec	240 min	N/A	6.94	120	833	Resistance	I	ESK-7FA	4
	03SOV-201	CRD Air Supply Isol Valve	0.1st sec	120 min	10 sec	240 min	N/A	1.52	125	190	Resistance	M	ESK-7FB	
		Continuous Control	N/A	N/A	N/A	N/A	N/A	0.17	125	21	Resistance			
9	27MAP Panel	Foxboro Inst Pwr Supply	0 sec	7.2nd sec.	0 sec	240 min	N/A	4	125	500	VA	I	LP-23AG	5
18	71INV-1A	27 MAP Pnl-Inst INV Loads	0 sec	7.2nd sec.	0 sec	240 min	N/A	12	125	1533	VA	I	1.49-164	5, 6

NOTES: (Timing Sequence and Individual Load Current Justifications) cont'd on page 16

PANEL 71DC-A5 (Cont'd)

NOTES : (Timing Sequence and Individual Load Current Justifications)

1) 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 is conservatively based on the maximum output rating with 65% efficiency. Per tech manual G080-0166 maiximum output is 20Amps @25VDC.
The efficiency is based on sound engineering judgement and the telephone memorandum with Datametrics in Appendix 8.

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

3) These valves are manually controlled from 09-75 for postulated conditions of a LOCA in conjunction with a rupture of RBCLCWS pipe.
Therefore, it is not expected that these Group C isolation valves operate.

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

5) The Monitoring and Analyzing panel (27MAP) contains both AC and DC instrument loads The normal supply is
via MCC-252 & MCC-253. The DC loads are provided with battery backup power from circuit 9.
The AC loads are provided with battery back-up via DC to AC Inverter Panel 71INV-1A, which is fed from circuit 18.
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 8.6-1
of 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.

6) Normal load is 966VA per calculation JAF-CALC-ELEC-01153. 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 0.966KW is 0.966KW/0.965 = 1KW. The total efficiency at 0.966KW output is: (0.966KW/(1KW + 0.532KW))x100% = 63%. Therefore, the load on this circuit is 1532W.

7) Actual measurement of load during WR 01-10997-00 was 131.01VDC @ 0.927AMPS (121.4Watts). For conservatism 10% margin was added to 121.4watts for a total of 133.6watts. 133.6watts was used for the loading table. 121watts was removed from the continuous control load on 71BCB-2A table.

8) This circuit consists of 4 HGA relays, 1 HFA relays, 1 HMA.

BUS 71BMCC-1

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	13MOV-16	RCIC Steam Outboard Iso- Close	43 sec	55 sec	N/A	N/A	45.3	6.5	125	812.5	VA	M	ESK-11AQ	1
		RCIC Steam Outboard Iso Cntl	43 sec	55 sec	N/A	N/A	N/A	0.58	125	72.8	Resistance	M		
		Continuous control	0 sec	120 min	N/A	N/A	N/A	0.19	125	24.2				
OA2	13MOV-18	RCIC Pump Suction	N/A	N/A	N/A	N/A	N/A	N/A	N/A		VA	M	ESK-11AR	7
OB1	13MOV-20	RCIC Disch Upstrm Shutoff	N/A	N/A	N/A	N/A	N/A	N/A	N/A		VA	M	ESK-11AR	7
OB2	13MOV-21	RCIC Pmp Disch Isol Va-Open	1st sec	17.8th sec	2nd sec	18.8th sec	44.5	6.5	125	812.5	VA	M	ESK-11AS	2
	(O)	RCIC Pmp Isol VA Control	1st sec	17.8th sec	2nd sec	18.8th sec	N/A	0.58	125	72.8	Resistance	M		
	13MOV-21	RCIC Pmp Disch Isol Va-Close	43 sec	1 min 3.5 sec	N/A	N/A	44.5	6.5	125	812.5	VA	M		
	(C)	RCIC Pmp Isol VA Control	43 sec	1 min 3.5 sec	N/A	N/A	N/A	0.58	125	72.8	Resistance	M		
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.19	132	25.5				
OC1	13MOV-27	RCIC Min Flow Isol VA-Open	4th sec	8.9th sec	14th sec	18.9th sec	45.7	8.4	125	1050	VA	M	ESK-11AU	3
	(O)	RCIC Min Flow Isol VA Control	4th sec	8.9th sec	14th sec	18.9th sec	N/A	0.58	125	72.8	Resistance	M		
	13MOV-27	RCIC Min Flow Isol VA- Close	9th sec	15.7th sec	19th sec	25.7th sec	45.70	8.4	125	1050	VA	M		
	(C)	RCIC Min Flow Isol VA Contro	9th sec	15.7th sec	19th sec	25.7th sec	N/A	0.58	125	72.8	Resistance	M		
		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.19	125	24.2				
OC2	13MOV-30	RCIC Test Return Open	N/A	N/A	30 min	30 min 31.4 sec	15.3	4.2	125	525	VA	M	ESK-11AS	4
		RCIC Test Return Control	N/A	N/A	30 min	30 min 31.4 sec	N/A	0.58	125	72.8	Resistance	M		
		Continuous control	N/A	N/A	0 sec	240 min	N/A	0.19	125	24.2				
OD1	27MOV-123	Bypass on AOV-118 -Open	N/A	N/A	N/A	N/A	N/A	N/A	125		VA	I	ESK-11AAP	8
OE1	13P-3(M)	RCIC Gland Seal Vac Pump	0.1st sec	120 min	10th sec	240 min	57.5	23	125	2875	VA	II/III	ESK-11CC	5
		RCIC Gland Vac Pmp Cntl	0.1st sec	120 min	10th sec	240 min	0.64	0.62	125	77.4	Resistance	II/III		
		Continuous control	0 sec	0.1st sec	0 sec	10th sec	N/A	0.19	125	24.2				
OE2	13P-4(M)	RCIC Gland Seal Cond Pump	3rd sec	120 min	14th sec	240 min	53.2	21.7	125	2708.125	VA	II/III	ESK-11CC	6
		RCIC Gland Cond Pmp Cntl	3rd sec	120 min	14th sec	240 min	0.64	0.62	125	77.4	Resistance	II/III		
		Continuous control	0.1 sec	3rd sec	0 sec	14th sec	N/A	0.19	125	24.2				

NOTES: (Timing Sequence and Individual Load Current Justifications) cont'd on page 18

BUS 71BMCC-1 (cont'd)

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Both the FLA. and LRC for these motors was obtained from Appendix 8. For sequencing of this RCIC 13MOV-16 see Appendix 15
The 12 second stroke time at 125 VDC obtained from the ASME Section XI IST Program - Valve Test Data Report.

2) Both the FLA. and LRC for these motors was obtained from Appendix 8.

13MOV-21 opens on low-low reactor level with turbine trip throttle valve fully open as soon as 13MOV-131 come off its closed seat.
Has approximattely 11 second stroke time. Closes when 13MOV-131 fully closed.
The 13 second stroke time at 125 VDC obtained from the ASME Section XI IST Program - Valve Test Data Report.
Open stroke time for the Battery degraded voltage (15.28 sec + 10% = 16.8 sec) was obtained from BWR Owners Group Dc Motor Performance methodology NEDC-32958 Rev. 0
Close stroke time for the Battery degraded voltage **(18.62 sec + 10% = 20.5 sec)** was obtained from BWR Owners Group Dc Motor Performance methodology NEDC-32958 Rev. 0

3) Both the FLA. and LRC for these motors was obtained from Appendix 8.

13MOV-27 opens when 125 PSIG RCIC pump discharge pressure is achieved. It takes about 4 second to reach this pressure after
13MOV-131 has been given a open signal. Has approximattely 4.8 second stroke time.
This valve will automaticaly go closed once it has completed its opening stroke and after RCIC flow has reached 80 GPM.
80 GMP occurs approximately 5.1 second after 13MOV-131 has given an open signal. Therefore this valve will close 8.8 second
after the low-low reactor water level.
The 4.72 second stroke time at 125 VDC obtained from the ASME Section XI IST Program - Valve Test Data Report.
Open stroke time for the Battery degraded voltage (4.49 sec + 10% = 4.9 sec) was obtained from BWR Owners Group Dc Motor Performance methodology NEDC-32958 Rev. 0
Close stroke time for the Battery degraded voltage (6.12 sec + 10% = 6.7 sec) was obtained from BWR Owners Group Dc Motor Performance methodology NEDC-32958 Rev. 0

4) Both the FLA. and LRC for these motors was obtained from Appendix 8. For sequencing of this RCIC 13MOV-30 see Appendix 15
The 28.5 second stroke time at 125 VDC obtained from the MOV Data Base.
Open stroke time for the Battery degraded voltage is 28.5 sec + 10% = 31.4 sec

5) 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 250% of FLA. This also includes the starting resistance.
This is consistent with NEMA ICS-2. Appendix 14 demonstrates that 250% of FLA is appropriate.
Pump No. 13P-3 starts on RCIC initiation signal. For LOCA this pump starts at the beginning of the duty cycle because or lo-lo level. For SBO this pump starts at 10 seconds (see Appendix 12) because of Rx level lo-lo.

6) 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, Appendix 8
The starting current of these motors was assumed conservatively to be 250% of FLA. This also includes the starting resistance.
This is consistent with NEMA ICS-2. Appendix 14 demonstrates that 250% of FLA is appropriate.
Pump No. 13P-4 starts when the barometric condensate pump is high, which occurs after steam has leaked off and condensed in the vacuum tank.
This is considered a "random" load and is placed a the most critical time in the duty cycle at least 1 second after receiving a reactor lo-lo- level.
1 second is selected as being reasonable engineering judgement. The most critical period occurs at 3rd second for LOCA. For SBO this will occur at 14 seconds.
becouse this is the hightest loaded interval after 10 seconds and is considered most critical.

7) This MOV is not cycled during LOCA and SBO.

8) This MOV is not cycled during LOCA and SBO. Although this MOV will receive a closure signal during a LOCA, this is a normally closed valve and therefore, not considered a load.

BUS 71BMCC-3

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	13MOV-39	Supp Pool Downstream Shutoff	N/A	N/A	N/A	N/A	N/A	N/A	N/A		VA	M	ESK-11AT	1
OA2	13MOV-41	Supp Pool Upstream Shutoff	N/A	N/A	N/A	N/A	N/A	N/A	N/A		VA	I	ESK-11AT	1
OB1	13MOV-131	RCIC Turb Steam Inlet VA (O)	0.1st sec	17.5th sec	10th sec	27.4th sec	40.5	6.5	125	812.5	VA	M	ESK-11AQ	2
		RCIC Turb Steam Inlet VA Cntl	0.1st sec	17.5th sec	10th sec	27.4th sec	N/A	0.58	125	72.8	Resistance	M		
		Continuous control	17.6th sec	120 min	0 sec	240 min	N/A	0.19	132	25.5				
OB2	13MOV-132	RCIC Turb Oil Cooler Isol (O)	0.1st sec	13.1st sec	10th sec	23th sec	36.1	6	125	750	VA	M	ESK-11AU	3
		RCIC Turb Oil Cooler Isol Cntl	0.1st sec	13.1st sec	10th sec	23th sec	N/A	0.58	125	72.8	Resistance	M		
		Continuous control	13.2st sec	120 min	0 sec	240 min	N/A	0.19	132	25.5				

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 this motor was obtained from Appendix 8.
13MOV-131 opens on low-low reactor water level. Has approximattely 15.4 second stroke time at 125 VDC . Closes on reactor high water level of 218.2".
Open stroke time for the Battery degraded voltage (15.82 sec + 10% = 17.4 sec) was obtained from BWR Owners Group Dc Motor Performance methodology NEDC-32958 Rev. 0

2) Both the FLA. and LRC for this motor was obtained from Appendix 8.
13MOV-132 opens on low-low reactor water level. Has approximattely 10 second stroke time at 125 VDC. Closure is manuals.
Open stroke time for the Battery degraded voltage (11.82 sec + 10% = 13 sec) was obtained from BWR Owners Group Dc Motor Performance methodology NEDC-32958 Rev. 0

PANEL 71HO1

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
H01	4kV Bkr 71-10102	Normal Sta XFMR T-4 feed to bus 10100 (Tri	0.1 sec	3.1st sec	0.1 sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5A	1
H01	4kV Bkr 71-10110	Reac Recirc PP 02-2P-1A (Trip)	0.1st sec	0.2nd sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5C	2
H01	4kV Bkr 71-10112	Reserve Sta XFMR T-3 feed to bus 10100 (Tr	N/A	N/A	N/A	N/A	6	N/A	125	N/A	Resistance	II/III	ESK-5B	3
H01	Ckt. 1HONA03	Bus 10100 Undervoltage Oper	0.1st sec	120 min	0.1st sec	240 min	N/A	0.22	125	N/A	Resistance	II/III	ESK-5G	4
H01		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.26	125	32	Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Breaker No. 71-10102 will trip when either the undervoltage relays actuate at 3 seconds or when reverse power is sensed (ESK-8CB, 71-32-1UPRN05). Breaker tripping is momentary. However, since it is unknown exactly when the 71-32-1UPRN05 picks up, the duty cycle will conservatively show this breaker trip from 0.1 seconds to 3.1 second for LOCA and from 0.1 seconds to 3.1 second for SBO .

2) Breaker No.71-10110 trips on initiation of event for LOCA and 3 seconds for SBO.

3) Breaker No. 71-10112 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 1SAM17A relay (0.12amps + 0.069amps) and 1HLA relay (4.3 watts). See G080-0576 and G080-C019.

PANEL 71HO3

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
H03	4kV Bkr 71-10302	Normal Sta XFMR T-4 feed to bus 10300 (TRIP)	0.1sec	3.1st sec	0.1sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AA	1
H03	4kV Bkr 71-10304	Feed to bus 10500 (TRIP)	6.2 sec	6.3rd sec	8.7th sec	8.8th sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AX	2
		Feed to bus 10500 (CLOSE)	119th min 20 sec	119th min 20.1 sec	N/A	N/A	6	N/A	125	N/A	Resistance	II/III	ESK-5AX	3
		Breaker Charging Motor Current	119th min 20.2 sec	119th min 25 sec	N/A	N/A	68	14	125		VA	II/III		
H03	4kV Bkr 71-10310	Condensate Pump 33P-8A (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AE	
	86U-1CNDA02	37P-8A Undervoltage Trip Aux Relay	3rd sec	120 min	3rd sec	240th min	N/A	0.06	125	8	Resistance	II/III		
H03	4kV Bkr 71-10312	Reserve Sta XFMR T-3 feed to bus 10300 (TRIP)	N/A	N/A	N/A	N/A	6	N/A	125	N/A	Resistance	II/III	ESK-5AB	
		Reserve Sta XFMR T-3 feed to bus 10300 (CLOSE)	119th min 0 sec	119th min 0.1 sec	N/A	N/A	6	N/A	125	N/A	Resistance	II/III		3
		Breaker Charging Motor Current	119th min 0.2 sec	119th min 5 sec	N/A	N/A	68	14	125		VA			
H03	4kV Bkr 71-10320	Service Water Pump 46P-1A (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AF	
	86U-1SWSA01	46P-1A Undervoltage Trip Aux Relay	3rd sec	120 min	3rd sec	240th min	N/A	0.06	125	8	Resistance	II/III		
H03	4kV Bkr 71-10330	Circ Water Pump 36P-1A (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AC	
H03	4kV Bkr 71-10340	Aux Feed to 600V NSR busses (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AH	
H03	4kV Bkr 71-10350	Cond Booster Pump 33P-9A (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AD	
	86U-1CNDA01	33P-9A Undervoltage Trip Aux Relay	3rd sec	120 min	3rd sec	240th min	N/A	0.06	125	8	Resistance	II/III		
H03	4kV Bkr 71-10360	Clsd Loop Clg Wtr Pump 37P-2A (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AG	
	86U-1TBCA01	37P-2A Undervoltage Trip Aux Relay	3rd sec	120 min	3rd sec	240th min	N/A	0.06	125	8	Resistance	II/III		
H03	Ckt 1HONC03	Bus 10300 Undervoltage Oper	0.1st sec	120 min	0.1st sec	240 min	N/A	0.24	125	N/A	Resistance	II/III	ESK-5H	4
H03		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. 71-10302 will trip when either the undervoltage relays actuate at 3 seconds or when reverse power is sensed (ESK-8CB, 71-32-1UPRN05). Breaker tripping is momentary. However, since it is unknown exactly when the 71-32-1UPRN05 picks up, the duty cycle will conservatively show this breaker trip from 0.1 seconds to 3.1 second for LOCA and from 0.1 seconds to 3.1 second for SBO .

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.

4) The load is 1SAM17A 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.

PANEL 71H05

Comp 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
H05	4kV Bkr 71-10502	EDG-A feed to bus 10500 (CLOSE)	7.2nd sec	7.3rd sec	9.7th sec	9.8th sec	6	N/A	125	N/A	Resistance	I	ESK-5BB	
		Breaker Charging Motor Current	7.4rd sec	12.2nd sec	9.9th sec	14.7 sec	68	14	125	N/A	VA	I		
	K10-1EDGA01	EDG A Egn. Failure	N/A	N/A	9.7th sec	239 min	1.41	0.086	120	10	Resistance	I		
		EDG-A feed to bus 10500 (TRIP)	N/A	N/A	9.7th sec	9.8th sec	6	N/A	125	N/A				
		EDG-A feed to bus 10500 (CLOSE)	N/A	N/A	239th min 7.2 sec	239th min 7.3 sec	6	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor Current	N/A	N/A	239th min 7.4 sec	239th min 12.2 sec	68	14	125	N/A	VA	I		
H05	4kV Bkr 71-10510	RHR Serv Wtr PP 10P-1C (CLOSE)	2 min 30 sec	2 min 30.1 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BQ	5
		Breaker Charging Motor Current	2 min 30.2 sec	2 min 35 sec	N/A	N/A	68	14	125	N/A	VA	I		
	10SOV-101C	RHR Pmp Mtr Cooling SOV	0 sec	2 min 30 sec	N/A	N/A	N/A	0.21	125	26.6	Resistance	I		
H05	4kV Bkr 71-10512	EDG-C feed to bus 10500 (CLOSE)	7.2nd sec	7.3nd sec	9.7th sec	9.8h sec	6	N/A	125	N/A	Resistance	I	ESK-5BC	
		Breaker Charging Motor Current	7.4rd sec	12.2nd sec	9.9th sec	14.7sec	68	14	125	N/A	VA	I		
	K10-1EDGC01	EDG C Egn. Failure	N/A	N/A	9.7th sec	239 min	1.41	0.086	120	10	Resistance	I		
		EDG-C feed to bus 10500 (TRIP)	N/A	N/A	9.7th sec	9.8th sec	6	N/A	125	N/A	Resistance			
H05	4kV Bkr 71-10514	Bus 10300 feed to bus 10500 (TRIP)	6.2nd sec	6.3rd sec	8.7th sec	8.8th sec	6	N/A	125	N/A	Resistance	I	ESK-5AX	1
		Bus 10300 feed to bus 10500 (CLOSE	119th min 40 sec	119th min 40.1 sec	N/A	N/A	6	N/A	125	N/A	Resistance			
		Breaker Charging Motor Current	119th min 40.2 sec	119th min 45 sec	N/A	N/A	68	14	125	N/A	VA			
H05	4kV Bkr 71-10520	RHR Serv Wtr PP 10P-1A (CLOSE)	2 min	2 min 0.1 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BG	5
		Breaker Charging Motor Current	2 min 0.2 sec	2 min 5 sec	N/A	N/A	68	14	125	N/A	VA			
	10SOV-101A	RHR Pmp Mtr Cooling SOV	0 sec	2 min	N/A	N/A	N/A	0.21	125	26.6	Resistance	I		
H05	4kV Bkr 71-10530	Core Spray PP 14P-1A (TRIP)	N/A	N/A	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BF	1
		Core Spray PP 14P-1A (CLOSE)	18.2nd sec	18.3rd sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		2
		Breaker Charging Motor Current	18.4rd sec	23.2nd sec	N/A	N/A	68	14	125	N/A	VA	I		
H05	4kV Bkr 71-10540	RHR PP-B 10P-3B (TRIP)	N/A	N/A	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BV	1
		RHR PP-B 10P-3B (CLOSE)	13.2nd sec	13.3rd sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		2
		Breaker Charging Motor Current	13.4rd sec	18.2nd sec	N/A	N/A	68	14	125	N/A	VA	I		
H05	4kV Bkr 71-10550	RHR PP-A 10P-3A (CLOSE)	1st sec	1.1st sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BU	1
		Breaker Charging Motor Current	1.2st sec	6th sec	N/A	N/A	68	14	125	N/A	VA	I		
		RHR PP-A 10P-3A (TRIP)	6.2nd sec	6.3rd sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		1
		RHR PP-A 10P-3A (CLOSE)	8.2nd sec	8.3rd sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		2
		Breaker Charging Motor Current	8.4rd sec	13.2nd sec	N/A	N/A	68	14	125	N/A	VA	I		
H05	4kV Bkr 71-10560	Feed to 600V busses 11500 & 12500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-5BE	3
H05	K8-1EDGA002	EDG-A&C Tie Brk Closing Rel	1.9th sec	120 min	4.4th sec	4.5th sec	1.41	0.086	120	10	Resistance	I	ESK-5BD	
	4kV Bkr 71-10504	EDGs A & C Tie Breaker(CLOSE)	2nd sec	2.1st sec	4.5th sec	4.6th sec	6	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor Current	2.2th sec	6th sec	4.7th sec	9.5th sec	68	14	125	N/A	VA	I		
	62-1EDGA02	EDG-A&C Output Brk Closing Rel	7th sec	8.2 sec	9.5th sec	10.7th sec	N/A	0.06	125	8	Resistance	I		
	62X-1EDGA02	EDG-A&C Output Brk Closing Rel	7th sec	8.2 sec	9.5th sec	10.7th sec	N/A	0.03	125	4	Resistance	I		
	K9-1EDGA002	Gen Tie to EDG-A&C (Trip)	7.3rd sec	120 min	9.8th sec	239 min	1.41	0.086	120	10	Resistance	I		
		EDGs A & C Tie Breaker (Trip)	7.3rd sec	7.4rd sec	9.8th sec	9.9th sec	6	N/A	125	N/A	Resistance	I		

PANEL 71HO5 (cont'd)

H05	Ckt # 1HOEA03	Emer Bus 10500 Undervoltage, Load Shedding and Sequencing	0.1 sec	7.2nd	0.1 sec	239th min 7.3 sec	N/A	1.02	125	N/A	Resistance	1	ESK-5BS	
H05		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) 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.
2) For the LOCA + LOBC scenario timing is based on the load sequence included in UFSAR table 8.6-1
3) This breaker is not automatically actuated as result of LOCA and SBO.
4) EDG A & C Tie breaker is closed when both engines reach 200 rpm.
5) RHR SW are manually started by operators after RHR Pump Start. RHR SW pump 10P-1A starts at 2 min and RHR SW Pump 10P-1C starts at 2 min 30 sec.

PANEL 71HO7

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
H07	4kV Bkr 71-10702	Normal Sta XFMR T-4 feed to bus 10700 (TRIP)	0.1sec	3.1st sec	0.1sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AS	1
H07	4kV Bkr 71-10710	Condensate PP 33P-8C (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AU	
	86U-1CNDC02	33PP-8C Undervoltage Trip Aux Relay	3rd sec	120 min	3rd sec	240th min	N/A	0.06	125	8	Resistance	II/III		
H07	4kV Bkr 71-10720	Service Water Pump 46P-1C (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AW	
	86U-1SWSC01	46P-1C Undervoltage Trip Aux Relay	3rd sec	120 min	3rd sec	240th min	N/A	0.06	125	8	Resistance	II/III		
H07	4kV Bkr 71-10730	Circ Water Pump 36P-1C (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AT	
H07	4kV Bkr 71-10740	Cond Booster Pump 33P-9C (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AV	
	86U-1CNDC01	33P-9C Undervoltage Trip Aux Relay	3rd sec	120 min	3rd sec	240th min	N/A	0.06	125	8	Resistance	II/III		
H07	4kV Bkr 71-10750	Clsd Loop Clg Water Pump 37P-2C (TRIP)	3rd sec	3.1st sec	3rd sec	3.1st sec	6	N/A	125	N/A	Resistance	II/III	ESK-5AZ	
	86U-1TBCC01	37P-2C Undervoltage Trip Aux Relay	3rd sec	120 min	3rd sec	240th min	N/A	0.06	125	8	Resistance	II/III		
H07	Ckt 1HONE02	Bus 10700 Undervoltage Operation	3rd sec	120 min	3rd sec	240th min	N/A	0.07	125	8.6	Resistance	II/III	ESK-5AS	2
H07		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.51	125	64	Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) Breaker No. 71-10702 will trip when either the undervoltage relays actuate at 3 seconds or when reverse power is sensed (ESK-8CB, 71-32-1UPRN05). Breaker tripping is momentary. However, since it is unknown exactly when the 71-32-1UPRN05 picks up, the duty cycle will conservatively show this breaker trip from 0.1 seconds to 3.1 second for LOCA and from 0.1 seconds to 3.1 second for SBO .

2) The 10700 bus undervoltage relays 71-27AB-1HONE02 and 71-27CB-1HONE02 (GE Model IAV54E) has a dial setting of 5 which coresponce to a 3 sec time delay at 0 volts. The load is 1 HLA relay (4.3 watts) and 1 HGA (4.3 watts). See G080-0213 and G080-C019.

PANEL 71L13

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
L13	600V Bkr 71-11302	L13 Ctrl Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6A	
L13	600V Bkr 71-11330	RB Clg Wtr PP 15P-2C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AE	
L13	600V Bkr 71-11316	RB Clg Wtr PP 15P-2A 52X Energize	2nd sec	4.4th sec	2nd sec	4.4th sec	N/A	1	125	125	Resistance	II/III	ESK-6AC	1
		RB Clg Wtr PP 15P-2A Close	2.1st sec	4.4th sec	2.1st sec	4.4th sec	44	N/A	125	N/A	Resistance	II/III		
L13	600V Bkr 71-11318	RB Vent Supply Fan 66FN-5A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AT	
L13	600V Bkr 71-11320	RB Vent Supply Fan 66FN-5C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AT	
L13	600V Bkr 71-11326	RB Vent Return Fan 66FN-12A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AT	
L13	600V Bkr 71-11304	Tie to Bus 11400	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6E	
L13		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.30	125	37	Resistance			

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) 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).

PANEL 71L15

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
L15	600V Bkr 71-11502	Control Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-6G	
L15	600V Bkr 71-11516	CRD Water Pump 03P-16A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-6AK	1

Note:

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

PANEL 71L23

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
L23	600V Bkr 71-12302	Tie to Bus 12400	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6B	
L23	600V Bkr 71-12310	Water Ht Sys Pump	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AX	
L23	600V Bkr 71-12316	Air Compressor 39AC-1A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AG	1
L23	600V Bkr 71-12318	Air Rem Vac Pump	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AA	

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) 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.

PANEL 71L25

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
L25	600V Bkr 71-1250	L25 Ctrl Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-6G	
L25	600V Bkr 71-1251	ESW Pmp 46P-2B 52X Energize	2nd sec	3.9th sec	2nd sec	6.4 sec	N/A	1	125	125	Resistance	I	ESK-6AF	1, 2
		ESW PP 46P-2A 52CC (Close)	2.1st sec	3.9th sec	2.1st sec	6.4 sec	44	N/A	125	N/A	Resistance	I		
L25		Continuous control	0 sec	120 min	0 sec	240 min	N/A	0.21	125	26	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.

2) 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).

PANEL 71L33

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
L33	600V Bkr 71-13302	L33 Ctrl Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6C	
L33	600V Bkr 71-13326	Turb Bldg Exh Fan 67FN-6A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AW	
L33	600V Bkr 71-13320	Air Compressor 39AC-1C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AJ	1

NOTES: (Timing Sequence and Individual Load Current Justifications)

1) 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.

PANEL 71L43

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
L43	71-14302	Control Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6D	
L43	71-14320	TB Vent Supply Fan 67FN-5A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6AV	
L43	71-14304	Control Tie to Bus 14400	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	II/III	ESK-6F	

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

Computed by: A. Barton
Checked by: B. Marks

LOCA DISCHARGE PROFILE DATA

Gould NCN-33								
Time (min.)	Ampere Rate	Adjusted Amps	Amps per pos plate (16 plates)	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
0	73.54	73.54	4.60	0.00	0.00		1.960	117.60
1	737.56	737.56	46.10	0.77	0.77		1.905	114.29
2	441.05	441.05	27.57	0.46	1.23		1.938	116.27
3	441.05	441.05	27.57	0.46	1.69		1.938	116.27
4	441.05	441.05	27.57	0.46	2.15		1.938	116.27
5	441.05	441.05	27.57	0.46	2.61		1.938	116.27
6	441.05	441.05	27.57	0.46	3.07		1.938	116.27
7	441.05	441.05	27.57	0.46	3.52		1.938	116.27
8	441.05	441.05	27.57	0.46	3.98		1.938	116.27
9	441.05	441.05	27.57	0.46	4.44		1.938	116.27
10	441.05	441.05	27.57	0.46	4.90		1.938	116.27
11	441.05	441.05	27.57	0.46	5.36		1.938	116.27
12	441.05	441.05	27.57	0.46	5.82		1.938	116.27
13	441.05	441.05	27.57	0.46	6.28		1.938	116.27
14	441.05	441.05	27.57	0.46	6.74		1.938	116.26
15	441.05	441.05	27.57	0.46	7.20		1.938	116.26
16	441.05	441.05	27.57	0.46	7.66		1.938	116.26
17	441.05	441.05	27.57	0.46	8.12		1.938	116.26
18	441.05	441.05	27.57	0.46	8.58		1.938	116.26
19	441.05	441.05	27.57	0.46	9.04		1.938	116.26
20	441.05	441.05	27.57	0.46	9.50		1.938	116.26
21	441.05	441.05	27.57	0.46	9.96		1.938	116.25
22	441.05	441.05	27.57	0.46	10.42		1.938	116.25
23	441.05	441.05	27.57	0.46	10.88		1.938	116.25
24	441.05	441.05	27.57	0.46	11.34		1.938	116.25
25	441.05	441.05	27.57	0.46	11.79		1.938	116.25
26	441.05	441.05	27.57	0.46	12.25		1.938	116.25
27	441.05	441.05	27.57	0.46	12.71		1.938	116.25
28	441.05	441.05	27.57	0.46	13.17		1.938	116.25
29	441.05	441.05	27.57	0.46	13.63		1.938	116.25
30	441.05	441.05	27.57	0.46	14.09		1.937	116.25
31	441.05	441.05	27.57	0.46	14.55		1.937	116.25
32	441.05	441.05	27.57	0.46	15.01		1.937	116.25
33	441.05	441.05	27.57	0.46	15.47		1.937	116.25
34	441.05	441.05	27.57	0.46	15.93		1.937	116.25
35	441.05	441.05	27.57	0.46	16.39		1.937	116.25
36	441.05	441.05	27.57	0.46	16.85		1.937	116.25
37	441.05	441.05	27.57	0.46	17.31		1.937	116.25
38	441.05	441.05	27.57	0.46	17.77		1.937	116.25
39	441.05	441.05	27.57	0.46	18.23		1.937	116.25
40	441.05	441.05	27.57	0.46	18.69		1.937	116.25
41	441.05	441.05	27.57	0.46	19.15		1.937	116.25

Computed by: A. Barton
Checked by: B. Marks

LOCA DISCHARGE PROFILE DATA

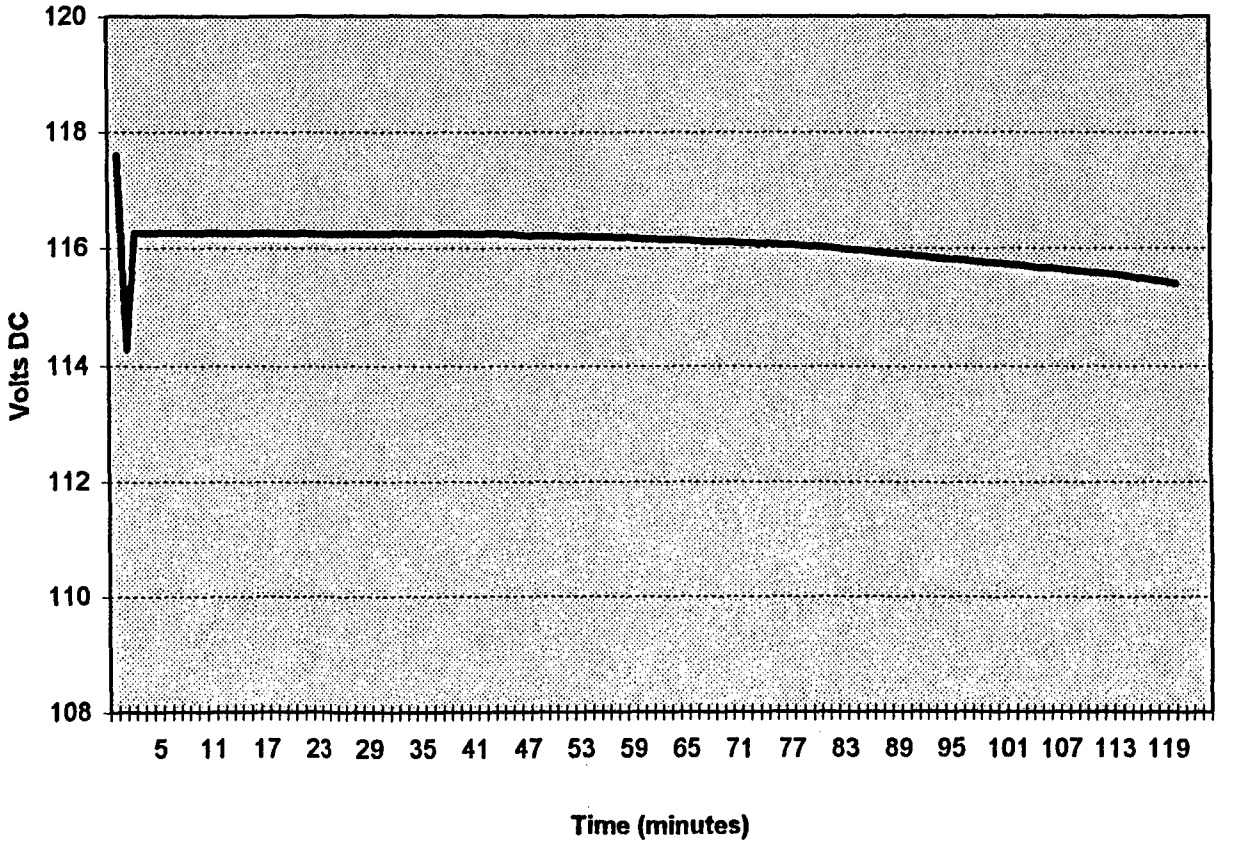
Gould NCN-33								
Time (min.)	Ampere Rate	Adjusted Amps	Amps per pos plate (16 plates)	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
42	441.05	441.05	27.57	0.46	19.60		1.938	116.25
43	441.05	441.05	27.57	0.46	20.06		1.937	116.25
44	441.05	441.05	27.57	0.46	20.52		1.937	116.24
45	441.05	441.05	27.57	0.46	20.98		1.937	116.24
46	441.05	441.05	27.57	0.46	21.44		1.937	116.23
47	441.05	441.05	27.57	0.46	21.90		1.937	116.22
48	441.05	441.05	27.57	0.46	22.36		1.937	116.22
49	441.05	441.05	27.57	0.46	22.82		1.937	116.21
50	441.05	441.05	27.57	0.46	23.28		1.937	116.21
51	441.05	441.05	27.57	0.46	23.74		1.937	116.21
52	441.05	441.05	27.57	0.46	24.20		1.937	116.20
53	441.05	441.05	27.57	0.46	24.66		1.937	116.20
54	441.05	441.05	27.57	0.46	25.12		1.937	116.20
55	441.05	441.05	27.57	0.46	25.58		1.937	116.20
56	441.05	441.05	27.57	0.46	26.04		1.937	116.19
57	441.05	441.05	27.57	0.46	26.50		1.936	116.19
58	441.05	441.05	27.57	0.46	26.96		1.936	116.18
59	441.05	441.05	27.57	0.46	27.42		1.936	116.17
60	441.05	441.05	27.57	0.46	27.87		1.936	116.16
61	441.05	441.05	27.57	0.46	28.33		1.936	116.16
62	441.05	441.05	27.57	0.46	28.79		1.936	116.15
63	441.05	441.05	27.57	0.46	29.25		1.936	116.15
64	441.05	441.05	27.57	0.46	29.71		1.936	116.14
65	441.05	441.05	27.57	0.46	30.17		1.936	116.13
66	441.05	441.05	27.57	0.46	30.63		1.935	116.13
67	441.05	441.05	27.57	0.46	31.09		1.935	116.12
68	441.05	441.05	27.57	0.46	31.55		1.935	116.11
69	441.05	441.05	27.57	0.46	32.01		1.935	116.11
70	441.05	441.05	27.57	0.46	32.47		1.935	116.10
71	441.05	441.05	27.57	0.46	32.93		1.935	116.10
72	441.05	441.05	27.57	0.46	33.39		1.935	116.09
73	441.05	441.05	27.57	0.46	33.85		1.935	116.08
74	441.05	441.05	27.57	0.46	34.31		1.935	116.08
75	441.05	441.05	27.57	0.46	34.77		1.935	116.07
76	441.05	441.05	27.57	0.46	35.23		1.934	116.06
77	441.05	441.05	27.57	0.46	35.69		1.934	116.06
78	441.05	441.05	27.57	0.46	36.14		1.934	116.05
79	441.05	441.05	27.57	0.46	36.60		1.934	116.04
80	441.05	441.05	27.57	0.46	37.06		1.934	116.02
81	441.05	441.05	27.57	0.46	37.52		1.934	116.01
82	441.05	441.05	27.57	0.46	37.98		1.933	116.00
83	441.05	441.05	27.57	0.46	38.44		1.933	115.99
84	441.05	441.05	27.57	0.46	38.90		1.933	115.97

Computed by: A. Barton
Checked by: B. Marks

LOCA DISCHARGE PROFILE DATA

Gould NCN-33								
Time (min.)	Ampere Rate	Adjusted Amps	Amps per pos plate (16 plates)	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
85	441.05	441.05	27.57	0.46	39.36		1.933	115.96
86	441.05	441.05	27.57	0.46	39.82		1.932	115.94
87	441.05	441.05	27.57	0.46	40.28		1.932	115.93
88	441.05	441.05	27.57	0.46	40.74		1.932	115.91
89	441.05	441.05	27.57	0.46	41.20		1.932	115.90
90	441.05	441.05	27.57	0.46	41.66		1.931	115.88
91	441.05	441.05	27.57	0.46	42.12		1.931	115.87
92	441.05	441.05	27.57	0.46	42.58		1.931	115.86
93	441.05	441.05	27.57	0.46	43.04		1.931	115.84
94	441.05	441.05	27.57	0.46	43.50		1.930	115.83
95	441.05	441.05	27.57	0.46	43.95		1.930	115.81
96	441.05	441.05	27.57	0.46	44.41		1.930	115.80
97	441.05	441.05	27.57	0.46	44.87		1.930	115.78
98	441.05	441.05	27.57	0.46	45.33		1.930	115.77
99	441.05	441.05	27.57	0.46	45.79		1.929	115.76
100	441.05	441.05	27.57	0.46	46.25		1.929	115.74
101	441.05	441.05	27.57	0.46	46.71		1.929	115.73
102	441.05	441.05	27.57	0.46	47.17		1.929	115.71
103	441.05	441.05	27.57	0.46	47.63		1.928	115.70
104	441.05	441.05	27.57	0.46	48.09		1.928	115.68
105	441.05	441.05	27.57	0.46	48.55		1.928	115.67
106	441.05	441.05	27.57	0.46	49.01		1.928	115.66
107	441.05	441.05	27.57	0.46	49.47		1.927	115.64
108	441.05	441.05	27.57	0.46	49.93		1.927	115.63
109	441.05	441.05	27.57	0.46	50.39		1.927	115.61
110	441.05	441.05	27.57	0.46	50.85		1.927	115.60
111	441.05	441.05	27.57	0.46	51.31		1.926	115.58
112	441.05	441.05	27.57	0.46	51.77		1.926	115.57
113	441.05	441.05	27.57	0.46	52.22		1.926	115.55
114	441.05	441.05	27.57	0.46	52.68		1.926	115.53
115	441.05	441.05	27.57	0.46	53.14		1.925	115.51
116	441.05	441.05	27.57	0.46	53.60		1.925	115.49
117	441.05	441.05	27.57	0.46	54.06		1.924	115.47
118	441.05	441.05	27.57	0.46	54.52		1.924	115.45
119	441.05	441.05	27.57	0.46	54.98		1.924	115.43
120	441.05	441.05	27.57	0.46	55.44		1.923	115.40

D. C. BATTERY "A" LOCA CURVE



Computed by: A. Barton
Checked by: B. Marks

SBO DISCHARGE PROFILE DATA

Gould NCN-33								
Time (min.)	Ampere Rate	Adjusted Amps	Amps per pos plate (16 plates)	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
0	63.99	63.99	4.00	0.00	0.00		1.960	117.60
1	673.62	673.62	42.10	0.70	0.70		1.915	114.88
2	489.77	489.77	30.61	0.51	1.21		1.933	116.00
3	489.77	489.77	30.61	0.51	1.72		1.933	116.00
4	489.77	489.77	30.61	0.51	2.23		1.933	116.00
5	489.77	489.77	30.61	0.51	2.74		1.933	116.00
6	489.77	489.77	30.61	0.51	3.25		1.933	116.00
7	489.77	489.77	30.61	0.51	3.76		1.933	116.00
8	489.77	489.77	30.61	0.51	4.27		1.933	116.00
9	489.77	489.77	30.61	0.51	4.78		1.933	116.00
10	489.77	489.77	30.61	0.51	5.29		1.933	116.00
11	489.77	489.77	30.61	0.51	5.80		1.933	116.00
12	489.77	489.77	30.61	0.51	6.31		1.933	116.00
13	489.77	489.77	30.61	0.51	6.82		1.933	116.00
14	489.77	489.77	30.61	0.51	7.33		1.933	116.00
15	489.77	489.77	30.61	0.51	7.84		1.933	116.00
16	489.77	489.77	30.61	0.51	8.35		1.933	115.99
17	489.77	489.77	30.61	0.51	8.86		1.933	115.99
18	489.77	489.77	30.61	0.51	9.37		1.933	115.98
19	489.77	489.77	30.61	0.51	9.88		1.933	115.97
20	489.77	489.77	30.61	0.51	10.40		1.933	115.97
21	489.77	489.77	30.61	0.51	10.91		1.933	115.97
22	489.77	489.77	30.61	0.51	11.42		1.933	115.97
23	489.77	489.77	30.61	0.51	11.93		1.933	115.97
24	489.77	489.77	30.61	0.51	12.44		1.933	115.97
25	489.77	489.77	30.61	0.51	12.95		1.933	115.97
26	489.77	489.77	30.61	0.51	13.46		1.933	115.96
27	489.77	489.77	30.61	0.51	13.97		1.933	115.96
28	489.77	489.77	30.61	0.51	14.48		1.933	115.96
29	489.77	489.77	30.61	0.51	14.99		1.933	115.96
30	489.77	489.77	30.61	0.51	15.50		1.933	115.96
31	489.77	489.77	30.61	0.51	16.01		1.933	115.96
32	489.77	489.77	30.61	0.51	16.52		1.933	115.96
33	489.77	489.77	30.61	0.51	17.03		1.933	115.96
34	489.77	489.77	30.61	0.51	17.54		1.933	115.96
35	489.77	489.77	30.61	0.51	18.05		1.933	115.96
36	489.77	489.77	30.61	0.51	18.56		1.933	115.95
37	489.77	489.77	30.61	0.51	19.07		1.933	115.95
38	489.77	489.77	30.61	0.51	19.58		1.932	115.95
39	489.77	489.77	30.61	0.51	20.09		1.932	115.94
40	489.77	489.77	30.61	0.51	20.60		1.932	115.93
41	489.77	489.77	30.61	0.51	21.11		1.932	115.92
42	489.77	489.77	30.61	0.51	21.62		1.932	115.90

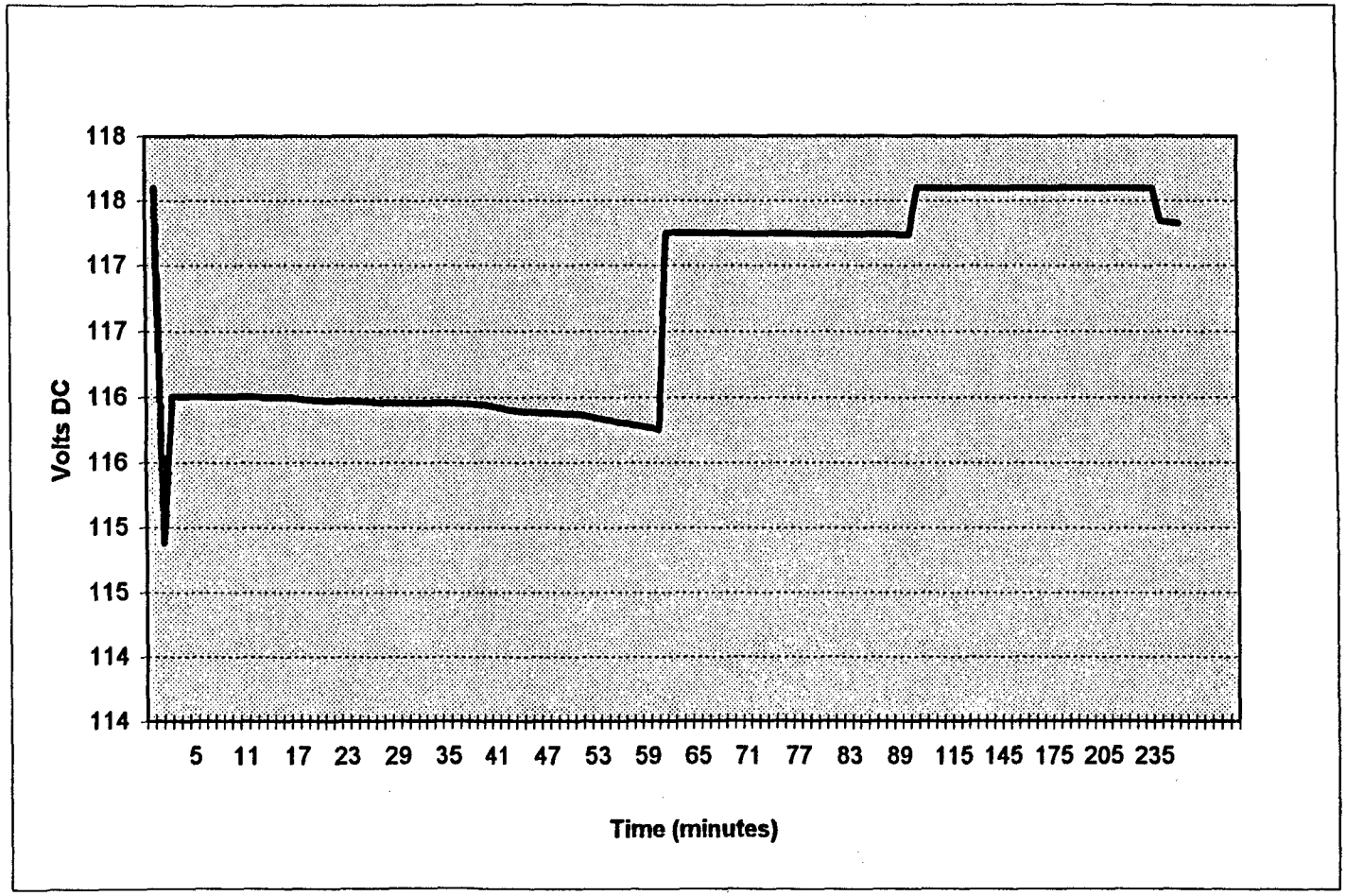
SBO DISCHARGE PROFILE DATA

Gould NCN-33								
Time (min.)	Ampere Rate	Adjusted Amps	Amps per pos plate (16 plates)	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
43	489.77	489.77	30.61	0.51	22.13		1.932	115.89
44	489.77	489.77	30.61	0.51	22.64		1.932	115.89
45	489.77	489.77	30.61	0.51	23.15		1.931	115.89
46	489.77	489.77	30.61	0.51	23.66		1.931	115.88
47	489.77	489.77	30.61	0.51	24.17		1.931	115.88
48	489.77	489.77	30.61	0.51	24.68		1.931	115.88
49	489.77	489.77	30.61	0.51	25.19		1.931	115.87
50	489.77	489.77	30.61	0.51	25.70		1.931	115.87
51	489.77	489.77	30.61	0.51	26.21		1.931	115.86
52	489.77	489.77	30.61	0.51	26.72		1.931	115.85
53	489.77	489.77	30.61	0.51	27.23		1.931	115.84
54	489.77	489.77	30.61	0.51	27.74		1.930	115.82
55	489.77	489.77	30.61	0.51	28.25		1.930	115.81
56	489.77	489.77	30.61	0.51	28.76		1.930	115.80
57	489.77	489.77	30.61	0.51	29.27		1.930	115.79
58	489.77	489.77	30.61	0.51	29.78		1.930	115.78
59	489.77	489.77	30.61	0.51	30.29		1.929	115.77
60	489.77	489.77	30.61	0.51	30.80		1.929	115.76
61	269.12	269.12	16.82	0.28	31.08		1.954	117.25
62	269.12	269.12	16.82	0.28	31.36		1.954	117.25
63	269.12	269.12	16.82	0.28	31.64		1.954	117.25
64	269.12	269.12	16.82	0.28	31.92		1.954	117.25
65	269.12	269.12	16.82	0.28	32.20		1.954	117.25
66	269.12	269.12	16.82	0.28	32.48		1.954	117.25
67	269.12	269.12	16.82	0.28	32.76		1.954	117.25
68	269.12	269.12	16.82	0.28	33.05		1.954	117.25
69	269.12	269.12	16.82	0.28	33.33		1.954	117.25
70	269.12	269.12	16.82	0.28	33.61		1.954	117.25
71	269.12	269.12	16.82	0.28	33.89		1.954	117.25
72	269.12	269.12	16.82	0.28	34.17		1.954	117.25
73	269.12	269.12	16.82	0.28	34.45		1.954	117.25
74	269.12	269.12	16.82	0.28	34.73		1.954	117.25
75	269.12	269.12	16.82	0.28	35.01		1.954	117.25
76	269.12	269.12	16.82	0.28	35.29		1.954	117.25
77	269.12	269.12	16.82	0.28	35.57		1.954	117.25
78	269.12	269.12	16.82	0.28	35.85		1.954	117.24
79	269.12	269.12	16.82	0.28	36.13		1.954	117.24
80	269.12	269.12	16.82	0.28	36.41		1.954	117.24
81	269.12	269.12	16.82	0.28	36.69		1.954	117.24
82	269.12	269.12	16.82	0.28	36.97		1.954	117.24
83	269.12	269.12	16.82	0.28	37.25		1.954	117.24
84	269.12	269.12	16.82	0.28	37.53		1.954	117.24
85	269.12	269.12	16.82	0.28	37.81		1.954	117.24
86	269.12	269.12	16.82	0.28	38.09		1.954	117.24

SBO DISCHARGE PROFILE DATA

Gould NCN-33								
Time (min.)	Ampere Rate	Adjusted Amps	Amps per pos plate (16 plates)	Amp Hours per pos plate	Cumulative A.H./pos. Discharge		Volts per cell	Actual Battery Voltage
87	269.12	269.12	16.82	0.28	38.37		1.954	117.24
88	269.12	269.12	16.82	0.28	38.65		1.954	117.24
89	269.12	269.12	16.82	0.28	38.93		1.954	117.24
90	269.12	269.12	16.82	0.28	39.21		1.954	117.24
95	167.45	167.45	10.47	0.87	40.08		1.960	117.60
100	167.45	167.45	10.47	0.87	40.96		1.960	117.60
105	167.45	167.45	10.47	0.87	41.83		1.960	117.60
110	167.45	167.45	10.47	0.87	42.70		1.960	117.60
115	167.45	167.45	10.47	0.87	43.57		1.960	117.60
120	167.45	167.45	10.47	0.87	44.45		1.960	117.60
125	167.45	167.45	10.47	0.87	45.32		1.960	117.60
130	167.45	167.45	10.47	0.87	46.19		1.960	117.60
135	167.45	167.45	10.47	0.87	47.06		1.960	117.60
140	167.45	167.45	10.47	0.87	47.93		1.960	117.60
145	167.45	167.45	10.47	0.87	48.81		1.960	117.60
150	167.45	167.45	10.47	0.87	49.68		1.960	117.60
155	167.45	167.45	10.47	0.87	50.55		1.960	117.60
160	167.45	167.45	10.47	0.87	51.42		1.960	117.60
165	167.45	167.45	10.47	0.87	52.29		1.960	117.60
170	167.45	167.45	10.47	0.87	53.17		1.960	117.60
175	167.45	167.45	10.47	0.87	54.04		1.960	117.60
180	167.45	167.45	10.47	0.87	54.91		1.960	117.60
185	167.45	167.45	10.47	0.87	55.78		1.960	117.60
190	167.45	167.45	10.47	0.87	56.66		1.960	117.60
195	167.45	167.45	10.47	0.87	57.53		1.960	117.60
200	167.45	167.45	10.47	0.87	58.40		1.960	117.60
205	167.45	167.45	10.47	0.87	59.27		1.960	117.60
210	167.45	167.45	10.47	0.87	60.14		1.960	117.60
215	167.45	167.45	10.47	0.87	61.02		1.960	117.60
220	167.45	167.45	10.47	0.87	61.89		1.960	117.60
225	167.45	167.45	10.47	0.87	62.76		1.960	117.60
230	167.45	167.45	10.47	0.87	63.63		1.960	117.60
235	167.45	167.45	10.47	0.87	64.50		1.960	117.60
238	223.61	223.61	13.98	0.70	65.20		1.956	117.34
239	223.61	223.61	13.98	0.23	65.44		1.956	117.34
240	223.61	223.61	13.98	0.23	65.67		1.955	117.33

D. C. BATTERY "A" SBO CURVE



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

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Rev. 2
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D-06

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

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

Compt 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	71LPERDC1	Emerg Lighting Panel	II/III	GE	IC2800-1607	See design input 2.19	120	78	18	108.12	30.12	YES	106.18	88.18	YES
A03	71LPERDC2	Emerg Lighting Panel	II/III	GE	IC2800-1607	See design input 2.19	120	78	18	107.08	29.08	YES	105.16	87.16	YES
A05	71LPEADC1	Emerg Lighting Panel	II/III	GE	IC2800-1612	See design input 2.19	120	78	18	105.83	27.83	YES	103.94	85.94	YES
A07	71LPESWDC1	Emerg Lighting Panel	II/III	GE	IC2800-1607	See design input 2.19	120	78	18	110.02	32.02	YES	108.04	90.04	YES
B06	71LPE1	Emerg Lighting Panel	II/III	GE	IC2800-1607	See design input 2.19	120	78	18	109.80	31.80	YES	106.03	88.03	YES
C03	71UPS-1	Uninterruptible MMG Dist	II/III	GE	5CD193YA801A800	Dwg No.1.15-4	120	90	90	107.41	17.41	YES	108.22	18.22	YES
D01	31P-7A	RFPT Emerg Oil Pump	II/III	GE	5CD256AY	IEEE-946 (80% of nominal)	125	100	100	101.22	1.22	YES	105.45	5.45	YES
			II/III	GE	IC2820-A100BB3J	G080-0702	120	75.6	9.6	111.76	36.16	YES	111.76	102.16	YES
			II/III	GE	IC2800-1621AM3H	See design input 2.19	120	78	18	111.76	33.76	YES	111.76	93.76	YES
			II/III	GE	IC2800-A501AB23C	See design input 2.21	120	75.6	9.6	111.76	36.16	YES	111.76	102.16	YES
			II/III	GE	IC2820-A100BB3J	See design input 2.22	120	75.6	7.6	111.76	36.16	YES	111.76	104.20	YES
D02	94P-13	Gen Emerg Seal Oil Pump	II/III	GE	5CD164WA803A800	IEEE-946 (80% of nominal)	120	96	96	97.55	1.55	YES	103.28	7.28	YES
			II/III	GE	IC2800-1621AM3H	See design input 2.19	120	78	18	109.26	31.26	YES	107.30	89.30	YES
			II/III	GE	IC2820-A100BB3K	See design input 2.22	120	75.6	7.6	109.26	33.66	YES	107.30	99.74	YES
			II/III	GE	IC2800-A501AB23C	See design input 2.21	120	75.6	9.6	109.26	33.66	YES	107.30	97.70	YES

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

Compt 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	71LPERDC1	Emerg Lighting Panel	II/III	GE	IC2800-1607	See design input 2.19	120	78	18	109.87	31.87	YES	106.90	88.90	YES
A03	71LPERDC2	Emerg Lighting Panel	II/III	GE	IC2800-1607	See design input 2.19	120	78	18	108.81	30.81	YES	105.87	87.87	YES
A05	71LPEADC1	Emerg Lighting Panel	II/III	GE	IC2800-1612	See design input 2.19	120	78	18	107.54	29.54	YES	104.64	86.64	YES
A07	71LPESWDC1	Emerg Lighting Panel	II/III	GE	IC2800-1607	See design input 2.19	120	78	18	111.80	33.80	YES	108.77	90.77	YES
B06	71LPE1	Emerg Lighting Panel	II/III	GE	IC2800-1607	See design input 2.19	120	78	18	111.58	33.58	YES	108.56	90.56	YES
C03	71UPS-1	Uninterruptible MMG Dist	II/III	GE	5CD193YA801A800	Dwg No.1.15-4	120	90	90	109.15	19.15	YES	108.60	18.60	YES
D01	31P-7A	RFPT Emerg Oil Pump	II/III	GE	5CD256AY	IEEE-946 (80% of nominal)	125	100	100	101.14	1.14	YES	106.58	6.58	YES
			II/III	GE	IC2820-A100BB3J	G080-0702	120	75.6	9.6	111.86	36.26	YES	111.86	102.26	YES
			II/III	GE	IC2800-1621AM3H	See design input 2.19	120	78	18	109.15	31.15	YES	108.60	90.60	YES
			II/III	GE	IC2800-A501AB23C	See design input 2.21	120	75.6	9.6	101.14	25.54	YES	106.58	96.98	YES
			II/III	GE	IC2820-A100BB3J	See design input 2.22	120	75.6	7.6	111.86	36.26	YES	111.86	104.30	YES
D02	94P-13	Gen Emerg Seal Oil Pump	II/III	GE	5CD164WA803A800	IEEE-946 (80% of nominal)	120	96	96	99.13	3.13	YES	103.68	7.68	YES
			II/III	GE	IC2800-1621AM3H	See design input 2.19	120	78	18	111.03	33.03	YES	108.03	90.03	YES
			II/III	GE	IC2820-A100BB3K	See design input 2.22	120	75.6	7.6	99.13	23.53	YES	103.68	96.12	YES
			II/III	GE	IC2800-A501AB23C	See design input 2.21	120	75.6	9.6	111.03	35.43	YES	108.03	98.43	YES

PANEL 71DC-A1 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	Load I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Ref.	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 Acceptable
02	1UPRN07	Unit & NSS Transf BU Prot	II/III	GE	N/A	N/A	125	N/A	N/A	105.85	N/A	N/A	104.84	N/A	N/A
05	71DTR	Digital Transient Recorder	II/III	E-Max	Fast Track II	E-Max FAX 7/10/1998	125	60	60	116.64	56.64	YES	108.52	48.52	YES
06	71RL-5	115kV Sta UV Trip Bus A	II/III	Agastat	7012PBL	A348-C008	125	100	50	106.85	6.85	YES	106.86	56.86	YES
			II/III	GE	12HEA61B235	GE GEZ-7723 (Excerpt), App. 8	125	70	70	106.85	36.85	YES	106.86	36.86	YES
12	71PCB-10052	345kV Bkr Alt. 1 Failure	II/III	GE	NAA Special	GE Fax Dated 09/30/00	125	100	25	110.28	10.28	YES	109.23	84.23	YES
14	71PCB-10042	345kV Bkr Trip Coil	II/III	GE	ATB-362-7	GE Summary of CB Equipment 8/28/71	125	70	70	95.89	25.89	YES	95.88	25.88	YES
19	71PCB-10042	345kV Bkr Alt. 1 Failure	II/III	GE	NAA Special	GE Fax Dated 09/30/00	125	100	25	110.28	10.28	YES	109.23	84.23	YES
21	71PCB-10052	345kV Bkr Trip Coil	II/III	GE	ATB-362-7	GE Summary of CB Equipment 8/28/71	125	70	70	100.16	30.16	YES	100.15	30.15	YES

PANEL 71DC-A1 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	Load I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Ref.	Component Nominal Voltage	Component Pickup Voltage	Component Dropout Voltage	SBO Pickup Minimum Voltage	SBO Pickup Margin	SBO Pickup Acceptable	SBO Dropout Minimum Voltage	SBO Dropout Margin	SBO Dropout Acceptable
02	1UPRN07	Unit & NSS Transf BU Prot	II/III	GE	N/A	N/A	125	N/A	N/A	108.90	N/A	N/A	106.85	N/A	N/A
05	71DTR	Digital Transient Recorder	II/III	E-Max	Fast Track II	E-Max FAX 7/10/1998	125	60	60	116.67	56.67	YES	109.25	49.25	YES
06	71RL-5	115kV Sta UV Trip Bus A	II/III	Agastat	7012PBL	A348-C008	125	100	50	107.57	7.57	YES	107.91	57.91	YES
			II/III	GE	12HEA61B235	GE GEZ-7723 (Excerpt), App. 8	125	70	70	107.57	37.57	YES	107.91	37.91	YES
12	71PCB-10052	345kV Bkr Alt. 1 Failure	II/III	GE	NAA Special	GE Fax Dated 09/30/00	125	100	25	112.06	12.06	YES	109.96	84.96	YES
14	71PCB-10042	345kV Bkr Trip Coil	II/III	GE	ATB-362-7	GE Summary of CB Equipment 8/28/71	125	70	70	97.43	27.43	YES	97.47	27.47	YES
19	71PCB-10042	345kV Bkr Alt. 1 Failure	II/III	GE	NAA Special	GE Fax Dated 09/30/00	125	100	25	112.06	12.06	YES	109.96	84.96	YES
21	71PCB-10052	345kV Bkr Trip Coil	II/III	GE	ATB-362-7	GE Summary of CB Equipment 8/28/71	125	70	70	101.78	31.78	YES	101.82	31.82	YES

PANEL 71DC-A2 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
01	PANEL 09-15	RPS Trip Backup Scram	I	GE	12HFA151A2F	GE Fax Dated 09/30/00	125	75	12.5	110.67	35.67	YES	106.45	93.95	YES
		03SOV-140A	I	ASCO	NP8316	ASCO E-mail Dated 11/20/01	125	90	90	110.67	20.67	YES	106.45	16.45	YES
03	PANEL 09-46	Core Spray Channel A Logic	I	GE	12HFA151A2F	G080-0233	125	75	12.5	116.34	41.34	YES	106.67	94.17	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75	37.5	116.34	41.34	YES	106.67	69.17	YES
			I	GE	12HGA11A52F	G080-0213	125	75	12.5	116.34	41.34	YES	106.67	94.17	YES
04	PANEL 09-32	RHR Channel A Logic	I	GE	12HFA151A2F	G080-0233	125	75	12.5	116.00	41.00	YES	106.36	93.86	YES
			I	GE	12HGA11A52F	G080-0213	125	75	12.5	116.00	41.00	YES	106.36	93.86	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75	37.5	116.00	41.00	YES	106.36	68.86	YES
			I	GE	CR2820 Series A	GE Technical Inquiry 08/08/97	125	87.5	12.5	116.00	28.50	YES	106.36	93.86	YES
			I	Agastat	ETR	A348-0342	125	100	56.25	116.00	16.00	YES	106.36	50.11	YES
			I	Agastat	E7012PH	A348-C008	125	100	12.5	116.00	16.00	YES	106.36	93.86	YES
08	31SOV-12A	RFPT 31FPD-5A Trip SOV	II/III	ASCO	Cat No. 106A231	ASCO Data Form No. V-5192 AR	125	90	90	107.59	17.59	YES	103.50	13.50	YES
09	PANEL 09-30	Relay Cabinet CH A RCIC Panel	I	GE	12HFA151A2F	G080-0233	125	75	12.5	116.07	41.07	YES	106.38	93.88	YES
			I	GE	12HGA11A52F	G080-0213	125	100	12.5	116.07	16.07	YES	106.38	93.88	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75	37.5	116.07	41.07	YES	106.38	68.88	YES
			I	GE	CR2820B Series A	GE Technical Inquiry 08/08/97	125	87.5	12.5	116.07	28.57	YES	106.38	93.88	YES
			M	GE	IC2800-1607AD	See design input 2.19	125	75	18	116.07	41.07	YES	106.38	88.38	YES
			M	Lambda	JWS-150-48/A	JE-01-013	125	85	85	116.07	31.07	YES	106.38	21.38	YES
10	PANEL 09-04	13INV-152	I	Topaz	125-GW-125-60-115	T248-049	125	101.5	101.5	115.96	14.46	YES	106.22	4.72	YES
	13SOV-012	HPCI & RCIC SOV's	II/III	ASCO	NP8320	ASCO Bulletin N0.8320	125	90	90	110.03	20.03	YES	105.81	15.81	YES
11	02-184P-3A(M)	RWR MG Set A Emergency Lube Oil Pump	II/III	GE	5CD14D05A341520	IEEE-946 (80% of nominal)	125	100	100	89.61	-10.39	NO	103.20	3.20	YES
			II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	109.59	34.59	YES	103.20	90.70	YES
			II/III	Agastat	7012PBL	A348-C008	125	100	50	109.59	9.59	YES	103.20	53.20	YES
			II/III	GE	CR106 Cat No.SO26DEA	Same data as for CR105 coil	125	62.5	37.5	109.59	47.09	YES	103.20	65.70	YES
14	PANEL 09-21	Steam Leak Det Sys Logic	I	Topaz	125-GW-125-60-115	T248-049	125	101.5	101.5	115.66	14.16	YES	105.89	4.39	YES
16	09-30 (13TS-1)	RCIC Valve Trip Sol	M	Trombetta	G-206-A5-PB	Terry Co. Fax No.716-596-3753	125	100	100	110.90	10.90	YES	106.68	6.68	YES
18	02-1841A(BKR)	Reac Recir M/G Set A Trip	II/III	GE	12HGA11A52F	G080-0213	125	100	12.5	110.47	10.47	YES	111.38	98.88	YES
			II/III	GE	AKF-2-25	GE Material Spec for AK15/25	125	70	70	110.47	40.47	YES	111.38	41.38	YES
19	71L25	600V SWGR Emer Bus 12500	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	70	116.53	26.53	YES	100.36	30.36	YES
22	PANEL 09-45	ADS System Logic	I	GE	12HFA151A2F	G080-0233	125	75	12.5	110.41	35.41	YES	106.21	93.71	YES
			I	GE	12HGA11A52F	G080-0213	125	100	12.5	110.41	10.41	YES	106.21	93.71	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75	37.5	110.41	35.41	YES	106.21	68.71	YES
			I	Agastat	ETR14D3EC2004	A348-0342	125	100	56.25	110.41	10.41	YES	106.21	49.96	YES
	02SOV-71E1	02SOV-71E1	I	Target Rock	1/2SMS-S-02-1	QDR No. 35.8	125	92	92	108.07	16.07	YES	106.35	14.35	YES

PANEL 71DC-A2 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
01	PANEL 09-15	RPS Trip Backup Scram	I	GE	12HFA151A2F	GE Fax Dated 09/30/00	125	75	12.5	112.77	37.77	YES	107.35	94.85	YES
		03SOV-140A	I	ASCO	NP8316	ASCO E-mail Dated 11/20/01	125	90	90	112.77	22.77	YES	107.35	17.35	YES
03	PANEL 09-46	Core Spray Channel A Logic	I	GE	12HFA151A2F	G080-0233	125	75	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	37.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HGA11A52F	G080-0213	125	75	12.5	N/A	N/A	N/A	N/A	N/A	N/A
04	PANEL 09-32	RHR Channel A Logic	I	GE	12HFA151A2F	G080-0233	125	75	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HGA11A52F	G080-0213	125	75	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	37.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	CR2820 Series A	GE Technical Inquiry 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	56.25	N/A	N/A	N/A	N/A	N/A	N/A
			I	Agastat	E7012PH	A348-C008	125	100	12.5	N/A	N/A	N/A	N/A	N/A	N/A
08	31SOV-12A(OP	RFPT 31FPD-5A Trip SOV	II/III	ASCO	Cat No. 106A231	ASCO Data Form No. V-5192 AR	125	90	90	109.64	19.64	YES	104.36	14.36	YES
09	PANEL 09-30	Relay Cabinet CH A RCIC Panel	I	GE	12HFA151A2F	G080-0233	125	75	12.5	116.35	41.35	YES	107.28	94.78	YES
			I	GE	12HGA11A52F	G080-0213	125	75	12.5	116.35	41.35	YES	107.28	94.78	YES
			I	GE	12HMA124A2	GE Fax Dated 09/30/00	125	75	37.5	116.35	41.35	YES	107.28	69.78	YES
			I	GE	CR2820B Series A	GE Technical Inquiry 08/08/97	125	87.5	12.5	116.35	28.85	YES	107.28	94.78	YES
			M	GE	IC2800-1607AD	See design input 2.19	125	75	18	116.35	41.35	YES	107.28	89.28	YES
			M	Lambda	JWS-150-48/A	JE-01-013	125	85	85	116.35	31.35	YES	107.28	22.28	YES
10	PANEL 09-04	13INV-152	I	Topaz	125-GW-125-60-115	T248-049	125	101.5	101.5	116.21	14.71	YES	107.12	5.62	YES
	13SOV-012	HPCI & RCIC SOV's	II/III	ASCO	NP8320	ASCO Bulletin N0.8320	125	90	90	115.75	25.75	YES	108.77	18.77	YES
11	02-184P-3A(M)	RWR MG Set A Emergency Lube Oil Pump	II/III	GE	5CD14D05A341520	IEEE-946 (80% of nominal)	125	100	100	89.46	-10.54	NO	103.38	3.38	YES
			II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	108.06	33.06	YES	107.74	95.24	YES
			II/III	Agastat	7012PBL	A348-C008	125	100	50	108.06	8.06	YES	107.74	57.74	YES
			II/III	GE	CR106 Coil SO26DEA	Same data as for CR105 coil	125	62.5	37.5	108.06	45.56	YES	107.74	70.24	YES
14	PANEL 09-21	Steam Leak Det Sys Logic	I	Topaz	125-GW-125-60-115	T248-049	125	101.5	101.5	115.95	14.45	YES	106.79	5.29	YES
16	09-30 (13TS-1)	RCIC Valve Trip Sol	M	Trombetta	G-206-A5-PB	Terry Co. Fax No.716-596-3753	125	100	100	111.39	11.39	YES	113.62	13.62	YES
18	02-1841A(BKR)	Reac Recir M/G Set A Trip	II/III	GE	12HGA11A52F	G080-0213	125	100	12.5	109.30	9.30	YES	109.30	96.80	YES
			II/III	GE	AKF-2-25	GE Material Spec for AK15/25	125	70	70	109.30	39.30	YES	109.30	39.30	YES
19	71L25	600V SWGR Emer Bus 12500	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	70	113.19	23.19	YES	N/A	N/A	N/A
22	PANEL 09-45	ADS System Logic	I	GE	12HFA151A2F	G080-0233	125	75	12.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	GE	12HGA11A52F	G080-0213	125	100	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	37.5	N/A	N/A	N/A	N/A	N/A	N/A
			I	Agastat	ETR14D3EC2004	A348-0342	125	100	56.25	N/A	N/A	N/A	N/A	N/A	N/A
	02SOV-71K1	02SOV-71K1	I	Target Rock	1/2SMS-S-02-1	QDR No. 35.8	125	92	92	104.08	12.08	YES	104.41	12.41	YES
	02SOV-71L1	02SOV-71L1	I	Target Rock	1/2SMS-S-02-1	QDR No. 35.8	125	92	92	103.91	11.91	YES	104.24	12.24	YES

PANEL 71DC-A3 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
01	09-ECCS1-EP	SRV Cab	I	Lambda	JWS300-24	M1-97-070	125	105	105	110.41	5.41	YES	106.44	1.44	YES
06	1ESWA04	ESW Lockout Matrix	I	GE	CR2811A212J	Telecon with GE Dated 06/10/97	125	78.75	43.75	109.72	30.97	YES	107.11	63.36	YES
			I	GE	12HFA154E221-	G080-1269	125	76.25	76.25	109.72	33.47	YES	107.11	30.86	YES
07	09AR-6A	Standby Gas Treat Cont A	I	GE	CR2810	Telecon with GE Dated 11/23/94	125	106.25	75	108.38	2.13	YES	106.62	31.62	YES
			I	S & D	219XXF102	S440-C016	125	100	100	108.38	8.38	YES	106.62	6.62	YES
			I	Agastat	E7014PF	A348-C008	125	100	12.5	108.38	8.38	YES	106.62	94.12	YES
09	94EHC	Main Turbine EHC Panel	II/III	C.P.Clare	HGSM51111V00	www.srddevices.com	125	19	19	110.08	91.08	YES	106.18	87.18	YES
			II/III	Asco	106S141	Asco E-Mail 4/26/2002	125	90	90	110.08	20.08	YES	106.18	16.18	YES
10	94-1TEHN05	Main Turb.Master Trip	II/III	GE	CR2810	Telecon with GE Dated 11/23/94	125	106.25	75	110.74	4.49	YES	107.19	32.19	YES
13	38MOV-VB1	Cond Vac Bkr Valve	II/III	Peerless	CZ26755	IEEE-946 (80% of nominal)	125	100	100	N/A	N/A	N/A	N/A	N/A	N/A
		Cond Vac Bkr Valve Cntl	II/III	GE	CR109	Used data for CR105 Contactor	125	62.5	37.5	N/A	N/A	N/A	N/A	N/A	N/A
20	Panel HO1	4160V SWGR Bus 10100	II/III	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.22	47.22	YES	105.28	35.28	YES
22	Panel HO3	4160V SWGR Bus 10300	II/III	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.22	47.22	YES	97.16	27.16	YES
24	Panel HO7	4160V SWGR Bus 10700	II/III	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	117.18	47.18	YES	99.70	29.70	YES

PANEL 71DC-A3 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
01	09-ECCS1-EP	SRV Cab	I	Lambda	JWS300-24	M1-97-070	125	105	105	116.09	11.09	YES	106.55	1.55	YES
06	1ESWA04	ESW Lockout Matrix	I	GE	CR2811A212J	Telecon with GE Dated 06/10/97	125	78.75	43.75	111.79	33.04	YES	107.68	63.93	YES
			I	GE	12HFA154E221-	G080-1269	125	76.25	76.25	111.79	35.54	YES	107.68	31.43	YES
07	09AR-6A	Standby Gas Treat Cont A	I	GE	CR2810	Telecon with GE Dated 11/23/94	125	106.25	75	110.24	3.99	YES	107.18	32.18	YES
			I	S & D	219XXF102	S440-C016	125	100	100	110.24	10.24	YES	107.18	7.18	YES
			I	Agastat	E7014PF	A348-C008	125	100	12.5	110.24	10.24	YES	107.18	94.68	YES
09	94EHC	Main Turbine EHC Panel	II/III	C.P.Clare	HGSM51111V00	www.srddevices.com	125	19	19	111.96	92.96	YES	106.74	87.74	YES
			II/III	Asco	106S141	Asco E-Mail 4/26/2002	125	90	90	111.96	21.96	YES	106.74	16.74	YES
10	94-1TEHN05	Main Turb.Master Trip	II/III	GE	CR2810	Telecon with GE Dated 11/23/94	125	106.25	75	112.64	6.39	YES	107.76	32.76	YES
13	38MOV-VB1	Cond Vac Bkr Valve	II/III	Peerless	CZ26755	IEEE-946 (80% of nominal)	125	100	100	86.59	-13.41	NO	103.90	3.90	YES
		Cond Vac Bkr Valve Cntl	II/III	GE	CR109	Used data for CR105 Contactor	125	62.5	37.5	86.59	24.09	YES	86.59	49.09	YES
20	Panel HO1	4160V SWGR Bus 10100	II/III	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	111.05	41.05	YES	103.93	33.93	YES
22	Panel HO3	4160V SWGR Bus 10300	II/III	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	111.64	41.64	YES	99.17	29.17	YES
24	Panel HO7	4160V SWGR Bus 10700	II/III	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	111.69	41.69	YES	100.22	30.22	YES

PANEL 71DC-A4 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Ref.	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 Acceptable
02	93FPAC	Force Paralleling Cntl Pnl													
	TBRX1	Start Tie Brk Control	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	107.12	9.62	YES	102.43	52.43	YES
	TBRX2	Start Tie Brk Permissive	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	107.12	9.62	YES	102.43	52.43	YES
	TD8M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	107.00	7.00	YES	102.42	89.92	YES
	VSRX1	EDG A Start Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	108.07	10.57	YES	102.44	52.44	YES
	VSRX2	EDG C Start Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	108.07	10.57	YES	102.44	52.44	YES
	CRF	EDG A & C Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	108.05	10.55	YES	102.91	52.91	YES
	TD9M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	108.05	8.05	YES	102.44	89.94	YES
	TD9X	EDG A & C Force Parallel	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 6/10/97	120	75.6	43.75	106.46	30.86	YES	102.44	58.69	YES
04	94GEN-EX	41TC Triping Solenoid	II/III	GE	CR9500A204B13A	E-MAIL from GE 07/10/2000	125	N/A	N/A	103.88	N/A	N/A	95.56	N/A	N/A
08	Panel HO5	4160V Emerg Bus Close	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	97.49	27.49	YES	N/A	N/A	N/A
		4160V Emerg Bus Trip	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	97.49	27.49	YES	N/A	N/A	N/A
11	93ECP-A	EDG "A" Ctrl & Ann													
	K1	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 6/10/97	125	78.75	43.75	103.33	24.58	YES	93.35	49.60	YES
	TBR	Tie Brk	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	104.91	7.41	YES	100.92	50.92	YES
	TD6	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	104.91	4.91	YES	100.92	88:42	YES
	TD7	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	104.91	4.91	YES	100.92	88.42	YES
	K4	Loss of Gen Field	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	105.94	8.44	YES	100.92	50.92	YES
	FFR	Field Flash	I	GE	CR2811 Coil 22D135G441	See attached Telecon 6/10/97	120	75.6	43.75	105.50	29.90	YES	100.86	57.11	YES
	VSR	Volt Speed	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	105.94	8.44	YES	100.92	50.92	YES
	TD5	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	109.91	9.91	YES	93.79	81.29	YES
	SOV-1A	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	109.89	19.89	YES	93.77	3.77	YES
	SOV-2A	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	109.89	19.89	YES	93.78	3.78	YES
	K2	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 4/18/97	125	62.5	37.5	109.91	47.41	YES	93.79	56.29	YES
	ESP40	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	96.61	17.86	YES	93.79	50.04	YES
	ESP200	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	101.81	23.06	YES	100.92	57.17	YES
	ESP400	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	105.94	27.19	YES	100.92	57.17	YES
	C2	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 4/18/97	125	62.5	37.5	109.91	47.41	YES	93.79	56.29	YES
	TD10	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	106.59	6.59	YES	106.13	93.63	YES
	TD1	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	106.59	6.59	YES	93.79	81.29	YES
	93GS-5A	EDG "A" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	95.40	3.40	YES	101.26	9.26	YES
	93P-4A	EDG "A" Fuel oil pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	97.01	1.01	YES	100.73	4.73	YES
	ESS	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	101.81	11.81	YES	100.91	10.91	YES
	62-	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	106.13	6.13	YES	100.92	88.42	YES
	93EGP-A	Gen "A" Cont Panel													
	Field Flash	EDG "A" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27	125	90	90	101.89	11.89	YES	101.89	11.89	YES
	K2/VR	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	107.96	15.96	YES	101.89	9.89	YES
	TDVR	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	107.96	7.96	YES	101.89	89.39	YES
	P/S-A	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	110-370	85	85	116.93	31.93	YES	93.56	8.56	YES

PANEL 71DC-A4 for LOCA PICK UP & DROP OUT VOLTAGES (cont'd)

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Ref.	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 Acceptable
12	93ECP-C	EDG "C" Ctrl & Ann													
	K1	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 6/10/97	125	78.75	43.75	103.42	24.67	YES	94.90	51.15	YES
	TBR	Tie Brk	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	105.29	7.79	YES	101.23	51.23	YES
	TD6	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	105.29	5.29	YES	101.23	88.73	YES
	TD7	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	105.29	5.29	YES	101.23	88.73	YES
	K4	Loss of Gen Field	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	105.95	8.45	YES	101.23	51.23	YES
	FFR	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	75.6	43.75	105.95	30.35	YES	101.18	57.43	YES
	VSR	Volt Speed	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	106.31	8.81	YES	101.23	51.23	YES
	TD5	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	105.29	5.29	YES	95.35	82.85	YES
	SOV-1A	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	110.10	20.10	YES	95.33	5.33	YES
	SOV-2A	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	109.89	19.89	YES	95.34	5.34	YES
	K2	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 4/18/97	125	62.5	37.5	110.13	47.63	YES	95.35	57.85	YES
	ESP40	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	98.28	19.53	YES	95.35	51.60	YES
	ESP200	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	98.82	20.07	YES	101.23	57.48	YES
	ESP400	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	98.82	20.07	YES	101.23	57.48	YES
	C2	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 4/18/97	125	62.5	37.5	110.13	47.63	YES	95.35	57.85	YES
	TD10	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	105.29	5.29	YES	106.48	93.98	YES
	TD1	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	105.29	5.29	YES	95.35	82.85	YES
	93GS-5C	EDG "C" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	96.98	4.98	YES	102.02	N/A	N/A
	93P-4C	EDG "C" Fuel Oil Pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	98.62	2.62	YES	101.04	N/A	N/A
	ESS	Speed Switch	I	Synchro-Start	ESSB-4AT	Technical Manual M494-0254	100-140	90	90	102.57	12.57	YES	101.22	11.22	YES
	62-	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	106.48	6.48	YES	101.23	88.73	YES
	93EGP-C	Gen "C" Cont Panel													
	Field Flash	EDG "C" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27	125	90	90	102.48	12.48	YES	102.48	12.48	YES
	K2/VR	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	107.96	15.96	YES	102.48	10.48	YES
	TDVR	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	107.96	7.96	YES	102.48	89.98	YES
	P/S-C	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	110-370	85	85	116.95	31.95	YES	95.13	10.13	YES

PANEL 71DC-A4 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Ref.	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 Acceptable
02	93FPAC	Force Paralleling Cntl Pnl													
	TBRX1	Start Tie Brk Control	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	104.80	7.30	YES	103.56	53.56	YES
	TBRX2	Start Tie Brk Permissive	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	104.80	7.30	YES	103.56	53.56	YES
	TD8M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	104.80	4.80	YES	103.56	91.06	YES
	VSRX1	EDG A Start Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	104.80	7.30	YES	103.56	53.56	YES
	VSRX2	EDG C Start Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	104.80	7.30	YES	103.56	53.56	YES
	CRF	EDG A & C Field Flashing	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	104.80	7.30	YES	103.56	53.56	YES
	TD9M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	104.80	4.80	YES	103.56	91.06	YES
	TD9X	EDG A & C Force Parallel	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 6/10/97	125	78.75	43.75	104.80	26.05	YES	103.56	59.81	YES
04	94GEN-EX	41TC Triping Solenoid	II/III	GE	CR9500A204B13A	E-MAIL from GE 07/10/2000	125	N/A	N/A	105.83	N/A	N/A	97.08	N/A	N/A
08	Panel HO5	4160V Emerg Bus Close	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	113.48	43.48	YES	N/A	N/A	N/A
		4160V Emerg Bus Trip	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	113.48	43.48	YES	N/A	N/A	N/A
11	93ECP-A	EDG "A" Ctrl & Ann													
	K1	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 6/10/97	125	78.75	43.75	110.90	32.15	YES	96.07	52.32	YES
	TBR	Tie Brk	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	110.90	13.40	YES	96.07	46.07	YES
	TD6	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	110.90	10.90	YES	96.07	83.57	YES
	TD7	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	110.90	10.90	YES	96.07	83.57	YES
	K4	Loss of Gen Field	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	110.90	13.40	YES	96.07	46.07	YES
	FFR	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	110.90	32.15	YES	96.07	52.32	YES
	VSR	Volt Speed	I	SQ.D	KPD-13 Class 8501	S345-C006 & App. 8	130	97.5	50	110.90	13.40	YES	96.07	46.07	YES
	TD5	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	110.90	10.90	YES	96.07	83.57	YES
	SOV-1A	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	110.90	20.90	YES	96.07	6.07	YES
	SOV-2A	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	110.90	20.90	YES	96.07	6.07	YES
	K2	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 4/18/97	125	62.5	37.5	110.90	48.40	YES	96.07	58.57	YES
	ESP40	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	110.90	32.15	YES	96.07	52.32	YES
	ESP200	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	110.90	32.15	YES	96.07	52.32	YES
	ESP400	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 6/10/97	125	78.75	43.75	110.90	32.15	YES	96.07	52.32	YES
	C2	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 4/18/97	125	62.5	37.5	110.90	48.40	YES	96.07	58.57	YES
	TD10	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	110.90	10.90	YES	96.07	83.57	YES
	TD1	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	110.90	10.90	YES	96.07	83.57	YES
	93GS-5A	EDG "A" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	100.18	8.18	YES	109.15	17.15	YES
	93P-4A	EDG "A" Fuel oil pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	96.62	0.62	YES	101.89	5.89	YES
	ESS	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	110.90	20.90	YES	96.07	6.07	YES
	62-	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	110.90	10.90	YES	96.07	83.57	YES
	93EGP-A	Gen "A" Cont Panel													
	Field Flash	EDG "A" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27	125	90	90	110.31	20.31	YES	110.31	20.31	YES
	K2/VR	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	110.31	18.31	YES	110.31	18.31	YES
	TDVR	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	110.31	10.31	YES	110.31	97.81	YES
	P/S-A	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	110-370	85	85	117.04	32.04	YES	95.85	10.85	YES

PANEL 71DC-A5 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
01	09-95	ECCS Cab Power	I	Datametric	147D8661P1	G080-0166	125	105	105.00	113.46	8.46	YES	105.79	0.79	YES
02	06-INV-1A	Feedwater Inverter A	M	Topaz	N250-GWR-125-60	T248-0049	125	101.5	101.5	113.37	11.87	YES	105.69	4.19	YES
05	09-32	HPCI Inboard Isol Valve	I	GE	12HGA11A52F	G080-0213	125	75	12.5	114.37	39.37	YES	106.78	94.28	YES
				GE	12HFA151A2F	G080-0233	125	75	12.5	114.37	39.37	YES	106.78	94.28	YES
			I	GE	12HMA124A9	GE Fax Dated 09/30/00	125	75	37.5	114.37	39.37	YES	106.78	69.28	YES
07	09ARI-2	Alternate Rod Insertion Sys.	M	Agastat	EGPD003	A348-0342	125	100	56.25	113.20	13.20	YES	105.68	49.43	YES
			M	W	ARD660S	Fax from Westinghouse 8/26/97	120	96	12	113.20	17.20	YES	105.68	93.68	YES
			M	Agastat	ETR14D3C003	A348-0342	125	100	56.25	113.20	13.20	YES	105.68	49.43	YES
	03SOV-201		M	Valcor	V70900	Dwg No. 7.68-66	125	90	90	105.05	15.05	YES	103.08	13.08	YES
09	27MAP Panel	23E/S-200A	I	Foxboro	N-2ARPS05-A6-BB4	Mod. F1-89-158	125	104	104	112.91	8.91	YES	105.20	1.20	YES
18	71INV-1A	27 MAP Pnl-Inst INV Loads	I	HDR Power	STI-03-1	Dwg No. 1.49-160	125	101.5	101.5	111.90	10.40	YES	104.11	2.61	YES

PANEL 71DC-A5 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
01	09-95	ECCS Cab Power	I	Datametric	147D8661P1	G080-0166	125	105	105.00	114.10	9.10	YES	107.25	2.25	YES
02	06-INV-1A	Feedwater Inverter A	M	Topaz	N250-GWR-125-60	T248-0049	125	101.5	101.5	114.01	12.51	YES	107.15	5.65	YES
05	09-32	HPCI Inboard Isol Valve	I	GE	12HGA11A52F	G080-0213	125	75	12.5	115.01	40.01	YES	108.22	95.72	YES
				GE	12HFA151A2F	G080-0233	125	75	12.5	115.01	40.01	YES	108.22	95.72	YES
			I	GE	12HMA124A9	GE Fax Dated 09/30/00	125	75	37.5	115.01	40.01	YES	108.22	70.72	YES
07	09ARI-2	Alternate Rod Insertion Sys.	M	Agastat	EGPD003	A348-0342	125	100	56.25	107.78	7.78	YES	107.68	51.43	YES
			M	W	ARD660S	Fax from Westinghouse 8/26/97	120	96	12	107.78	11.78	YES	107.68	95.68	YES
			M	Agastat	ETR14D3C003	A348-0342	125	100	56.25	107.78	7.78	YES	107.68	51.43	YES
	03SOV-201		M	Valcor	V70900	Dwg No. 7.68-66	125	90	90	105.12	15.12	YES	105.02	15.02	YES
09	27MAP Panel	23E/S-200A	I	Foxboro	N-2ARPS05-A6-BB4	Mod. F1-89-158	125	104	104	113.56	9.56	YES	106.67	2.67	YES
18	71INV-1A	27 MAP Pnl-Inst INV Loads	I	HDR Power	STI-03-1	Dwg No. 1.49-160	125	101.5	101.5	112.54	11.04	YES	105.59	4.09	YES

BUS 71BMCC-1 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
OA1	13MOV-16	RCIC Steam Outboard Iso Vlv (Close)	I	Ancor	W8822741	JAF-CALC-RCIC-03074	125	94.50	94.50	96.63	2.13	YES	108.71	14.21	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	106.34	31.34	YES	106.34	88.34	YES
			I	GE	IC2800A1607F3J	See design input 2.19	120	75	18.00	106.34	31.34	YES	106.34	88.34	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	106.34	34.34	YES	106.34	97.94	YES
OB2	13MOV-21	RCIC Pmp Disch Isol VA (Open)	I	Velan	B12-2A5PS-2TS	JAF-CALC-RCIC-01955	125	92.77	92.77	93.44	0.68	YES	101.52	8.75	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	106.25	31.25	YES	104.08	86.08	YES
			I	GE	IC2800A1607F3H	See design input 2.19	120	75	18.00	106.25	31.25	YES	104.08	86.08	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	106.25	34.25	YES	104.08	95.68	YES
		RCIC Pmp Disch Isol VA (Close)	I	Velan	B12-2A5PS-2TS	JAF-CALC-RCIC-01955	125	92.77	92.77	94.19	1.42	YES	108.04	15.27	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	107.10	32.10	YES	110.36	92.36	YES
			I	GE	IC2800A1607F3J	See design input 2.19	120	75	18.00	107.10	32.10	YES	110.36	92.36	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	107.10	35.10	YES	110.36	101.96	YES
OC1	13MOV-27	RCIC Min Flow Bypass (Open)	I	Velan	W2-2A74-2TS	JAF-CALC-RCIC-03187	125	89.69	89.69	95.19	5.51	YES	105.96	16.27	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	101.98	26.98	YES	105.79	87.79	YES
			I	GE	IC2800A1607F3H	See design input 2.19	120	75	18.00	101.98	26.98	YES	105.79	87.79	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	101.98	29.98	YES	105.79	97.39	YES
		RCIC Min Flow Isol VA (Close)	I	Velan	W2-2A74-2TS	JAF-CALC-RCIC-03187	125	89.69	89.69	99.00	9.32	YES	107.15	17.46	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	106.06	31.06	YES	106.92	88.92	YES
			I	GE	IC2800A1607F3J	See design input 2.19	120	75	18.00	106.06	31.06	YES	106.92	88.92	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	106.06	34.06	YES	106.92	98.52	YES
OE1	13P-3	RCIC Gland Seal Vac Pump	M	Contin.	D225X	IEEE-946 (80% of nominal)	125	100	100	104.08	4.08	YES	101.48	1.48	YES
			M	GE	IC2800A1607F3J	See design input 2.19	120	75	18.00	107.89	32.89	YES	103.10	85.10	YES
			M	GE	IC2800A501AB23C	E-MAIL from GE 12/19/01	120	75.6	9.60	107.89	32.29	YES	103.10	93.50	YES
OE2	13P-4	RCIC Gland Seal Cond Pump	M	GE	5CD1462A900001	IEEE-946 (80% of nominal)	125	100	100	100.89	0.89	YES	104.69	4.69	YES
			M	GE	IC2800A1607F3J	See design input 2.19	120	75	18.00	104.33	29.33	YES	103.05	85.05	YES
			M	GE	IC2800A501AB23C	E-MAIL from GE 12/19/01	120	75.6	9.60	104.33	28.73	YES	103.05	93.45	YES

Notes :

1) Minimum motor terminal voltage for 13MOV- 16 (94.49 VDC or 75.59% rated) was obtaned from JAF-CALC-RCIC-03074 Rev. 0

2) Minimum motor terminal voltage for 13MOV- 21 (92.76 VDC or 74.21% rated) was obtaned from JAF-CALC-RCIC-01955 Rev. 2

3) Minimum motor terminal voltage for 13MOV- 27 (89.69 VDC or 71.74% rated) was obtaned from JAF-CALC-RCIC-03187 Rev. 0

4) Minimum motor terminal voltage for 13MOV- 30 (98.12 VDC or 78.5% rated) was obtaned from JAF-CALC-RCIC-03195 Rev. 0

BUS 71BMCC-1 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
OB2	13MOV-21	RCIC Pmp Disch Isol VA (Open)	I	Velan	B12-2A5PS-2TS	JAF-CALC-RCIC-01955	125	92.77	92.77	97.81	5.05	YES	103.92	11.16	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	111.22	36.22	YES	106.40	88.40	YES
			I	GE	IC2800A1607F3H	See design input 2.19	120	75	18.00	111.22	36.22	YES	106.40	88.40	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	111.22	39.22	YES	106.40	98.00	YES
OC1	13MOV-27	RCIC Min Flow Isol VA (Open)	I	Velan	W2-2A74-2TS	JAF-CALC-RCIC-03187	125	89.69	89.69	97.31	7.62	YES	104.79	15.10	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	104.25	29.25	YES	104.42	86.42	YES
			I	GE	IC2800A1607F3H	See design input 2.19	120	75	18.00	104.25	29.25	YES	104.42	86.42	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	104.25	32.25	YES	104.42	96.02	YES
		RCIC Min Flow Isol VA (Close)	I	Velan	W2-2A74-2TS	JAF-CALC-RCIC-03187	125	89.69	89.69	97.74	8.05	YES	107.41	17.72	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	104.70	29.70	YES	105.45	87.45	YES
			I	GE	IC2800A1607F3J	See design input 2.19	120	75	18.00	104.70	29.70	YES	105.45	87.45	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	104.70	32.70	YES	105.45	97.05	YES
OC2	13MOV-30	RCIC Test Return (Open)	M	Velan	B10-2A7PS-2TS	JAF-CALC-RCIC-03195	125	98.12	98.12	104.84	6.72	YES	108.67	10.54	YES
			I	GE	IC2800A1607D3G	See design input 2.19	120	75	18.00	108.22	33.22	YES	108.22	90.22	YES
			I	GE	IC2800A1607F3H	See design input 2.19	120	75	18.00	108.22	33.22	YES	108.22	90.22	YES
			I	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	108.22	36.22	YES	108.22	99.82	YES
OE1	13P-3	RCIC Gland Seal Vac Pump	M	Contin.	D225X	IEEE-946 (80% of nominal)	125	100	100	103.78	3.78	YES	103.89	3.89	YES
			M	GE	IC2800A1607F3J	See design input 2.19	120	75	18.00	107.58	32.58	YES	105.34	87.34	YES
			M	GE	IC2800A501AB23C	See design input 2.19	120	75.6	9.60	107.58	31.98	YES	105.34	95.74	YES
OE2	13P-4	RCIC Gland Seal Cond Pump	M	GE	5CD1462A900001	IEEE-946 (80% of nominal)	125	100	100	108.08	8.08	YES	104.43	4.43	YES
			M	GE	IC2800A1607F3J	See design input 2.19	120	75	18.00	105.40	30.40	YES	105.58	87.58	YES
			M	GE	IC2800A501AB23C	E-MAIL from GE 12/19/01	120	75.6	9.60	105.40	29.80	YES	105.58	95.98	YES

Notes :

1) Minimum motor terminal voltage for 13MOV- 16 (94.49 VDC or 75.59% rated) was obtaned from JAF-CALC-RCIC-03074 Rev. 0

2) Minimum motor terminal voltage for 13MOV- 21 (92.76 VDC or 74.21% rated) was obtaned from JAF-CALC-RCIC-01955 Rev. 2

3) Minimum motor terminal voltage for 13MOV- 27 (89.69 VDC or 71.74% rated) was obtaned from JAF-CALC-RCIC-03187 Rev. 0

4) Minimum motor terminal voltage for 13MOV- 30 (98.12 VDC or 78.5% rated) was obtaned from JAF-CALC-RCIC-03195 Rev. 0

BUS 71BMCC-3 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
OB1	13MOV-131	RCIC Turb Steam Inlet Isol Valve (Open)	M	Anchor	W9624628	JAF-CALC-RCIC-01993	125	87.15	87.15	91.79	4.63	YES	104.62	17.46	YES
			M	GE	IC2800A1607D3G	See design input 2.19	120	75	18	102.98	27.98	YES	101.98	83.98	YES
			M	GE	IC2800A1607F3H	See design input 2.19	120	75	18	102.98	27.98	YES	101.98	83.98	YES
			M	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	102.98	30.98	YES	101.98	93.58	YES
OB2	13MOV-132	RCIC Turb Lube Oil Cooler Water Supply Isol Valve (Open)	M	Velan	W7-374-2TS	JAF-CALC-RCIC-03171	125	86.59	86.59	92.48	5.89	YES	104.71	18.12	YES
			M	GE	IC2800A1607D3G	See design input 2.19	120	75	18	102.73	27.73	YES	101.74	83.74	YES
			M	GE	IC2800A1607F3H	See design input 2.19	120	75	18	102.73	27.73	YES	101.74	83.74	YES
			M	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	102.73	30.73	YES	101.74	93.34	YES

BUS 71BMCC-3 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
OB1	13MOV-131	RCIC Turb Steam Inlet Isol Valve (Open)	M	Anchor	W9624628	JAF-CALC-RCIC-01993	125	87.15	87.15	91.85	4.69	YES	106.70	19.54	YES
			M	GE	IC2800A1607D3G	See design input 2.19	120	75	18	103.04	28.04	YES	103.04	85.04	YES
			M	GE	IC2800A1607F3H	See design input 2.19	120	75	18	103.04	28.04	YES	103.04	85.04	YES
			M	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	103.04	31.04	YES	103.04	94.64	YES
OB2	13MOV-132	RCIC Turb Lube Oil Cooler Water Supply Isol Valve (Open)	M	Velan	W7-374-2TS	JAF-CALC-RCIC-03171	125	86.59	86.59	92.55	5.96	YES	106.79	20.20	YES
			M	GE	IC2800A1607D3G	See design input 2.19	120	75	18	102.80	27.80	YES	102.80	84.80	YES
			M	GE	IC2800A1607F3H	See design input 2.19	120	75	18	102.80	27.80	YES	102.80	84.80	YES
			M	GE	IC2820A200A3F	E-MAIL from GE 09/05/00	120	72	8.4	102.80	30.80	YES	102.80	94.40	YES

Notes:

1) Minimum motor terminal voltage for 13MOV- 131 (87.15 VDC or 69.72% rated) was obtaned from JAF-CALC-RCIC-01993 Rev. 2

2) Minimum motor terminal voltage for 13MOV- 132 (86.59 VDC or 69.27% rated) was obtaned from JAF-CALC-RCIC-03171 Rev. 0

PANEL 71HO1 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
H01	4kV Bkr 71-10102	4160V Transf 71T-4X	II/II	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	96.92	26.92	YES	96.81	26.81	YES
H01	4kV Bkr 71-10110	Reac Recirc PP	II/II	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	94.36	24.36	YES	94.46	24.46	YES
H01	4kV Bkr 71-10112	4160V Transf 71T-3X (Alt)	II/II	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
H01	Ckt # HONA03	4kV Bus 10100 UV	II/II	GE	SAM17A	G080-0576	125	62.5	62.5	107.07	44.57	YES	106.94	44.44	YES
			II/II	GE	HLA11B	G080-0657	125	75	75	107.07	32.07	YES	106.94	31.94	YES

PANEL 71HO1 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
H01	4kV Bkr 71-10102	4160V Transf 71T-4X	II/II	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	100.20	30.20	YES	93.78	23.78	YES
H01	4kV Bkr 71-10110	Reac Recirc PP	II/II	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	103.62	33.62	YES	103.94	33.94	YES
H01	4kV Bkr 71-10112	4160V Transf 71T-3X (Alt)	II/II	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
H01	Ckt # HONA03	4kV Bus 10100 UV	II/II	GE	SAM17A	G080-0576	125	62.5	62.5	110.69	48.19	YES	103.60	41.10	YES
			II/II	GE	HLA11B	G080-0657	125	75	75	110.69	35.69	YES	103.60	28.60	YES

PANEL 71HO3 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
H03	4kV Bkr 71-10302	4160V Transf 71T-4Y Trip	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	99.54	29.54	YES	89.55	19.55	YES
H03	4kV Bkr 71-10304	4160V Bus 10500 Trip	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	104.99	34.99	YES	104.99	34.99	YES
H03	4kV Bkr 71-10304	4160V Bus 10500 Close	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	97.53	27.53	YES	97.53	27.53	YES
	4kV Bkr 71-10304	71-10304 Brk Charging Motor	II/III	GE		G080-0631	125	90	90	95.16	5.16	YES	106.84	16.84	YES
H03	4kV Bkr 71-10310	Condencer Pump 33P-8A	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.27	28.27	YES	98.27	28.27	YES
	86U-1CNDA02	Brk UV Trip Aux Rly	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	98.66	23.66	YES	97.08	84.58	YES
H03	4kV Bkr 71-10312	4160V Transf 71T-3Y Trip	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
		4160V Transf 71T-3Y Close	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	92.04	22.04	YES	92.04	22.04	YES
		71-10312 Brk Charging Motor	II/III	GE	AMH-4.76-250	G080-0631	125	90	90	95.16	5.16	YES	106.81	16.81	YES
H03	4kV Bkr 71-10320	Service Water Pump 46P-1A	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	89.92	19.92	YES	89.92	N/A	N/A
	86U-1SWSA01	Brk UV Trip Aux Rly	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	98.66	23.66	YES	97.08	84.58	YES
H03	4kV Bkr 71-10330	Circ Water Pump 36P-1A	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.22	28.22	YES	98.22	28.22	YES
H03	4kV Bkr 71-10340	Aux Feed to 600V Buses	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.45	28.45	YES	98.45	28.45	YES
H03	4kV Bkr 71-10350	Cond Booster Pump 33P-9A	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.23	28.23	YES	98.23	28.23	YES
	86U-1CNDA01	Brk UV Trip Aux Rly	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	98.66	23.66	YES	97.08	84.58	YES
H03	4kV Bkr 71-10360	Clsd Loop Clg Wtr Pump	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.23	28.23	YES	98.23	N/A	N/A
	86U-1TBCA01	Brk UV Trip Aux Rly	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	98.66	23.66	YES	97.08	84.58	YES
H03	Ckt # HONA03	4kV Bus 10100 UV	II/II	GE	SAM17A	G080-0576	125	62.5	62.5	109.38	46.88	YES	96.82	34.32	YES
			II/II	GE	HLA11B	G080-0657	125	75	75	109.38	34.38	YES	96.82	21.82	YES

PANEL 71HO3 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
H03	4kV Bkr 71-10302	4160V Transf 71T-4Y Trip	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	101.24	31.24	YES	89.93	19.93	YES
H03	4kV Bkr71-10304	4160V Bus 10500 Trip	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	106.22	36.22	YES	106.22	36.22	YES
H03	4kV Bkr71-10310	Condencer Pump 33P-8A	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.69	28.69	YES	99.00	29.00	YES
	86U-1CNDA02	Brk UV Trip Aux Rly	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	99.08	24.08	YES	99.40	86.90	YES
H03	4kV Bkr 71-10312	4160V Transf 71T-3Y (Alt)	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
H03	4kV Bkr 71-10320	Service Water Pump 46P-1A	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.70	28.70	YES	99.02	29.02	YES
	86U-1SWSA01	Brk UV Trip Aux Rly	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	99.08	24.08	YES	99.40	86.90	YES
H03	4kV Bkr 71-10330	Circ Water Pump 36P-1A	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.63	28.63	YES	98.95	28.95	YES
H03	4kV Bkr 71-10340	Aux Feed to 600V Buses	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.87	28.87	YES	99.18	29.18	YES
H03	4kV Bkr 71-10350	Cond Booster Pump 33P-9A	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.65	28.65	YES	98.96	28.96	YES
	86U-1CNDA01	Brk UV Trip Aux Rly	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	99.08	24.08	YES	99.39	86.89	YES
H03	4kV Bkr 71-10360	Clsd Loop Clg Wtr Pump	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	98.94	28.94	YES	99.25	29.25	YES
	86U-1TBCA01	Brk UV Trip Aux Rly	II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	99.08	24.08	YES	99.39	86.89	YES
H03	Ckt # HONA03	4kV Bus 10100 UV	II/II	GE	SAM17A	G080-0576	125	62.5	62.5	111.25	48.75	YES	98.82	36.32	YES
			II/II	GE	HLA11B	G080-0657	125	75	75	111.25	36.25	YES	98.82	23.82	YES

PANEL 71H05 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
H05	4kV Bkr 71-10502	Ctrl Supply EDG-A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.29	27.29	YES	97.63	27.63	YES
		71-10502 Brk Charging Motor				G080-0631	125	90	90	99.31	9.31	YES	94.81	4.81	YES
H05	4kV Bkr 71-10510	RHR Serv Wtr Pump 10P-1C	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	112.05	42.05	YES	112.82	42.82	YES
	Close	71-10510 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.36	14.36	YES	111.12	21.12	YES
	10SOV-101C	RHR Pmp 10P-1C 10SOV-101C	I	ASCO	HC8210C13	E-Mail from ASCO 11/15/01	125	90	90	116.98	26.98	YES	97.33	7.33	YES
H05	4kV Bkr 71-10512	Ctrl Supply EDG-C Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.70	27.70	YES	98.04	28.04	YES
		71-10512 Brk Charging Motor	I	GE		G080-0631	125	90	90	99.61	9.61	YES	95.10	5.10	YES
H05	4kV Bkr 71-10514	Tie to Bus 10300 Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	103.68	33.68	YES	105.85	35.85	YES
		Tie to Bus 10300 Close			AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.88	24.88	YES	94.88	24.88	YES
		71-10514 Brk Charging Motor	I	GE		G080-0631	125	90	90	103.24	13.24	YES	109.45	19.45	YES
H05	4kV Bkr #10520	RHR Serv Wtr Pump 10P-1A	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	100.98	30.98	YES	101.00	31.00	YES
	Close	71-10520 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.49	14.49	YES	111.14	21.14	YES
	10SOV-101A	RHR Pmp 10P-1A 10SOV-101A	I	ASCO	HC8210C13	E-Mail from ASCO 11/15/01	125	90	90	116.98	26.98	YES	97.33	7.33	YES
H05	4kV Bkr 71-10530	Core Spray Pmp 14P-1A Trip	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
		Core Spray Pmp 14P-1A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.29	27.29	YES	98.72	28.72	YES
		71-10530 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.69	14.69	YES	110.98	20.98	YES
H05	4kV Bkr 71-10540	RHR Pump 10P-3B Trip	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
		RHR Pump 10P-3B Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	96.85	26.85	YES	98.26	28.26	YES
		71-10540 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.88	14.88	YES	109.85	19.85	YES
H05	4kV Bkr 71-10550	RHR Pump 10P-3A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	91.35	21.35	YES	91.35	21.35	YES
H05		71-10550 Brk Charging Motor	I	GE		G080-0631	125	90	90	98.70	8.70	YES	101.16	11.16	YES
		RHR Pump 10P-3A Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	103.68	33.68	YES	105.60	35.60	YES
		RHR Pump 10P-3A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	88.64	18.64	YES	88.65	18.65	YES
		71-10550 Brk Charging Motor	I	GE		G080-0631	125	90	90	95.54	5.54	YES	107.90	17.90	YES
H05	4kV Bkr 71-10560	Feed to 600V Bus	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
H05	4kV Bkr 71-10504	K8 EDG-A&C Brk Closing Rel	I	GE	CR2811A211G	Telecon with GE Dated 6/10/97	125	81.25	43.75	104.78	23.53	YES	97.47	53.72	YES
		EDG Tie A & C Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	89.38	19.38	YES	89.17	19.17	YES
		71-10504 Brk Charging Motor	I	GE		G080-0631	125	90	90	97.06	7.06	YES	100.96	10.96	YES
		62-1EDGA02 EDG A&C Closing	I	Agastat	E7012PB	A348-C008	125	100	12.5	107.30	7.30	YES	102.11	89.61	YES
		62X-1EDGA02 EDG A&C Closing	I	GE	HLA11B	G080-06571	125	75	75	107.30	32.30	YES	102.11	27.11	YES
		K9-1EDGA002 Tie Breaker Trip	I	GE	CR2811A211G	See attached Telecon 6/10/97	125	81.25	43.75	111.12	29.87	YES	97.43	53.68	YES
		EDG Tie A & C Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	110.20	40.20	YES	100.27	30.27	YES
H05	Ckt # 1HOEA03	Emer Bus 10500 UV	I	GE	SAM17A	G080-0576	125	77.5	77.5	117.17	39.67	YES	96.98	19.48	YES
			I	GE	HLA11B	G080-0657	125	75	75	117.17	42.17	YES	96.98	21.98	YES
			I	GE	HGA11J	G080-0213	125	75	25.00	117.17	42.17	YES	96.98	71.98	YES
			I	Agastat	E7012PB	A348-C008	125	100	12.5	117.17	17.17	YES	96.98	84.48	YES
			I	Agastat	E7012PC	A348-C008	125	96	12.5	117.17	21.17	YES	96.98	84.48	YES
			I	GE	HFA100	G080-0233	125	75	12.5	117.17	42.17	YES	96.98	84.48	YES
			I	Brown Boveri	ITE-27N	B455-0002	125	70	70	117.17	47.17	YES	96.98	26.98	YES

PANEL 71H05 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
H05	4kV Bkr 71-10502	Ctrl Supply EDG-A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.29	24.29	YES	94.33	24.33	YES
		71-10502 Brk Charging Motor				G080-0631	125	90	90	98.85	8.85	YES	107.54	17.54	YES
		K10-1EDGA01 EDG A Egn. Fail	I	GE	CR2811A211G	Telecon with GE dated 6/10/97	125	81.25	43.75	107.30	26.05	YES	107.34	63.59	YES
		Ctrl Supply EDG-A Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	101.52	31.52	YES	101.56	31.56	YES
		Ctrl Supply EDG-A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	99.10	29.10	YES	99.10	29.10	YES
		71-10502 Brk Charging Motor				G080-0631	125	90	90	105.00	15.00	YES	111.95	21.95	YES
H05	4kV Bkr 71-10510	RHR SWP 10P-1C Trip	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
H05	4kV Bkr 71-10512	Ctrl Supply EDG-C Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.68	24.68	YES	94.72	24.72	YES
		71-10512 Brk Charging Motor				G080-0631	125	90	90	99.15	9.15	YES	107.63	17.63	YES
		K10-1EDGC01 EDG C Egn. Fail	I	GE	CR2811A211G	Telecon with GE dated 6/10/97	125	81.25	43.75	107.51	26.26	YES	110.40	66.65	YES
		Ctrl Supply EDG-C Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	102.74	32.74	YES	102.78	32.78	YES
H05	4kV Bkr 71-10514	Tie to Bus 10300	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	105.86	35.86	YES	105.86	35.86	YES
H05	4kV Bkr 71-10520	RHR Serv Wtr Pump 10P-1A	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
H05	4kV Bkr 71-10530	Core Spray Pump 14P-1A close	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
		Core Spray Pump 14P-1A trip	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
H05	4kV Bkr 71-10540	RHR Pump 10P-3B trip	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
		RHR Pump 10P-3B close	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
H05	4kV Bkr 71-10550	RHR Pump 10P-3A Close	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
		71-10550 Brk Charging Motor				G080-0631	125	90	90	N/A	N/A	N/A	N/A	N/A	N/A
		RHR Pump 10P-3A Trip	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
H05	4kV Bkr #10560	Feed to 600V Bus	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
H05	4kV Bkr 71-10504	K8 EDG-A&C Brk Closing Rel	I	GE	CR2811A211G	Telecon with GE dated 6/10/97	125	81.25	43.75	112.82	31.57	YES	112.64	68.89	YES
		EDG Tie A & C Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	96.10	26.10	YES	96.10	26.10	YES
		71-10504 Brk Charging Motor				G080-0631	125	90	90	104.47	14.47	YES	105.26	15.26	YES
		62-1EDGA02 EDG A&C Closing	I	Agastat	E7012PB	A348-C008	125	100	12.5	106.74	6.74	YES	100.62	88.12	YES
		62X-1EDGA02 EDG A&C Closing	I	GE	HLA11B	G080-0657	125	77.5	77.5	106.74	29.24	YES	100.63	23.13	YES
		K9-1EDGA002 Tie Breaker Trip	I	GE	CR2811A211G	See attached Telecon 6/10/97	125	81.25	43.75	107.36	26.11	YES	110.41	66.66	YES
		EDG Tie A & C Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	108.55	38.55	YES	99.80	29.80	YES
H05	Ckt # 1HOEA03	Emer Bus 10500 UV	I	GE	SAM17A	G080-0576	125	77.5	77.5	110.44	32.94	YES	97.94	20.44	YES
			I	GE	HLA11B	G080-0657	125	75	75	110.44	35.44	YES	97.94	22.94	YES
			I	GE	HGA11J	G080-0213	125	75	25.00	110.44	35.44	YES	97.94	72.94	YES
			I	Agastat	E7012PB	A348-C008	125	100	12.5	110.44	10.44	YES	97.94	85.44	YES
			I	Agastat	E7012PC	A348-C008	125	100	12.5	110.44	10.44	YES	97.94	85.44	YES
			I	GE	HFA100	G080-0233	125	75	12.5	110.44	35.44	YES	97.94	85.44	YES
			I	Brown Boveri	ITE-27N	B455-0002	125	70	70	110.44	40.44	YES	97.94	27.94	YES

PANEL 71HO7 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
H07	4kV Bkr 71-10702	4160V Transf 71T-4Y	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	117.12	47.12	YES	86.50	16.50	YES
H07	4kV Bkr 71-10710	Cond PP 33P-8C	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	95.76	25.76	YES	95.76	25.76	YES
	86U- Pmp 33PP-8C UV Trip Aux Relay		II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	96.17	21.17	YES	96.17	83.67	YES
H07	4kV Bkr 71-10720	Service Water Pump	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	95.76	25.76	YES	95.76	25.76	YES
	86U- Pmp 46P-1C UV Trip Aux Relay		II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	96.17	21.17	YES	96.17	83.67	YES
H07	4kV Bkr 71-10730	Circ Water Pump	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	95.78	25.78	YES	95.78	25.78	YES
H07	4kV Bkr 71-10740	Cond Booster Pump	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	75	12.5	95.77	20.77	YES	95.77	83.27	YES
	86U- Pmp 33P-9C UV Trip Aux Relay		II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	96.17	21.17	YES	96.17	83.67	YES
H07	4kV Bkr71-10750	Clsd Loop Clg Water PP	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	95.76	25.76	YES	95.76	25.76	YES
	86U- Pmp 37P-2C UV Trip Aux Relay		II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	96.17	21.17	YES	96.17	83.67	YES
H07	Ckt # HONE02	4kV Bus 10700 UV	II/II	GE	HLA11B	G080-0657	125	75	75	96.16	21.16	YES	96.16	21.16	YES
			II/II	GE	HGA11J	G080-0213	125	75	25	96.16	21.16	YES	96.16	71.16	YES

PANEL 71HO7 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
H07	4kV Bkr 71-10702	4160V Transf 71T-4Y	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	99.78	29.78	YES	86.95	N/A	N/A
H07	4kV Bkr 71-10710	Cond PP 33P-8C	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	96.26	26.26	YES	96.57	N/A	N/A
	86U- Pmp 33PP-8C UV Trip Aux Relay		II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	96.68	21.68	YES	96.98	84.48	YES
H07	4kV Bkr 71-10720	Service Water Pump	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	96.26	26.26	YES	96.57	26.57	YES
	86U- Pmp 46P-1C UV Trip Aux Relay		II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	96.68	21.68	YES	96.99	84.49	YES
H07	4kV Bkr 71-10730	Circ Water Pump	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	96.29	26.29	YES	96.59	26.59	YES
H07	4kV Bkr 71-10740	Cond Booster Pump	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70.0	96.27	26.27	YES	96.58	26.58	YES
	86U- Pmp 33P-9C UV Trip Aux Relay		II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	96.68	21.68	YES	96.99	84.49	YES
H07	4kV Bkr 71-10750	Clsd Loop Clg Water PP	II/III	GE	AMH-4.76-250	JDED-00-0290 10/04/00	125	70	70	96.26	26.26	YES	96.57	26.57	YES
	86U- Pmp 37P-2C UV Trip Aux Relay		II/III	GE	12HFA51A42F	G080-0233	125	75	12.5	96.68	21.68	YES	96.98	84.48	YES
H07	Ckt # HONE02	4kV Bus 10700 UV	II/II	GE	HLA11B	G080-0657	125	75	75	96.67	21.67	YES	96.97	21.97	YES
			II/II	GE	HGA11J	G080-0213	125	75	25.00	96.67	21.67	YES	96.97	71.97	YES

PANEL 71L13 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
L13	600V Bkr 71-11316	RB Clg Pmp 15P-2A 52X Pickup	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	108.39	18.39	YES	84.77	-5.23	NO
		RB Clg Pmp 15P-2A 52CC Close	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	86.67	-3.33	NO	84.63	-5.37	NO

PANEL 71L13 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
L13	600V Bkr 71-11316	RB Clg Pmp 15P-2A 52X Pickup	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	110.44	20.44	YES	85.21	-4.79	NO
		RB Clg Pmp 15P-2A 52CC Close	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	87.74	-2.26	NO	85.07	-4.93	NO

PANEL 71L25 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
L25	600V Bkr 71-12510	ESW Pmp 46-2B 52X Pickup	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	108.70	18.70	YES	98.79	8.79	YES
		ESW Pmp 46-2B 52CC Close	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	100.56	10.56	YES	99.37	9.37	YES

PANEL 71L25 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
L25	600V Bkr 71-12510	ESW Pmp 46-2B 52X Pickup	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	111.08	21.08	YES	99.61	9.61	YES
		ESW Pmp 46-2B 52CC Close	I	GE	AK-2A-25-1	GE Material Spec for AK15/25	125	90	90	102.11	12.11	YES	100.20	10.20	YES

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

The following are components that do not meet the minimum voltage criteria. These components are analyzed below.

LOCA/LOOP:

A. The Reactor Recirculation Pump MG set emergency DC lube oil pump 02-184P-3A(M) does not meet the minimum voltage requirements. This pump is started 6 seconds into the duty cycle and continues for the duration of the duty cycle. The voltage at starting is approximately 90VDC. The minimum required is 100VDC. It recovers to greater than 100VDC at 7.2 seconds and remains above 100VDC for the remainder of the duty cycle. Based on engineering judgement, 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.

B. The closing of the Reactor Building Closed Loop Cooling Pump feeder breaker 71-11316 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. The minimum pickup is 90VDC. The voltage drops to approximately 85VDC during closing. The closing solenoid is rated for 90VDC. If this coil doesn't pickup it will burn itself out quickly as it is not rated for continuous duty at this voltage. This is a non safety related function and it is not required to close for LOCA/LOOP.

Station Blackout (SBO)

A. The Reactor Recirculation Pump MG set emergency DC lube oil pump 02-184P-3A(M) does not meet the minimum voltage requirements. This pump is started 6 seconds into the duty cycle and continues for 60 minutes. The voltage at starting is approximately 89 VDC. The minimum required voltage is 100VDC. The voltage recovers to greater than 100VDC at 8 seconds and remains above 100VDC for the remainder of the duty cycle. Based on engineering judgement, 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.

B. Condenser Vacuum Breaker Valve - 38MOV-VB1. The operation of this valve is not required for any safety-related function. This valve is opened at 2 minutes into the event. The voltage dips to about 70% of rated motor terminal voltage on inrush while the voltages for the other components in the same

panel are around 110V for the same time period. After inrush the voltage would be approximately 104 VDC at the terminals of the motor, which is greater than 80% minimum voltage required by IEEE STD- 946 (100 VDC). At reduced voltage this valve will operate but slower and less starting torque. 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 2 minutes for sizing purposes. AOP-49 requires that Operations commence opening this valve within 30 minutes. Since the valve is operated within at least 60 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 80 volts at the MOV). The valve still strokes against the required differential pressure (1 atmosphere or about 15 psi) with an assumed load profile (see Appendix 8). The DCM analysis shows at low voltage, the motor slows down and the stroke time increases accordingly (stroke time about 98 seconds). The low differential pressure and associated low total thrust requirement means that the MOV is not significantly challenged. Therefore, the reduced voltage at the valve is acceptable.

C. The closing of the Reactor Building Closed Loop Cooling Pump feeder breaker 71-11316 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. The minimum pickup is 90VDC. The voltage drops to approximately 85VDC during closing. The closing solenoid is rated for 90VDC. This is a non safety related function and it is not required to close for SBO.

The following is an analysis of available voltages at the loads when the battery voltage is allowed to drop to 112.2VDC for LOCA and 111.6 for SBO (see section 1.3.7 of the main text for methodology). The following components are ones that do not meet their required minimum voltage criteria when the battery is allowed to drop to 112.2 for LOCA and 111.6 for SBO. These values are being used for determining battery sizing and available margin and to establish acceptance criteria for discharge testing to satisfy Technical Specifications. In addition to the loads evaluated below, the above loads will also be degraded slightly further, however, the justification remains the same.

LOCA/LOOP

A. Based on the voltage drop profile in appendix 4, the EDG Fuel Oil Pump 93P-4A(M) has 1.01VDC margin (i.e. above the minimum allowed voltage of 96VDC) with a corresponding battery voltage of 113.36VDC. Should the battery be allowed to drop to 112.2VDC, the corresponding motor voltage

during starting would be 95.85VDC and does not meet its minimum voltage requirements (96VDC). This corresponds to 0.15VDC below the minimum at the moment of starting and dips slightly lower than that during inrush (after the motor has begun to rotate). The EDG Fuel Oil Pump starts at the beginning of the duty cycle (0.3 seconds) and operates for the entire duty cycle. This voltage recovers to above minimum voltage at 1.7 seconds and remains above minimum for the remainder 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 battery voltage of 112.2VDC.

B. Based on the voltage drop profile in appendix 4, 13MOV-21 has 1.42VDC margin while closing at 43 seconds. The minimum allowed is 92.77VDC based on JAF-CALC-ELEC-01955. However, calculation JAF-CALC-ELEC-01955 ultimately bases the RVFt on the available I_{LRA} during starting. The calculation uses starting of 28.943AMPs. The locked rotor starting resistance as calculated in Appendix 8 is 2.812 ohms. If the battery voltage were reduced to 112.2VDC the available voltage at the MOV terminals would be 91.09VDC (94.19-(115.3-112.2). The available I_{LRA} would be 32.39Amps. This exceeds the value in JAF-CALC-ELEC-01955 and therefore, is acceptable. Closing stroke envelopes the opening stroke.

C. Based on the voltage drop profile in appendix 4, 13MOV-16 has 2.13VDC margin while closing at 43 seconds. The minimum allowed is 94.50VDC based on JAF-CALC-ELEC-03074. However, calculation JAF-CALC-ELEC-03074 ultimately bases the RVFt on the available I_{LRA} during starting. The calculation uses starting of 32.129. The locked rotor starting resistance as calculated in Appendix 8 is 2.761 ohms. If the battery voltage were reduced to 112.2VDC the available voltage at the MOV terminals would be 93.53VDC (96.63-(115.3-112.2). The available I_{LRA} would be 33.88Amps. This exceeds the value in JAF-CALC-ELEC-03074 and, therefore, is acceptable.

SBO

A. Based on the voltage drop profile in appendix 4, the EDG Fuel Oil Pump 93P-4A(M) has 0.62VDC margin (i.e. above the minimum allowed voltage of

96VDC) with a corresponding battery voltage of 113.47VDC. Should the battery be allowed to drop to 111.6VDC, the corresponding motor voltage during starting would be 94.75VDC (96.62-(113.47-111.6)) and does not meet its minimum voltage requirements (96VDC). 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. 94.75VDC corresponds to 1.25VDC below the minimum at the moment of starting. and dips slightly lower than that during inrush (after the motor has begun to rotate). The EDG Fuel Oil Pump starts at the beginning of the duty cycle (2.8 seconds). This voltage recovers to above minimum voltage at 4 seconds 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 "A" EDG is required to start, there is sufficient margin such that the minimum voltage is met. That is, the pump motor terminal voltage will remain above 96VDC with a battery voltage of 111.6VDC. Based on the above facts and sound engineering judgment this pump will perform its intended safety function at a battery voltage of 111.6VDC during an SBO event.

B. The RFPT DC lube oil pump 31P-7A(M) does not meet the minimum pickup voltage requirements when battery voltage is reduced to 111.6VDC. This pump is started at 17 seconds into the duty cycle and continues until 60 minutes into the SBO event. The voltage at starting is approximately 99VDC with a battery voltage of 111.6VDC. The minimum required is 100VDC. It 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.

C. The Main Turbine Emergency Seal Oil Pump 94P-13(M) does not meet the minimum pickup voltage requirements when battery voltage is reduced to 111.6VDC. This pump is started at 0.1 seconds into the duty cycle and continues until 60 minutes into the SBO event. The voltage at starting is approximately 95.5VDC with a battery voltage of 111.6VDC. The minimum required is 96VDC. It recovers to greater than 96VDC after starting and remains above 96VDC for the remainder of the duty cycle. 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.

CONCLUSIONS

Based on the above analysis, the "A" Station Battery will be able to perform its intended safety function with a battery voltage of 112.2VDC during a LOCA and 111.6VDC during an SBO.

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

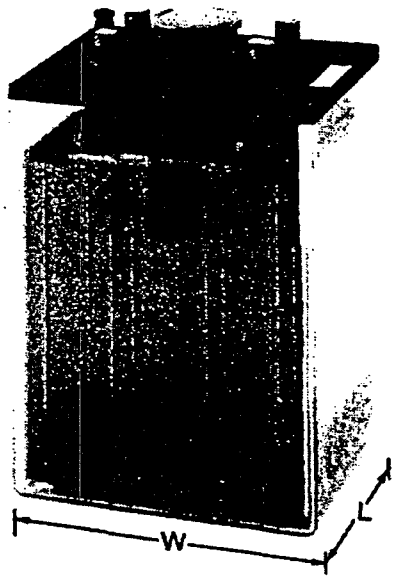
GNB

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

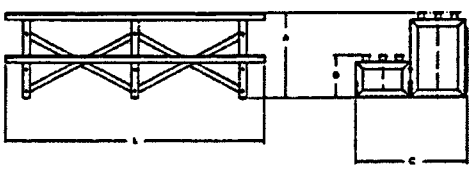
AMP DATA
NAN/NCN CELLS

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

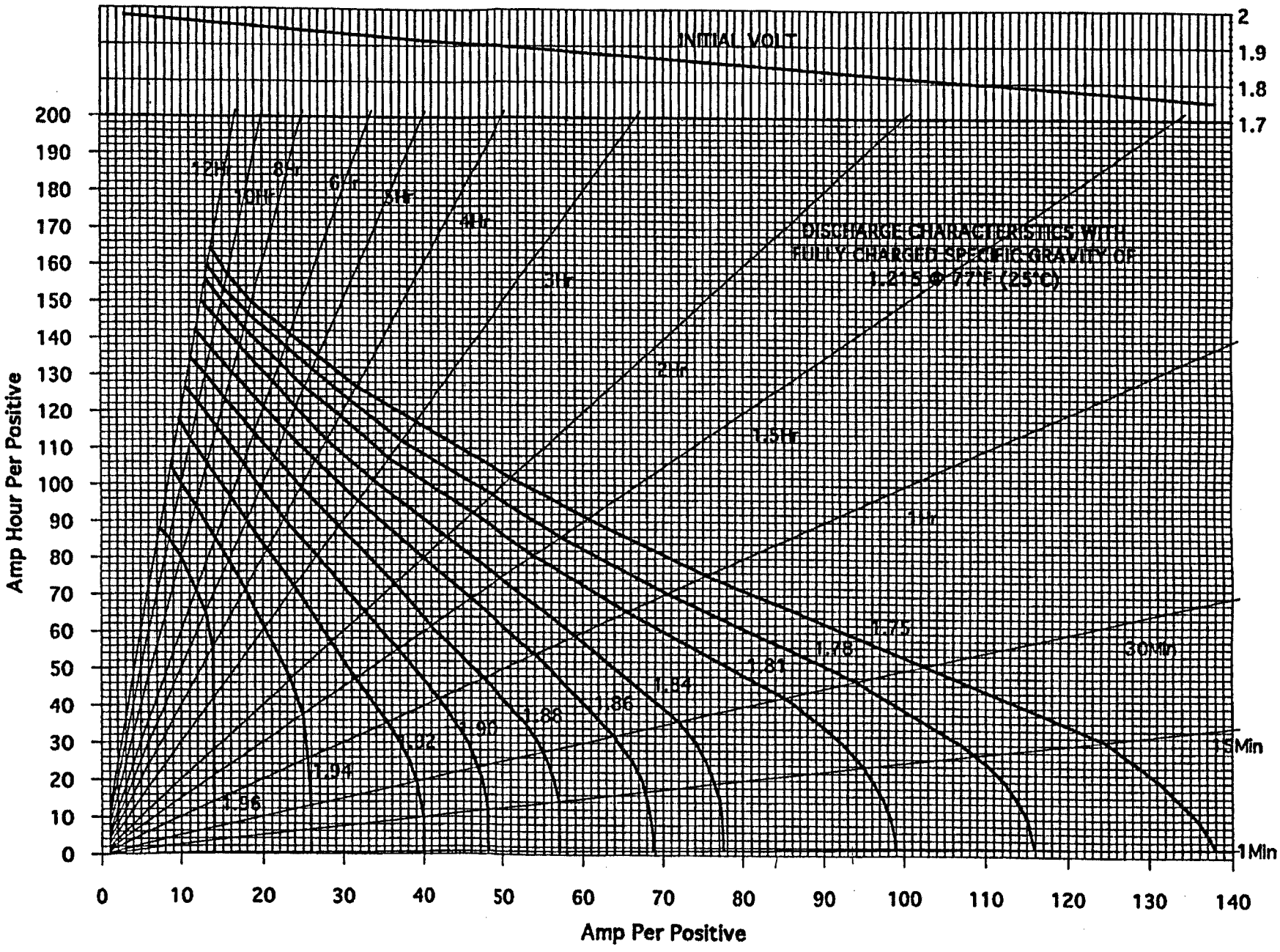
GNB Technologies
Industrial Battery Company
829 Parkview Boulevard
Lombard, IL 60148-3249
U.S.A.
Telephone: 708.629.5200
Facsimile: 708.629.2635
A Pacific Dunlop Company

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 8	5	4	3	2	1.5	1	MINUTES 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
Fast 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
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(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
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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

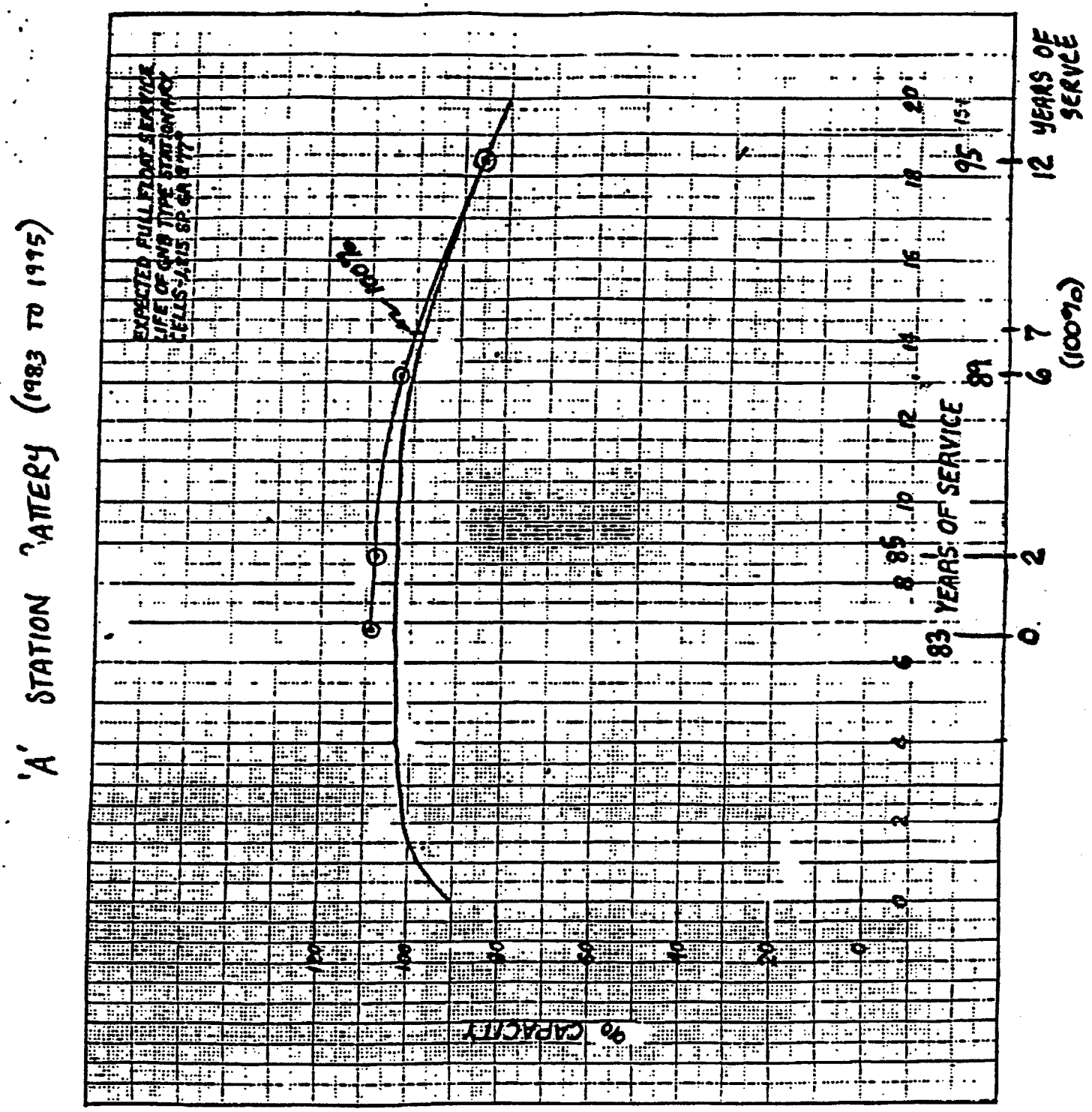
B. MARKS
ELECTRICAL ENGINEER

BM:cf

Attachments

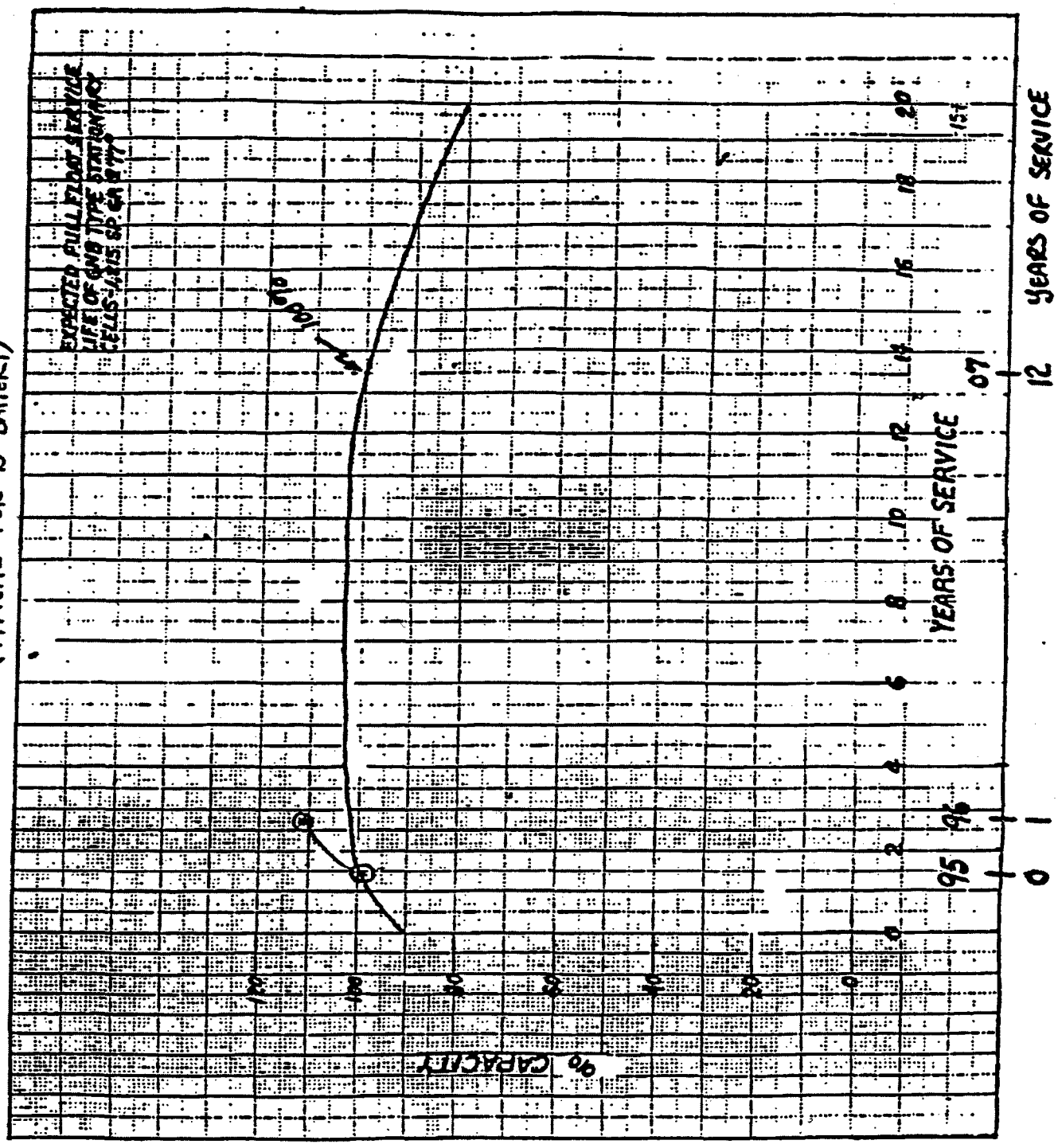
CC: J. Stead
A. Barton
D Starczeski
T. Andersen
B Lonberger
T. Savory
M Abramski
D Parker
RMS
JENG File

ATTACHMENT 1

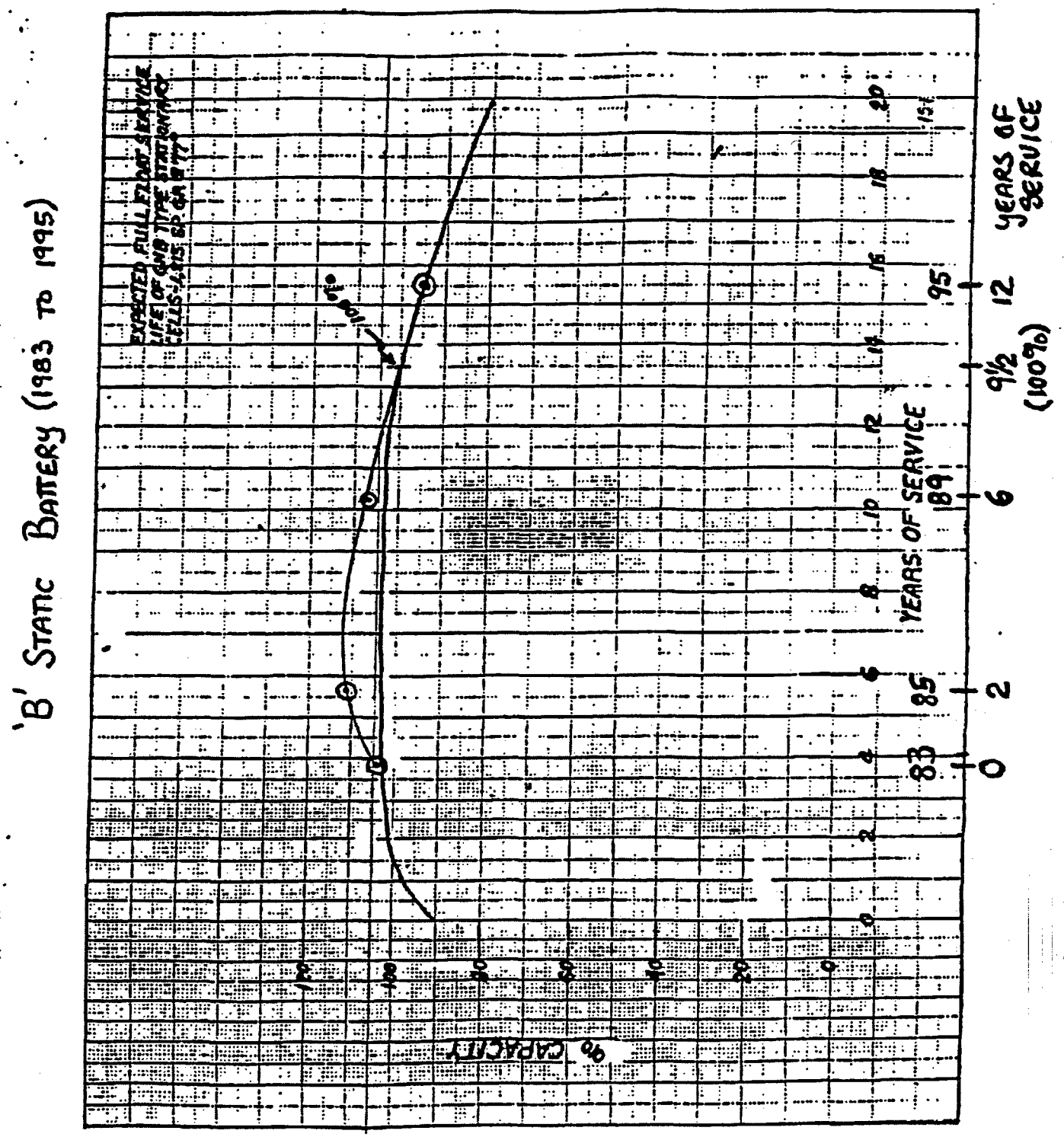


a

ATTACHMENT 2



ATTACHMENT 3



"A" Statio ttery 1/8/01 10:5 1

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	288 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.

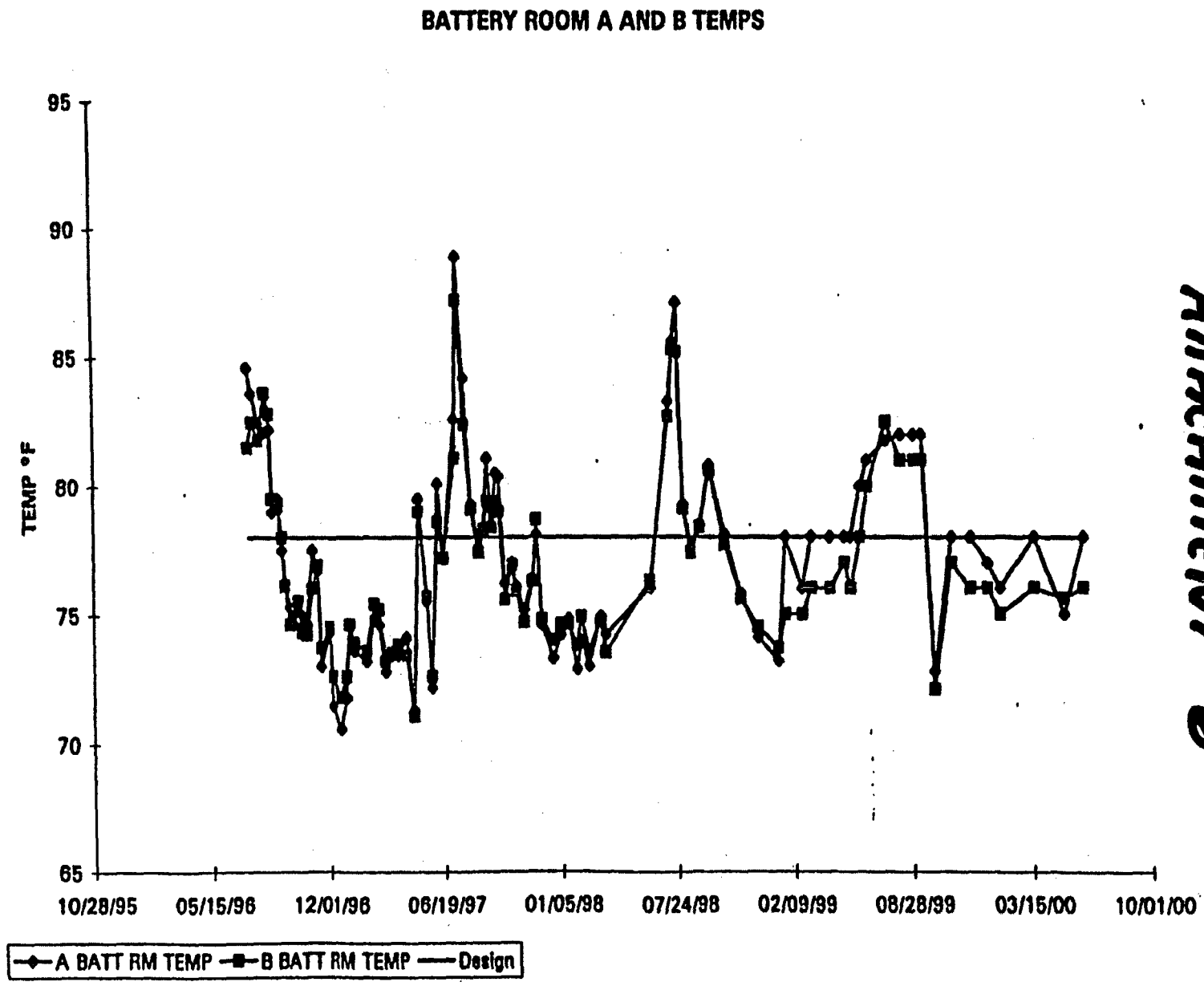
ATTACHMENT 4

"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 "A" Sizing & Voltage Drop
Appendix 8
Manufacturer's Data and Reference Material

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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	0.0118	—	—	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 1-4

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. 916254849764 P. 01

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

FAX

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

OCT-25-01 THU 02:38 PM 53 FAX NO. 919254843764 P.06

NORMALLY OPEN D-C CONTACTORS

FOR ALL CLASSES OF LOAD TO 250 VOLTS D-C

Section

BULLETIN 1025

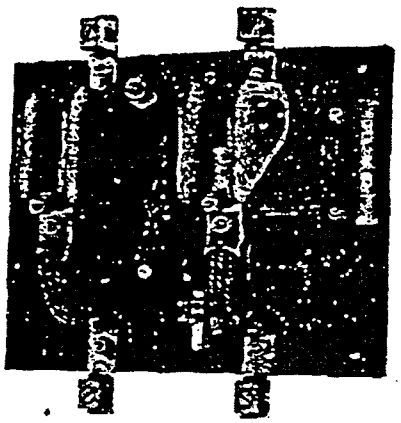

Figure 7. 2 Pole, 200 Ampere, Catalog No. 2514.

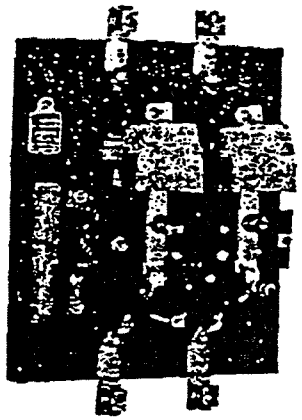

Figure 8. 2 Pole, 60 Ampere, Catalog No. 2508.

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.

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	0.80	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 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.

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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	126.00
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	184.00
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	294.00	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

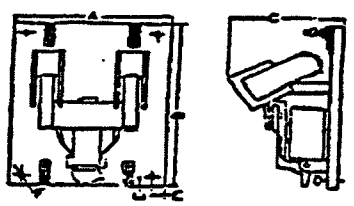


Figure 9. Outline Dimensions.

† 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			
		Top	Bottom	A	B	C	D	E	F	Weight	Width	Height	Depth	Weight
30	1	0	0	4	6	3½	½	½	⅛	8	6	10	4½	14
	2	0	0	4	6	3¼	½	½	⅛	9	6	10	4½	15
60	1	⅜	⅜	6	10	5¼	¾	⅝	5/16	11	8	14	6½	24
	2	⅜	⅜	8	10	5¾	¾	⅝	5/16	16	10	14	6½	31
100	1	¾	1	6	10	5¼	¾	⅝	5/16	12	8	16	7	37
	2	1	1¼	10	10½	6½	1	¾	5/16	24	12	17	7½	48
150	1	1 1/16	1 1/16	4½	12	7	¾	⅝	5/16	20	6½	21	8	39
	2	1⅛	1½	11	11	6½	1	¾	5/16	28	13	21	7½	68
200	1	1 3/16	1 1/16	6⅛	12	6	¾	⅝	5/16	30	8½	21	8	38
	2	1⅛	1½	11	11	6½	1	¾	5/16	28	13	21	7½	68
300	1	1½	1¼	12½	14	6½	1	¾	5/16	27	16	27	7½	72
	2	1⅛	1¼	20	14	6½	1	¾	5/16	44	23	27	7½	112

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

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

-----Original Message-----
From: ASCOBILL@aol.com [mailto:ASCOBILL@aol.com]
Sent: Tuesday, November 20, 2001 8:23 AM
To: Barton, Alex
Subject: Re: 03SOV-140A or B (71DC-A2 Ckt 1 or 71DC-B2 Ckt. 2)

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

> Subj: RE: 03SOV-140 A or B (71DC-A2 Ckt 1 or 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

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.

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

ASCO®

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

QUOTE NO:

TO FAX NO: 315-349-6981

COMPANY: FITZPATRIC NUCLEAR POWER

ATTN: ALEX

AVD TECHNICAL GROUP (PH - 973-966-2082)

__ KARL BINDER/MANAGER

__ 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

```
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     ER000001 -- 07/15/82 RNM ISSUED FOR S.O. 76183K.
  611     ER00103568  A 830216 FWC ADDED REBLD KIT/DEL SFK
  612     ER00109829  B 022184 AEW SOL ASSY WAS 158038-2H
  613     ER110444  C 03/20/84 AEW COIL WAS 98-824-HC.
  614     ER00112358  D 840923 FWC 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 For W. Hotchkiss Date 3/2/96

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	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 250 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.

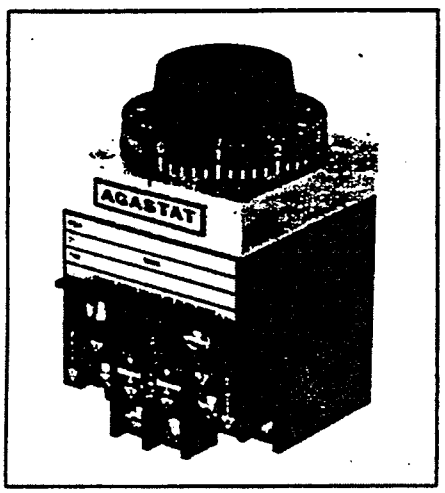
3.2.3 Electrical Enclosure

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 x 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

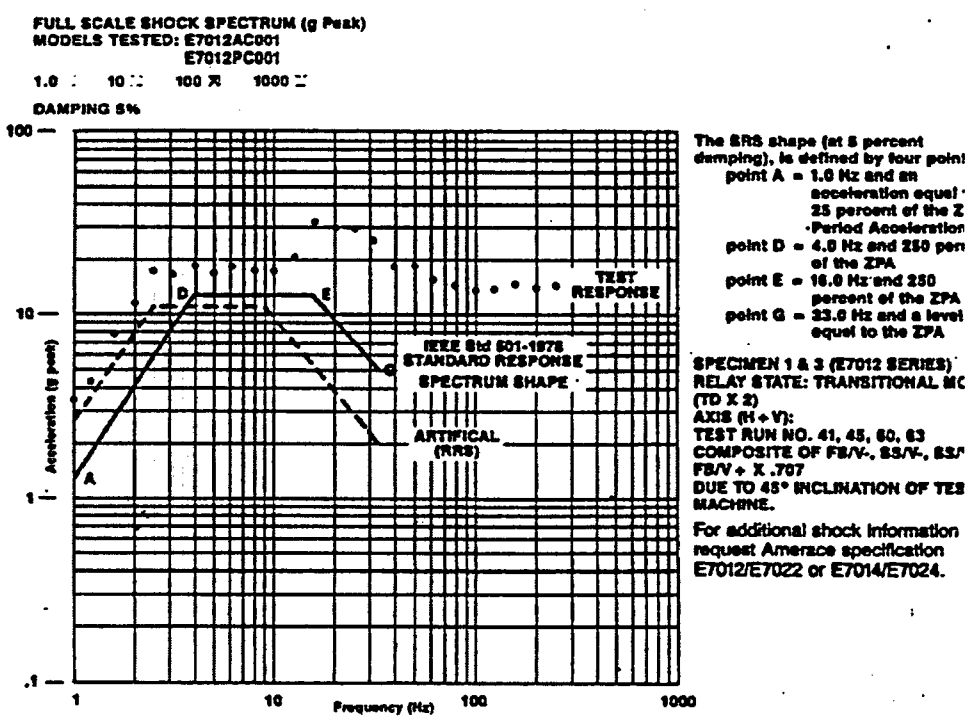
Since the timing relays are intended for use in auxiliary and control buildings, and not in the reactor containment areas, a hostile environment test was performed in place of the Loss of Coolant Accident (LOCA) test. Relays were subjected to combination extreme temperature/humidity plus under/over voltage 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 1650V 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 X 10^5 (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.	Model E7012 and E7022 2.13 lbs. Model E7014 and E7024 2.43 lbs.

(Weight may vary slightly with particular coil voltage.)

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 — 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 1980; 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 or 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%	1.92 sec	9.4%
50°F	1.87	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 E.J. Lugyal

DATE 2-25-80

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 E.J. Lusyak

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	9.6%	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	1.69	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	1.39	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. Lugyak

DATE 2-25-80

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 Apprx.	15 Apprx.	6 Apprx.	6 Apprx.	6 Apprx.
Drop-out	NA	13 Apprx.	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	DB "A"	DB "B"	DB "C"	DB "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 Apprx.	6 Apprx
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 listed 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) COILS
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)

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.
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- 76006 REQ.- 309-72034-1

CUST. NO. ACCN- S.O.- H99611

REV.

STAMPING INFORMATION FOR BKR. N. P. 103A3825

S/N 0202A7808-201, 202 REQ. NO. 309-72034-1 TYPE ATB-362-7-37

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 AMP

MAX. SYM. INT. AMP. 41,000 AT 330 KV MAX. ASYM. INT. AMP. 53,300 AT 330 KV

CLOSING AND LATCHING ABILITY 65,000 AMP. IMPULSE WITHSTAND 1500 KV

TRIP COIL 366A0845G20 VOLTS 125DC AMP. 15 OPER. RANGE 70-140 VOLTS

CLOS. COIL 366A0845G20 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.

-8/72 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 63,100 LB. YEAR MFG. 1972 ⊙

3/72 CAUTION: BEFORE INSTALLING OR OPERATING READ INST. GEK-12388 RENEWAL PARTS GEK-12774

STAMPING INFORMATION FOR COMPRESSOR N.P. 81719

NO 0202A9808-201.202 TYPE NAO-14 145CFM

NET WEIGHT 1600 LBS

OPERATING VOLTAGE 575 VOLTS 3 PHASE 60 CY C

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

COMPRESSOR DELIVERY AT 2000 LB./SQ. IN. 14SCFM CUBIC FEET FREE AIR

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

1/9/72 NP81719 DIFF. 225 PSI START 100A. RUN 14A.

Nuclear Power Plant
James A. FitzPatrick
P.O. Box 41
Lycoming, New York 13093
315 342 3840

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
Page 2 of 2

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: Sung Kim — Date: 10-4-00
Sung Kim
Sr. Electrical Engineer II

Approved By: Tom Savory — 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	Shd APS		
Project Engineer Approval	L.S.	L.S.		
CATEGORY I A Equipment Specialist Review	12-10-69	3-4-70		
Quality Assurance Review	H.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

3.

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 PHONE: 315-349-6622
DES ENG

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-50/25, AK-100 BKRS THE BOTTOM of the Sheets are marked LRS-50-3 & 4 and dated 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?

APR-09-97 WED 11:22 AM

P. 02

ATTACHMENT 'D'

125VDC - PB16 - LF/VI
REV. 1
DATE: 12/13/88
PAGE # D-1

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	(95-125)	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
  - Short-time-delay
- Fault - 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

RECEIVED
WITH LETTER
FOR NINE MILE POINT NUCLEAR STATION
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 P.03

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

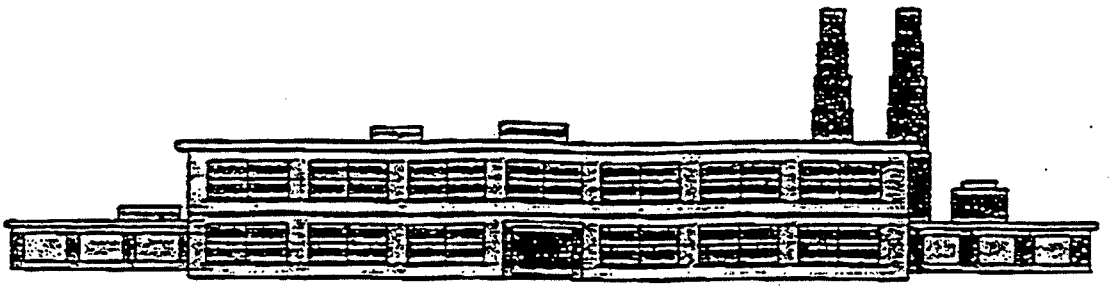
BREAKER RATINGS	AK-15	AK-25	AK-50	AK-75	AK-100
Frame Size (Maximum Coil Rating) Amps A-C	225	600	1,600	3,000	4,000
Amps D-C	225	600	2,000	4,000	6,000
Short Time Amps. A-C (symmetrical)	9,000	22,000	50,000	65,000	85,000
D-C	10,000	15,000	50,000	75,000	100,000
600 V. A-C & 250 V. D-C					
Interrupting 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.: _____

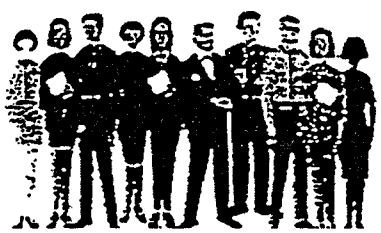
Number of Pages (including Cover): 1

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 = 1.9/1.8) 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...

Kim, Sung

From: Deaver, Tim K (IndSys, SalemVA) [Tim.Deaver@indsys.ge.com
Sent: Monday, July 10, 2000 5:04 PM
To: 'Kim, Sung'
Subject: RE: Inrush Current

Sung:

Below is as much information as I can pull together for you on this contactor. If I get more, I will forward to you.

Tim

----Original Message----
From: Kim, Sung [mailto:Sung.Kim@nypa.gov]
Sent: Monday, July 10, 2000 10:04 AM
To: Deaver, Tim K (IndSys, SalemVA)
Cc: Savory, Thomas; Marks, Brian
Subject: Inrush Current

What is the magnitude and the duration of the inrush current for the closing and tripping circuits of the GE power circuit breaker 206B4913 ? The control power is 125 VDC.
The nameplate data of the Field Contactor is IC2812
206B4913G3
600V 265A 60CYC

The renewal parts list indicates: Nomenclature Catalogue Number Description

41 - Coil group 273A3983 consists of the following:

closing coil (CC) - 393B202G11, Operating Coil, 125 VDC, 31 ohms, intermittently rated.

tripping solenoid (TC) - CR9500A204B13A, 125 VDC, 57.6 ohms, 1.66 inrush amps,
intermittently rated, coil no. 15D2G80.

41X - CR161FBZ00477 Relay, 125 VDC (replaced by 192A9770P2, no info available)

41Y - 12HGA11J52 Relay, 125 VDC, 3650 ohms @25C

41R1,41R2 - 12HFA54B218H Relay, 125 VDC for pick-up and drop-out, (no ohms given, probably between 1000 and 2000 based on standard 12HFA51 & 71 relays.

What is the Power Circuit Breaker Operating (Closing/Tripping) inrush current and the duration?
What is the individual part's data for coil resistance or rated volt-amps (VA)?

My e-Mail address is kim.s@nypa.gov.
My Phone # is 315-349-6839, and my fax # is 315-349-6216.

Thank you very much.

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.

. 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
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

November 4, 1996
JDED-96-0564
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 72.2°F
Fluke QE-18
51 probe QE-18C

AGASTAT
MODEL
E7014PCØØ2 Pick-up @ 70.36 VDC Pick-up
SN# 88370408 39 MA current pu
Cat # CT88-5781 item #2 10 VDC drop out

Sorensen DCR150-6B
Supply
⊖ ⊕

Voltmeter	Ammeter	Contact detector
Fluke	Simpson	Fluke
QE14	E 720	
Cal due 2/2/97	Cal due 8/26/97	

E7012PCØØ2 Pick up @ 71.77 VDC, 70.38 VDC pick-up
SN# 88370398 39 MA 39 MA current pu.
Cat# CT88-5781 item# 12 VDC ; 11 VDC drop out

E7022PKØØ Pick up @ 76, 78, 77.5 VDC 77.6 Pick-up
SN# 88370433 40 MA 40 40.5 ma
Cat# CT 88-2965 35-36 VDC drop out

SQUARE "D" 89 VDC 86 90.5, 91.85 pick-up
KDP13V63 (125VDC) 6.4 ma current PU
CT# 59568208 44 VDC ≈ drop out

Date
S 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
			/	— of —

Subject/Title	QA Class

Preparer/Date	Reviewer/Date	Method	Approval/Date

JC790362

CR 105 K000BLA

COIL 15D21G26

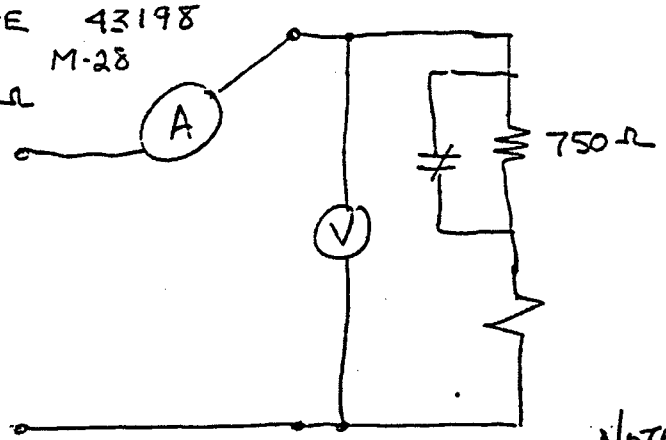
115/125 VDC

CT-C1

CAL DUE 2/2/97

VM FLUKE 8060A
Q-E14

SERIES RESISTOR
OHMITE 43198
M-28
750 Ω



PS SORENSEN
DCR 150-6B

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

Nº 001

10/27/96 - 0640 my finding 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 not

AB 705 CONTACTOR - NON AUTO RESET OL -

DER-96-1223 Reviewed draft - made changes.

10AM - helped OP's 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 1 comment

Station Batt - help with Relay PM data

Tuesday 10/29/96 0700

DER TO B Bruce for act's data

Tested CR 105 contactor PU ≈ 62 Vdc look OK.

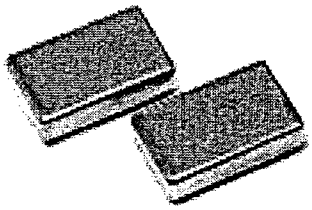
the [D] relay KDP appears to be a PU problem.

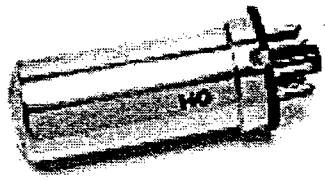
Decision to replace the 2 coils that were removed about 16 yrs ago. has been made.

SRC DEVICES

HG SERIES REED RELAYS

HGRM · HGR2M · HGR2MT · HGSR · HGSM
HGWR · HGWM · HGW2MT · HG · HGM · HGJM · HGJ2MT





DESCRIPTION

The HGRM is available in single side and bistable adjustments for all types of industrial as well as classic telecom and datacom applications. A potted relay body with a metal can guarantees a double sealing technology, standard in all relays. The powerful switching rating (100W-500V-2A) and the input-output 1kVAC isolation make it an all-around product. Form-C/break-before-make and Form-D/make-before-break are available.

The HGJM and HGWM relay families are designed for industrial use, especially for process control and data loggers. Both families feature fast operating speeds, Common Open Time and combine very low noise and thermal EMF. They are ideal relays for flying capacitance type as well as for direct reading process controls. These relays offer a magnetic and an electro-static shield for minimizing all external influences. A life of billions of operations, low & stable contact resistance and a 1KVAC input-output isolation make these families the highest industrial standard of their kind. No other relay offers so much in such a small package.

FEATURES

- Stable contact resistance over life
- 100W - 500V - 2A switching power
- Common Open Time (some series)
- Zero load switching
- High insulation resistance
- Long life >1 x 10^9
- Single side and bistable adjustments
- Bounce-free operation
- Low noise and thermal emf (HGWM & HGJM)
- Form-C & D
- Load handling capability from signal level to 100VA (500 VDC or 2A maximum load switching capability, HGSM & HGSR)
- Can switch up to 80Hz (HGSM, HGSR)
- Octal plug in high performance reed relay multipole 1 & 2 Form-D
- 250 VA switching capability
- Operating rates up to 200Hz
- Magnetically shielded

APPROVALS

- UL recognition
- CSA certification (HGRM)
- FCC68 compatible (HGRM & HGJM)

APPLICATIONS

- Process control
- Data loggers
- Traffic control systems
- Signalling
- Industrial
- PLCs
- Metering
- Telecom (HGRM)

RATINGS (@ 25° C)

Parameter	Min	Typ	Max	Unit
Switching Voltage			500	Volts
Switching Current				
HGJM/HGWM/HGWR			2	Amps
HGRM/HGSR/HGSM			2	Amps
HGM/HG			5	Amps
Carry Current				
HGJM/HGWM/HGWR			5	Amps
HGRM/HGSR/HGSM			5	Amps
HGM/HG			10	Amps
Switching Frequency				
HGJM/HGWM/HGWR			200	Hz
HGRM/HGSR/HGSM			200	Hz
HGM/HG			80	Hz
Contact Resistance			30	mΩ

(See detailed specifications for more information)

COIL SPECIFICATIONS

	Contact Form	Coil Voltage			Coil Resistance			Operate Voltage		
Units		Volts			Ω			Volts		
Conditions					+/- 10%, 25°C			Must operate by 25°C		
Part #		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
HGJM 51111 K00	1-Form-C/SSS		5	15	112.5	125	137.5			2.9
HGJM 51111 P00	1-Form-C/SSS		12	35	616.5	685	753.5			7.1
HGJM 51111 T00	1-Form-C/SSS		24	68	2385	2650	2915			14
HGJM 51111 W00	1-Form-C/SSS		48	125	8865	9850	10835			29
HGJ2MT 54211 G00	2-Form-C/SSS		5	14	49.5	55	60.5			2.6
HGJ2MT 54211 L00	2-Form-C/SSS		12	36	333	370	407			6.7
HGJ2MT 54211 P00	2-Form-C/SSS		24	69	1233	1370	1507			13
HGWR 56211 H00	1-Form-C/SSS		3	5	23.4	26	28.6			1.2
HGWR 56211 L00	1-Form-C/SSS		6	12	117	130	143			2.9
HGWR 56211 P00	1-Form-C/SSS		12	20	360	400	440			4.9
HGWR 56211 T00	1-Form-C/SSS		24	38	1215	1350	1485			10.1
HGWR 56211 W00	1-Form-C/SSS		48	70	4050	4500	4950			21.8
HGWR 58211 T00	1-Form-C/BS		1.5	5	25.2	28	30.8			±0.7
HGWR 58211 P00	1-Form-C/BS		3	12	108	120	132			±1.6
HGWR 58211 L00	1-Form-C/BS		6	20	360	400	440			±3.1
HGWR 58211 H00	1-Form-C/BS		12	38	1215	1350	1485			±6.7
HGWR 58211 E00	1-Form-C/BS		24	70	4050	4500	4950			±14.4
HGWR 58212 N00	1-Form-C/BS/DC		9	19	306	340	374			±4.1
HGWR 58212 P00	1-Form-C/BS/DC		12	26	585	650	715			±5.9
HGWR 58212 T00	1-Form-C/BS/DC		24	40	1350	1500	1650			±10.4
HGWM 51111 K00	1-Form-C/SSS		5	11	105.3	117	128.7			2.9
HGWM 51111 P00	1-Form-C/SSS		12	27	648	720	792			7
HGWM 51111 T00	1-Form-C/SSS		24	52	2457	2730	3003			14
HGWM 51111 W00	1-Form-C/SSS		48	100	9000	10000	11000			28
HGW2MT 54111 G00	2-Form-C/SSS		5	11	50.4	56	61.6			2.9
HGW2MT 54111 L00	2 Form-C/SSS		12	28	352.8	392	431.2			7
HGW2MT 54111 P00	2 Form-C/SSS		24	54	1296	1440	1584			14
HGRM 51111/55211 J00	1-Form-C/SSS		5	11	63	70	77			1.8
HGRM 51111/55211 N00	1-Form-C/SSS		12	28	391.5	435	478.5			4.6
HGRM 51111/55211 R00	1-Form-C/SSS		24	55	1575	1750	1925			8.8
HGRM 51111/55211 V00	1-Form-C/SSS		48	103	5490	6100	6710			17
HGR2MT 51111 F00	2-Form-C/SSS		5	11	33.3	37	40.7			2
HGR2MT 51111 K00	2-Form-C/SSS		12	30	225	250	275			5
HGR2MT 51111 N00	2-Form-C/SSS		24	56	783	870	957			10
HGR2M 53211 H00	2-Form-C/SSS		5	16	108	120	132			2.65
HGR2M 53211 M00	2-Form-C/SSS		12	42	702	780	858			6.65
HGR2M 53211 Q00	2-Form-C/SSS		24	81	2610	2900	3190			12.2
HGR2M 53211 T00	2-Form-C/SSS		48	164	10800	12000	13200			26.5
HGSR 51211 J00	1-Form-C/SSS		5	11	63	70	77			1.8
HGSR 51211 N00	1-Form-C/SSS		12	28	391.5	435	478.5			4.6
HGSR 51211 R00	1-Form-C/SSS		24	55	1575	1750	1925			8.8
HGSR 51211 V00	1-Form-C/SSS		48	103	5490	6100	6710			17
HGSM 51111 IC0	1-Form-C/SSS		5	22	302	335	369			3.5
HGSM 51111 K00	1-Form-C/SSS		5	16	126	140	154			2.3
HGSM 51111 P00	1-Form-C/SSS		12	41	846	940	1034			6
HGSM 51111 T00	1-Form-C/SSS		24	80	3258	3620	3982			12
HGSM 51111 V00	1-Form-C/SSS		48	122	7740	8600	9460			19
HG 11331 G00	1-Form-D/SSS		5	8.3	31.5	35	38.5			3.4
HG 11331 K00	1-Form-D/SSS		12	16.5	126	140	154			7.1
HG 11331 N00	1-Form-D/SSS		24	34	522	580	638			14
HG 11331 R00	1-Form-D/SSS		48	65	1935	2150	2365			28
HGM 11411 H00	1-Form-D/SSS		5	6.4	18.63	20.7	22.77			2.84
HGM 11411 M00	1-Form-D/SSS		12	16	115.2	128	140.8			7.2
HGM 11411 Q00	1-Form-D/SSS		24	31	450	500	550			14.9
HGM 11411 T00	1-Form-D/SSS		48	66	1953	2170	2387			29.8
HGPM 11441 M00	1-Form-D/SSS		5	16	115.2	128	140.8			2.75
HGPM 11441 R00	1-Form-D/SSS		12	39	703.8	782	860.2			6.7
HGPM 11441 U00	1-Form-D/SSS		24	79	2862	3180	3498			13.8
HGPM 11441 X00	1-Form-D/SSS		48	156	10980	12200	13420			27

SSS: Single Side Stable Relay BS: Bistable Relay DC: Double Coil

COMPANY OR COMPONENT — COMPLETE MAILING ADDRESS

TAD MARKS NYPA JAF MAINT.

GENERAL ELECTRIC — QUICK LETTER—WHEN REPLY NEEDED

FROM — NAME — COMPONENT — COMPLETE MAILING ADDRESS

PAUL QUINN GE SSM JAF

SUBJECT TC2800-1600 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 TC2800-1600 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.

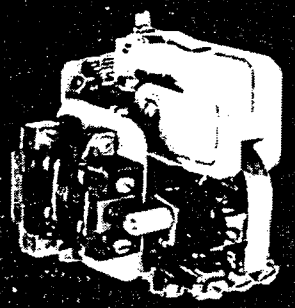
FN-754 (3 SHTS.) (3-75) REV.

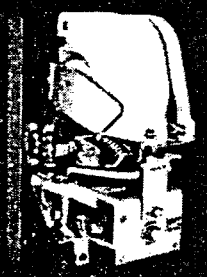
DATE SIGNED

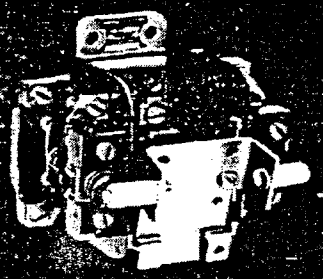
Wilson Jones • Chicago • MADE IN U.S.A.

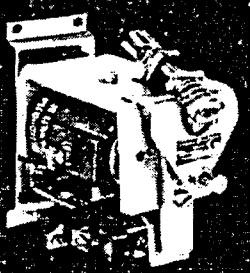
GEA-6621C
Handbook Section 2659C
April 25, 1966

CONTROL ACCESSORIES









DC CONTACTORS AND RELAYS

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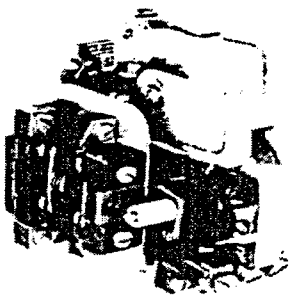
GENERAL ELECTRIC

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 kn in advance, factory-mounted interlo can be ordered. If flexibility in appli tion is desired, order interlocks separat and mount as needed. Select volt range depending on application.

HOW TO ORDER

By catalog number—Order contactors complete IC number, where given, cluding form number, coil number, interlock designation (if required). Or accessories (rectifiers, resistors, auxili contactors) for unit-mounted contact as separate items included in the c tactor price.

Example: *For a NEMA Size 1 contac having one normally open pole wit blowout rating of 25 amp, and two n mally open interlock circuits, for ope tion on 550 volts DC—specify contac IC2800-1607F19F and series resi 151A3984G1—5700 ohms.*

By description—To order contactors which a form number is not listed, or 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 Pr GO-1
1	25	1 NO	none	....	..	1607A	$40	$85	BA200B	$60	BA250B	$145
			1	....	....	1607B	43	88	BA200C	63	BA250C	148
			2	....	....	1607C	43	88	BA200D	63	BA250D	148
			5	....	....	1607D ✠	43	88	BA200E	63	BA250E	148
			10	....	....	1607E	43	88	BA200F	63	BA250F	148
			25	....	....	1607F ✠	43	88	BA200A	63	BA250A	148
		1 NC	....	2	no	1608F	63	108	BB200D	83	BB250D	168
			....	5	no	1608H	63	108	BB200E	83	BB250E	168
			....	10	no	1608K	63	108	BB200F	83	BB250F	168
			....	25	no	1608M	63	108	BB200A	83	BB250A	168
			....	25	yes	1608L	73	118	.....	93	.....	178
			....	none	no	1608B	60	105	BB200B	80	BB250B	165
		2 NO*	25	....	....	.....	...	...	BA201A	116	BA251A	221
		1 NO and 1 NC	2	2	no	1609F	88	133	BC200D	108	BC250D	193
			5	5	no	1609H ✠	88	133	BC200E	108	BC250E	193
			10	10	no	1609K	88	133	BC200F	108	BC250F	193
			25	25	no	1609M	88	133	BC200A	108	BC250A	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	53	98	BD200B	78	BD250B	165
			5	....	....	1617F	57	102	BD200C	82	BD250C	167
			10	....	....	1617E	57	102	BD200D	82	BD250D	167
			25	....	....	1617C	57	102	BD200E	82	BD250E	167
			50	....	....	1617B ✠	57	102	BD200A	82	BD250A	167
		1 NC	....	none	no	1618B	82	127	BE200B	107	BE250B	192
			....	5	no	1618K	86	131	BE200C	111	BE250C	196
			....	10	no	1618H	86	131	BE200D	111	BE250D	196
			....	25	no	1618D	86	131	BE200E	111	BE250E	196
			....	50	no	1618F	86	131	BE200A	111	BE250A	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.

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DC CONTACTORS AND RELAYS

GENERAL-PURPOSE CONTACTOR

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 Price GO-10
2	50	1 NO and 1 NC	5	5	no	1619P	$120	$165	BF200C	$145	BF250C	$230
			10	10	no	1619R	120	165	BF200D	145	BF250D	230
			25	25	no	1619D	120	165	BF200E	145	BF250E	230
			50	50	no	1619F	120	165	BF200A	145	BF250A	230
			50	50	yes	1619E	138	183	.....	163	.....	248
			50	none	no	1619M	116	161	.....	141	.....	226
			50	none	yes	1619L✠	134	179	.....	159	.....	244
		2 NO and 1 NC	5	5	no	1613BJ	154	199	.....	169		254
			10	10	no	1613BH	134	199	.....	169		254
			25	25	no	1613BG	154	199	.....	169		254
			50	50	no	1613BF	154	199	.....	169		254
			50	50	yes	1613BA	172	217	.....	197		282
			50	none	no	1613BM	150	195	.....	165		250
			50	none	yes	.....	178	223	.....	193		278
		2 NO and 2 NC	5	5	no	1614BJ	199	244	CR200V	222	CR250C	307
			10	10	no	1614BH	199	244	CR200W	222	CR250D	307
			25	25	no	1614BG	199	244	CR200X	222	CR250E	307
			50	50	no	1614BF	199	244	CR200S	222	CR250A	307
			50	50	yes	1614BA	217	262	CR200L	242	.....	327
			50	none	no	.....	183	228	.....	206		291
			50	none	yes	.....	201	246	.....	224	.....	309
3	100	1 NO	none	.....		1621AN	77	122	BX200H	107	BX250H	192
			5	.....		1621AS	82	127	BX200J	112	BX250J	197
			10	.....		1621AR	82	127	BX200K	112	BX250K	197
			25	.....		1621AQ	82	127	BX200L	112	BX250L	197
			50	.....		1621AP	82	127	BX200M	112	BX250M	197
			100	.....		1621AM✠	82	127	BX200G	112	BX250G	197
		1 NC	.....	5	no	.....	118	163	.....	148		233
			.....	10	no	.....	118	163	.....	148		233
			.....	25	no	.....	118	163	.....	148		233
			.....	50	no	1620AV	118	163	.....	148		233
			.....	100	no	1620AP	118	163	BR200AR	148		233
			.....	100	yes	1620AM	138	183		168		253
			.....	none	no	1620AQ	113	168		153		238
		2 NO	none	.....		1622AN	112	157	BY200H	142	BY250H	227
			5	.....		1622AS	122	167	BY200J	152	BY250J	237
			10	.....		1622AR	122	167	BY200K	152	BY250K	237
			25	.....		1622AQ	122	167	BY200L	152	BY250L	237
			50	.....		1622AP	122	167	BY200M	152	BY250M	237
			100	.....		1622AM✠	122	167	BY200G	152	BY250G	237
		1 NO and 1 NC	5	5	no	1625BD	158	203	.....	188		273
			10	10	no	1625BC	158	203	.....	188		273
			25	25	no	1625BB	158	203	.....	188		273
			50	50	no	1625BA	158	203	.....	188		273
			100	100	no	1625AQ	158	203	.....	188		273
			100	100	yes	1625AM	178	223	.....	208		293
			100	none	no	1625AS	153	198	.....	183		268
			100	none	yes	1625AP✠	173	218	.....	203		288
		2 NO and 1 NC	5	5	no	1623BD	198	243	.....	228		316
			10	10	no	1623BE	198	243	.....	228		316
			25	25	no	1623BF	198	243	.....	228		316
			50	50	no	1623BG	198	243	.....	228		316
			100	100	no	1623AQ	198	243	.....	228		316
			100	100	yes	1623AM	218	263	.....	248		333
			100	none	no	1623AS	193	238	.....	223		308
			100	none	yes	1623AP✠	213	258	.....	243		328

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 Price GO-10
115/120 V DC	3✠	3✠	3	3	203	203	203	203	*	PRICE INCLUDED IN ABOVE
230/240/250 V DC	2✠	2✠	2✠	2✠	202✠	202✠	202✠	202✠	*	
500 V DC	37‡	4	4	4	204	204	204	204	*	
550 V DC	38‡	5	5	5	211	205	205	205	*	
110 V AC	9‡	16‡	15‡	15‡					202	
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 necessary. To insure proper electrical clearance on NO-NC forms, locate NC contact at bottom of interlock.

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DC CONTACTORS AND RELAYS

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 Addition GO-10
1	DC	500	151A3984G1—4000 ohms			NONE
		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		
		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	3⅞	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 between 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 AC
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		
						DC Motor Circuit		Inductive Circuit with Discharge Resistor
	8-hr	60-min	30-min	10-min		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 Loads (Except infrared lamp loads) 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	230/240/250 v
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

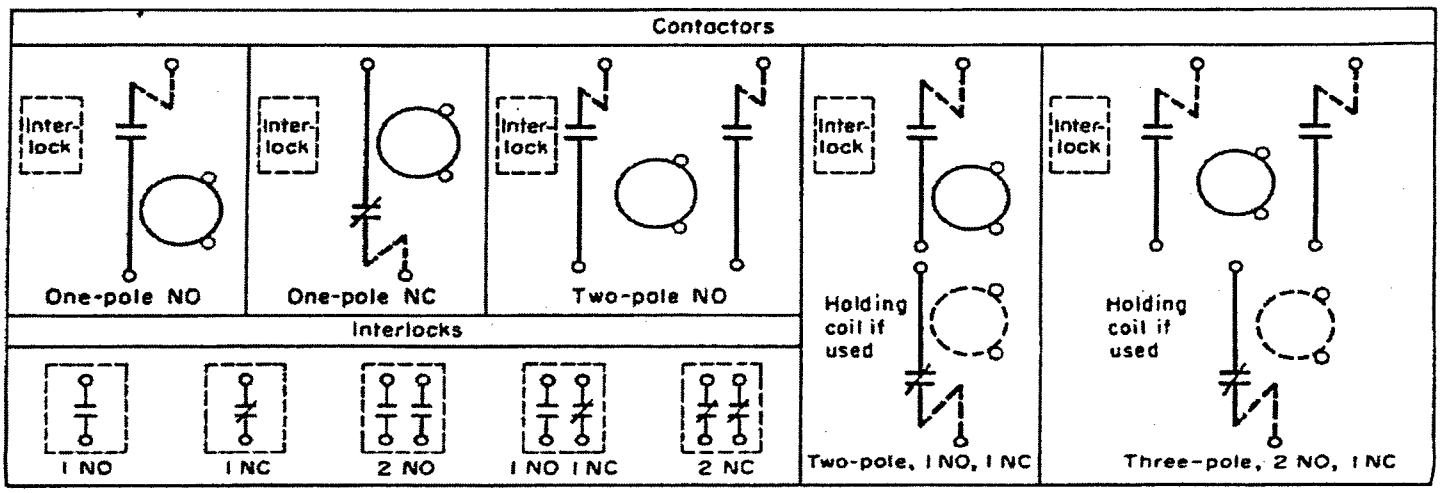
Contactor Size	Poles	Number of Contactors	CURRENT REQUIREMENTS—AMP VOLTS DC 115/120	230/240/250	500	550	BURDEN—VOLT-AMPERES* VOLTS AC 115	220	440
1	1 NO	1	0.133	0.076	0.069	0.071	31	46	48.5
	1 NC	1	0.133	0.076	0.069	0.071	31	46	48.5
	1 NO–1 NC**	1	0.133	0.076	0.069	0.071	31	46	48.5
	2 NO	2	0.263	0.139	0.076	0.066	34	53	57
2	1 NO	1	0.135	0.083	0.038	0.028	27.6	48.5	48.5
	1 NC	1	0.135	0.083	0.038	0.028	27.6	48.5	48.5
	1 NO–1 NC**	1	0.135	0.083	0.038	0.028	27.6	48.5	48.5
	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

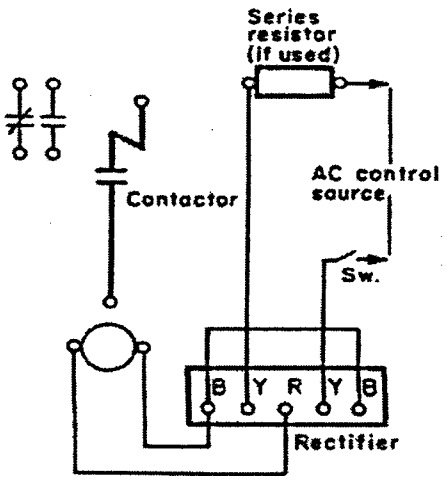
* Volt-ampere Burden includes power requirements of rectifier series resistor and auxiliary contactor.

**Listed power requirements pertain to operating coil only; holding coil if used will have same power requirements as operating coil.

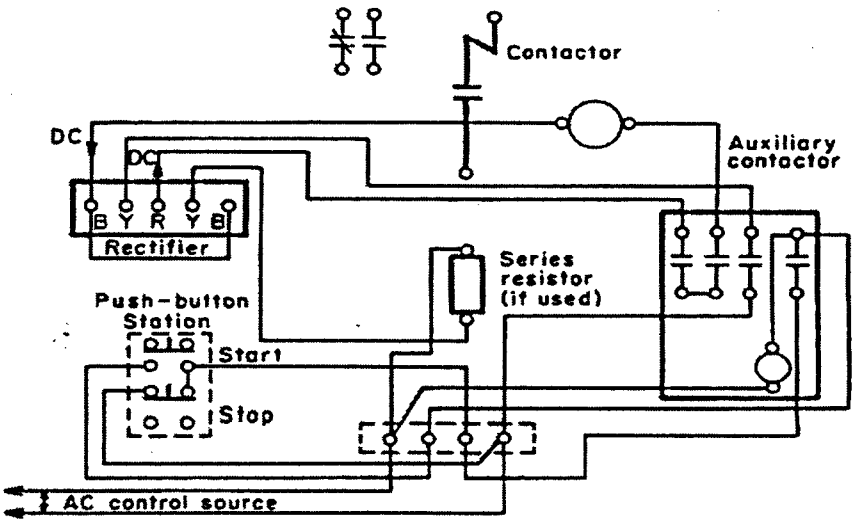
† Listed power requirements pertain to operating coil only; holding coil if used will have one-half power requirements of operating coil.

WIRING SYMBOLS (FRONT VIEW)





Size 1 and 2 contactor—typical diagram for a-c operation



Size 3 contactor—typical diagram for a-c operation

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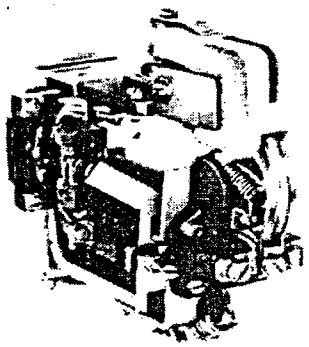
DC CONTACTORS AND RELAYS

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 designation. Specify accessories, where called for, as separate items included in the contactor price.

Example: *To order a 50-amp, 110-volt AC contactor with two NO interlocks, a blowout rating of 10 amp and a time-delay of 0.5 seconds, specify contactor IC2800-B301CR210D with resistor 151A-3984G1—90 ohms. IC- and rectifier 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)

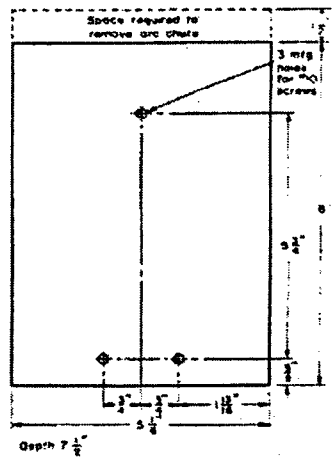
Time Delay in Seconds: Without Interlock	Time Delay in Seconds: With Two-circuit Interlocks	Designation: AC Operation 115/120	AC Operation 230/240/250	AC Operation 500 v	AC Operation 550 v	AC Operation 110 v	AC Operation 220 v	AC Operation 440 v
IC2800-B310								
0.25–0.33	0.2 –0.25	Y203	Y202	Y204	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

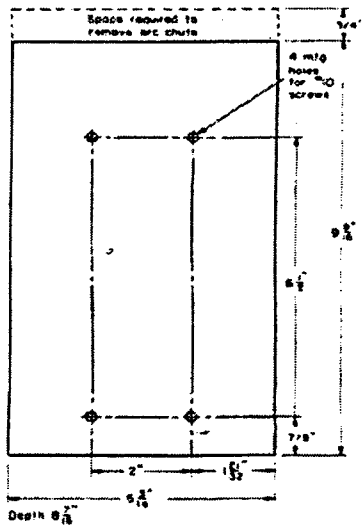
Number of Interlock Circuits	Designation	Price Addition, GO-10
None		
2 NO	D	$12
1 NO, 1 NC	C	12
2 NC	B	12

Step 4—Specify Accessories (For listed voltages only. Included in contactor price)

Control Volts	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



Mounting Dimensions IC2800-B310



Mounting Dimensions IC2800-B410

Refer to Page 15 for Dimensions of Accessories.

NORMALLY CLOSED

WHERE TO USE

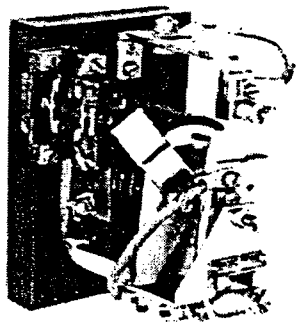
Used to short-out resistance steps in starting DC motors. Contactors are normally closed, without blowouts, and are not designed to interrupt power.

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
1.03–2.14	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

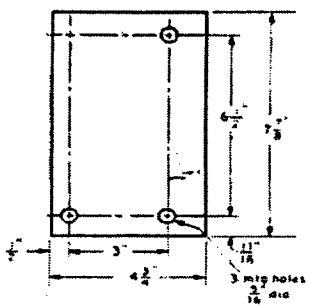
Refer to Page 15 for Dimensions of Accessories.

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.

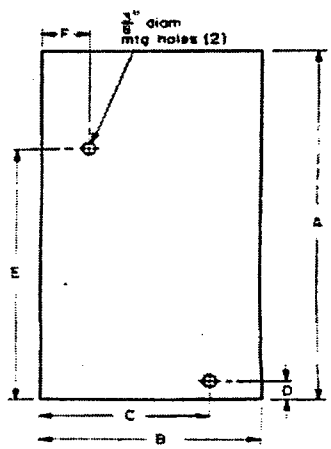
CONTROL POWER REQUIREMENTS

Volts	Amperes			
	IC2800—A501		IC2800-Y109	IC2800-Y110
	Without holding resistor	With holding resistor		
115/120	0.55	0.262	1.03	1.08
230/240/250	0.31	0.141	0.56	0.56
500	0.17	0.08	0.35	0.31
550	0.12	0.06	0.25	0.34



Depth 6 in Weight 10 lbs

Mounting Dimensions IC2800-A501



Mounting Dimensions IC2800-Y109 and -Y110

IC2800 Form	Dimensions in Inches						Depth
	A	B	C	D	E	F	
Y109	8 1/2	4 3/8	3 1/2	1/2	6	1	6 1/8
Y110	10 1/2	6 1/8	4 3/4	3/4	7 1/8	1 1/4	7 1/8

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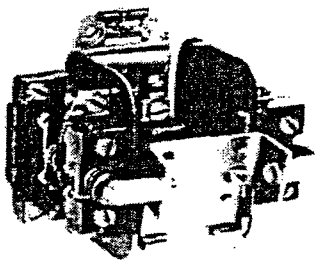
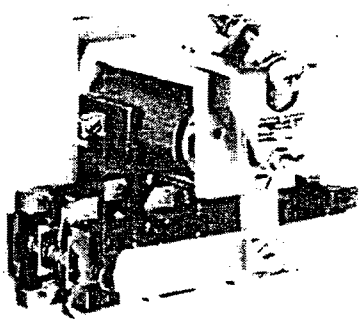
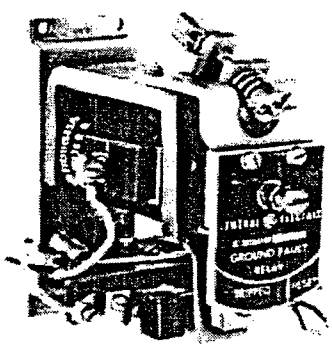
GENERAL-PURPOSE RELAYS



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 Price, GO-10
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		

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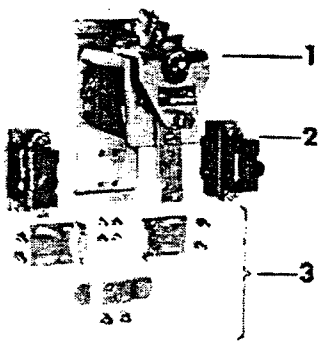
GENERAL-PURPOSE RELAYS



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	Ohms at 25 C: A100	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			*	.

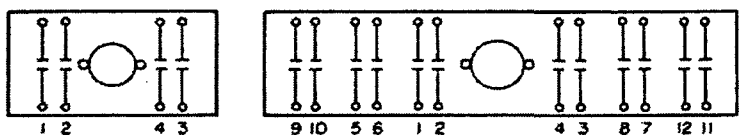
* Specify current rating required.

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	Contact Positions
1	1
2	1-2
4	1-2-4-3

Heavy-duty Relay: Number of Contacts	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 far 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 Circuits 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-04167

SUBJECT: INTERPETATION OF DROPOUT VOLTAGE INCREASE DUE TO CONTINUOUS OPERATION (MORE THAN 4 HOURS)

REFERENCES: V/M G080-0213, 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 G080-0213 "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. N/A (If Applicable)

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

JUN-14-1999 09:41 GE SUPPLY SYRACUSE P.01/01

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

TOTAL P.01

JUL-19-2000 10:52 GE SUPPLY SYRACUSE P.01/01

/E 7/19/00 SINGLE LEVEL BILL OF MATERIAL INQUIRY AME7C KK
EXTENDED DESCRIPTION

ITEM NUMBER 22D1350G441 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

Thanks Tim Romanowski

Regards
Al Stott
GE Supply

TOTAL P.01

JAN-22-2222 29:42 GE SUPPLY SYRACUSE =.21/21
DATE 8/20/00

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

AJ

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

this is what's available for info

on your cost

Regards

Al

DATE 06/19/2000 Single level Parts List (REL) BMG408R 02

Rev# Family
Asm# : 15D21G026 COIL DATA 17 COIL
Struc# : COIL132601

Desc no		Description
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#: 800-789-1518
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: C00-33649: 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.01/2

To Tim Kowalowski	From AL STOTT
Co./Dept.	Co. GE Supply
Phone #	Phone #
Fax # 3496981	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						
6①						

①This 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.O. 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
HFA65D	①	35-80 AC 30-60 DC	①	①			Adjustable 250 to 2000 ms factory set at 2000 ms	
HFA65E	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.

GEZ-7723

HEA

Multicontact Auxiliary Relays

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 ¼ 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	.....

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 number

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		A154B-H	5(2.3)	7(3.2)
	Back connected drawout case		A174B-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		A154E-H	5(2.3)	7(3.2)
	Back connected drawout case		A174E-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

	Voltage and Frequency	Reset Coil Rating 110V Dc	125V Dc	220V Dc	250V Dc	120V 60 Hz	120V 50 Hz
OPERATE COIL RATING		Form Numbers					
	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.

③ This 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: 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.O. Contact When Voltage Reduced to Zero: 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
HF[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

No change since Apr. 23, 1979 issue. (e/c) Data subject to change without notice

GENERAL ELECTRIC

PROTECTIVE RELAYS

★Type HFA

★Multicontact Auxiliary Relays

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	

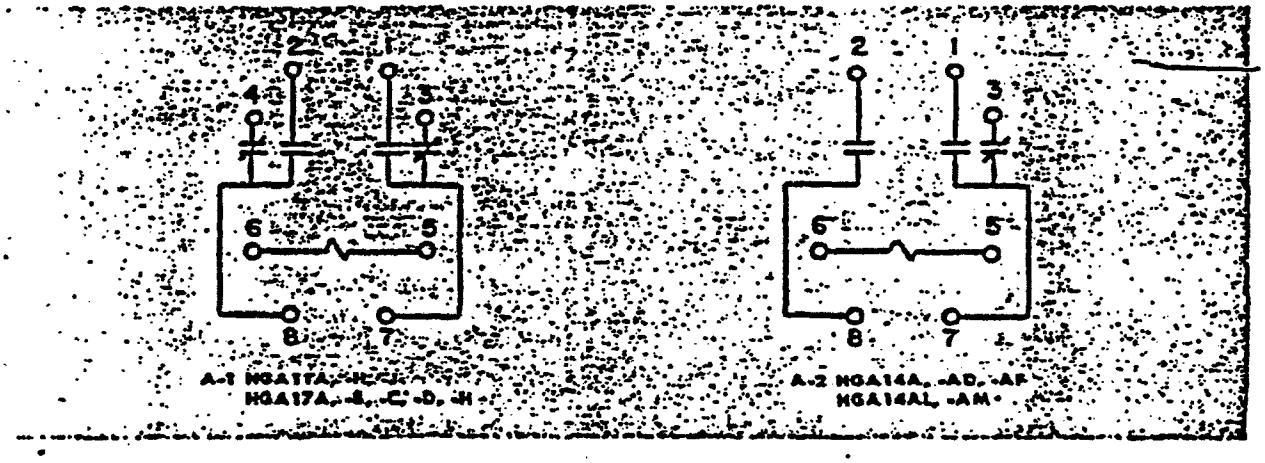
▲ These relays are adjusted to give the proper time delays at rated voltage. Since these adjustments affect the pickup voltage point, it is not possible to accurately predict the pickup voltage.

TYPE HGA GET-7290 AUXILIARY

TABLE V Operating Characteristics, Type HGA Relays

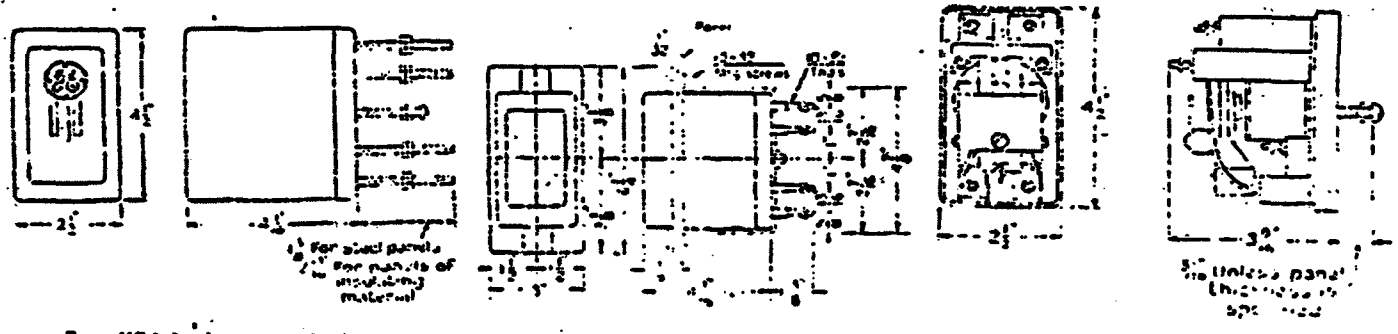
Model	Pickup in Percent of Rating			Dropout in Percent of Rating		Operating Times in Cycles (50 cycle basis)			
						At Pickup		At Dropout	
	Voltage		Current	Voltage	Current	To Close a NO contact	To Open a NC contact	To Open a NO contact	To Close a NC contact
	Hot	Cold							
HGA11A, -H, -J	a-c 80 d-c 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 relays

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.

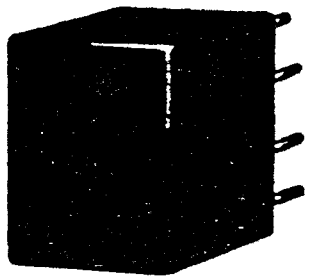
The HMA25A is similar to the HMA24A except it is surface mounted, back connected with glass cover.

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.

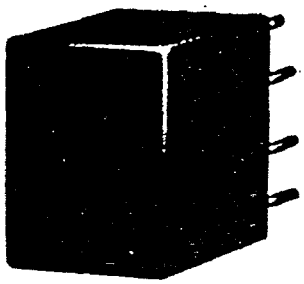
Accelerated life tests—conducted at elevated temperature and maximum voltage—have established a projected service life of 40 years to 1 percent failure (that is, when 1 percent of all such relays have failed) at 55C and 110 percent rated voltage. Under nominal conditions—that is, at an ambient temperature 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: 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
>
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>
> 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

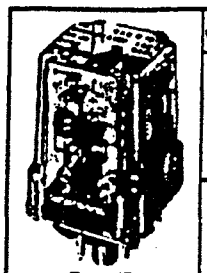
CLASS 8501

Class 8501 Type K relays are designed for multipole switching applications at 240 volts or below. These relays have industry standard wiring and pin arrangements which allows for their use as replacements for many similar relays without wiring or hardware modifications.

- 240 Volt 10 Amperes
- AC or DC Operation
- DPDT or 3PDT
- DPDT Latching Relay
- Manual Operator/Pilot Light Options
- 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	..	$19.
	DPDT	Pilot Light	KP-12	P14	22.
	3PDT	None	KP-13	...	23.
	3PDT	Pilot Light	KP-13	P14	26.
DC	DPDT	None	KPD-12	....	19.
	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

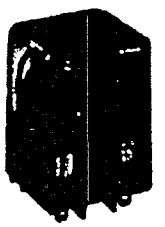
Input Voltage	Contact Arrangement	Options	Type	Price
AC 50/60 Hz	DPDT	None Available	KF-12	$12.
	3PDT		KF-13	13.
DC	DPDT	None Available	KFD-12	12.
	3PDT		KFD-13	13.

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 for 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. With this feature the relay can be manually switched to simulate normal 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 RELAYS

TYPE

CLASS 850

APPLICATION DATA — TYPE K

CONTACT RATINGS

AC						DC		
Volts	Amperes				HP	Volts	Amperes	
	Inductive 35% PF			Resistive 75% PF			Make Break	Continuous
	Make	Break	Continuous	Make, Break & Continuous				
120	30	3	10	10	¼△	6-120	60 VA	10 A
240	15	1.5	10*	10*	⅓			

* 3 pole devices have 6⅔ Amps max. continuous rating.
△ 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

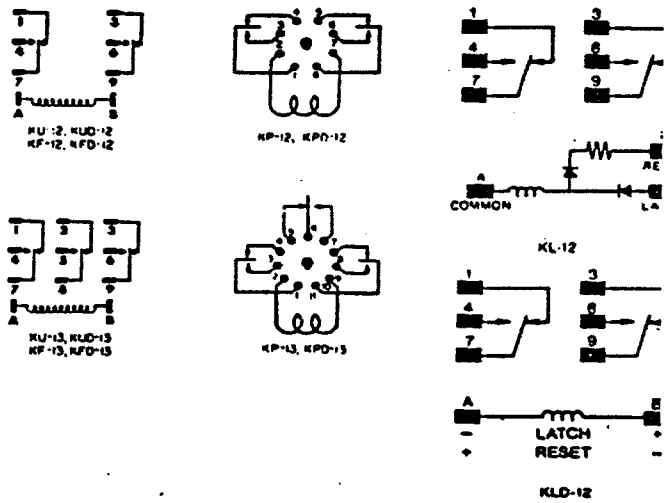
Standard Voltages:

	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

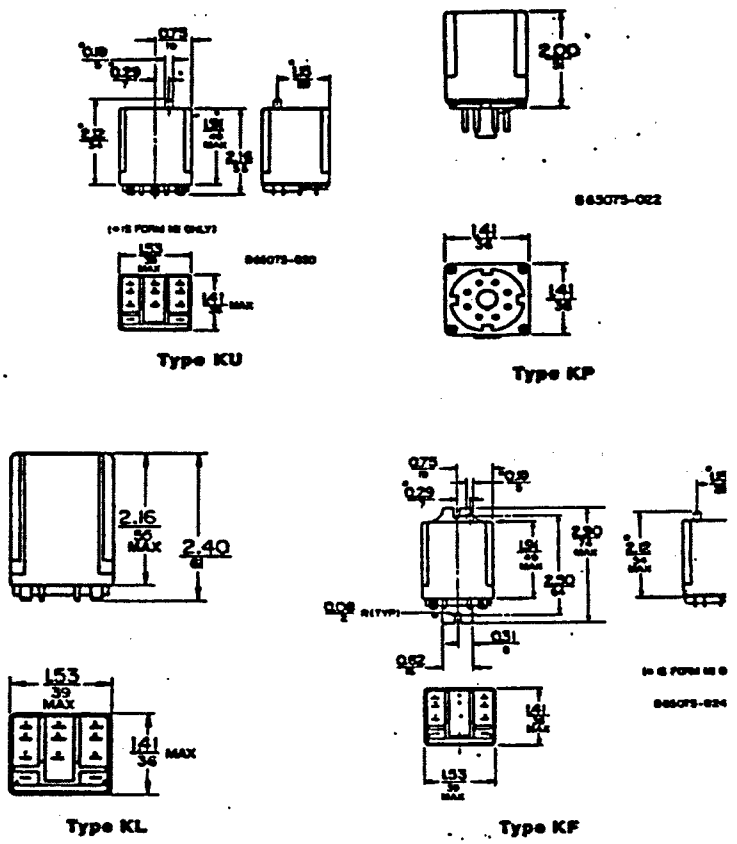
Operate:
AC: 85% of Nominal Voltage at 25°C (77°F)
DC: 75% of Nominal Voltage at 25°C (77°F)

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

General Purpose Relays

Type K – Plug-in Relay

Application Data, Dimensions, Wiring Diagrams

Class 8501

›nt. .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 ½ 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

ll

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

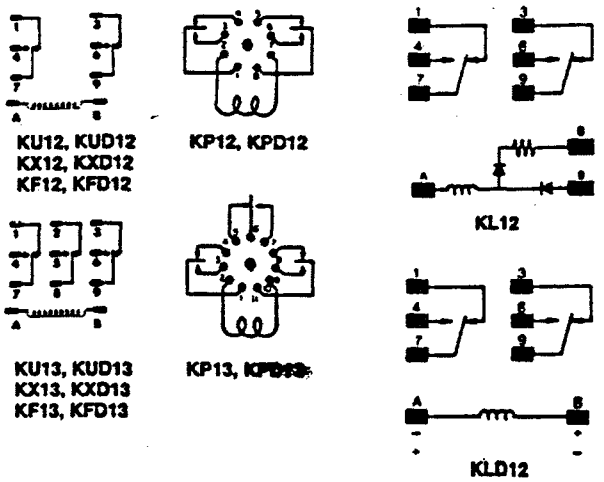
›erminals: Solder/plug–in
JL/CSA: Type K with recommended Class 8501 Type NR Socket

File E78351
CCN NLDX

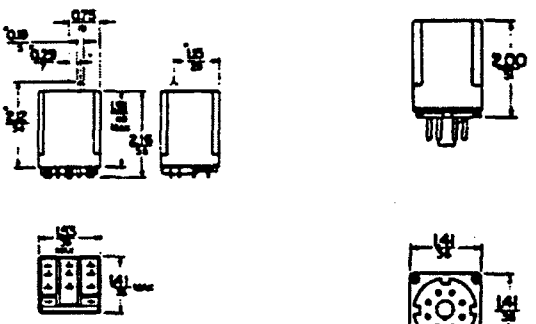
File LR15734M51
Class 321104

UL component recognized under CCN NLDX2.

Wiring Diagrams

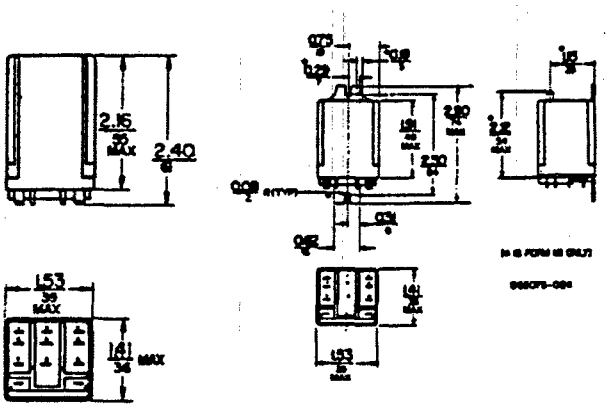


Approximate Dimensions



Type KU and KX

Type KP



Type KL

Type KF

Dual Dimensions: Inches / Millimeters

2 GENERAL PURPOSE RELAYS

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-C006 (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) ~~ms~~ resulted in a dropout of 44 ± 2VDC. This is consistant with the "typical" range. For conservation, the subject calculations will use 50VDC for the dropout voltage for the square D KPD-13 CLASS 8501 relays

AGREEMENTS/COMMITMENTS: None

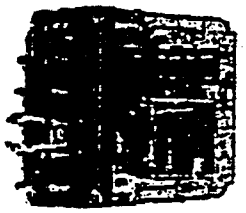
Prepared By: Brian Marks **Date:** 5/30/02
Title: Senior Electrical Engineer
Reviewer: Alex Debes **Date:** 5/30/02
Title: ELECTRICAL Engineer

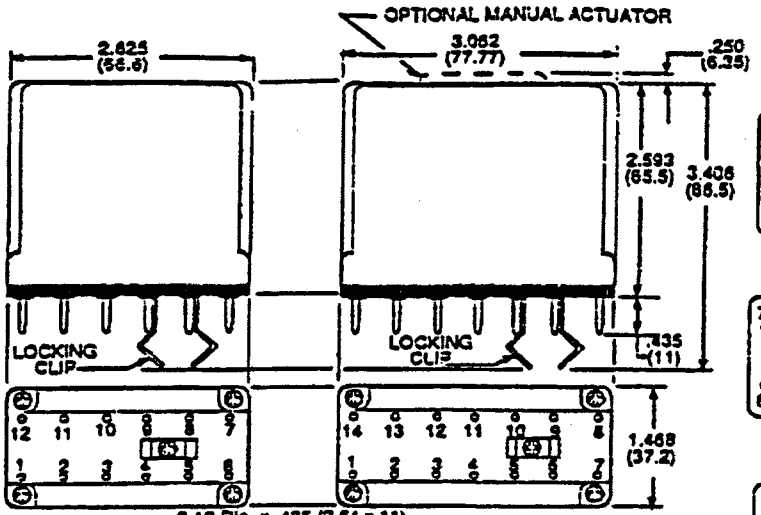
Distribution:

SERIES 219

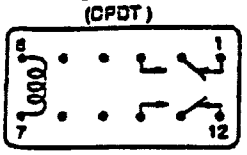
300 VOLT GENERAL PURPOSE PLUG-IN RELAY

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.

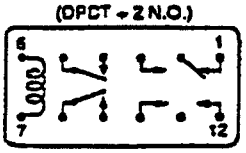




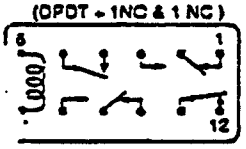
219XBXP (DPDT)



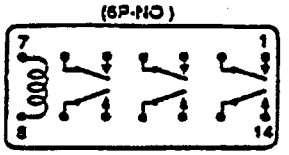
219BBXP (DPDT + 2 N.O.)



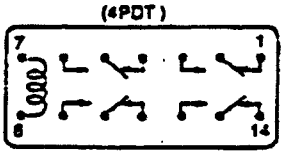
219ABAP (DPDT + 1NC & 1 NC)



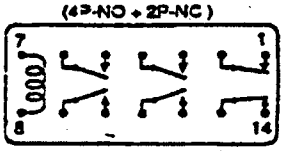
219FXXP (6P-NO)



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

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 +60°C
LIFE EXPECTANCY	
Mechanical:	10 Million Operations no load
Electrical:	100,000 Operations @ Rated Load.
MISCELLANEOUS	
Enclosure:	Clear polycarbonate.

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 68 feature (Check with factory for UL & CSA Listing).

COIL SPECIFICATIONS @ 25°C

AC RELAYS 50/60 HZ (COIL DATA @ 60Hz Voltage)					DC RELAYS, LS WATTS (2.5 W @ 125VDC)			
Nominal Voltage	Resistance Ohms	Milliamperes Open	Milliamperes Closed	Impedance Ohms	Nominal Voltage	Resistance Ohms	Milliamperes Cold	Milliamperes Hot
6	1.1	1500	840	7.2	6	16.5	365	304
12	4.2	750	410	27	12	63.5	189	147
24	15.5	375	200	120	24 (28)*	250	96	77
120	540	75	40	2700	32	375	86	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")
- ABx (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 "68"

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.

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, RRS engineering has reviewed your request

The pick up & drop out voltage for 120VDC relay model AR0660S per nema stds is:

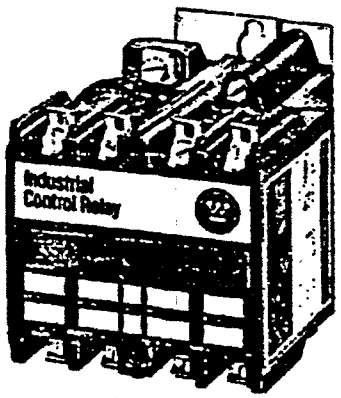
pickup 80% of rated = 96 VDC

drop out > 10% of rated = > 12 VDC

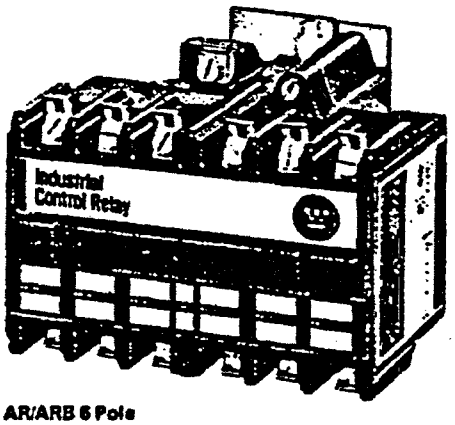
No. of Pages (including cover sheet) 1

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 installation, 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	Contacts 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	$18
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	Max. Current Break	Max. VA Make	Max. VA Bre
120	10	60	6	7200	720
240	10	30	3	7200	720

600 Volt Ac Cartridges: NEMA A600

Volts	Cont. Current	Max. Current Make	Max. Current Break	Max. VA Make	Max. VA Bre
120	10	60	6	7200	720
240	10	30	3	7200	720
480	10	15	1.5	7200	720
600	10	12	1.2	7200	720

Dc Cartridges NEMA N600

Volts	Cont. Current	Make or Break Two Poles in Series	Make or Break Single Pole	Max. VA Make Break
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 N

Ordering Information
Order by Catalog Number

Relays listed in the price table are supplie with NO contacts convertible to NC. When ordering relays with NO and NC poles, ad $4.00 list per relay. Order by description.

To order relays with screw terminals for ri type connectors, add suffix R to catalog number of relay. No extra charge. Exampl AR420AR.

Ac relays listed in price tables have 120/60 110/50 coils designated by suffix letter A. D relays have a 120 volt coil designated by s fix letter S. For other coil voltages, see tabl page 9 and substitute suffix letter shown i table for desired voltage for suffix letters A S in catalog numbers.

93-K2VR-A, -B, -C, -D

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-H∅
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.

∅ 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

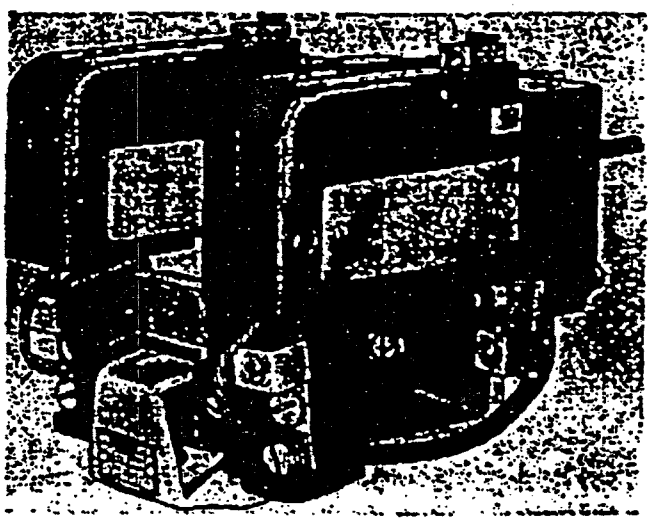


Fig. 3—Type M-220-2H Front-connected Contactor

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 manner 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 of interlock is mounted on the molded base of the contactor, occupying a space between the arc shield. The moving arm of the interlock is secured to the contactor armature by means of a single screw. Care should be taken when installing an interlock to make certain that its moving parts function freely and that the contact gaps and overtravels conform to the information given in its instruction leaflet.

The sequence in which the various switching operations occur as the contactor magnet closes is as follows: (1) the Type L-46 normally closed interlock opens; (2) the main contacts close, (3) the Type L-46 normally-open interlock closes, and (4) the Type L-47 normally-closed interlock opens. (Note: a single contactor can accommodate only two of the three varieties of interlocks at one time.)

MECHANICAL INTERLOCK

A Type M-25 mechanical interlock (Style No. 1320750) may be employed to safeguard a pair of contactors against the closing of one if the other is already closed. The contactors are mounted side by side on 6 inch centers.

INSTALLATION AND MAINTENANCE

Arc Shields—The arc shields and their arc horns are essential to the performance of the contactor and these should always be in place. The flexible connections leading from the arc horns should always be securely fastened to the moving contacts. The arc shields may be removed by pulling them directly forward, allowing the magnetic blowout pole-pieces (which act as their fixed supports) to guide them in their sliding movement. In replacing the arc shields care must be taken that the guiding recesses in their sides locate themselves properly on and be gripped firmly by the supporting guides. If a pair of guides are found to be spread apart so that they no longer grip the arc box firmly, remove the arc box and spring the guides together by squeezing them with the fingers. The arc shields should be pushed back as far as they will go, until they are held securely against the molded base by the spring grips.

Armature and Bearing—The knife-edge bearing requires no maintenance other than the removal of accumulated dirt. Oil should not be used as it hastens the collection of dust.

The magnet pole-face is secured to the core by means of a bolt having a head that projects forward into a hole in the armature. Care should be taken that the parts maintain proper alignment, and particularly that the bolt-head be accurately centered in the armature hole. Dirt should not be allowed to accumulate.

Operating Coil—When a new operating coil is installed, the identification label should be examined to make certain that the voltage rating and the coil 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 1/16 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 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 11/32 to 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	30B4265G17
550	1289377	1289377

* Contactors shown in light face are obsolete.

Fig. 6—Style Numbers of Commonly Used Operating Coils

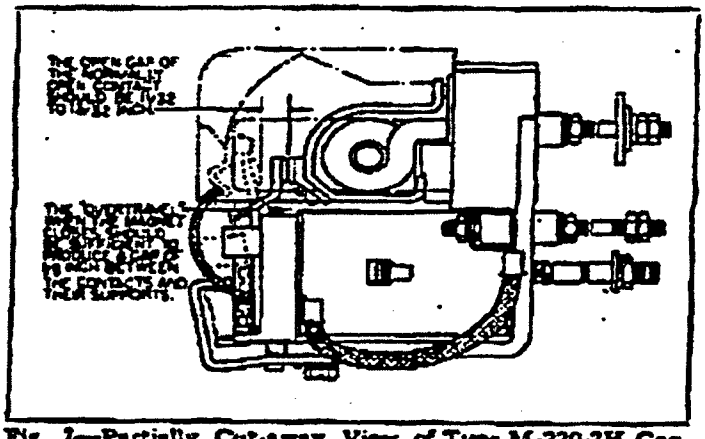


Fig. 7—Partially Cut-away View of Type M-220-2H Contactor with Armature in Closed Position

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.

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

JUL-25-1997 15:54 ALLEN-BRADLEY CO. 315 463 5882 P.01

TYPE "N"
HEATER ELEMENT RESISTANCE VALUE TABLES

HEATER CATALOG NUMBER	ENGINEERING PART NUMBER	RESISTANCE (OHMS)		
		MINIMUM (-7%)	NOMINAL	MAXIMUM (+7%)
NN4	X-42901	36.7.	39.5	42.2
NN3X	40033-001-01	31.2	33.5	35.8
NN3	X-42902	26.0	28.0	30.0
NN2X	40033-001-02	21.8	23.5	25.1
NN2	X-42903	18.1	19.5	20.9
NN1X	40033-001-03	14.7	15.8	16.9
NN1	X-42904	12.1	13.0	13.9
N1X	40033-001-04	9.9	10.7	11.4
N1	X-42905	8.4	9.00	9.6
N2X	40033-002-01	7.00	7.50	8.03
N2	X-42906	5.91	6.35	6.79
N3X	40033-002-02	4.83	5.20	5.56
N3	X-42907	3.95	4.25	4.55
N4X	40033-002-03	3.21	3.45	3.69
N4	X-42908	2.62	2.82	3.02
N5	X-42909	2.14	2.31	2.47
N6	X-42910	1.77	1.90	2.03
N7	X-42911	1.43	1.54	1.65
N8	X-42912	1.16	1.25	1.34
N9	X-42913	0.98	1.05	1.12
N10	X-42914	0.80	0.86	0.92
N11	X-42915	0.65	0.70	0.75
N12	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 "N"
HEATER ELEMENT RESISTANCE VALUE TABLES

HEATER CATALOG NUMBER	ENGINEERING PART NUMBER	RESISTANCE (OHMS)		
		MINIMUM (-7%)	NOMINAL	MAXIMUM (+7%)
N36	X-42940	0.0074	0.0080	0.0086
N37	X-42941	0.0066	0.0071	0.0076
N38	X-42942	0.0055	0.0059	0.0063
N39	E-13027	0.0048	0.0052	0.0056
N40	E-13026	0.0040	0.0044	0.0047
N41	E-13029	0.0036	0.0039	0.0041
N42	E-13028	0.0031	0.0033	0.0035
N43	E-13035	0.0025	0.00270	0.0029
N44	E-13034	0.0021	0.00225	0.0024
N45	E-13033	0.00176	0.00190	0.00203
N46	E-13032	0.00154	0.00166	0.00177
N70	E-13031	0.00128	0.00138	0.00147
N71	X-263562	0.00087	0.00094	0.00101
N72	X-263563	0.00074	0.00080	0.00086
N73	X-262564	0.00062	0.00067	0.00072
N74	X-262565	0.000437	0.00470	0.000502
N75	X-262566	0.000367	0.000395	0.000422
N76	X-262567	0.000307	0.000330	0.000355
N77	X-262568	0.000251	0.000270	0.000290
N78	X-262569	0.000209	0.000225	0.000241
N79	X-262570	0.000178	0.000192	0.000205
N80	X-262571	0.000150	0.000162	0.000173
N81	X-262572	0.000126	0.000135	0.000144

DRESSER - RAND
STEAM TURBINE DIVISION
(TURBODYNE-TERRY)

37 Coats Street
Wellsville, NY, 14895
Phone 716-596-3631

FAX No. 716-596-3753
Date: 4/15/97

Receiving Fax No. 315-349-6981

Page 1 of 1

To: Alex Barton
Company: N.Y.P.A.
Site: James A. Fitzpatrick

From: Ed Grandusky E.G.
Nuclear Product Engineer
Copy: R. Kling
W. Sweeney
V. Funk

SUBJECT: Trombetta Solenoid

TEXT: Per Terry Drawing 890160A the Trombetta Solenoids p/n 890160A01 (G-206-A5 PB) and p/n 890160A02 (G-206-A7-QB) are suitable for operating between 100 and 140 VDC.

o 11.

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. Hamrada G/C	R. G. McKee G/C	R. G. McKee 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 ~~THEK24125~~ THFK22H125 DD213A6384P048
Relays: ① 2 ea. IC2800-A501AB23C 100A
② IC2820A100-BB3K 10A
Contactor ③ IC2800-1621AM3H 100A
Resistors: ① IC9033-C2B42 .42 Ω
② IC9133-476C514G112 ___ Ω no value stamped
Heater: CR123F65.8B
OL Relay: CR124E028

(2)

71 BCB-2B-OC2
label ID#
Serial #- 274X0441M02-C02
Amps/H.P. - 7.5 H.P.
25 VDC
Size - 3 Type-RVNR
Cy - DC
Diagram# - 187B8333
Sh. 9

Breaker: THED 124100A
Resistors: ① - C4B70 70Ω HARD TO READ - MIGHT BE OFF A LITTLE

Resistor : ② IC9033- AID20 20Ω
Relay: ① IC2820A100 - BB3J 10A
② IC2800-A501AB23C 100A
Contactor: ③ IC 2820A100- BB3J 10A
④ IC2800 - 1621AM3H 100A

Heater: CR123F71.9B
OL Relay: CR124E027

Some #'s were hard to read - so there might be a misread # or letter - Sorry ☺

JUL-01-98 WED 11:47 E MAX FAX NO. 3037902352 P. 01

e-max
I ments, Incorporated
1 nverness Way South
Englewood, Colorado 80112
303-799-6640 FAX 790-2352

July 1, 1998

New York Power Authority
Mr. Rich Korenski
FAX 315-349-6474

71-DTR3F

Subj: Purchase Order S 98 02897
JAF Nuclear Power Pant

In response to your inquiry of June 29, 1998, I have the following:

Loads for the FAXTRAX Cabinet

AC Source - 200W
If printer added to the line, 275W

DC Source - 125W max.

Note: On start-Up the systems may experieince surges of 5 or 6 A.

Fuses in the FAXTRAX System:

FAXTRAX Printer, CRT, Convenience receptacle -	10A 250V Bussman NON-10
DC Input from Station Battery -	2 each 5A 250V Bussman NON-5
FAXTRAX Recorder Front Panel -	1 each 8A 250V Littelfuse

If I may be of further assistance, please contact me.

Cynthia Everhart

Cynthia Everhart

F1-88-224

1.50-43 — VENDOR WIRING DIAG. REV. 0A-0 OF DTR.

125 VDC SOURCE 71DC-A1 CKT # 5, FE-1AK REV 8A.

120 VAC SOURCE 71ACUPS CKT # 21 SE-11A, REV. 15

1.50-47 EXT. CONN. DIAG OF DTR.

BD-172 - BLOCK DIAG. REV. 0A-3 OF DTR.

NOTE

: EXISTING OSCILLOGRAPH EQUIPMENT LOADS ARE DISCONNECTED, FEEDERS ARE EXTENDED TO NEW DTR.

e-max
Instruments, Incorporated
13 Inverness Way South
'nglewood, Colorado 80112
03-799-6640 FAX 790-2352

July 10, 1998

Mr. Rich Korenski
New York Power Authority
FAX 315-349-6474

Subj: JAF Nuclear Power Plant
Refurbishment of Digital Transient Recorder
P. O. #S 98 01369

Confirming or telephone conversation, the DC Input Range of the DTR is 60 - 180 Vdc.

If I may be of further assistance, please contact me.

Cynthia Everhart

Cynthia Everhart

93-AR1-1EDGD12 THRU 93-AR18-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 13Ø VDC	ESK-11BT
93-74-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 125VDC	ESK-11BQ
93-ISX-1EDGD12	GE 12HFA151A2H	ESK-11BQ
93-K1-1EDGD12	GE CR2811A257AA COIL-22D135G41 COIL-22D121ØG41	ESK-11BQ
93-TBR-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 13ØVDC	ESK-11BQ
93-TD6-1EDGD12	AGA E7Ø12PDØØ2 COIL-8837Ø399	ESK-11BQ
93-TD7-1EDGD12	AGA E7Ø12PDØØ2 COIL-8837Ø4ØØ	ESK-11BQ
93-K4-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 13ØVDC	ESK-11BQ
93-FFR-1EDGD12	GE CR2811 COIL-22D135G441	ESK-11BQ
93-VSR-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 13ØVDC	ESK-11BQ
93-K3-1EDGD12	GE CR2811A257AA COIL-22D135G41 COIL-22D121ØG41	ESK-11BR
93-TD5-1EDGD12	AGA E7D14PCØØ2 COIL-8837Ø411	ESK-11BR
93-K2-1EDGD12	GE CR1Ø5KØØØBLA COIL-15D21G26	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 CR105K000BLA 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 E7012FD002 COIL-88370397	ESK-11BS
93-86X1-1EDGD12	SQD KPD-13 CLASS 8501, 130VDC	↓
93-TD1-1EDGD12	AGA E7022PK002 COIL-88370429	↓
93-62-1EDGD12 (T1-1PG12)	AGA E7012PC	↓

93-74C-1EDGB13	GE CR2811 COIL-22D135G641	ESK-11BP
93TBRX1-1EDGB13	SQ.D KPD-13 CLASS 85Ø1, 13ØVDC	
93TBRX2-1EDGB13		
93TD8M-1EDGB13	AGA E7Ø14PCØØ2 COIL-8837Ø4Ø7	
93TD8X-1EDGB13	SQ.D KPD-13 CLASS 85Ø1, 13ØVDC	
93FTS1-1EDGB13		
93FTS2-1EDGB13		
93VSRX1-1EDGB13		
93VSRX2-1EDGB13		
93-GFR-1EDGB13		
93TD9M-1EDGB13	AGA E7Ø14PCØØ2 COIL-8837Ø4Ø9	
93TD9X-1EDGB13	GE CR2811 COIL-22D135G641	
93FTS1A-1EDGB13	SQ.D KPD-13 CLASS 85Ø1, 13ØVDC	
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

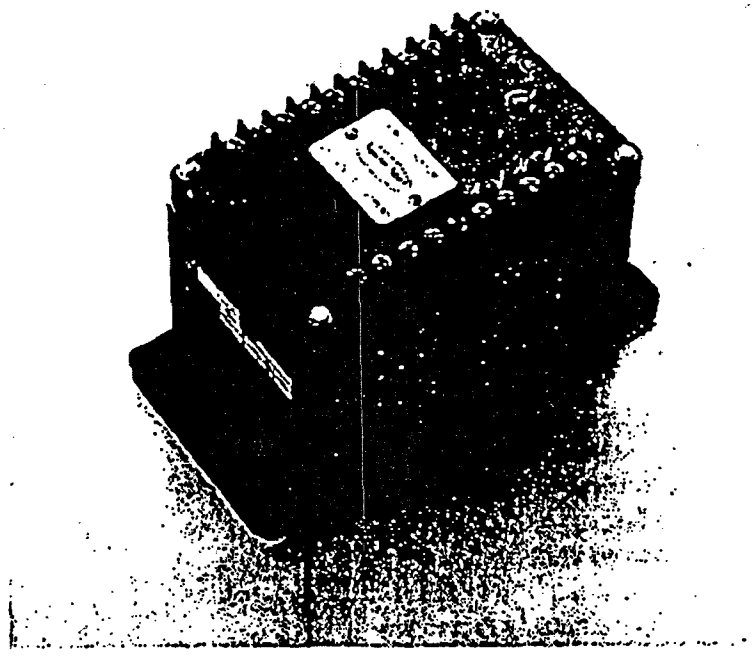
847-967-7730
Fax: 847-967-7832

Synchro-Start PRODUCTS, INC.

Electronic Speed Switches

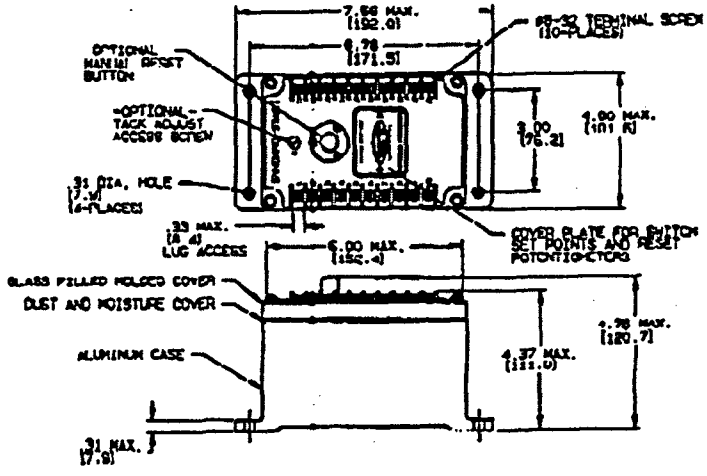
ESSB

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



© 1994 Synchro-Start Products, Inc. L SAL 032 Rev A 0/94 5M

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: 708/967-7730 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.001/00

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
ALEX BARTON
PHONE 315 349 6622

TEST ESSB FOR CURRENT CONSUMPTION @ 125 VDC. RELAYS ENERGIZED + DE-ENERGIZED.

DENERGIZED — ENERGIZED —				
(STANBY)	1 RELAY	2 RELAYS	3 RELAYS	4 RELAYS
39.6 mA	51 mA	63 mA	74.7 mA	86 mA

Synchro-Start Products, Inc.
Control & Sensor Technology

Synchro-Start Products, Inc.
6250 West Howard Street
Niles, Illinois 60714-3433
USA

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 STANBY (RELAYS DE-ENERGIZ
THE CURRENT IS 39.6 mA
THE CURRENT INCREASES BY ≅ 10m
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	SYNCHO-START PRODUCTS (847) 967-7730

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 ~~W~~ 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 DOBU 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:

PARTICIPANTS:

NAME	ORGANIZATION
GAIL	GRAHAM WHITE MANUFACTURING
ROBERT BAKER	NYPA

SUMMARY OF ISCUSSION:

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) 387-5620

REQUESTED DO & PU SOV DATA
PICKUP 87.5 VDC @ 200 PSI
DROP OUT BETWEEN 10 — 30 VDC
@ 200 PSI

AGREEMENTS/COMMITMENTS:

NONE

Prepared By: Robert Baker Date: 11/20/96

Title: Maint Engr.

Reviewer: _____ Date _____

JUN-30-00 FRI 02:53 PM DATCON FAX NO. 7175696372 P. 01

MAXIMA TECHNOLOGIES

FAX

TO: Jim 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

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: 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 Dahlen 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 locate 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.

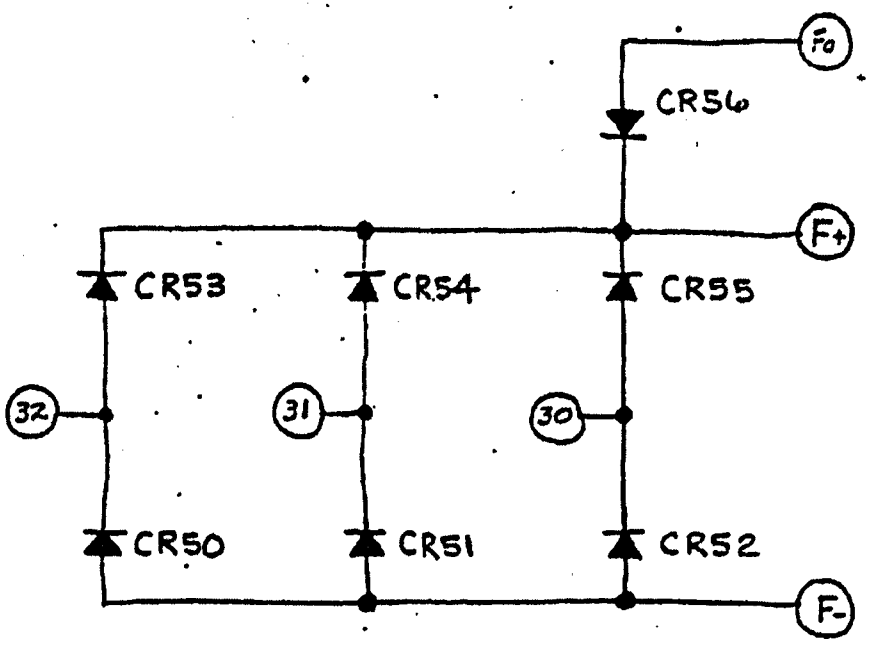
Sincerely,

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 ± NA FRACTIONS ± NA ANGLES ± NA

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	NA

BASLER ELECTRIC CO.
HIGHLAND, ILLINOIS

DWG SIZE A

DRAWING NO. 90 34519 911

REV

NTE Semiconductor Cross Reference

Manufacturer Part No.	1N3296
NTE Part No.	NTE6162
Data Sheets	[redacted]
Manufacturer Notes:	
Date Updated:	12/12/2001

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 ^{2}t 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 Nelson	Fax # (914) 681-6450	Company or Component	Location
			Date Sent 2/9/92
FROM Heidi Hewitt	Fax # (814) 875-2883	Company or Component GE MOTORS	Location Erie, PA

SUBJECT your request for information

5CD164UJA 803A 800 - 10HP. 1750RPM. 120V ARMATURE, 120V FIELD,
(94P-13) ARM AMPS = 71, FIELD AMPS = 1.15. TEFC
ENCLOSURE. CD259AT FRAME (94P-13)

5CD 1986801A601 - 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, CD184AT FRAME

5CD256E105C 7.5HP. 3500RPM. 125V ARMATURE, 120V FIELD,
SN = EG-1-576 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

7.5Hp, 3500RPM, 125VOLTS

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

94P-13(M) 3/16/99

HP 10, RPM 1750, VOLTS 120
ARM AMPS 71, WOUND SHUNT
FLD AMPS 1.15, FIELD OHM @25°C 74
INSUL CLASS F, DUTY CONT., MAX AMB 40°C
PWR SUP CODE DC GEN.
TYPE CD259AT, ENCL TEFC
INSTR GEH3967
MOD. 5CD164WA803A8DO
SBR AH-1-686

94P-13(M) Walkdown Data

SYSTEM # 02-184
COMP. # PM-3A

ELECTRIC MOTOR DATA

COMP. NO.	COMP. NAME
02-184 PM 3A	Recirc Fluid Dr. Emer Lube Oil Pump

MANUFACTURER	MCC	MCC LOCATION	COMP LOCATION	ESK	~~FE~~	FE
GE "Reliance"		RR	MG Set Room	11CA	10A2	46m

H.P.	TYPE	BKR. SIZE	STARTER SIZE	Starter Model #	Motor Model #
1					5CD14D05A341520

VOLTAGE	PHASE	SERIAL NUMBER	DESIGN	CODE	HERTZ
125	DC	LF-1-1211			

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: Bearing 186AT

DATE	WRED #	BRIEF DESCRIPTION OF JOB	DATE	WRED #	BRIEF DESCRIPTION OF JOB
1/15/92	10835	Grease PM Motor pm			
2/13/95	94 5071-00	CHECK BRUSHES TGS			

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 (815) 745-2100 (IL) FAX -2135 (FAX)

SUBJECT 3/4HP REGENT TYPE DC MOTOR DATA

DISCUSSION/ACTION:

MODEL # MUD9C75BB ; TAG #s 9366-5A, 5B, 5C, 5D
MUD = UNIVERSAL MOTOR → RUNS ON AC OR DC ;
VERY UNSTABLE CHARACTERISTICS - LRA = STARTING AMP
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. ____

KJ 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 KJ 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 ;
3.8A FLA ; STARTING AMPS NTE 150% FLA
MODEL # L24437 (T1-AW ; 23-MOV-19 - TAG #
125 VDC ; 1.11A 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 sec
30 ft lb run : 5 min.

DISTRIBUTION:

NUC GEN FILES NO. ___

MOD FILE NO. ___

KJ Nelson 2/5/92
SIGNATURE DATE

TSSO-1
Figure 1

New York Power Authority

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 Date: 10/11/96
Title: Lead Systems Engineer
Reviewer: Pete Donahue Date: 10/11/96
Title: Acting Tech Services Manager

Distribution: (other than participants) J. Stead T. Powers T. Andersen

13P-3
TYPE D225X
Serial # F80031
Hp 3 , 1900 RPM
125V , 23Amp
winding STAB. SHT.
Continuous duty
40°C
Continental Elect Co
115V .45AMP SPACE HEATER

13P-3(M) Motor Walkdown Data

13P-4 GE Kinemat 1C
Hp 3 RPM 3500
125VOLTS
21 ARM AMPS
Wound COMP.
Fld amps 0.665A
Fld ohms @25°C 146
CLASS B insulation
Duty Cont
Max AMB 40°C
120V SP. HTR
TYPE L182AY
ENCL DPFG
INSTR GEH 3256
MOD # 5CD14C02A900001
SER # JD-1-755

13P-4(M) Motor Walkdown Data

(MOV 1024)
SYS/VALVE NO. 38 MOV VB
Q.A. CAT. II/III

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME
38 MOV VB1 (MOV 1024)	CONDENSER VACUUM BREAKER MOV

MANUFACTURER	MCC	ESK	SE	COMP. LOCATION & ELEVATION
PORTER PEERLESS	NONE BRKR#13 71DCA3 RELAY ROOM	(FEUHR) 11AB	10L 10AX	295 ELV. TURBINE RM - EAST SIDE ON GRATING 5' BELOW TBN 300' FLOOR

H.P./TORQUE	TYPE	MODEL NO.
0.722/10 FTLB	COMPOUND	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125 VDC	—	—	CZ26755	—	—

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
29	—	5 MIN	DG56D

AMP.(F.L.)	RPM	TEMP. RISE AMBIENT	INSUL. CLASS
6	1900	75°C / 40°C	B

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS

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. 1VACA06	RECOMMENDED: OPEN 1.00 CLOSE 1.00
TYPE GATE	SER. NO. 147741	BKR. AMPS 20	MAX: OPEN 2.75 CLOSE 2.75
SIZE 12 INCH	ORDER NO. 360340A	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	
	3	3		49	49	LIMITORQUE	
AMPS F.L. AT TORQUE TRIP	4	4	TORQUE SWITCH SETTING	1.00	1.00	MCC	

BRAKE INFO, BOLTING TORQUE, MISC INFO

NO BRAKE - VERIFIED MOTOR & OPERATOR NAMEPLATE DATA 2-28-87 Steel

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Inputs, 3/26/02, 1:36 PM

Select Valve--> Open stroke for 38MOV-VB1, low voltage

General Information	Required?	Value
Valve Type	yes	wedge gate
Flow type	yes	pumped flow
Stroke direction	yes	open
Fluid (blowdown only)	no	steam
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	1.000
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	2,700
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	76.87
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	87.0
Cable resistance, R_{cable} (ohms)	yes	1.2372
Thermal overload resistance, R_{tol} (ohms)	yes	0.0650
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	15
Valve pressure at full open, P_B (psig)	yes	0
Flow rate, Q_{max} (gpm)	yes	2500
Fluid density, ρ (lbs/ft^3)	yes	62.400
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	44.5
Fully open stem thrust, F_O (lbs)	yes	1,500
Nominal motor torque, τ_{nom} (ft-lbs)	yes	14.3
Maximum motor torque (ft-lbs)	yes	1.7
Maximum adjusted motor torque (ft-lbs)	yes	2.8
Minimum motor speed (rpm)	yes	1101
Minimum instantaneous actuator capability (lbs)	yes	14,029
Minimum instantaneous margin (lbs)	yes	11,329
Maximum allowable thrust at unwedging	yes	10,226
Efficiency at minimum instantaneous capability	yes	0.400

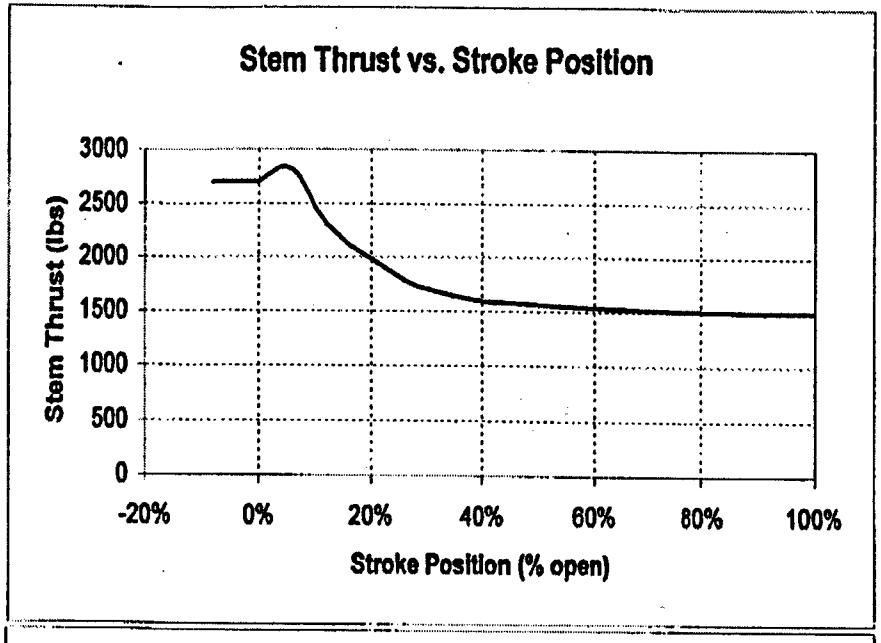
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

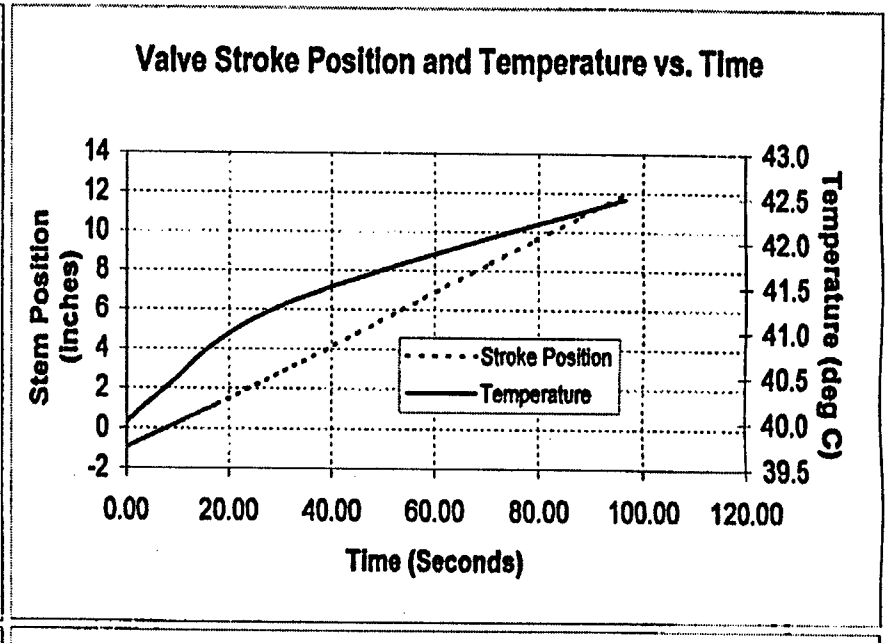
Warnings

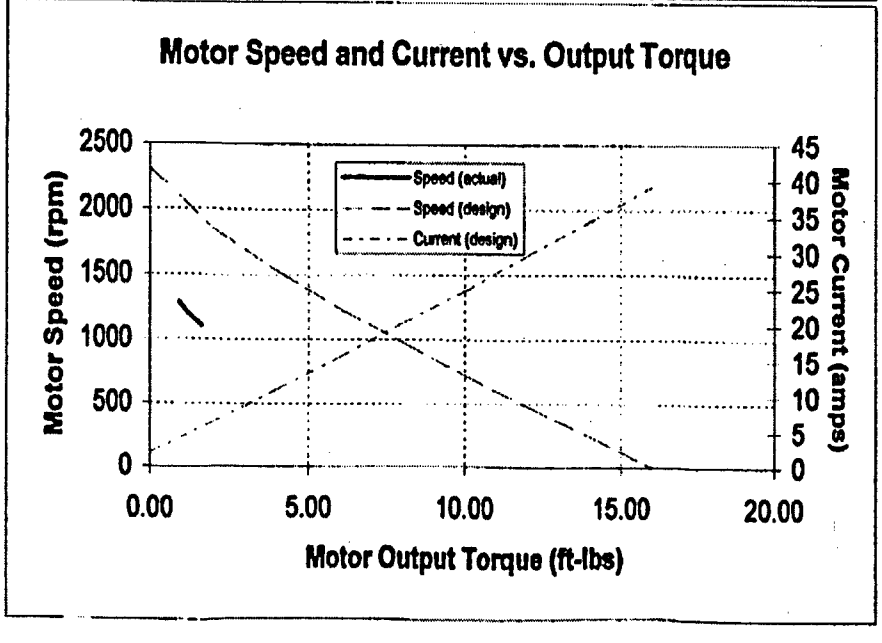
Predicted Stroke Time (Seconds): 97.70

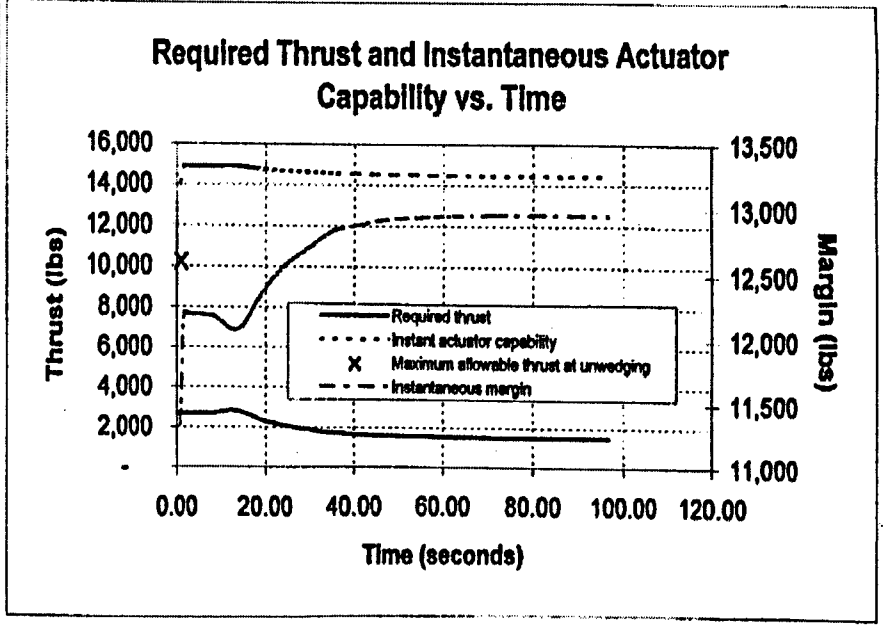
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
-8%	-0.96	2700												0.00	40.0				0
-7%	-0.86	2700	2700	51.08		0.400	1.66	5.66	87.00	80	2.76	1101	0.80	0.80	40.0	265	14,029	11,329	0
-6%	-0.77	2700	2700	51.08	644	0.423	1.57	5.45	87.00	80	2.60	1121	0.79	1.59	40.1	282	14,897	12,197	0
-6%	-0.67	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.79	2.38	40.1	282	14,901	12,201	0
-5%	-0.58	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.79	3.17	40.2	282	14,899	12,199	0
-4%	-0.48	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.79	3.96	40.2	282	14,897	12,197	0
-3%	-0.38	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.79	4.75	40.2	282	14,895	12,195	0
-2%	-0.29	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.79	5.54	40.3	282	14,893	12,193	0
-2%	-0.19	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.79	6.33	40.3	282	14,891	12,191	0
-1%	-0.10	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.79	7.12	40.4	282	14,888	12,188	0
0%	-0.01	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.69	7.81	40.4	282	14,886	12,186	0
0%	0.00	2700	2700	51.08	656	0.424	1.57	5.45	87.00	80	2.60	1121	0.10	7.91	40.4	282	14,884	12,184	0
1%	0.12	2735	2717	51.41	656	0.424	1.58	5.47	87.00	80	2.62	1119	0.99	8.90	40.4	282	14,889	12,172	72
2%	0.24	2769	2752	52.07	655	0.424	1.60	5.51	87.00	80	2.65	1115	0.99	9.89	40.5	282	14,896	12,144	167
3%	0.36	2804	2787	52.73	652	0.425	1.61	5.55	87.00	80	2.68	1111	1.00	10.89	40.5	282	14,902	12,115	277
4%	0.48	2839	2822	53.38	650	0.425	1.63	5.59	87.00	80	2.71	1107	1.00	11.89	40.6	282	14,908	12,086	413
5%	0.60	2836	2837	53.88	648	0.426	1.64	5.61	87.00	80	2.73	1105	1.00	12.89	40.7	282	14,908	12,071	570
6%	0.72	2812	2824	53.43	647	0.425	1.63	5.59	87.00	80	2.72	1107	1.00	13.89	40.7	282	14,901	12,077	745
7%	0.84	2760	2786	52.71	647	0.425	1.61	5.55	87.00	80	2.68	1111	1.00	14.89	40.8	282	14,888	12,102	886
8%	0.96	2676	2718	51.42	650	0.424	1.58	5.47	87.00	80	2.62	1119	0.99	15.88	40.8	281	14,867	12,149	1040
9%	1.08	2583	2629	49.74	654	0.422	1.53	5.37	87.00	80	2.54	1129	0.98	16.86	40.9	281	14,841	12,211	1172
10%	1.20	2467	2525	47.77	660	0.421	1.46	5.25	87.00	80	2.44	1141	0.97	17.83	40.9	280	14,811	12,286	1300
12%	1.44	2312	2389	45.21	667	0.419	1.40	5.09	87.00	80	2.32	1157	1.91	19.74	41.0	279	14,772	12,383	1497
14%	1.68	2215	2263	42.82	677	0.417	1.34	4.94	87.00	81	2.20	1172	1.89	21.63	41.0	279	14,736	12,472	1664
16%	1.92	2118	2167	40.99	685	0.415	1.28	4.83	87.00	81	2.11	1183	1.87	23.50	41.1	278	14,707	12,540	1809
18%	2.16	2048	2083	39.41	692	0.414	1.24	4.72	87.00	81	2.03	1193	1.86	25.36	41.2	278	14,682	12,599	1928
20%	2.40	1982	2015	38.13	698	0.413	1.20	4.64	87.00	81	1.97	1203	1.84	27.20	41.2	277	14,661	12,646	2020
22%	2.64	1917	1950	36.86	704	0.412	1.16	4.56	87.00	81	1.91	1213	1.82	29.02	41.3	277	14,641	12,691	2080
24%	2.88	1851	1884	35.64	710	0.411	1.13	4.48	87.00	81	1.85	1224	1.81	30.83	41.3	277	14,621	12,737	2146
26%	3.12	1785	1818	34.40	716	0.410	1.09	4.40	87.00	81	1.78	1235	1.79	32.62	41.3	276	14,601	12,782	2200
28%	3.36	1736	1761	33.31	722	0.409	1.06	4.33	87.00	81	1.73	1244	1.78	34.40	41.4	276	14,583	12,823	2240
30%	3.60	1710	1723	32.60	728	0.408	1.04	4.28	87.00	81	1.69	1251	1.77	36.17	41.4	276	14,572	12,849	2281
35%	4.20	1644	1677	31.73	732	0.408	1.01	4.23	87.00	81	1.65	1258	4.40	40.57	41.5	275	14,557	12,880	2342
40%	4.80	1597	1621	30.66	736	0.407	0.98	4.16	87.00	82	1.60	1268	4.37	44.94	41.6	275	14,536	12,916	2384
45%	5.40	1580	1589	30.06	742	0.406	0.96	4.12	87.00	82	1.57	1273	4.35	49.28	41.7	275	14,524	12,935	2413
50%	6.00	1563	1571	29.73	745	0.406	0.95	4.10	87.00	82	1.55	1276	4.34	53.62	41.8	275	14,515	12,944	2430
55%	6.60	1546	1555	29.41	746	0.406	0.94	4.07	87.00	82	1.54	1279	4.33	57.95	41.8	274	14,507	12,952	2443
60%	7.20	1535	1541	29.15	748	0.406	0.93	4.06	87.00	82	1.52	1281	4.32	62.27	41.9	274	14,499	12,958	2458
70%	8.40	1518	1526	28.88	749	0.405	0.93	4.04	87.00	82	1.51	1283	8.62	70.89	42.1	274	14,491	12,964	2473
80%	9.60	1508	1513	28.63	751	0.405	0.92	4.02	87.00	82	1.50	1286	8.61	79.50	42.2	274	14,479	12,966	2479
90%	10.80	1501	1505	28.47	752	0.405	0.91	4.01	87.00	82	1.49	1287	8.60	88.11	42.4	274	14,470	12,965	2483
100%	12.00	1500	1501	28.39	753	0.405	0.91	4.01	87.00	82	1.49	1288	8.60	96.70	42.5	274	14,461	12,960	2484
UNW	—	—	*10226*	*193.48*	*60*	*0.364*	*6.92*	*17.80*	87.00	64	*14.33*	102	—	—	—	*193*	10,226	0	—
Screen	—	—	*2700*	*51.08*	—	*0.400*	1.66	*39.20*	87.00	36	*6.33*	344	—	*347.3*	*59.2*	*112*	5,920	3,220	—
w/filter	—	—	*2700*	*51.08*	*653*	*0.424*	1.57	5.45	87.00	80	*2.65*	1116	—	*107.1*	*45.3*	*277*	14,623	11,923	—
Valve:	Open stroke for 38MOV-VB1, low voltage																		

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Output Plots, 3/26/02, 1:36 PM









Valve: Open stroke for 38MOV-VB1, low voltage

SYS/ VALVE NO. 13 MOV-16
Q.A. CAT. IEQ

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO. 13 MOV-16	VALVE NAME RCIC Steam outboard Isolation Valve				
MANUFACTURER Peerless Winsmith	MCC BMCC-1	ESK NA Q	SE NOT	COMP. LOCATION & ELEVATION Drywell Entrance	
H.P./TORQUE .72 10 Ft-lbs	TYPE Compound	MODEL NO. Have motor data sheet			
VOLTAGE 125	PHASE DC	HZ →	MOTOR SERIAL NO. TV44556	DESIGN	CODE
AMP(L.R.) 38	SERV. FACTOR	DUTY 5 min		FRAME DG 56D	
AMP.(F.L.) 6.5	RPM 1900	TEMP. RISE 115C 40°C Amb		INSUL. CLASS RH	
OVERLOAD RELAY NO. CR124K028	HEATER NO. K21.3B	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS

TOTAL STEM TRAVEL	INCHES OR TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES NA TURNS 30			27.5	10	27.5	0

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Anchor/Darling	TYPE SB-00	NO. 1CIC A01	RECOMMENDED: OPEN 1.0 CLOSE 1.0
TYPE Gate	SER. NO. L439638	BKR. AMPS	MAX: OPEN 1.75 CLOSE 1.75
SIZE 3"	ORDER NO. 177438.10	CONTACTOR SIZE	STOP PLATE IN PLACE YES NO

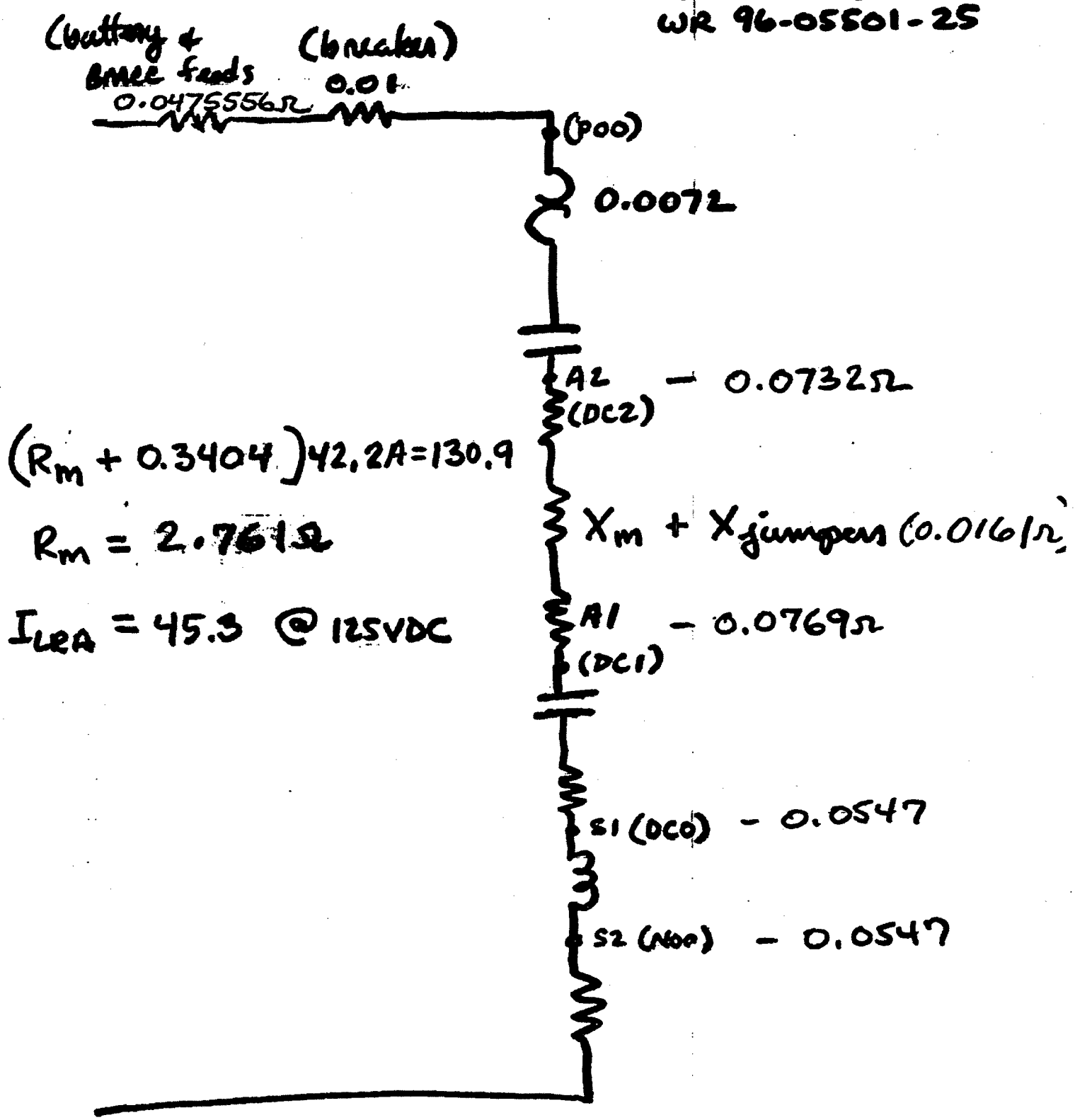
ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
						LIMITORQUE	C-7
AMPS F.L. AT TORQUE TRIP			TORQUE SWITCH SETTING			MCC	C-2

BRAKE INFO, BOLTING TORQUE, MISC INFO
RAT # of operator 43.6
operator mounting Bolts - 1/2" Allen, GLS Cover bolts 1/4" Allen and (2) 1/2" nuts
Need to Remove Packing table in order to do rotor col.
use an 8' sling and a come along around the pipe to provide a pick point for chain
Call see wr 95-07557-00

13MOV-16

LRA 42.2 @ 130.9
WR 96-05501-25



Corrected to 25°C

U P D A T E S E T P O I N T D A T A Screen 1 of

Component Id: 13MOV-16 EQ Class: EQ
Desc: RCIC STEAM SUPPLY OUTBD ISOL VALVE OPER
Valve QA: I Valvop QA: I
Power Supply: 71BMCC-1-OA1 Source: 11B
Valvetorque Model Number: SB-00-10

Required Stroke Time: 12.00. Source: TECH SPEC - CLOSE TIME
Switch To Light Time: 7.43. Source: MP-59.36/37 11/19/96

Current Open: 5.00. Current Close: 5.40. Amps at T.S.T.: 14.90.
FLA: 6.50 . LRA: 42.5 . Source: MP-59.36/37 11/19/98.

MIN TST: 6177.00. MAX TST: 112.00. MAX Total: 13243.00.	TORQUE SWITCH SETTINGS	Closed Actual: 2.00. Open Actual: 2.00. Source: MP-59.36 11/19/98 .

Limiter Plate(Y/N): Y. Setting: 2.25. Source: MP-59.36 11/19/98
Rotor #1: 90-95 . Rotor #2: 33-38 .
Rotor #3: 90-95 . Rotor #4: FC . Source: F1-90-197 MOD

SYS/VALVE NO. 13MOV-21
Q.A. CAT. 1 EQ

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO. 13MOV-21	VALVE NAME RCIC Pump Disch To Reactor InBD Isol.				
MANUFACTURER Peerless	MCC W.C. 1-OB2	ESK 11AS	SE 10W	COMP. LOCATION & ELEVATION West Crescent 259' EL.	
H.P./TORQUE .72 Start 10ftlbs Run 2ftlbs	TYPE Compound	MODEL NO.			
VOLTAGE 125	PHASE DC	HZ —	MOTOR SERIAL NO. QR01926	DESIGN	CODE
AMP(L.R.) 29.0	SERV. FACTOR	DUTY 5 min		FRAME DG56D	
AMP.(F.L.) 6.5	RPM 1900	TEMP. RISE 115°c	Amb. Temp 40°c	INSUL. CLASS RH	
OVERLOAD RELAY NO. CR124K028	HEATER NO. K17.8B	HEATER AMPS 15.4	APPROX. HTR. % 300%	ARM AMPS	FIELD AMPS

TOTAL STEM TRAVEL INCHES 3¾" TURNS ____	INCHES OR TURNS FROM FULL CLOSED	ROTORS	1 3½"	2 1⅜"	3 3½"	4 F.C.

LIMITORQUE VALVE OPERATOR DATA

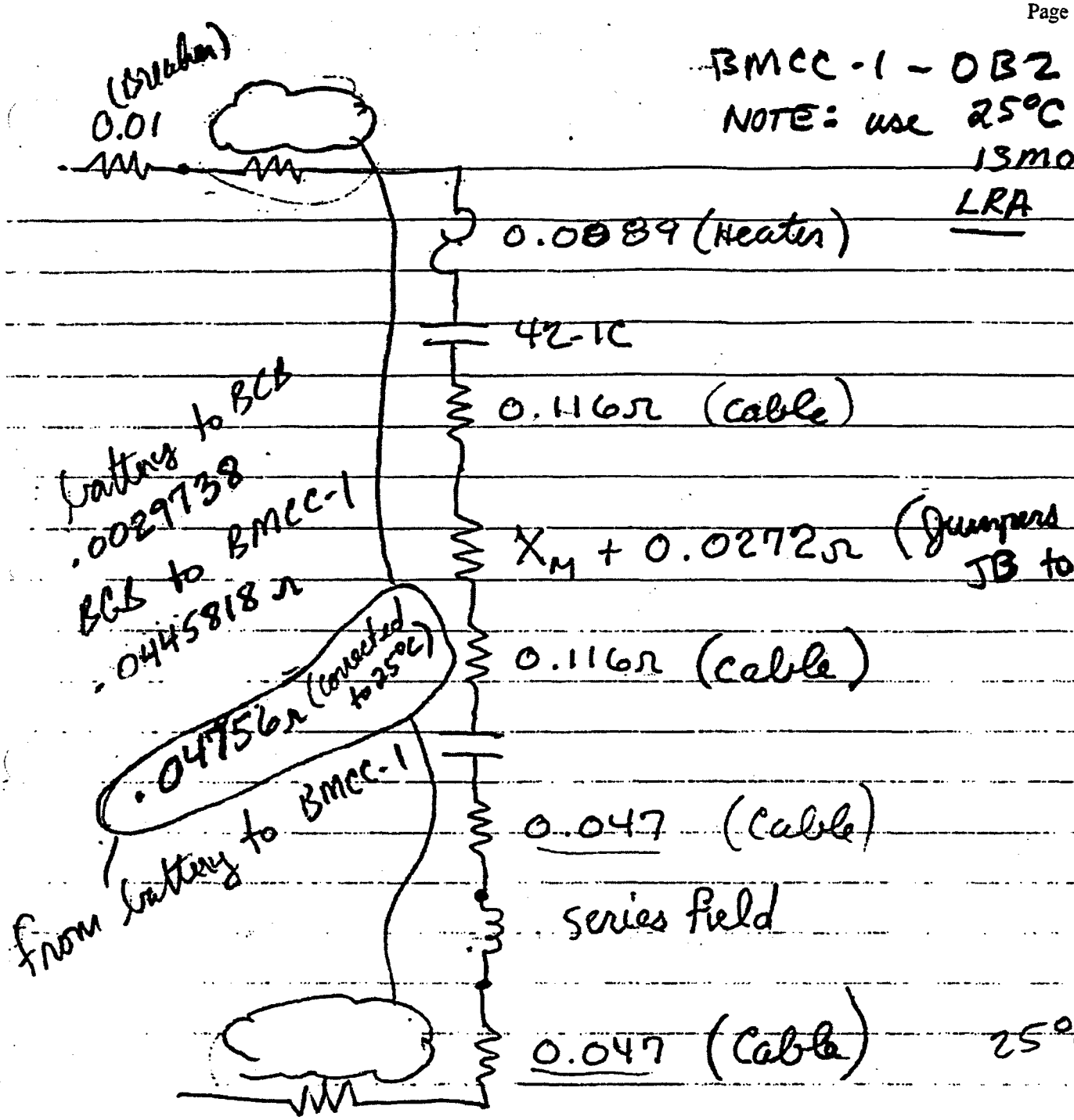
VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Velan	TYPE SMB-00	NO. 1CICA04	RECOMMENDED: OPEN 1.25 CLOSE 1.25
TYPE Gate	SER. NO. 127162	BKR. AMPS 20	MAX: OPEN 2.0 CLOSE 2.0
SIZE 4"	ORDER NO. 350920T	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME ~~MIN~~/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	9	8		11	11	LIMITORQUE	C-3
AMPS F.L. AT TORQUE TRIP		12	TORQUE SWITCH SETTING	1.5	2.0	MCC	C-2

BRAKE INFO, BOLTING TORQUE, MISC INFO

BMCC-1 - OB2
NOTE: use 25°C
13MOV-21
LRA



$$(R_M + 0.4197\Omega)\ 41\text{Amps} = 132.5V$$

$$R_M = R_A + R_S = 2.812\ \Omega$$

$$\boxed{I_{LRA} = 44.5\text{Amps @ } 125VDC}$$

13MOV-21(OP)

INRUSH	DATE	O/C	Batt volt	Notes	WR
38.8	11/26/98	O	~125	Test #4	97-03237-02
38.3	11/26/98	C	~125	Test #4	97-03237-02
38.8	11/26/98	O	~125	Test #3	97-03237-02
38.3	11/26/98	C	~125	Test #3	97-03237-02
40.6	11/1/98	O	132.5	Test #2	97-03237-00
40.6	11/1/98	C	132.5	Test #2	97-03237-00
41.1	11/1/98	O	132.5	Test #1*	97-03237-00
41.1	11/1/98	C	132.5	Test #1*	97-03237-00
40.8	5/1/92	O	130	Test #7	
37.9	5/1/92	C	130	Test #7	

* Test was not used as valve was disassembled and reassembled

• Use 41 amps at 132.5V (at battery) based on above readings.

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Inputs, 2/19/02, 1:34 PM

Select Valve--> Open stroke for 13MOV-21

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	0.375
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.375
Seat ring face ID, $D_{body-ID}$ (inches)	yes	3.468
Seat ring inner diameter, D_{sr} (inches)	yes	3.375
Globe valve stroke length, D (inches)	no	0.000
Isolation-to-wedging travel, X (percent)	yes	12.17%
Packing load, F_{pack} (lbs)	yes	1,500
Required thrust (including water inertia), F_R (lbs)	yes	6,728
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	55.86
Motor gear set ratio, MGSR	yes	0.606
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.01500
Overhauling stem factor, SF_O (ft-lbs/lb)	yes	0.00141
Voltage at MCC, V_{mcc} (volts)	yes	107.0
Cable resistance, R_{cable} (ohms)	yes	0.3872
Thermal overload resistance, R_{tol} (ohms)	yes	0.0189
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	1295
Valve pressure at full open, P_B (psig)	yes	1295
Flow rate, Q_{max} (gpm)	yes	400
Fluid density, ρ (lbs/ft^3)	yes	62.426
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	938.4
Fully open stem thrust, F_O (lbs)	yes	-423
Nominal motor torque, τ_{nom} (ft-lbs)	yes	14.3
Maximum motor torque (ft-lbs)	yes	4.5
Maximum adjusted motor torque (ft-lbs)	yes	5.9
Minimum motor speed (rpm)	yes	1030
Minimum instantaneous actuator capability (lbs)	yes	16,314
Minimum instantaneous margin (lbs)	yes	9,750
Maximum allowable thrust at unwedging	yes	14,955
Efficiency at minimum instantaneous capability	yes	0.382

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%	—

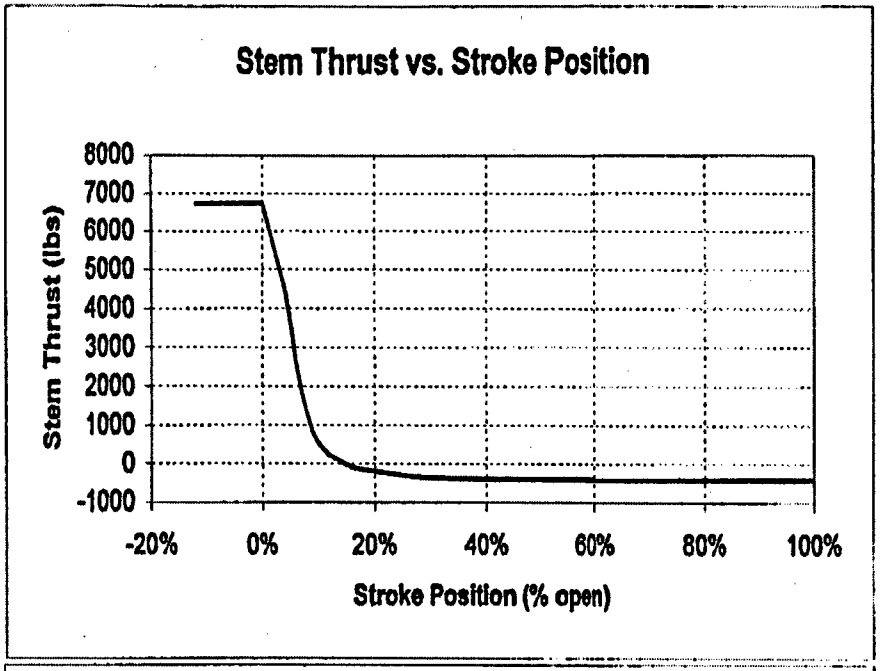
Warnings

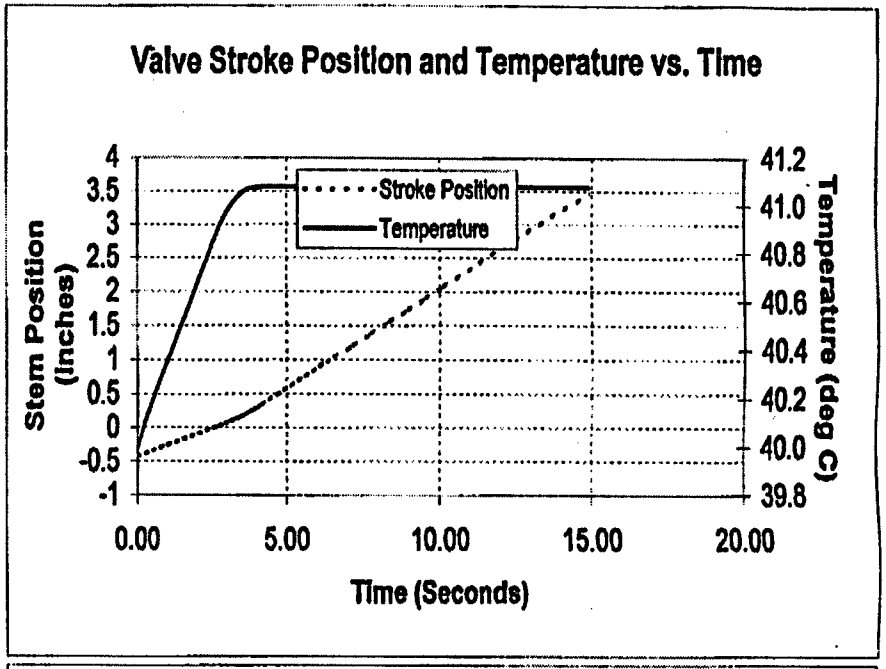
Predicted Stroke Time (Seconds): 15.28

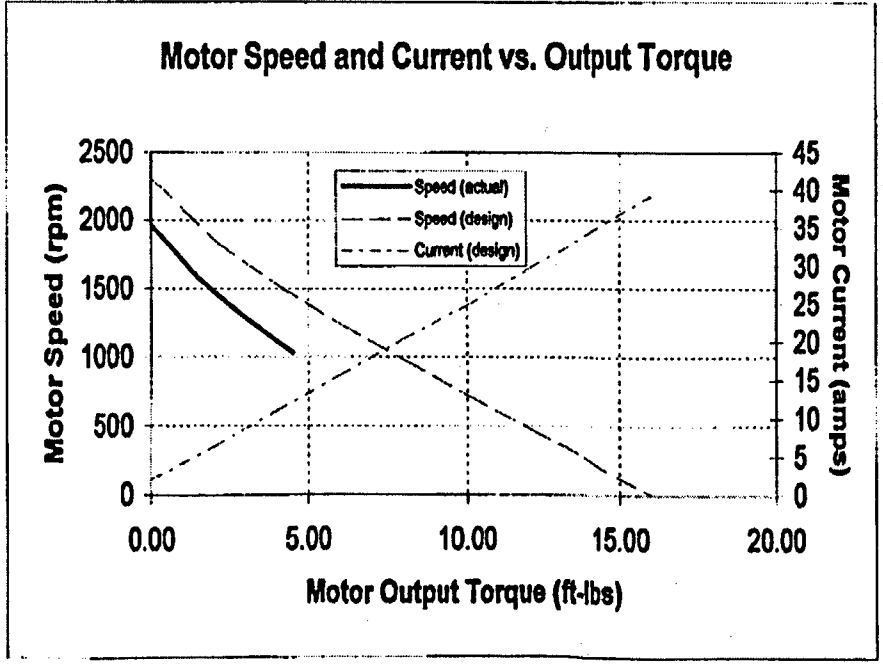
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
-12%	-0.42	6728												0.00	40.0				0
-11%	-0.38	6728	6728	100.92		0.400	4.52	12.19	107.00	102	5.85	1030	0.27	0.27	40.1	247	16,478	9,750	0
-10%	-0.34	6728	6728	100.92	830	0.447	4.04	11.09	107.00	102	5.21	1110	0.25	0.53	40.2	278	16,502	11,774	0
-9%	-0.30	6728	6728	100.92	895	0.449	4.03	11.06	107.00	103	5.20	1112	0.25	0.78	40.3	278	16,550	11,822	0
-7%	-0.25	6728	6728	100.92	896	0.449	4.03	11.06	107.00	103	5.20	1112	0.25	1.04	40.4	278	16,546	11,818	0
-6%	-0.21	6728	6728	100.92	896	0.449	4.03	11.06	107.00	103	5.20	1112	0.25	1.29	40.4	278	16,540	11,812	0
-5%	-0.17	6728	6728	100.92	896	0.449	4.03	11.06	107.00	103	5.20	1112	0.25	1.55	40.5	278	16,534	11,806	0
-4%	-0.13	6728	6728	100.92	896	0.449	4.03	11.06	107.00	103	5.20	1111	0.25	1.80	40.6	278	16,529	11,801	0
-2%	-0.08	6728	6728	100.92	895	0.449	4.03	11.06	107.00	103	5.21	1111	0.25	2.06	40.7	278	16,523	11,795	0
-1%	-0.04	6728	6728	100.92	895	0.449	4.03	11.06	107.00	103	5.21	1111	0.25	2.31	40.8	278	16,517	11,789	0
0%	0.00	6728	6728	100.92	895	0.449	4.03	11.06	107.00	103	5.21	1111	0.23	2.54	40.8	278	16,511	11,783	0
0%	0.00	6728	6728	100.92	895	0.449	4.03	11.06	107.00	103	5.21	1111	0.02	2.57	40.9	278	16,506	11,778	0
1%	0.03	6177	6453	96.79	895	0.449	3.86	10.68	107.00	103	4.99	1139	0.20	2.77	40.9	278	16,533	12,081	53
2%	0.07	5626	5902	88.53	917	0.449	3.53	9.92	107.00	103	4.55	1195	0.19	2.96	41.0	279	16,604	12,702	118
3%	0.10	5075	5351	80.26	963	0.450	3.19	9.15	107.00	103	4.10	1252	0.19	3.15	41.0	280	16,694	13,343	182
4%	0.14	4525	4800	72.00	1009	0.448	2.88	8.42	107.00	104	3.69	1309	0.18	3.33	41.0	280	16,663	13,863	244
5%	0.17	3658	4091	61.37	1055	0.439	2.50	7.56	107.00	104	3.20	1379	0.17	3.50	41.1	275	16,335	14,244	293
6%	0.21	2620	3139	47.08	1111	0.426	1.98	6.36	107.00	104	2.52	1476	0.16	3.65	41.1	268	17,875	14,736	328
7%	0.24	1824	2222	33.33	1189	0.413	1.44	5.18	107.00	105	1.83	1586	0.15	3.80	41.1	261	17,422	15,200	347
8%	0.28	1288	1556	23.34	1277	0.404	1.03	4.28	107.00	105	1.31	1692	0.14	3.94	41.1	256	17,065	15,530	361
9%	0.31	830	1059	15.89	1363	0.396	0.72	3.58	107.00	106	0.90	1775	0.13	4.07	41.1	252	16,826	15,767	370
10%	0.35	556	693	10.40	1430	0.391	0.48	3.05	107.00	106	0.60	1838	0.13	4.19	41.1	249	16,626	15,933	377
12%	0.42	229	392	5.89	1481	0.386	0.27	2.60	107.00	106	0.34	1891	0.25	4.44	41.1	247	16,455	16,063	384
14%	0.49	70	149	2.24	1524	0.382	0.10	2.23	107.00	106	0.13	1935	0.24	4.68	41.1	245	16,314	16,164	389
16%	0.55	-88	-9	0.01	1559	0.380	0.00	2.00	107.00	106	0.00	1962	0.24	4.92	41.1	243	172,614	172,605	392
18%	0.62	-147	-117	0.17	1581	0.380	0.01	2.02	107.00	106	0.01	1960	0.24	5.15	41.1	243	172,679	172,562	394
20%	0.69	-188	-167	0.24	1579	0.380	0.01	2.02	107.00	106	0.01	1959	0.24	5.39	41.1	244	172,709	172,542	395
22%	0.76	-229	-208	0.29	1579	0.380	0.01	2.03	107.00	106	0.02	1959	0.24	5.63	41.1	244	172,734	172,526	396
24%	0.83	-270	-250	0.35	1578	0.380	0.02	2.04	107.00	106	0.02	1958	0.24	5.87	41.1	244	172,759	172,509	397
26%	0.90	-311	-291	0.41	1577	0.380	0.02	2.04	107.00	106	0.02	1957	0.24	6.10	41.1	244	172,784	172,493	397
28%	0.97	-340	-326	0.46	1577	0.381	0.02	2.05	107.00	106	0.03	1957	0.24	6.34	41.1	244	172,805	172,479	398
30%	1.04	-350	-345	0.49	1576	0.381	0.02	2.05	107.00	106	0.03	1956	0.24	6.58	41.1	244	172,816	172,471	398
35%	1.21	-375	-363	0.51	1576	0.381	0.02	2.05	107.00	106	0.03	1956	0.59	7.17	41.1	244	172,827	172,464	399
40%	1.39	-393	-384	0.54	1576	0.381	0.03	2.06	107.00	106	0.03	1956	0.59	7.77	41.1	244	172,840	172,456	399
45%	1.56	-398	-395	0.56	1576	0.381	0.03	2.06	107.00	106	0.03	1956	0.59	8.36	41.1	244	172,847	172,451	399
50%	1.73	-403	-401	0.56	1575	0.381	0.03	2.06	107.00	106	0.03	1955	0.59	8.96	41.1	244	172,850	172,449	400
55%	1.91	-408	-406	0.57	1575	0.381	0.03	2.06	107.00	106	0.03	1955	0.59	9.55	41.1	244	172,853	172,447	400
60%	2.08	-411	-410	0.58	1575	0.381	0.03	2.06	107.00	106	0.03	1955	0.59	10.15	41.1	244	172,855	172,445	400
70%	2.43	-417	-414	0.58	1575	0.381	0.03	2.06	107.00	106	0.03	1955	1.19	11.33	41.1	244	172,858	172,444	400
80%	2.77	-420	-419	0.59	1575	0.381	0.03	2.06	107.00	106	0.03	1955	1.19	12.52	41.1	244	172,860	172,442	400
90%	3.12	-423	-422	0.59	1575	0.381	0.03	2.06	107.00	106	0.03	1955	1.19	13.71	41.1	244	172,862	172,441	400
100%	3.47	-423	-423	0.60	1575	0.381	0.03	2.06	107.00	106	0.04	1955	1.19	14.90	41.1	244	172,863	172,440	400
UNW	—	—	*14955*	*224.32*	*124*	*0.384*	*10.45*	*25.93*	107.00	96	*14.33*	154	—	—	—	*224*	14,955	(0)	—
Screen	—	—	*6728*	*100.92*	—	*0.400*	*4.52*	*39.20*	107.00	91	*6.80*	828	—	*31.5*	*52.8*	*211*	14,049	7,321	—
w/ifter	—	—	*6728*	*100.92*	*882*	*0.448*	*4.03*	*11.07*	107.00	103	*5.34*	1095	—	*23.8*	*47.7*	*271*	16,044	11,316	—

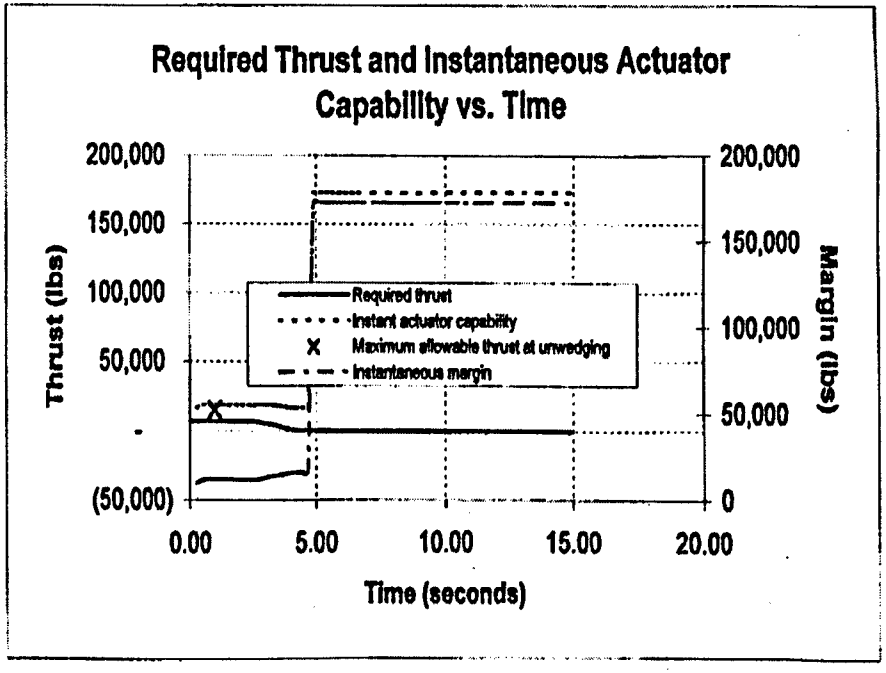
Valve: Open stroke for 13MOV-21

BWROG DCM for A Battery MOVs (ba V 2.0.xls, Output Plots, 2/19/02, 1:34 PM









Valve: Open stroke for 13MOV-21

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Inputs, 5/30/02, 4:12 PM

Select Valve—> Close stroke for 13MOV-21

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	0.375
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.375
Seat ring face ID, $D_{body-ID}$ (inches)	yes	3.468
Seat ring inner diameter, D_{sr} (inches)	yes	3.375
Globe valve stroke length, D (inches)	no	0.000
Isolation-to-wedging travel, X (percent)	yes	12.17%
Packing load, F_{pack} (lbs)	yes	1,500
Required thrust (including water inertia), F_R (lbs)	yes	4,019
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	55.86
Motor gear set ratio, MGSR	yes	0.806
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.01500
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00141
Voltage at MCC, V_{mcc} (volts)	yes	107.0
Cable resistance, R_{cable} (ohms)	yes	0.3872
Thermal overload resistance, R_{tol} (ohms)	yes	0.0189
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	72
Valve pressure at full open, P_B (psig)	yes	1295
Flow rate, Q_{max} (gpm)	yes	400
Fluid density, ρ (lbs/ft^3)	yes	62.426
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	52.2
Fully open stem thrust, F_O (lbs)	yes	3,423
Nominal motor torque, τ_{nom} (ft-lbs)	yes	14.3
Maximum motor torque (ft-lbs)	yes	2.5
Maximum adjusted motor torque (ft-lbs)	yes	3.1
Minimum motor speed (rpm)	yes	1386
Minimum instantaneous actuator capability (lbs)	yes	16,813
Minimum instantaneous margin (lbs)	yes	13,389
Maximum allowable thrust at torque switch trip	yes	14,872
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

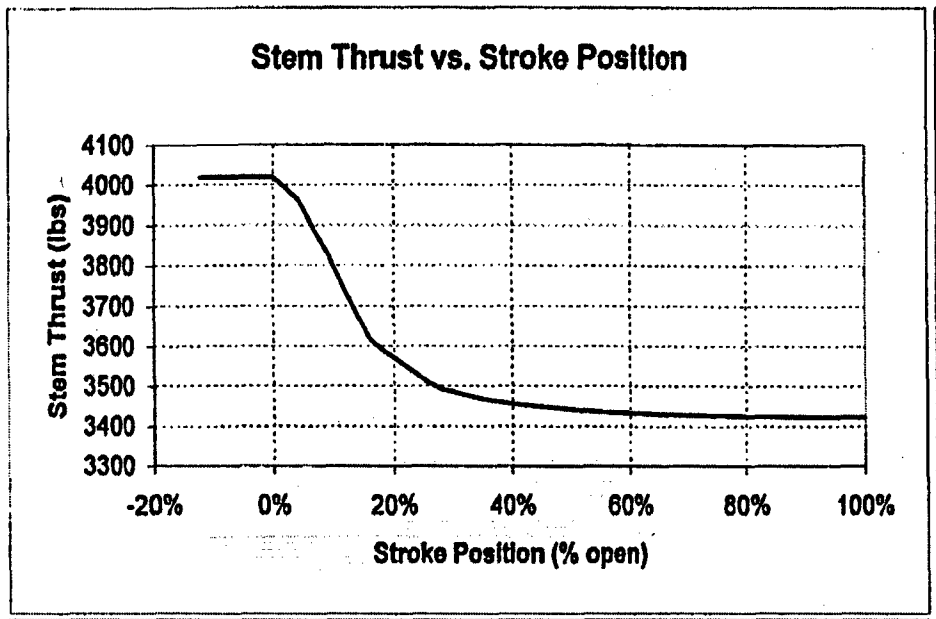
Predicted Stroke Time (Seconds): 18.62

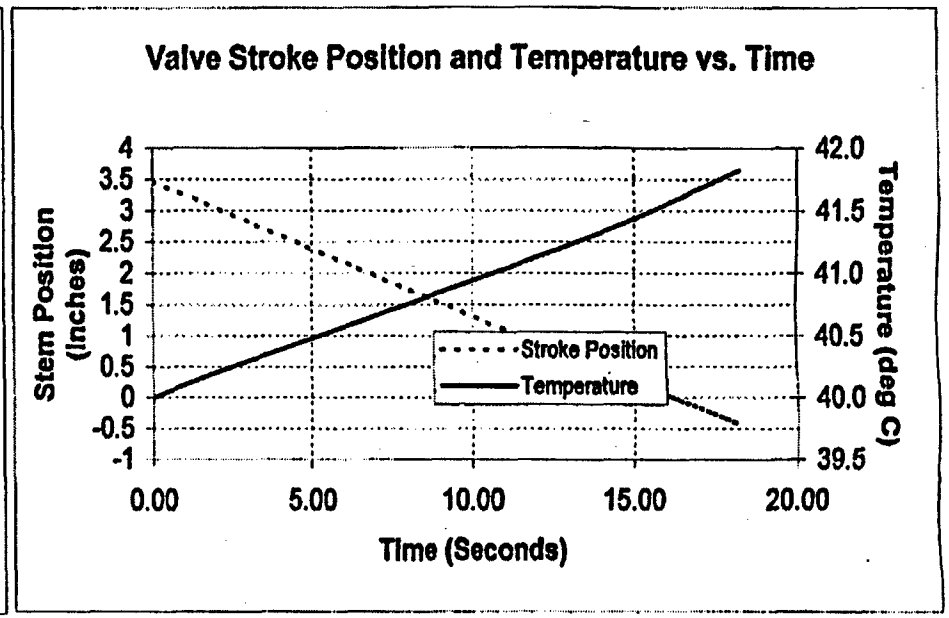
BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Results, 5/30/02, 4:12 PM

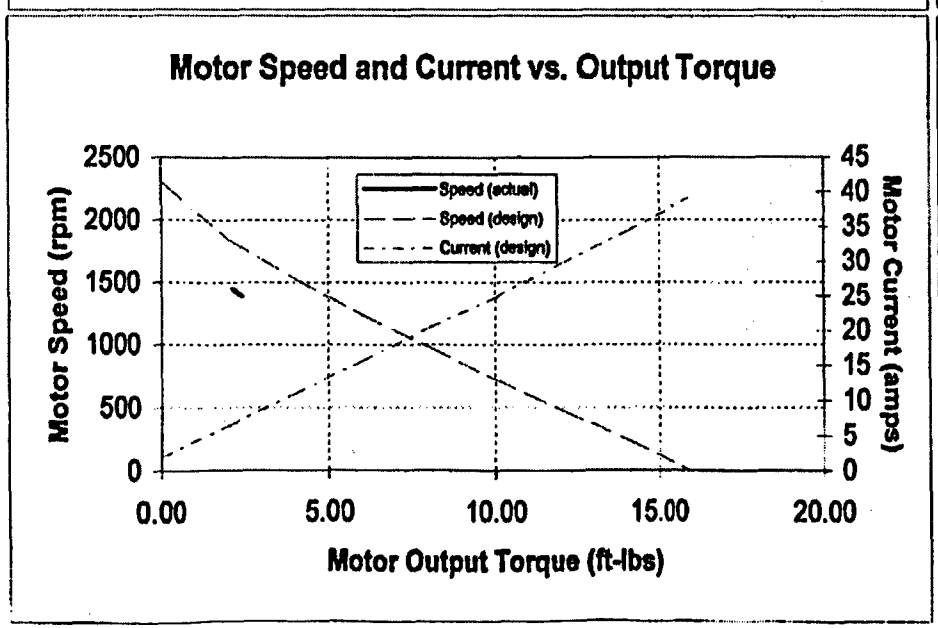
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
100%	3.47	3423												0.00	40.0				398
90%	3.12	3424	3423	51.35		0.400	2.30	7.09	107.00	104	2.92	1419	1.64	1.64	40.2	252	16,613	13,389	396
80%	2.77	3426	3425	51.37	1143	0.430	2.14	6.72	107.00	104	2.71	1448	1.61	3.24	40.3	272	18,101	14,676	397
70%	2.43	3428	3427	51.40	1167	0.431	2.14	6.71	107.00	104	2.71	1448	1.61	4.85	40.5	272	18,106	14,679	396
60%	2.08	3433	3431	51.46	1167	0.431	2.14	6.72	107.00	104	2.72	1448	1.61	6.46	40.6	271	18,098	14,667	394
55%	1.91	3436	3435	51.52	1167	0.431	2.14	6.72	107.00	104	2.72	1447	0.80	7.26	40.7	271	18,090	14,655	392
50%	1.73	3443	3440	51.59	1166	0.431	2.14	6.73	107.00	104	2.73	1446	0.80	8.06	40.8	271	18,087	14,648	390
45%	1.56	3449	3446	51.69	1166	0.431	2.15	6.74	107.00	104	2.73	1446	0.80	8.87	40.8	271	18,086	14,640	388
40%	1.39	3455	3452	51.78	1165	0.431	2.15	6.75	107.00	104	2.74	1445	0.80	9.67	40.9	271	18,084	14,632	384
35%	1.21	3468	3462	51.93	1165	0.431	2.16	6.76	107.00	104	2.74	1444	0.81	10.48	41.0	271	18,084	14,622	378
30%	1.04	3485	3477	52.15	1164	0.431	2.16	6.78	107.00	104	2.76	1442	0.81	11.28	41.1	271	18,086	14,609	370
28%	0.97	3492	3489	52.33	1162	0.431	2.17	6.79	107.00	104	2.76	1441	0.32	11.60	41.1	271	18,087	14,598	364
26%	0.90	3507	3500	52.49	1161	0.432	2.18	6.81	107.00	104	2.77	1440	0.32	11.93	41.1	271	18,090	14,590	358
24%	0.83	3529	3518	52.77	1160	0.432	2.19	6.83	107.00	104	2.79	1438	0.32	12.25	41.2	271	18,097	14,579	350
22%	0.76	3550	3539	53.09	1159	0.432	2.20	6.86	107.00	104	2.80	1435	0.32	12.57	41.2	272	18,106	14,566	341
20%	0.69	3571	3561	53.41	1157	0.432	2.21	6.88	107.00	104	2.82	1433	0.32	12.90	41.2	272	18,114	14,553	332
18%	0.62	3593	3582	53.73	1155	0.433	2.22	6.91	107.00	104	2.83	1431	0.32	13.22	41.2	272	18,122	14,540	318
16%	0.55	3619	3606	54.09	1153	0.433	2.24	6.94	107.00	104	2.85	1428	0.33	13.55	41.3	272	18,131	14,525	300
14%	0.49	3677	3648	54.72	1151	0.434	2.26	7.00	107.00	104	2.88	1424	0.33	13.88	41.3	272	18,150	14,502	278
12%	0.42	3735	3706	55.59	1148	0.434	2.29	7.07	107.00	104	2.92	1418	0.33	14.20	41.3	273	18,176	14,470	252
10%	0.35	3797	3766	56.49	1143	0.435	2.32	7.14	107.00	104	2.97	1412	0.33	14.53	41.4	273	18,203	14,437	220
9%	0.31	3831	3814	57.21	1138	0.436	2.35	7.20	107.00	104	3.00	1407	0.17	14.70	41.4	273	18,223	14,409	199
8%	0.28	3857	3844	57.66	1134	0.436	2.37	7.24	107.00	104	3.02	1404	0.17	14.86	41.4	274	18,235	14,391	178
7%	0.24	3880	3869	58.03	1132	0.437	2.38	7.27	107.00	104	3.04	1401	0.17	15.03	41.4	274	18,245	14,376	152
6%	0.21	3908	3894	58.41	1130	0.437	2.39	7.30	107.00	104	3.06	1399	0.17	15.20	41.5	274	18,256	14,361	128
5%	0.17	3940	3924	58.86	1127	0.437	2.41	7.34	107.00	104	3.08	1396	0.17	15.36	41.5	274	18,268	14,345	98
4%	0.14	3965	3952	59.29	1125	0.438	2.42	7.38	107.00	104	3.10	1393	0.17	15.53	41.5	274	18,280	14,328	71
3%	0.10	3979	3972	59.58	1123	0.438	2.43	7.40	107.00	104	3.11	1391	0.17	15.70	41.5	274	18,288	14,316	48
2%	0.07	3992	3985	59.78	1121	0.438	2.44	7.42	107.00	104	3.12	1390	0.17	15.86	41.6	274	18,292	14,307	29
1%	0.03	4006	3999	59.98	1120	0.438	2.45	7.43	107.00	104	3.13	1388	0.17	16.03	41.6	274	18,297	14,299	13
0%	0.00	4019	4012	60.18	1119	0.439	2.46	7.45	107.00	104	3.14	1387	0.17	16.20	41.6	275	18,302	14,290	0
0%	0.00	4019	4019	60.29	1118	0.439	2.46	7.46	107.00	104	3.15	1386	0.02	16.22	41.6	275	18,304	14,285	0
-1%	-0.04	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.19	16.40	41.6	275	18,303	14,284	0
-2%	-0.08	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	16.61	41.6	275	18,302	14,283	0
-4%	-0.13	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	16.81	41.7	275	18,300	14,281	0
-5%	-0.17	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	17.02	41.7	274	18,299	14,280	0
-6%	-0.21	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	17.22	41.7	274	18,297	14,278	0
-7%	-0.25	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	17.42	41.7	274	18,295	14,276	0
-9%	-0.30	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	17.63	41.7	274	18,294	14,275	0
-10%	-0.34	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	17.83	41.8	274	18,292	14,273	0
-11%	-0.38	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	18.04	41.8	274	18,290	14,271	0
-12%	-0.42	4019	4019	60.29	1117	0.439	2.46	7.46	107.00	104	3.15	1386	0.20	18.24	41.8	274	18,289	14,270	0
TST	—	—	14872	223.08	124	0.384	10.39	25.79	107.00	97	14.33	154	—	—	—	223	14,872	0	—
Screen	—	—	4019	60.29	—	0.400	2.70	39.20	107.00	91	4.06	1109	—	23.5	43.4	218	14,526	10,507	—
w/ter	—	—	4019	60.29	1116	0.439	2.46	7.46	107.00	104	3.16	1385	—	18.8	42.3	274	18,256	14,237	—

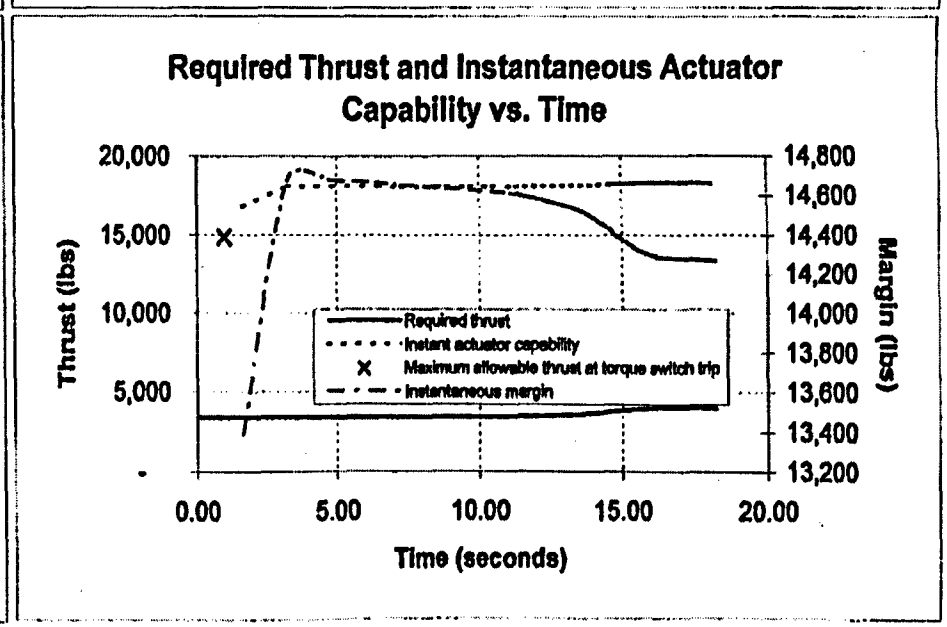
Valve: Close stroke for 13MOV-21

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Output Plots, 5/30/02, 4:12 PM









Valve: Close stroke for 13MOV-21

SYS/VALVE NO. 13 MOV-27
Q.A. CAT. 1EQ

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
13 MOV-27	RCIC Pump Min Flow Isol. Valve			
MANUFACTURER	MCC W.C	ESK	SE	COMP. LOCATION & ELEVATION
Peerless	1-OC1	11AV	10X	West Cresent 227' EL.

H.P./TORQUE	TYPE	MODEL NO.
1.08 START 15 FT# RUN 3 FT#	Compound	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125	D.C.	—	BW 86427		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
60.0		5 Min	DJ 56 F

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
8.4	1900	75°c	B

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124K028	K26.08	22.9	300%	—	—

TOTAL STEM TRAVEL		TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES ____	TURNS 6½			6	2⅜	6	F.C.

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Velan	TYPE SMB-00	NO. 1C1CA07C-1	RECOMMENDED: OPEN 1.25 CLOSE 1.25
TYPE Globe	SER. NO. 94992A	BKR. AMPS 20	MAX: OPEN 2.25 CLOSE 2.25
SIZE 2"	ORDER NO. 333688J	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	
	6.2	6.2		5.0	5.0	LIMITORQUE	C-2 or C-3
AMPS F.L. AT TORQUE TRIP	14	14	TORQUE SWITCH SETTING	1.5	1.5	MCC	C-2

BRAKE INFO, BOLTING TORQUE, MISC INFO

Auto Close
~~OPEN~~. MOV top sets at 5 o'clock no thread protrude from mov to gnce

LRA - 42.7 @ 129.6VD
13MOV-27
SE - 10X
ESK-11AU

(battery + bmcc feeds)
0.04756Ω

(breaker)
0.01Ω

0.0050

0.0525

$(R_m + 0.2998)42.7 = 129.6$

$R_m = 2.735$

$\boxed{I_{LRA} = 45.7 \text{ @ } 125VDC}$

$X_m + X_{jumpers}$ (0.0272Ω)
(JB to motor)

0.0525

0.0525

0.0525

129.38VDC (NO current from 1993 DP test)

6/6/92 Volts Static Test

open	Close
42.7	41.3

@ 129.6VDC

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Inputs, 2/19/02, 3:05 PM

Select Valve—> Open stroke for 13MOV-27

General Information	Required?	Value
Valve Type	yes	globe
Flow type	no	pumped flow
Stroke direction	yes	open
Fluid (blowdown only)	no	flashing water
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0.000
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.125
Seat ring face ID, $D_{body-ID}$ (inches)	no	1.500
Seat ring inner diameter, D_w (inches)	yes	1.500
Globe valve stroke length, D (inches)	yes	1.250
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	3,933
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	yes	42
Actuator overall ratio, OAR	yes	24.64
Motor gear set ratio, MGSR	yes	1.826
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.00936
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00393
Voltage at MCC, V_{mcc} (volts)	yes	107.0
Cable resistance, R_{cable} (ohms)	yes	0.2600
Thermal overload resistance, R_{tol} (ohms)	yes	0.0150
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	15 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.200
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	1251
Valve pressure at full open, P_B (psig)	yes	1251
Flow rate, Q_{max} (gpm)	yes	80
Fluid density, ρ (lbs/ft^3)	yes	62.426
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	884.3
Fully open stem thrust, F_O (lbs)	yes	256
Nominal motor torque, τ_{nom} (ft-lbs)	yes	22.5
Maximum motor torque (ft-lbs)	yes	3.7
Maximum adjusted motor torque (ft-lbs)	yes	4.7
Minimum motor speed (rpm)	yes	1350
Minimum instantaneous actuator capability (lbs)	yes	18,254
Minimum instantaneous margin (lbs)	yes	14,714
Maximum allowable thrust at unwedging	no	—
Efficiency at minimum instantaneous capability	yes	0.383

Warnings

Predicted Stroke Time (Seconds): 4.49

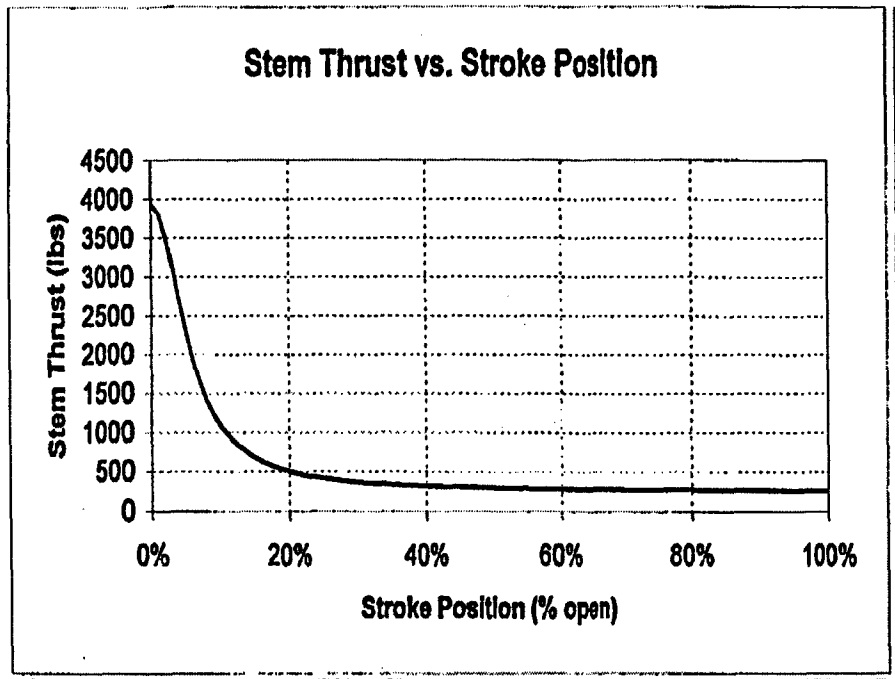
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

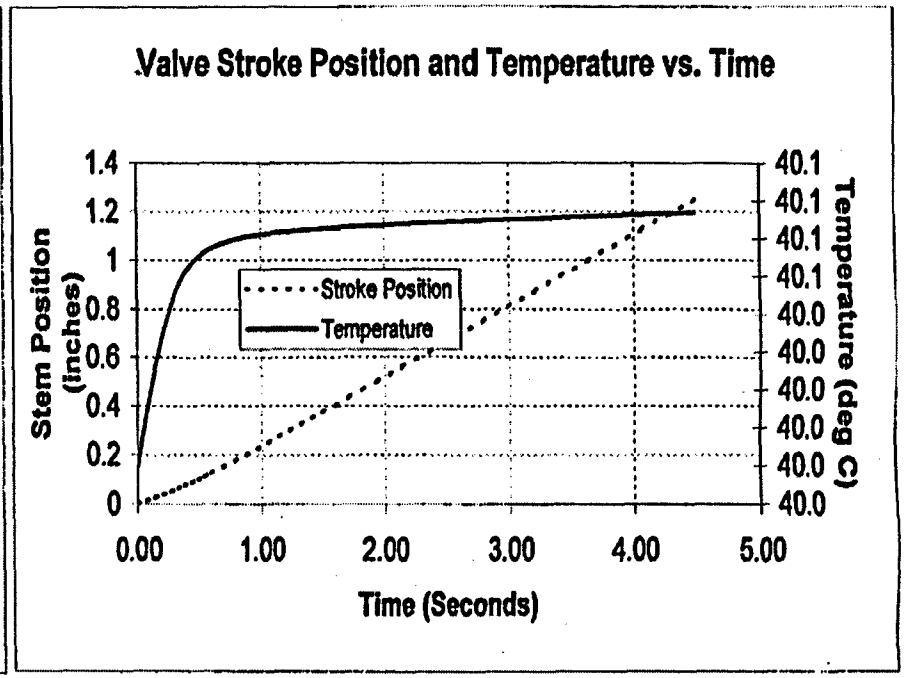
BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Results, 2/19/02, 3:05 PM

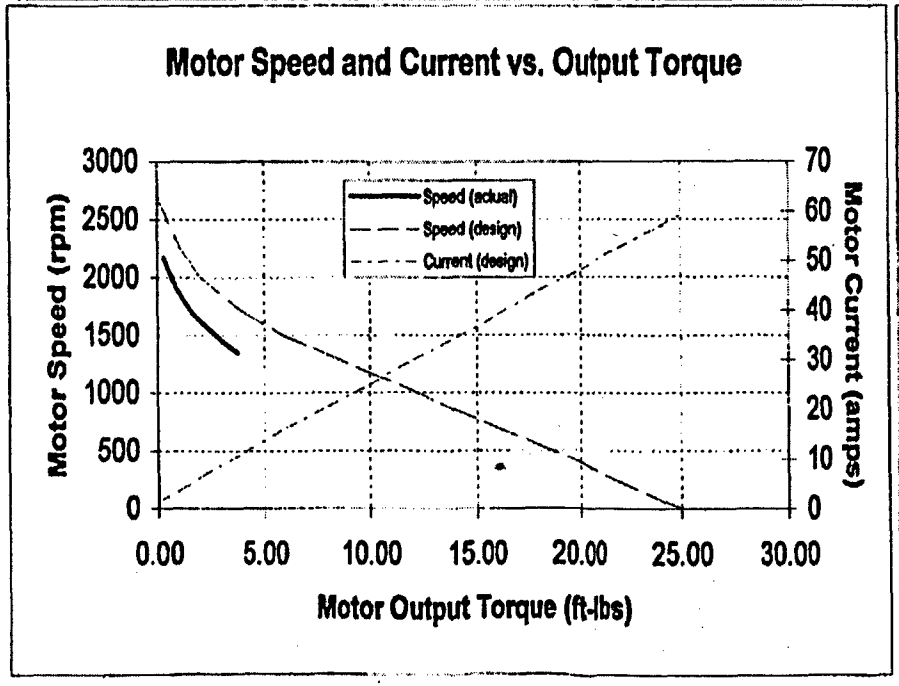
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
0%	0.00	3933												*0.00*	*40.0*				0
0%	0.00	3933	3933	36.81		*0.400*	3.74	10.66	107.00	104	4.75	1350	0.00	0.00	40.0	175	18,647	14,714	0
0%	0.00	3933	3933	36.81	2465	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
0%	0.00	3933	3933	36.81	2513	0.424	3.52	10.15	107.00	104	4.47	1376	0.00	0.00	40.0	185	19,800	15,867	0
1%	0.01	3811	3872	36.24	2513	0.423	3.47	10.04	107.00	104	4.41	1382	0.07	0.07	40.0	185	19,774	15,902	15
2%	0.03	3488	3649	34.15	2524	0.421	3.29	9.60	107.00	104	4.17	1404	0.07	0.13	40.0	184	19,679	16,030	28
3%	0.04	3063	3275	30.65	2564	0.417	2.98	8.86	107.00	105	3.78	1450	0.06	0.20	40.0	183	19,520	16,245	39
4%	0.05	2626	2844	26.62	2648	0.412	2.62	7.99	107.00	105	3.31	1512	0.06	0.26	40.0	181	19,336	16,492	48
5%	0.06	2231	2429	22.73	2761	0.407	2.27	7.14	107.00	105	2.85	1573	0.06	0.32	40.0	179	19,160	16,731	54
6%	0.08	1897	2064	19.32	2873	0.403	1.94	6.35	107.00	105	2.44	1628	0.06	0.37	40.1	178	19,006	16,942	60
7%	0.09	1624	1761	16.48	2973	0.400	1.67	5.62	107.00	105	2.10	1675	0.06	0.43	40.1	177	18,881	17,121	63
8%	0.10	1403	1514	14.17	3058	0.397	1.45	5.01	107.00	106	1.81	1729	0.05	0.48	40.1	176	18,780	17,266	66
9%	0.11	1226	1315	12.31	3158	0.395	1.27	4.52	107.00	106	1.58	1781	0.05	0.53	40.1	175	18,698	17,383	69
10%	0.13	1083	1155	10.81	3251	0.393	1.12	4.11	107.00	106	1.39	1822	0.05	0.58	40.1	174	18,632	17,477	70
12%	0.15	873	978	9.16	3327	0.391	0.95	3.69	107.00	106	1.19	1868	0.10	0.68	40.1	174	18,559	17,580	73
14%	0.18	731	802	7.50	3412	0.389	0.78	3.30	107.00	106	0.98	1919	0.10	0.78	40.1	173	18,483	17,681	75
16%	0.20	631	681	6.37	3504	0.388	0.67	3.03	107.00	106	0.83	1976	0.09	0.87	40.1	173	18,431	17,750	76
18%	0.23	559	595	5.57	3607	0.387	0.58	2.84	107.00	106	0.73	2016	0.09	0.96	40.1	172	18,394	17,799	77
20%	0.25	505	532	4.98	3681	0.386	0.52	2.70	107.00	106	0.65	2046	0.09	1.05	40.1	172	18,367	17,835	77
22%	0.28	464	485	4.54	3736	0.385	0.48	2.60	107.00	106	0.59	2068	0.09	1.14	40.1	172	18,347	17,862	78
24%	0.30	433	449	4.20	3777	0.385	0.44	2.52	107.00	106	0.55	2086	0.09	1.23	40.1	172	18,331	17,883	78
26%	0.33	408	420	3.93	3808	0.385	0.41	2.45	107.00	106	0.52	2099	0.09	1.32	40.1	171	18,319	17,899	78
28%	0.35	388	398	3.72	3833	0.384	0.39	2.40	107.00	106	0.49	2110	0.09	1.41	40.1	171	18,310	17,912	79
30%	0.38	371	379	3.55	3853	0.384	0.38	2.36	107.00	106	0.47	2119	0.09	1.50	40.1	171	18,302	17,922	79
35%	0.44	342	356	3.34	3868	0.384	0.35	2.31	107.00	106	0.44	2130	0.22	1.71	40.1	171	18,292	17,935	79
40%	0.50	322	332	3.11	3889	0.384	0.33	2.26	107.00	106	0.41	2141	0.22	1.93	40.1	171	18,281	17,949	79
45%	0.56	308	315	2.95	3910	0.384	0.31	2.22	107.00	106	0.39	2149	0.21	2.14	40.1	171	18,274	17,959	79
50%	0.63	299	304	2.84	3925	0.383	0.30	2.19	107.00	106	0.37	2155	0.21	2.36	40.1	171	18,269	17,965	80
55%	0.69	291	295	2.76	3935	0.383	0.29	2.17	107.00	106	0.36	2159	0.21	2.57	40.1	171	18,265	17,970	80
60%	0.75	286	289	2.70	3942	0.383	0.29	2.16	107.00	106	0.36	2162	0.21	2.79	40.1	171	18,263	17,974	80
70%	0.88	278	282	2.64	3948	0.383	0.28	2.14	107.00	106	0.35	2165	0.43	3.21	40.1	171	18,260	17,978	80
80%	1.00	273	276	2.58	3954	0.383	0.27	2.13	107.00	106	0.34	2168	0.43	3.64	40.1	171	18,257	17,981	80
90%	1.13	270	271	2.54	3960	0.383	0.27	2.12	107.00	106	0.33	2170	0.43	4.06	40.1	171	18,255	17,984	80
100%	1.25	267	268	2.51	3963	0.383	0.27	2.11	107.00	106	0.33	2172	0.43	4.49	40.1	171	18,254	17,985	80
UNW	—	—	*17680*	*165.48*	*281*	*0.411*	*16.34*	39.86	107.00	96	*22.50*	154	—	—	—	*165*	17,680	(0)	—
Screen	—	—	*3933*	*36.81*	—	*0.400*	3.74	*59.20*	107.00	91	*5.64*	1109	—	*8.3*	*41.9*	*151*	16,141	12,208	—
w/ter	—	—	*3933*	*36.81*	*2509*	*0.424*	3.52	10.15	107.00	104	*4.49*	1374	—	*6.7*	*41.4*	*184*	19,700	15,767	—

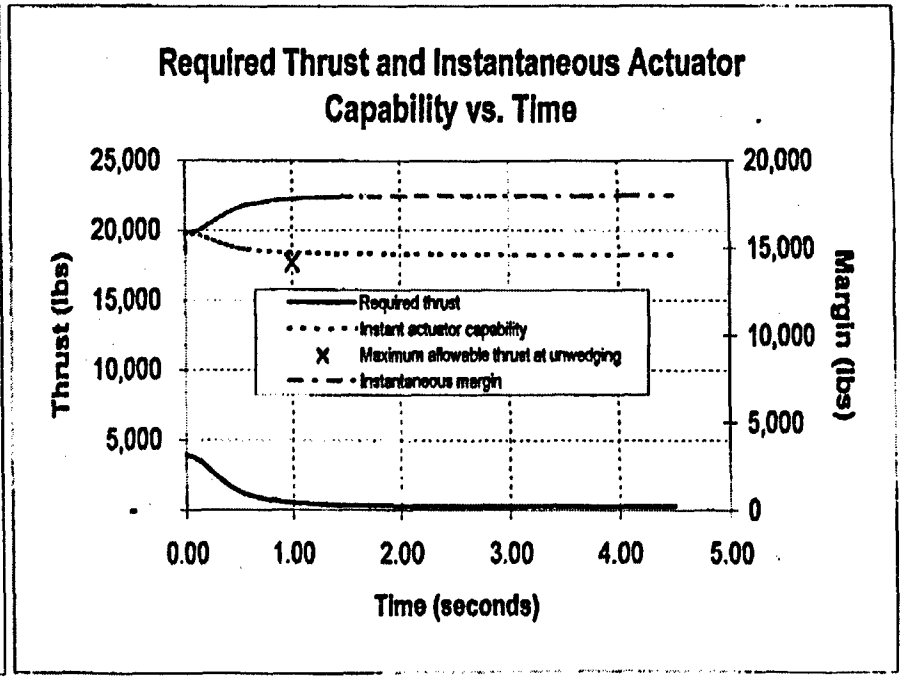
Valve: Open stroke for 13MOV-27

BWROG DCM for A Battery MOVs (ba[illegible]l, V 2.0.xls, Output Plots, 2/19/02, 3:05 PM









Valve: Open stroke for 12MOV-27

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Inputs, 2/19/02, 3:04 PM

Select Valve--> Close stroke for 13MOV-27

General Information	Required?	Value
Valve Type	yes	globe
Flow type	no	pumped flow
Stroke direction	yes	close
Fluid (blowdown only)	no	flashing water
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0.000
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.125
Seat ring face ID, $D_{body\text{-}ID}$ (inches)	no	1.500
Seat ring inner diameter, D_{sr} (inches)	yes	1.500
Globe valve stroke length, D (inches)	yes	1.250
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	3,933
Required thrust due to water inertia, F_{VM} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	yes	42
Actuator overall ratio, OAR	yes	24.64
Motor gear set ratio, MGSR	yes	1.826
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.00936
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00393
Voltage at MCC, V_{mcc} (volts)	yes	107.0
Cable resistance, R_{cable} (ohms)	yes	0.2800
Thermal overload resistance, R_{tol} (ohms)	yes	0.0158
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	15 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.200
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	1252
Valve pressure at full open, P_B (psig)	yes	1251
Flow rate, Q_{max} (gpm)	yes	80
Fluid density, ρ (lbs/ft^3)	yes	62.426
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	885.0
Fully open stem thrust, F_O (lbs)	yes	2,744
Nominal motor torque, τ_{nom} (ft-lbs)	yes	22.5
Maximum motor torque (ft-lbs)	yes	3.5
Maximum adjusted motor torque (ft-lbs)	yes	4.5
Minimum motor speed (rpm)	yes	1375
Minimum instantaneous actuator capability (lbs)	yes	18,780
Minimum instantaneous margin (lbs)	yes	15,816
Maximum allowable thrust at torque switch trip	yes	17,639
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

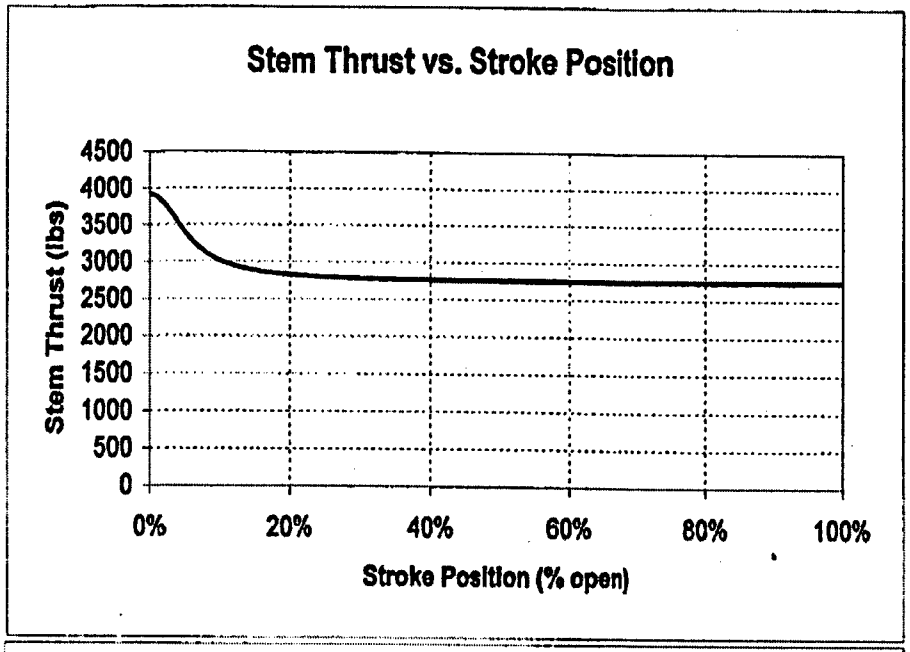
Predicted Stroke Time (Seconds): 6.12

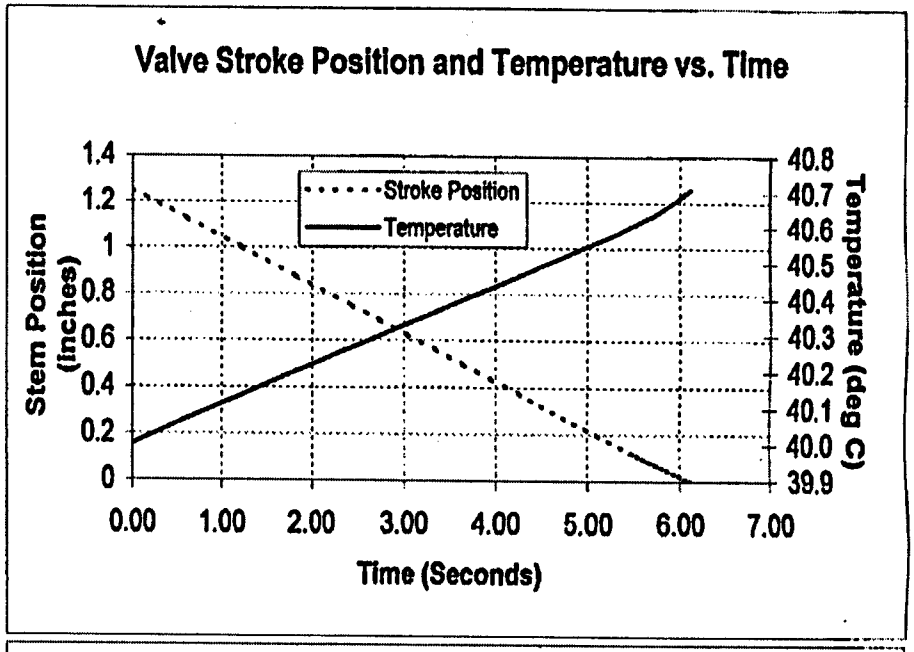
BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Results, 2/19/02, 3:04 PM

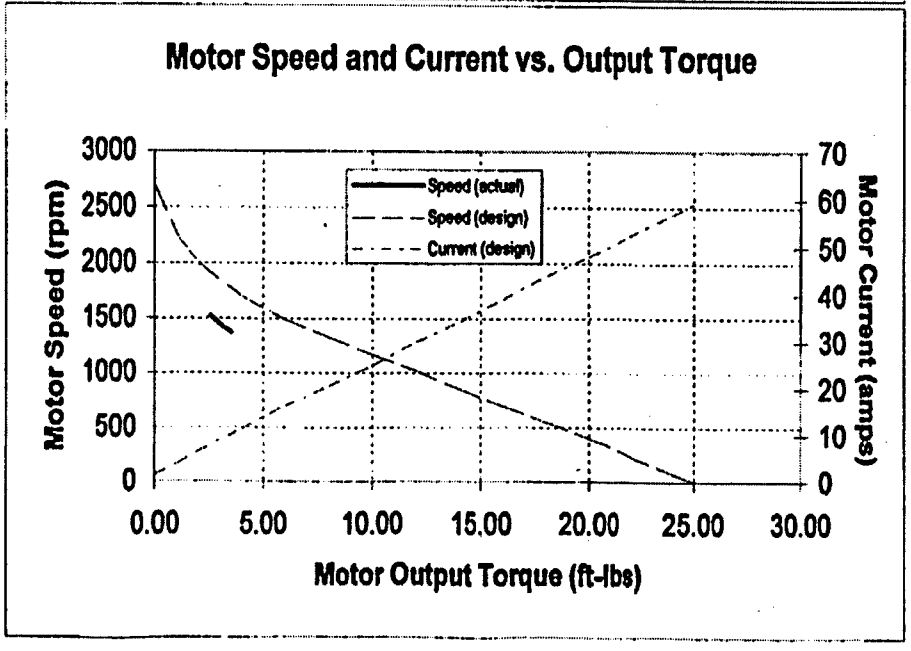
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
100%	1.25	2747												0.00	40.0				80
90%	1.13	2748	2747	25.72		0.400	2.61	7.96	107.00	105	3.29	1515	0.61	0.61	40.1	176	16,780	16,032	80
80%	1.00	2749	2748	25.72	2768	0.411	2.54	7.80	107.00	105	3.21	1526	0.61	1.22	40.1	181	19,293	16,545	80
70%	0.88	2751	2750	25.74	2787	0.411	2.54	7.80	107.00	105	3.21	1526	0.61	1.82	40.2	181	19,289	16,540	80
60%	0.75	2753	2752	25.76	2786	0.411	2.54	7.81	107.00	105	3.21	1525	0.61	2.43	40.3	181	19,286	16,534	80
55%	0.69	2755	2754	25.78	2785	0.411	2.55	7.81	107.00	105	3.21	1525	0.30	2.73	40.3	180	19,282	16,528	80
50%	0.63	2757	2756	25.80	2785	0.411	2.55	7.81	107.00	105	3.22	1525	0.30	3.03	40.3	180	19,281	16,525	80
45%	0.56	2760	2759	25.82	2784	0.411	2.55	7.82	107.00	105	3.22	1524	0.30	3.34	40.4	180	19,279	16,521	79
40%	0.50	2765	2762	25.86	2783	0.411	2.55	7.83	107.00	105	3.22	1524	0.30	3.64	40.4	180	19,279	16,516	79
35%	0.44	2771	2768	25.91	2782	0.411	2.56	7.84	107.00	105	3.23	1523	0.30	3.94	40.4	180	19,279	16,511	79
30%	0.38	2781	2776	25.98	2780	0.411	2.56	7.85	107.00	105	3.24	1522	0.30	4.25	40.5	180	19,280	16,504	79
28%	0.35	2786	2783	26.05	2778	0.411	2.57	7.87	107.00	105	3.25	1520	0.12	4.37	40.5	180	19,281	16,497	79
26%	0.33	2792	2789	26.11	2776	0.411	2.58	7.88	107.00	105	3.25	1519	0.12	4.49	40.5	180	19,282	16,493	78
24%	0.30	2801	2796	26.18	2775	0.411	2.58	7.90	107.00	105	3.26	1518	0.12	4.61	40.5	181	19,284	16,488	78
22%	0.28	2811	2806	26.26	2773	0.412	2.59	7.92	107.00	105	3.27	1517	0.12	4.73	40.5	181	19,287	16,482	78
20%	0.25	2824	2817	26.37	2770	0.412	2.60	7.94	107.00	105	3.29	1515	0.12	4.85	40.5	181	19,291	16,474	77
18%	0.23	2841	2833	26.51	2767	0.412	2.61	7.97	107.00	105	3.30	1513	0.12	4.98	40.5	181	19,297	16,464	77
16%	0.20	2865	2853	26.70	2763	0.412	2.63	8.01	107.00	105	3.33	1510	0.12	5.10	40.6	181	19,304	16,451	76
14%	0.18	2897	2881	26.96	2757	0.412	2.65	8.07	107.00	105	3.36	1506	0.12	5.22	40.6	181	19,315	16,434	75
12%	0.15	2943	2920	27.33	2750	0.413	2.69	8.15	107.00	105	3.40	1500	0.12	5.35	40.6	181	19,331	16,411	73
10%	0.13	3011	2977	27.86	2740	0.413	2.74	8.26	107.00	105	3.46	1492	0.12	5.47	40.6	181	19,354	16,377	70
9%	0.11	3057	3034	28.40	2724	0.414	2.78	8.36	107.00	105	3.52	1484	0.06	5.53	40.6	181	19,377	16,343	69
8%	0.10	3114	3086	28.88	2709	0.415	2.83	8.48	107.00	105	3.58	1476	0.06	5.59	40.6	182	19,398	16,312	66
7%	0.09	3186	3150	29.48	2696	0.415	2.88	8.61	107.00	105	3.65	1467	0.06	5.66	40.6	182	19,425	16,275	63
6%	0.08	3274	3230	30.23	2679	0.416	2.95	8.77	107.00	105	3.73	1456	0.06	5.72	40.6	182	19,458	16,228	60
5%	0.06	3382	3328	31.15	2658	0.417	3.03	8.97	107.00	105	3.84	1442	0.06	5.78	40.6	183	19,499	16,170	54
4%	0.05	3510	3446	32.26	2632	0.419	3.13	9.20	107.00	104	3.97	1425	0.06	5.85	40.7	183	19,548	16,102	48
3%	0.04	3651	3581	33.51	2602	0.420	3.24	9.47	107.00	104	4.11	1410	0.07	5.92	40.7	183	19,604	16,023	39
2%	0.03	3789	3720	34.82	2575	0.422	3.35	9.74	107.00	104	4.26	1396	0.07	5.98	40.7	184	19,662	15,942	28
1%	0.01	3893	3841	35.95	2550	0.423	3.45	9.98	107.00	104	4.38	1384	0.07	6.05	40.7	185	19,712	15,871	15
0%	0.00	3933	3913	36.63	2528	0.424	3.51	10.12	107.00	104	4.46	1377	0.07	6.12	40.7	185	19,742	15,829	0
0%	0.00	3933	3933	36.81	2515	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
0%	0.00	3933	3933	36.81	2511	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
0%	0.00	3933	3933	36.81	2511	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
0%	0.00	3933	3933	36.81	2511	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
0%	0.00	3933	3933	36.81	2511	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
0%	0.00	3933	3933	36.81	2511	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
0%	0.00	3933	3933	36.81	2511	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
0%	0.00	3933	3933	36.81	2511	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
0%	0.00	3933	3933	36.81	2511	0.424	3.52	10.15	107.00	104	4.48	1375	0.00	6.12	40.7	185	19,749	15,816	0
TST	—	—	17639	165.10	281	0.411	16.30	39.76	107.00	96	22.50	154	—	—	—	165	17,639	(0)	—
Screen	—	—	3933	36.81	—	0.400	3.74	59.20	107.00	91	5.64	1109	—	8.3	41.9	151	16,141	12,208	—
w/fter	—	—	3933	36.81	2509	0.424	3.52	10.15	107.00	104	4.49	1374	—	6.7	41.4	184	19,700	15,767	—

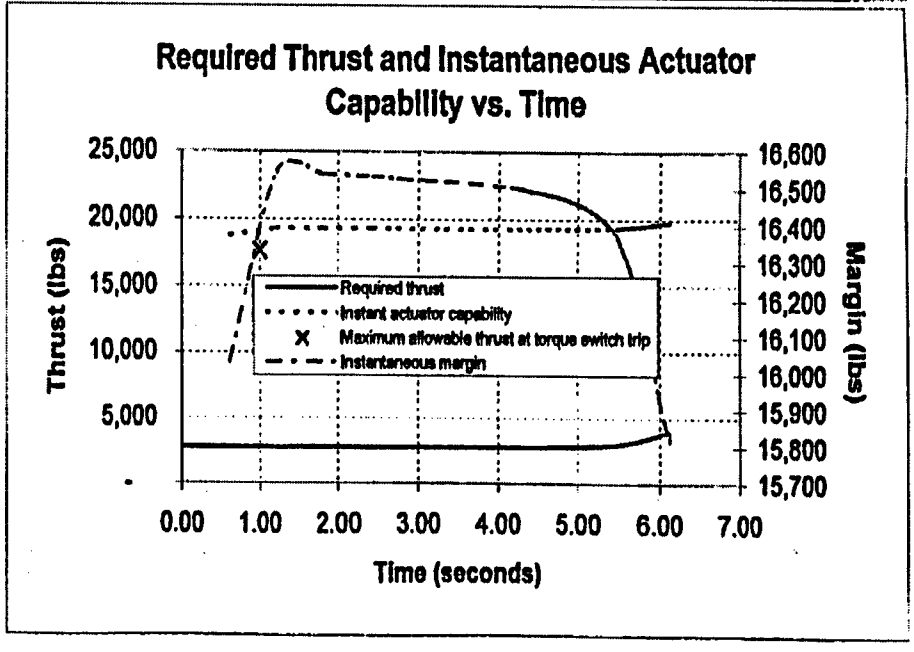
Valve: Close stroke for 13MOV-27

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Output Plots, 2/19/02, 3:04 PM









Valve: Close stroke for 13MOV-27

FOR REFERENCE

SYS/ VALVE NO. 13 MOV 30
Q.A. CAT. ~~II III~~ M

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME			
13 MOV 30	Full Flow test To Condensate Storage			
MANUFACTURER	MCC	ESK	SE	COMP. LOCATION & ELEVATION
Peerless	Bnccd	11A5	104	254' W Cabout RF Above MCC

H.P./ TORQUE	TYPE	MODEL NO.
.361 5 ft/lb	Compound	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125 DC	—	—	A40 8885		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
21		5 MIN	0656A

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
4.2	1900	40°C	B

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. NTR. %	ARM AMPS	FIELD AMPS
CR124K028	K14.8B	12.9	300		

TOTAL STEM TRAVEL	INCHES OR (TURNS) FROM FULL CLOSED	ROTORS 1	2	3	4
INCHES ____ TURNS 11		10.45	1.1	NA	NA

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Velan	TYPE SMB-000	NO. 1CICA08	RECOMMENDED: OPEN 1.50 CLOSE 1.50
TYPE Globe	SER. NO. 1273361	BKR. AMPS 20	MAX: OPEN 2.00 CLOSE 2.00
SIZE 3"	ORDER NO. 3509204	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

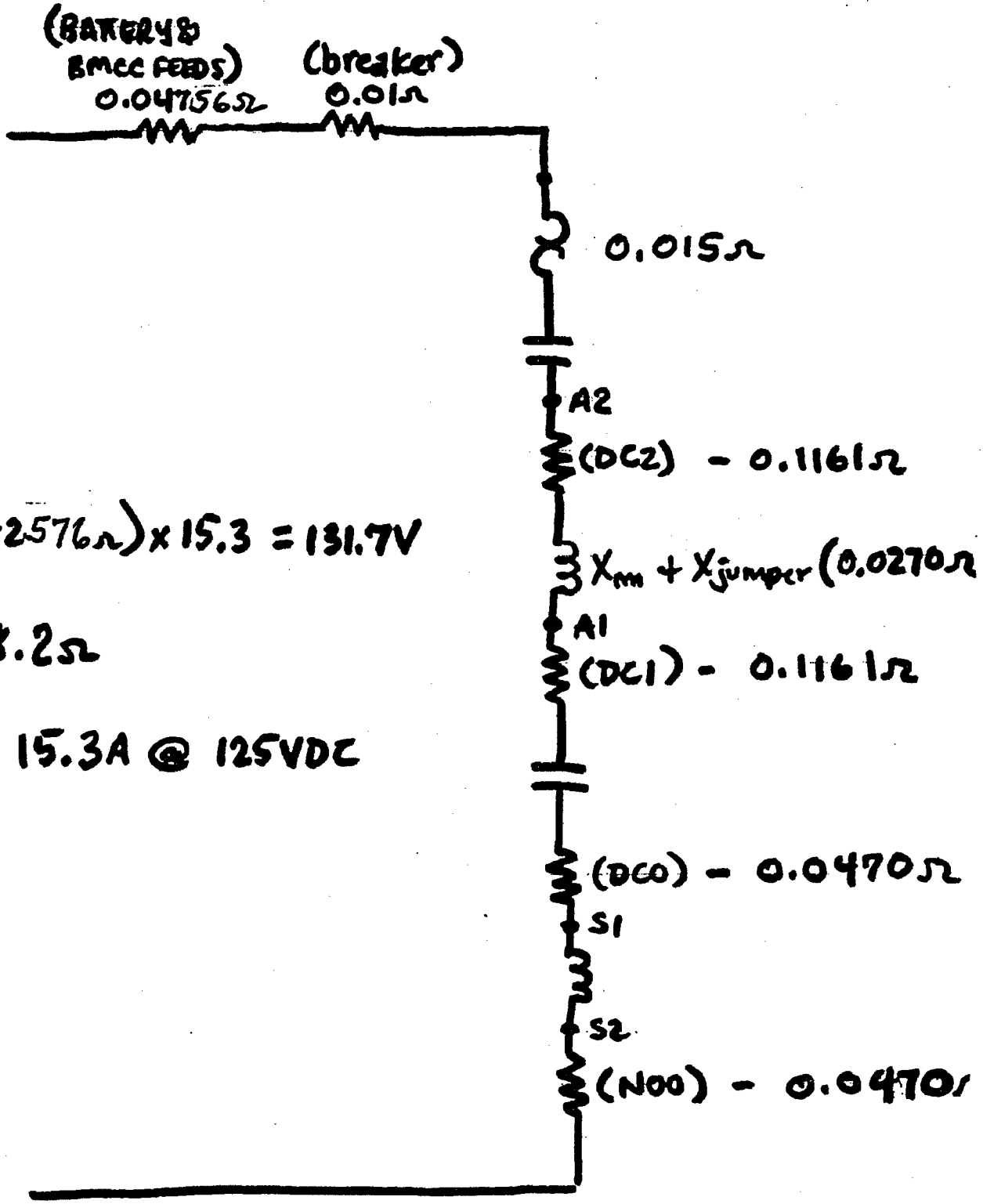
RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	2	2		sec 23	sec 23	LIMITORQUE	C-2 or C-3
AMPS F.L. AT TORQUE TRIP	4	4	TORQUE SWITCH SETTING	1.50	1.50	MCC	C-3

BRAKE INFO, BOLTING TORQUE, MISC INFO

Min - C-Clamp 90° off the way (Rest Tight shut-STOP packing STUDS IN WAY) Limit Switch COVER Gasket is NON ASBESTOS TYPE # 6298 (Steel) Erson Bucket OLD Anti Rotation Key reinstalled - new one was wrong. (Steel) 624

13MOV-30

LRA 15.3A @ 131.7V
WR 00-01537-00



$(R_M + 0.42576\Omega) \times 15.3 = 131.7V$

$R_M = 8.2\Omega$

$I_{LRA} = 15.3A$ @ 125VDC

corrected for 25°C

U P D A T E S E T P O I N T D A T A Screen 1 of

Component Id: 13MOV-30 EQ Class: N/A
LD Desc: RCIC FULL FLOW TEST TO COND STOR ISOL VALVE OPER
Valve QA: M Valvop QA: II/III
r Supply: 71BMCC-1-OC2 Source: 11B
L .torque Model Number: SMB-000

Required Stroke Time: 28.50. Source: NOMINAL MP 59.36 10/10/01
Switch To Light Time: 22.20. Source: MP-59.36 1/3/95

Current Open: 2.00. Current Close: 2.20. Amps at T.S.T.: 5.00
FLA: 4.20 . LRA: 21 . Source: MP-59.36 10/10/01 .

MIN TST: 6616.00. MAX TST: 81.00. MAX Total: 9106.00.	TORQUE SWITCH SETTINGS	Closed Actual: 1.75. Open Actual: 1.75. Source: MP-59.36 10/10/01 .

Limiter Plate(Y/N): Y. Setting: 2.00. Source: MP-59.39 3/4/92
Rotor #1: 90-95 . Rotor #2: 10-15 .
Rotor #3: SP . Rotor #4: SP . Source: MP-59.21 2/4/92

FOR REFERENCE ONLY

SYS/ VALVE NO. 13MOV-13
Q.A. CAT. 1

(MI-94-031) INFO

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO. 13MOV-131			VALVE NAME RCIC TURBINE STEAM INLET VALVE		
MANUFACTURER Perless		MCC CB1 BMCC-3	ESK 11AQ	SE 10AB	COMP. LOCATION & ELEVATION RCIC Enclosure on Platform WC
H.P./TORQUE .72 / 10 Ft lb	TYPE Compound		MODEL NO. 176-18-00470		
VOLTAGE 125 VDC	PHASE	HZ	MOTOR SERIAL NO. 0L52366	DESIGN	CODE
AMP(L.R.) 38	SERV. FACTOR		DUTY 5 MIN	FRAME DL 560	
AMP.(F.L.) 6.5	RPM 1900		TEMP. RISE 115°C	INSUL. CLASS RH	

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124K028	K17.8B		300 %		

TOTAL STEM TRAVEL	INCHES OR TURNS FROM FULL CLOSED	ROTORS	1	2	3	4
INCHES ____ TURNS 31.25			95% TURNS 29.75	33% TURNS 10.5	95% TURNS 29.75	FC

LIMITORQUE VALVE OPERATOR DATA

VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. Anchor/Darling	TYPE SMB-00	NO. 1CICA09	RECOMMENDED: OPEN CLOSE
TYPE 610BE	SER. NO. L448072	BKR. AMPS 15	MAX: OPEN CLOSE
SIZE 3"	ORDER NO. 188491.08	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) 2.5 NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	6.0	6.0				LIMITORQUE	INSIDE CLOSURE C3
AMPS F.L. AT TORQUE TRIP		7.0	TORQUE SWITCH SETTING			MCC	C2
						CONTROL ROOM	A14/A10

BRAKE INFO, BOLTING TORQUE, MISC INFO

New operator overhauled New Gasket's Installed. No "ASSpestos"

Extended mini-C for Votes

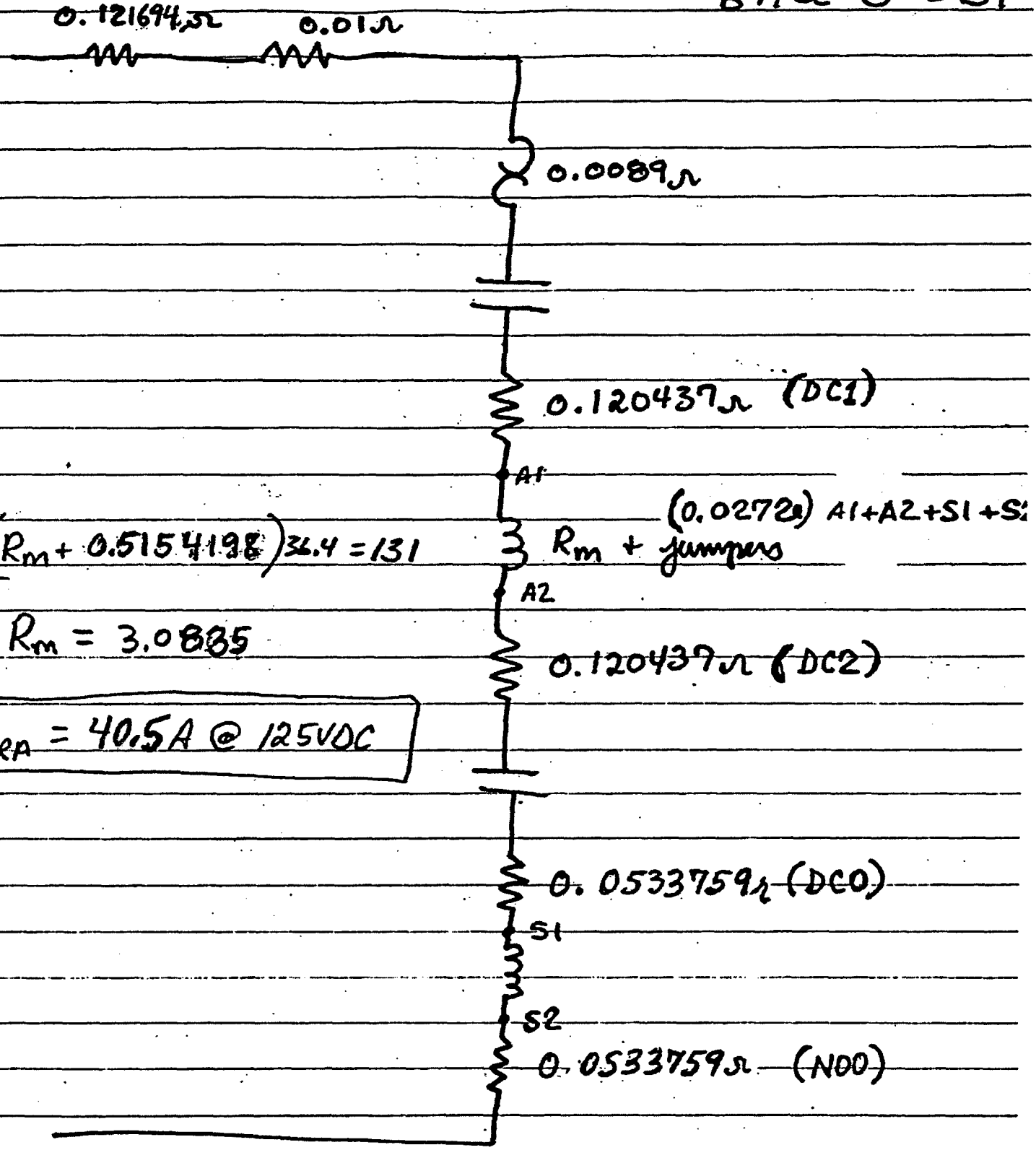
1/4" WRENCH FOR COVER

allen 1/2 combination too

13MOV-131

BMCC-3-OB1

(7158-1 to BMCC-3)



$(R_m + 0.5154198)32.4 = 131$

$R_m = 3.0885$

$I_{LRA} = 40.5A$ @ 125VDC

Cable resistances corrected to 25°C

13MOV-131 (Cont'd)

- 4/12/94 129.09VDC 36.9* LRA (close) 37.4 LRA (open)

- Operator replaced 11/96

  Baseline (DP) performed 1/6/97

  131VDC*, 35.9LRA (close), 36.4LRA (OPEN)

  * ESTIMATED VALUE FROM APPENDIX 13
  AT 71BCB-2A

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Inputs, 2/19/02, 9:22 AM

Select Valve—> Open stroke for 13MOV-131

General Information	*Required?*	*Value*
Valve Type	yes	globe
Flow type	no	blowdown
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	1.250
Seat ring face ID, $D_{body-ID}$ (inches)	no	2.500
Seat ring inner diameter, D_{sr} (inches)	yes	2.500
Globe valve stroke length, D (inches)	yes	1.500
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	7,148
Required thrust due to water inertia, F_{VI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	yes	145
Actuator overall ratio, OAR	yes	82.17
Motor gear set ratio, MGSR	yes	0.548
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.01190
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00423
Voltage at MCC, V_{mcc} (volts)	yes	125.0
Cable resistance, R_{cable} (ohms)	yes	0.4106
Thermal overload resistance, R_{tol} (ohms)	yes	0.0189
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	10 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	1195
Valve pressure at full open, P_B (psig)	yes	1195
Flow rate, Q_{max} (gpm)	yes	100
Fluid density, ρ (lbs/ft^3)	yes	62.400
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	no	10000
Calculated Values		
System resistance, K_{sys}	yes	1708.3
Fully open stem thrust, F_O (lbs)	yes	34
Nominal motor torque, τ_{nom} (ft-lbs)	yes	14.3
Maximum motor torque (ft-lbs)	yes	2.4
Maximum adjusted motor torque (ft-lbs)	yes	3.1
Minimum motor speed (rpm)	yes	1346
Minimum instantaneous actuator capability (lbs)	yes	31,763
Minimum instantaneous margin (lbs)	yes	25,521
Maximum allowable thrust at unwedging	no	—
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%	—

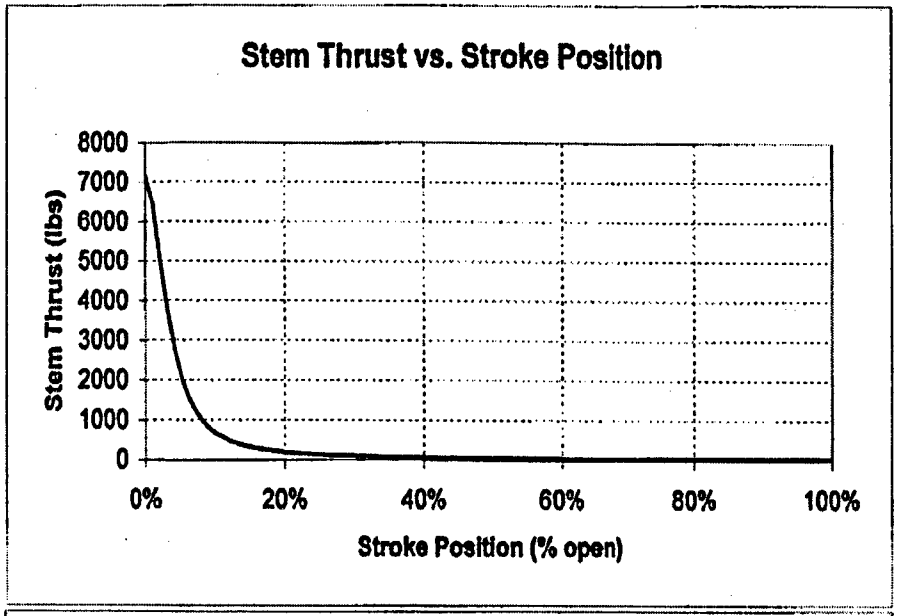
Warnings

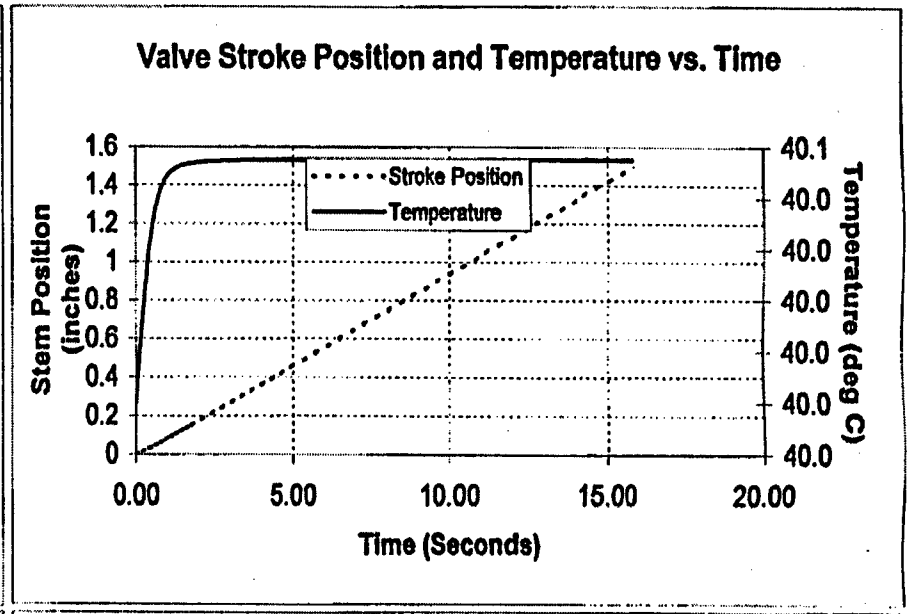
Predicted Stroke Time (Seconds): 15.82

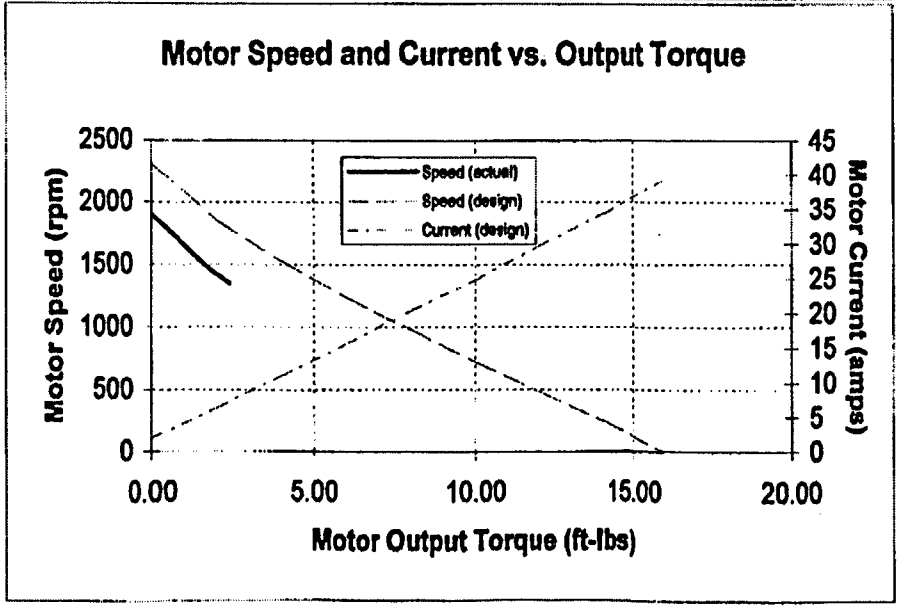
BWROG DCM for A Battery MOVs , ..ch), V 2.0.xls, Results, 2/19/02, 9:22 AM

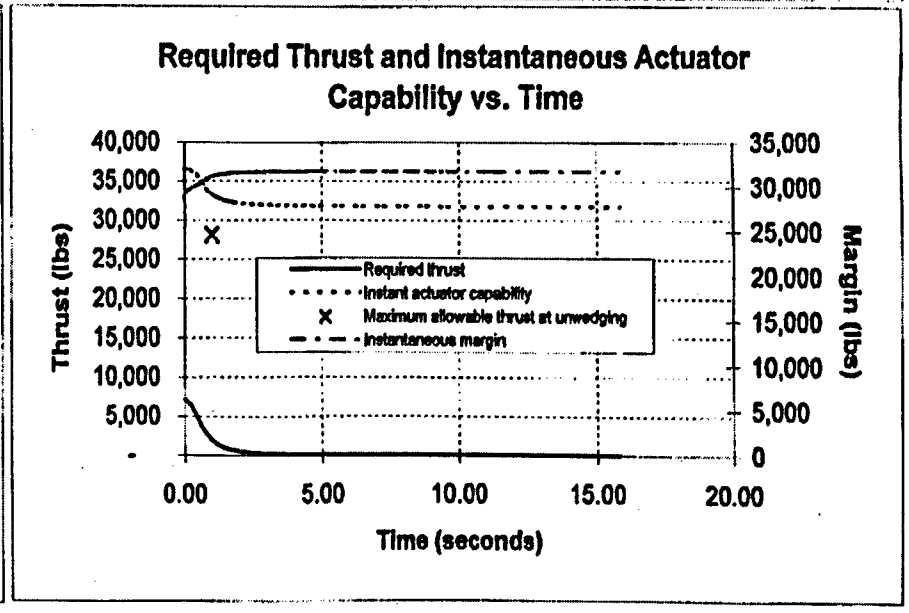
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
0%	0.00	7148												*0.00*	*40.0*				—
0%	0.00	7148	7148	78.63		*0.400*	2.39	7.30	104.00	101	3.14	1346	0.00	0.00	40.0	359	32,669	25,521	—
0%	0.00	7148	7148	78.63	737	0.446	2.15	6.74	104.00	101	2.81	1392	0.00	0.00	40.0	401	36,477	29,329	—
0%	0.00	7148	7148	78.63	762	0.446	2.15	6.73	104.00	101	2.81	1392	0.00	0.00	40.0	402	36,518	29,370	—
0%	0.00	7148	7148	78.63	762	0.446	2.15	6.73	104.00	101	2.81	1392	0.00	0.00	40.0	402	36,518	29,370	—
0%	0.00	7148	7148	78.63	762	0.446	2.15	6.73	104.00	101	2.81	1392	0.00	0.00	40.0	402	36,518	29,370	—
0%	0.00	7148	7148	78.63	762	0.446	2.15	6.73	104.00	101	2.81	1392	0.00	0.00	40.0	402	36,518	29,370	—
0%	0.00	7148	7148	78.63	762	0.446	2.15	6.73	104.00	101	2.81	1392	0.00	0.00	40.0	402	36,518	29,370	—
0%	0.00	7148	7148	78.63	762	0.446	2.15	6.73	104.00	101	2.81	1392	0.00	0.00	40.0	402	36,518	29,370	—
0%	0.00	7148	7148	78.63	762	0.446	2.15	6.73	104.00	101	2.81	1392	0.00	0.00	40.0	402	36,518	29,370	—
0%	0.00	7148	7148	78.63	762	0.446	2.15	6.73	104.00	101	2.81	1392	0.00	0.00	40.0	402	36,518	29,370	—
1%	0.02	6485	6816	74.96	762	0.446	2.05	6.51	104.00	101	2.67	1411	0.21	0.21	40.0	402	36,552	29,736	—
2%	0.03	5074	5779	63.57	772	0.436	1.77	5.90	104.00	101	2.31	1461	0.20	0.41	40.0	394	35,832	30,052	—
3%	0.05	3726	4401	48.41	800	0.423	1.39	5.06	104.00	102	1.81	1543	0.19	0.60	40.0	384	34,862	30,461	—
4%	0.06	2723	3225	35.48	845	0.412	1.05	4.31	104.00	102	1.38	1633	0.18	0.79	40.0	375	34,074	30,849	—
5%	0.08	2026	2374	26.12	894	0.404	0.79	3.73	104.00	102	1.02	1701	0.17	0.96	40.0	368	33,463	31,109	—
6%	0.09	1546	1786	19.65	931	0.398	0.60	3.32	104.00	103	0.77	1749	0.17	1.13	40.0	364	33,065	31,279	—
7%	0.11	1212	1379	15.17	958	0.394	0.47	3.03	104.00	103	0.60	1784	0.17	1.29	40.0	360	32,769	31,390	—
8%	0.12	972	1092	12.01	977	0.391	0.37	2.82	104.00	103	0.48	1809	0.16	1.46	40.0	358	32,558	31,466	—
9%	0.14	796	884	9.72	990	0.389	0.30	2.67	104.00	103	0.39	1827	0.16	1.62	40.0	356	32,403	31,519	—
10%	0.15	664	730	8.03	1000	0.388	0.25	2.55	104.00	103	0.32	1840	0.16	1.78	40.0	355	32,288	31,558	—
12%	0.18	484	574	6.31	1008	0.386	0.20	2.44	104.00	103	0.26	1854	0.32	2.10	40.0	354	32,170	31,596	—
14%	0.21	370	427	4.69	1015	0.384	0.15	2.33	104.00	103	0.19	1867	0.32	2.42	40.0	353	32,058	31,631	—
16%	0.24	294	332	3.65	1023	0.383	0.12	2.25	104.00	103	0.15	1876	0.32	2.73	40.0	352	31,966	31,654	—
18%	0.27	241	267	2.94	1027	0.383	0.09	2.21	104.00	103	0.12	1882	0.31	3.05	40.0	351	31,937	31,669	—
20%	0.30	202	222	2.44	1030	0.382	0.08	2.17	104.00	103	0.10	1886	0.31	3.36	40.0	351	31,902	31,680	—
22%	0.33	174	188	2.07	1033	0.382	0.07	2.14	104.00	103	0.08	1889	0.31	3.67	40.0	351	31,876	31,688	—
24%	0.36	152	163	1.79	1034	0.382	0.06	2.13	104.00	103	0.07	1891	0.31	3.99	40.0	350	31,856	31,694	—
26%	0.39	134	143	1.57	1036	0.381	0.05	2.11	104.00	103	0.06	1893	0.31	4.30	40.0	350	31,841	31,698	—
28%	0.42	121	128	1.40	1037	0.381	0.04	2.10	104.00	103	0.06	1894	0.31	4.61	40.0	350	31,829	31,702	—
30%	0.45	110	115	1.27	1037	0.381	0.04	2.09	104.00	103	0.05	1896	0.31	4.92	40.0	350	31,820	31,705	—
35%	0.53	90	100	1.10	1038	0.381	0.03	2.08	104.00	103	0.04	1897	0.78	5.70	40.0	350	31,808	31,708	—
40%	0.60	76	83	0.91	1039	0.381	0.03	2.06	104.00	103	0.04	1898	0.78	6.48	40.0	350	31,795	31,712	—
45%	0.68	66	72	0.79	1040	0.381	0.03	2.06	104.00	103	0.03	1899	0.78	7.26	40.0	350	31,787	31,715	—
50%	0.75	61	64	0.71	1040	0.381	0.02	2.05	104.00	103	0.03	1900	0.78	8.04	40.0	350	31,781	31,716	—
55%	0.83	56	59	0.65	1041	0.381	0.02	2.05	104.00	103	0.03	1901	0.78	8.82	40.0	350	31,776	31,718	—
60%	0.90	53	54	0.60	1041	0.381	0.02	2.04	104.00	103	0.02	1901	0.78	9.59	40.0	350	31,773	31,719	—
70%	1.05	48	50	0.55	1041	0.381	0.02	2.04	104.00	103	0.02	1901	1.56	11.15	40.0	349	31,770	31,720	—
80%	1.20	44	46	0.51	1041	0.380	0.02	2.04	104.00	103	0.02	1902	1.56	12.71	40.0	349	31,766	31,721	—
90%	1.35	42	43	0.47	1041	0.380	0.02	2.03	104.00	103	0.02	1902	1.56	14.26	40.0	349	31,764	31,721	—
100%	1.50	40	41	0.45	1042	0.380	0.01	2.03	104.00	103	0.02	1902	1.56	15.82	40.0	349	31,763	31,722	—
UNW	—	—	*28135*	*309.49*	*82*	*0.373*	*10.11*	25.07	104.00	93	*14.33*	149	—	—	—	*309*	28,135	0	—
Screen	—	—	*7148*	*78.63*	—	*0.400*	2.39	*39.20*	104.00	87	*3.76*	1094	—	*27.1*	*43.1*	*307*	27,917	20,769	—
w/fter	—	—	*7148*	*78.63*	*761*	*0.446*	2.15	6.73	104.00	101	*2.83*	1390	—	*21.3*	*42.0*	*399*	36,257	29,109	—
Valve:	Open stroke for 13MOV-131																		

BWROG DCM for A Battery MOVs (ba..., V 2.0.xls, Output Plots, 2/19/02, 9:22 AM









Valve: Open stroke for 13MOV-131

SYS/ VALVE NO. 13MOV-132
Q.A. CAT. M

FOR REFERENCE ONLY

AC & DC VALVE ELECTRIC MOTOR DATA

VALVE NO.	VALVE NAME
13 MOV-132	RCIC TB LUBE OIL COOLING WATER ISO.

MANUFACTURER	BMCC	ESK	SE	COMP. LOCATION & ELEVATION
PEERLESS	3	11AU	10AC	West Crescent 227' RCIC Room

H.P./TORQUE	TYPE	MODEL NO.
.722	COMPOUND WOUND.	

VOLTAGE	PHASE	HZ	MOTOR SERIAL NO.	DESIGN	CODE
125VDC			HX03054		

AMP(L.R.)	SERV. FACTOR	DUTY	FRAME
~~38~~ 38		5 MINUTE	DG56D

AMP.(F.L.)	RPM	TEMP. RISE	INSUL. CLASS
6.0	1900	75°C - AMBIENT 40°C	B

OVERLOAD RELAY NO.	HEATER NO.	HEATER AMPS	APPROX. HTR. %	ARM AMPS	FIELD AMPS
CR124K028	K17.8B		300		

TOTAL STEM TRAVEL	INCHES OR TURNS FROM FULL CLOSED	ROTORS 1 95%	2	3	4
INCHES ____ TURNS 5 3/4		5 1/2	1 3/4	N/A	≈ 3/4

LIMITORQUE VALVE OPERATOR DATA

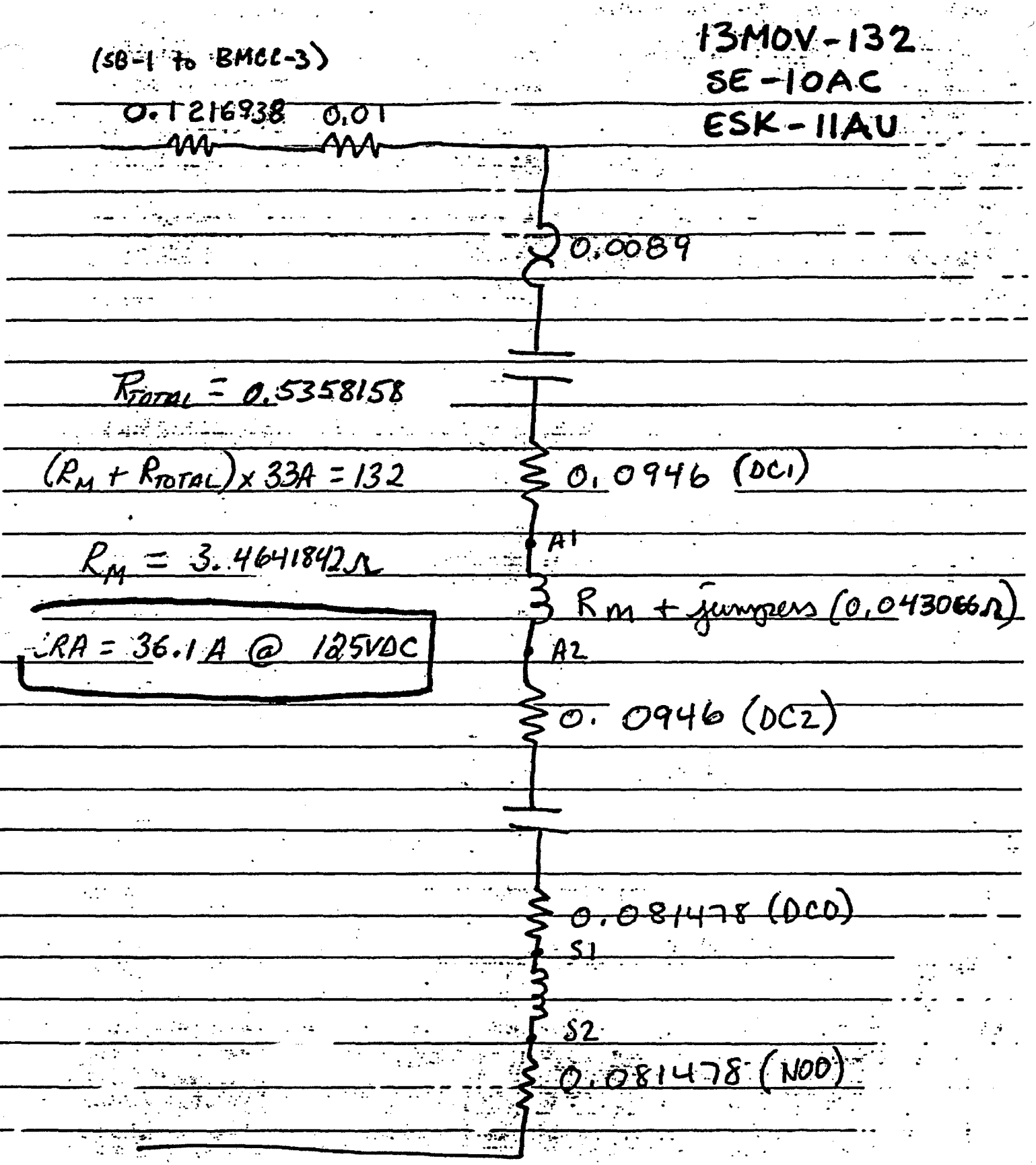
VALVE	LIMITORQUE	CIRCUIT	TORQUE SWITCH
MANU. VELAN	TYPE SMB-00	NO. 1C1A10	RECOMMENDED: REQUIRED OPEN 1.75 CLOSE 1.24
TYPE GLOBE	SER. NO. 119678	BKR. AMPS 15	MAX: OPEN 2.75 CLOSE 2.75
SIZE 2"	ORDER NO. 347489A	CONTACTOR SIZE 1	STOP PLATE IN PLACE (YES) 2.75 NO

ORIGINAL LIMITORQUE PLANT TEST DATA: DO NOT CHANGE

RUNNING AMPS F.L.	OPEN	CLOSE	OPERATING TIME MIN/SEC	OPEN	CLOSE	PLANT COMM JACKS	
	1.8	1.8		10.1	8.8	LIMITORQUE	C-3
AMPS F.L. AT TORQUE TRIP	N/A	5.0	TORQUE SWITCH SETTING	1.75	1.5	MCC	C-2

BRAKE INFO, BOLTING TORQUE, MISC INFO

13MOV-132
SE-10AC
ESK-11AU



All cable resistances corrected for 25°C

Votes testing 13MOV-132

3/6/92 32 LRA closing 32.5 opening
battery voltage unknown

6/3/98 31 LRA closing 33LRA opening
~ 132VDC

∴ use 33LRA @ 132VDC

BWROG DCM for A Battery MOVs (batch), V 2.0.xls, Inputs, 2/19/02, 2:38 PM

Select Valve--> Open stroke for 13MOV-132

General Information	*Required?*	*Value*
Valve Type	yes	globe
Flow type	no	pumped flow
Stroke direction	yes	open
Fluid (blowdown only)	no	flashing water
Load profile method	yes	Use default
Additional stroke time (seconds)	yes	0.000
Valve and Actuator Information		
Stem diameter, D_{stem} (inches)	yes	1.125
Seat ring face ID, $D_{body-ID}$ (inches)	no	1.500
Seat ring inner diameter, D_{sr} (inches)	yes	1.500
Globe valve stroke length, D (inches)	yes	1.150
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	3,899
Required thrust due to water inertia, F_{WI} (lbs)	yes	0
Flow coefficient, C_V (gpm/psi$^{1/2}$)	yes	42
Actuator overall ratio, OAR	yes	63.33
Motor gear set ratio, MGSR	yes	0.711
Actuator rated torque, τ_{rated}	yes	250
Stem factor, SF (ft-lbs/lb)	yes	0.00936
Overhauling stem factor, SF_O (ft-lbs/lb)	no	0.00393
Voltage at MCC, V_{mcc} (volts)	yes	104.0
Cable resistance, R_{cable} (ohms)	yes	0.4332
Thermal overload resistance, R_{tol} (ohms)	yes	0.0189
Nominal voltage, V_{nom} (volts)	yes	125
Motor type	yes	10 ft-lb, 125 VDC
Valve stem lead, lead (inches)	yes	0.200
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	1234
Valve pressure at full open, P_S (psig)	yes	1234
Flow rate, Q_{max} (gpm)	yes	75
Fluid density, ρ (lbs/ft^3)	yes	62.426
Ambient temperature (C)	yes	40
Length of upstream piping, L_{up} (pipe diameters)	no	1
Calculated Values		
System resistance, K_{sys}	yes	992.5
Fully open stem thrust, F_O (lbs)	yes	273
Nominal motor torque, τ_{nom} (ft-lbs)	yes	14.3
Maximum motor torque (ft-lbs)	yes	1.4
Maximum adjusted motor torque (ft-lbs)	yes	1.9
Minimum motor speed (rpm)	yes	1528
Minimum instantaneous actuator capability (lbs)	yes	28,906
Minimum instantaneous margin (lbs)	yes	25,926
Maximum allowable thrust at unwedging	no	—
Efficiency at minimum instantaneous capability	yes	0.383

Warnings

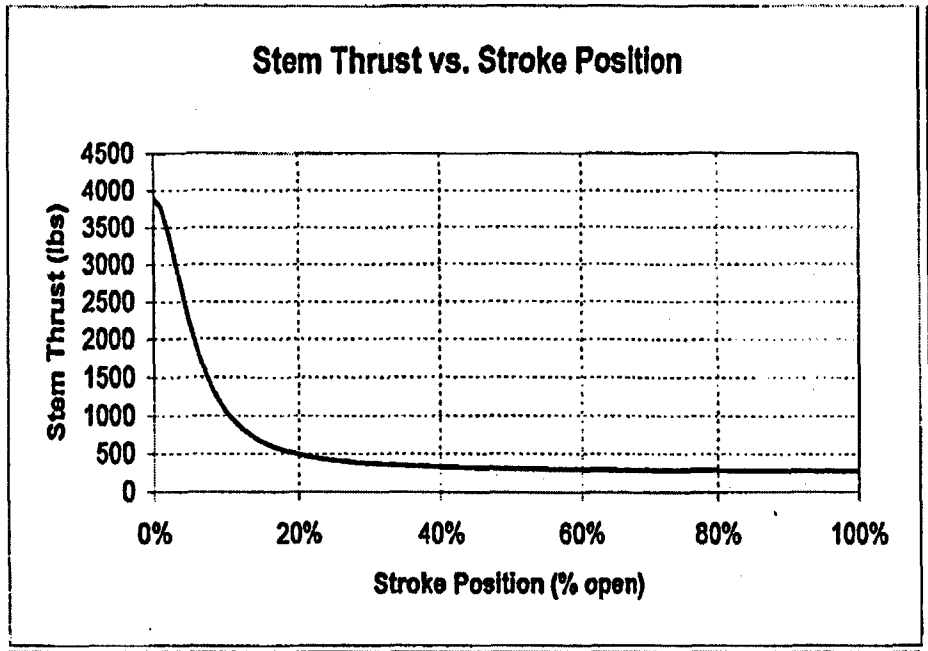
Predicted Stroke Time (Seconds): 11.82

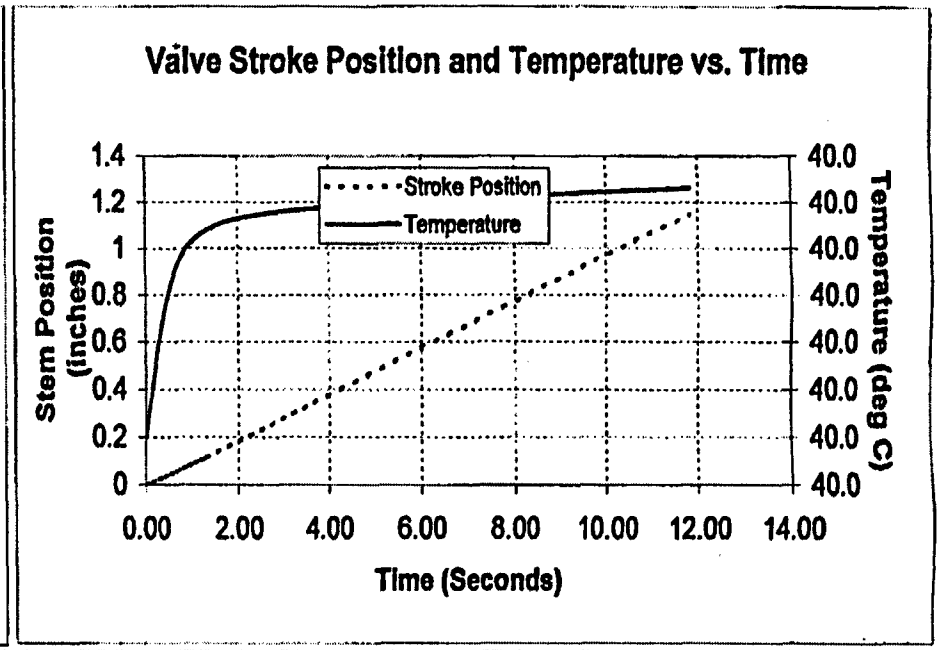
Not required	
100%	—
90%	—
80%	—
70%	—
60%	—
55%	—
50%	—
45%	—
40%	—
35%	—
30%	—
28%	—
26%	—
24%	—
22%	—
20%	—
18%	—
16%	—
14%	—
12%	—
10%	—
9%	—
8%	—
7%	—
6%	—
5%	—
4%	—
3%	—
2%	—
1%	—
0%	—
-0.0010%	—
-100%	—

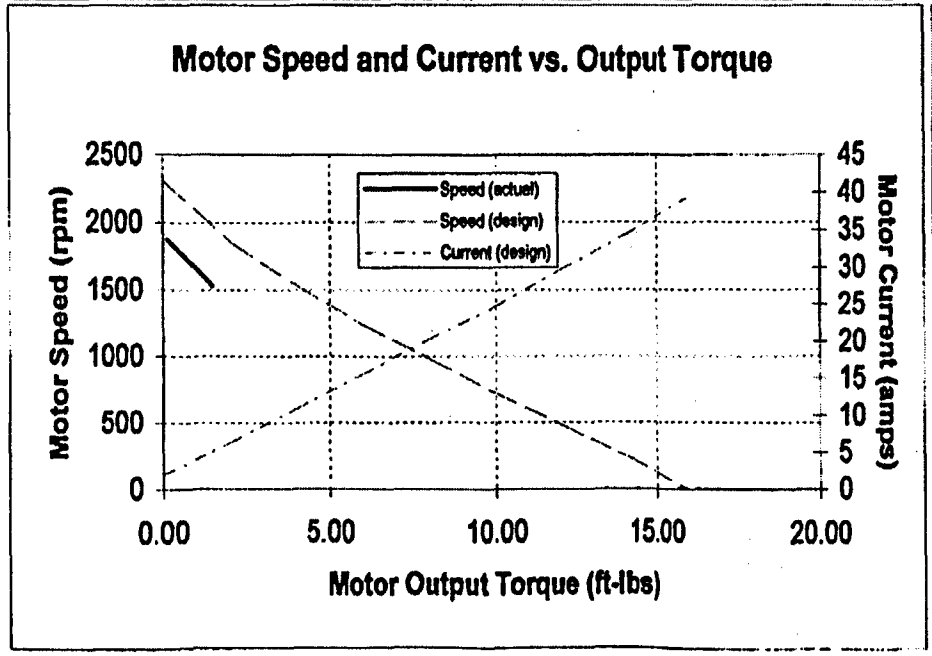
BWROG DCM for A Battery MOVs (..n), V 2.0.xls, Results, 2/19/02, 2:38 PM

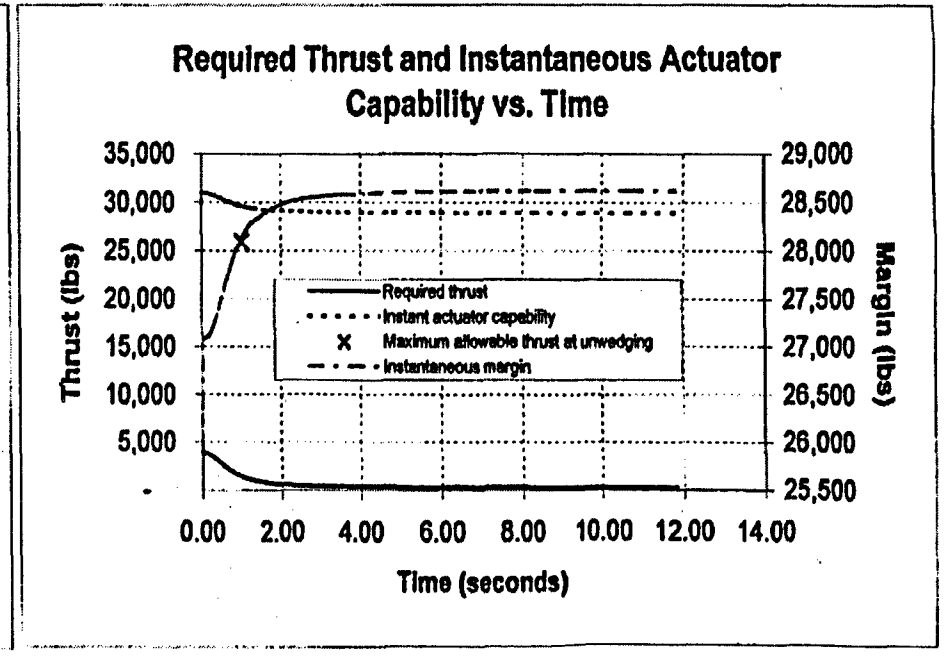
Stroke	Position	Stem Thrust	Average Stem Thrust	Average Stem Torque	Worm Speed	Gearbox Efficiency	Average Motor Torque	Motor Current	Vmcc	Motor Voltage	Adjusted Motor Torque	Motor Speed	Stroke Time Increment	Time	Motor Temp	Instant Torque Cap	Instant Act Cap	Instant Margin	Q
0%	0.00	3899												0.00	40.0				0
0%	0.00	3899	3899	36.49		0.400	1.44	5.17	104.00	102	1.87	1528	0.00	0.00	40.0	279	29,825	25,926	0
0%	0.00	3899	3899	36.49	1088	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,973	27,074	0
0%	0.00	3899	3899	36.49	1096	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,980	27,081	0
0%	0.00	3899	3899	36.49	1096	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,980	27,081	0
0%	0.00	3899	3899	36.49	1096	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,980	27,081	0
0%	0.00	3899	3899	36.49	1096	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,980	27,081	0
0%	0.00	3899	3899	36.49	1096	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,980	27,081	0
0%	0.00	3899	3899	36.49	1096	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,980	27,081	0
0%	0.00	3899	3899	36.49	1096	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,980	27,081	0
0%	0.00	3899	3899	36.49	1096	0.415	1.39	5.05	104.00	102	1.80	1542	0.00	0.00	40.0	290	30,980	27,081	0
1%	0.01	3764	3831	35.86	1096	0.415	1.37	5.00	104.00	102	1.77	1548	0.14	0.14	40.0	290	30,941	27,110	15
2%	0.02	3413	3589	33.59	1100	0.413	1.29	4.83	104.00	102	1.67	1569	0.14	0.28	40.0	288	30,803	27,215	27
3%	0.03	2963	3188	29.84	1115	0.409	1.15	4.53	104.00	102	1.49	1604	0.14	0.42	40.0	286	30,580	27,392	38
4%	0.05	2513	2738	25.63	1139	0.405	1.00	4.20	104.00	102	1.29	1644	0.13	0.55	40.0	284	30,331	27,593	46
5%	0.06	2117	2315	21.67	1168	0.401	0.85	3.88	104.00	102	1.10	1682	0.13	0.68	40.0	282	30,096	27,781	53
6%	0.07	1789	1953	18.28	1195	0.398	0.72	3.59	104.00	102	0.94	1716	0.13	0.81	40.0	280	29,892	27,939	57
7%	0.08	1526	1657	15.51	1219	0.395	0.62	3.36	104.00	102	0.80	1743	0.13	0.93	40.0	278	29,723	28,066	61
8%	0.09	1317	1421	13.30	1239	0.393	0.53	3.17	104.00	103	0.69	1765	0.12	1.06	40.0	277	29,587	28,166	63
9%	0.10	1151	1234	11.55	1254	0.392	0.47	3.02	104.00	103	0.60	1783	0.12	1.18	40.0	276	29,477	28,244	65
10%	0.12	1018	1084	10.15	1267	0.390	0.41	2.90	104.00	103	0.53	1798	0.12	1.30	40.0	275	29,390	28,305	67
12%	0.14	825	922	8.63	1277	0.389	0.35	2.77	104.00	103	0.45	1814	0.24	1.54	40.0	274	29,292	28,371	69
14%	0.16	696	761	7.12	1288	0.387	0.29	2.64	104.00	103	0.37	1829	0.24	1.78	40.0	273	29,196	28,435	71
16%	0.18	606	651	6.09	1300	0.386	0.25	2.55	104.00	103	0.32	1840	0.24	2.02	40.0	273	29,130	28,479	72
18%	0.21	541	574	5.37	1307	0.385	0.22	2.48	104.00	103	0.28	1848	0.24	2.25	40.0	272	29,083	28,510	72
20%	0.23	493	517	4.84	1313	0.385	0.20	2.44	104.00	103	0.26	1853	0.24	2.49	40.0	272	29,049	28,532	73
22%	0.25	457	475	4.45	1317	0.385	0.18	2.40	104.00	103	0.23	1857	0.24	2.72	40.0	272	29,024	28,548	73
24%	0.28	429	443	4.15	1320	0.384	0.17	2.38	104.00	103	0.22	1861	0.23	2.96	40.0	271	29,004	28,561	73
26%	0.30	407	418	3.91	1322	0.384	0.16	2.35	104.00	103	0.21	1863	0.23	3.19	40.0	271	28,989	28,571	74
28%	0.32	389	398	3.73	1324	0.384	0.15	2.34	104.00	103	0.20	1865	0.23	3.43	40.0	271	28,976	28,578	74
30%	0.35	375	382	3.57	1325	0.384	0.15	2.32	104.00	103	0.19	1867	0.23	3.66	40.0	271	28,967	28,585	74
35%	0.40	348	361	3.38	1326	0.383	0.14	2.31	104.00	103	0.18	1869	0.58	4.25	40.0	271	28,954	28,593	74
40%	0.46	331	340	3.18	1328	0.383	0.13	2.29	104.00	103	0.17	1871	0.58	4.83	40.0	271	28,941	28,601	74
45%	0.52	319	325	3.04	1329	0.383	0.13	2.28	104.00	103	0.16	1872	0.58	5.41	40.0	271	28,932	28,607	75
50%	0.58	310	315	2.95	1330	0.383	0.12	2.27	104.00	103	0.16	1873	0.58	6.00	40.0	271	28,925	28,611	75
55%	0.63	304	307	2.88	1331	0.383	0.12	2.26	104.00	103	0.15	1874	0.58	6.58	40.0	271	28,921	28,613	75
60%	0.69	299	302	2.82	1332	0.383	0.12	2.26	104.00	103	0.15	1875	0.58	7.16	40.0	271	28,917	28,616	75
70%	0.81	292	296	2.77	1332	0.383	0.11	2.25	104.00	103	0.15	1875	1.17	8.33	40.0	271	28,914	28,618	75
80%	0.92	288	290	2.72	1332	0.383	0.11	2.25	104.00	103	0.14	1876	1.16	9.49	40.0	271	28,910	28,620	75
90%	1.04	285	286	2.68	1333	0.383	0.11	2.24	104.00	103	0.14	1876	1.16	10.66	40.0	271	28,908	28,621	75
100%	1.15	283	284	2.66	1333	0.383	0.11	2.24	104.00	103	0.14	1877	1.16	11.82	40.0	271	28,906	28,622	75
UNW	—	—	*25907*	*242.49*	*105*	*0.381*	*10.05*	*24.93*	104.00	93	*14.33*	148	—	—	—	*242*	25,907	(0)	—
Screen	—	—	*3899*	*36.49*	—	*0.400*	1.44	39.20	104.00	86	2.29	1245	—	*17.5*	*40.7*	236	25,245	21,348	—
w/fter	—	—	*3899*	*36.49*	*1095*	*0.415*	1.39	5.05	104.00	102	*1.81*	1541	—	*14.2*	*40.5*	*289*	30,918	27,019	—
Valve:	Open stroke for 13MOV-132																		

BWROG DCM for A Battery MOVs (ba... 2.0.xls, Output Plots, 2/19/02, 2:38 PM









Valve: Open stroke for 13MOV-132

125V DC Station Battery "A" Sizing & Voltage Drop
Appendix 9
Battery Sizing Sheets

SIZING LEAD-ACID BATTERIES FOR STATIONARY APPLICATIONS

IEEE Std 485-1997

Project: 71SB-1 (Min voltage 112.2V), LOCA — Date: 5/30/02 — Page: 1 of 1

Lowest Expected Electrolyte Temp: 65°F — Minimum Cell Voltage: 1.87 — Cell Mfg: GNB — Cell Type: NCN — Sized By: Brian Marks

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity at T Min Rate (6A) Amps/Pos (R_T) or (6B) K Factor (K_T)	(7) Required Section Size (3) ÷ (6A) = Positive Plates or (3) x (6B) = Rated Amp Hrs: Pos Values	Neg Values
Section 1 - First Period Only - If A2 is greater than A1, go to Section 2.							
1	A1= 737.56	A1-0= 737.56	M1= 1	T=M1= 1	63	11.71	***
					Sec 1 Total	11.71	***
Section 2 - First Two Periods Only - If A3 is greater than A2, go to Section 3.							
1	A1= 737.56	A1-0= 737.56	M1= 1	T=M1+M2= 120	38	19.41	
2	A2= 441.05	A2-A1= -296.51	M2= 119	T=M2= 119	38		7.80
					Sec Sub Total	19.41	7.80
					2 Total	11.61	***
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 Sub Total		
					3 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 Sub Total		
					4 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 Sub Total		
					5 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 Sub Total		
					6 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 Sub Total		
					7 Total		***
Random Equipment Load Only (if Needed)							
R	AR=	AR-0=	MR=	T=MR=			***

Maximum Section Size (8) 11.71 + Random Section Size (9) - = Uncorrected Size - (us) (10) 11.71

US (11) 11.71 x Temp Corr (12) 1.08 x Design Marg (13) 1.015 x Aging Factor (14) 1.25 = (15) 16

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

SIZING LEAD-ACID BATTERIES FOR STATIONARY APPLICATIONS

IEEE Std 485-1997

Project: 71SB-1 (Min voltage 111.6V),SBO | Date: 5/30/02 | Page: 1 of 1

Lowest Expected Electrolyte Temp: 60°F | Minimum Cell Voltage:1.888 | Cell Mfg: GNB | Cell Type: NCI Sized By: Brian Marks

(1) Period	(2) Load (amperes)	(3) Change in Load (amperes)	(4) Duration of Period (minutes)	(5) Time to End of Section (minutes)	(6) Capacity at T Min Rate (6A) Amps/Pos (R_T) or (6B) K Factor (K_T)	(7) Required Section Size (3) ÷ (6A) = Positive Plates or (3) x (6B) = Rated Amp Hrs: Pos Values	Neg Values
Section 1 - First Period Only - If A2 is greater than A1, go to Section 2.							
1	A1= 673.62	A1-0= 673.62	M1= 1	T=M1= 1	69	9.76	***
					Sec 1 Total	9.76	***
Section 2 - First Two Periods Only - If A3 is greater than A2, go to Section 3.							
1	A1= 673.62	A1-0= 673.62	M1= 1	T=M1+M2= 60	54	12.47	
2	A2= 489.77	A2-A1= -183.85	M2= 59	T=M2= 59	54		-3.40
					Sec Sub Total	12.47	-3.40
					2 Total	9.07	***
Section 3 - First Three Periods Only - If A4 is greater than A3, go to Section 4.							
1	A1= 673.62	A1-0= 673.62	M1= 1	T=M1+M2+M3= 90	46	14.64	
2	A2= 489.77	A2-A1= -183.85	M2= 59	T=M2+M3= 89	46		-4.00
3	A3= 269.12	A3-A2= -220.65	M3= 30	T=M3= 30	64		-3.45
					Sec Sub Total	14.64	-7.44
					3 Total	7.20	***
Section 4 - First Four Periods Only - If A5 is greater than A4, go to Section 5.							
1	A1= 673.62	A1-0= 673.62	M1= 1	T=M1+...M4= 238	26.5	25.42	
2	A2= 489.77	A2-A1= -183.85	M2= 59	T=M2+M3+M4= 237	26.5		-6.94
3	A3= 269.12	A3-A2= -220.65	M3= 30	T=M3+M4= 178	31.8		-6.94
4	A4= 167.45	A4-A3= -101.67	M4= 148	T=M4= 148	36		-2.82
					Sec Sub Total	25.42	-16.70
					4 Total	8.72	***
Section 5 - First Five Periods Only - If A6 is greater than A5, go to Section 6.							
1	A1= 673.62	A1-0= 673.62	M1= 1	T=M1+...M5= 240	26.5	25.42	
2	A2= 489.77	A2-A1= -183.85	M2= 59	T=M2+...M5= 238	26.5		-6.94
3	A3= 269.12	A3-A2= -220.65	M3= 30	T=M3+M4+M5= 180	31.8		-6.94
4	A4= 167.45	A4-A3= -101.67	M4= 148	T=M4+M5= 150	36		-2.82
5	A5= 223.61	A5-A4= 56.16	M5= 2	T=M5= 2	69	0.81	
					Sec Sub Total	26.23	-16.70
					5 Total	9.53	***
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 Sub Total		
					6 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 Sub Total		
					7 Total		***
Random Equipment Load Only (if Needed)							
R	AR=	AR-0=	MR=	T=MR=			***

Maximum Section Size (8) 9.76 + Random Section Size (9) - = Uncorrected Size - (us) (10) 9.76

US (11) 9.76 x Temp Corr (12) 1.08 x Design Marg (13) 1.22 x Aging Factor (14) 1.25 = (15) 16

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

125V DC Station Battery "A" 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
7[illegible]B-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
[illegible]3-2B-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 "A" 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 Section 3.9.E reads as follows:

"125 v DC power is supplied from two plant batteries each sized to supply the required equipment at design power following a loss-of-coolant accident with a concurrent loss of normal and reserve power. Each battery is provided with a charger sized to maintain the battery in a fully charged state while supplying normal operating loads."

- 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 4 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 may tend 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 are trip on low steam pressure (75PSIG).

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 (as in a DBA LOCA) 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 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). Therefore, swapover of HPCI and RCIC from CST to Torus will not be required (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 circuit 1ZLCN05 which prevents all of the reserve power feeds to each switchgear from closing (after a 3 second time delay).

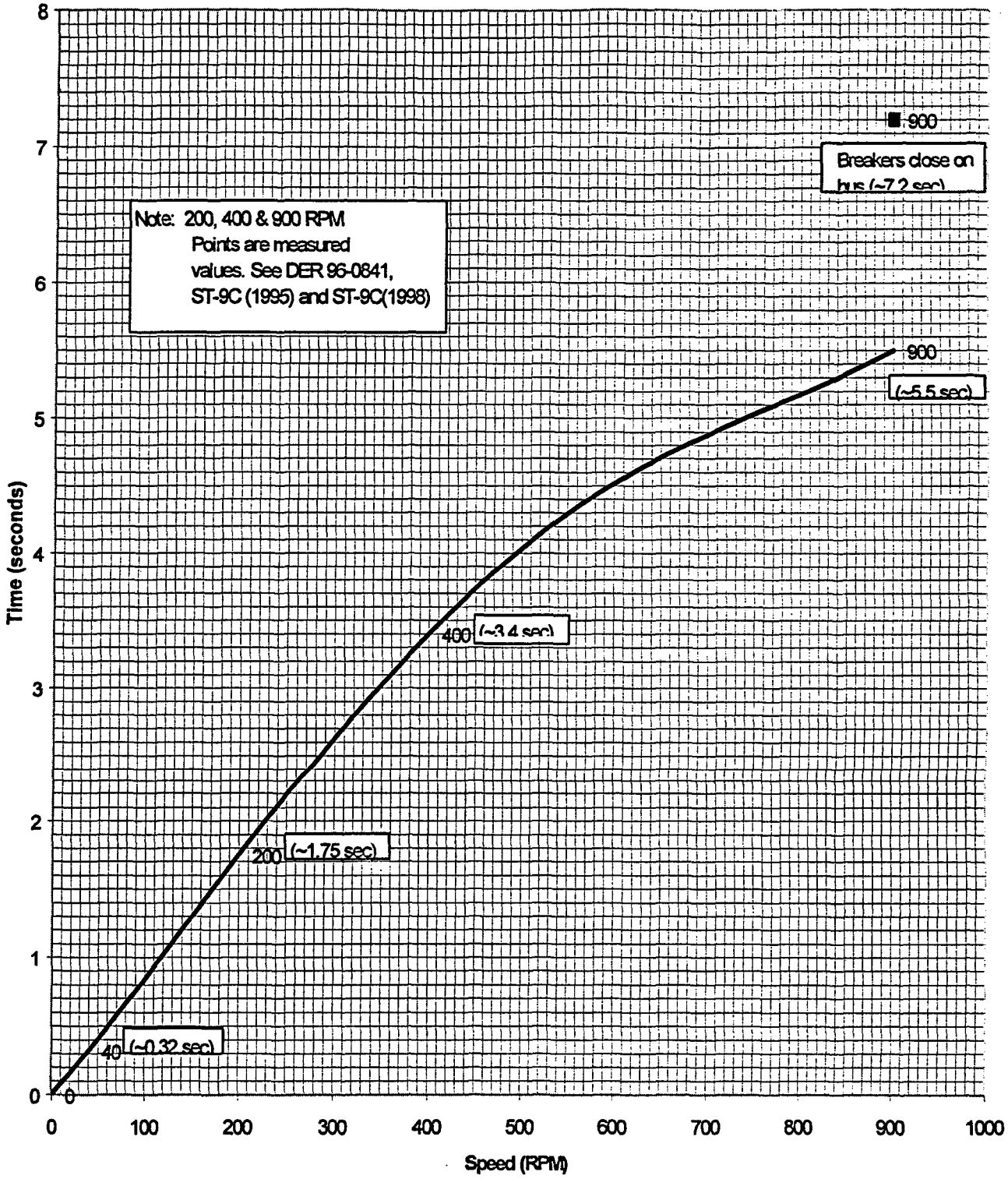
Since normal AC power is lost simultaneously with the LOCA a turbine trip would be anticipated due to loss of EHC pressure, loss of condenser vacuum, loss of Stator Water cooling or due to a Generator Reverse Power Trip (this causes a turbine customer trip). If the turbine tripped first on EHC pressure, 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 1UPRN07 or 1UPRN06 the Main Generator Exciter Breaker, 71-10102, 71-10302, 71-10042, and 71-10052 will trip. Additionally, the 10042 and 10052 mechanical backup trip initiating relays 71-62Z2/94B2-1YL1N14 and 71-62Z2/94B2-1YL1N11 will pickup but will time out before the backup trips. The initiating relay is the "62Z2" portion of these relays which are HGA type relays. These relays have at least a 2 cycle pickup (measured by testing). The tripping of the 10042 and 10052 breakers is 2 cycles. Therefore, relays 71-62Z2/94B2-1YL1N14 and 71-62Z2/94B2-1YL1N11 deenergize thru 50BF2/50BFN2 prior to initiating the backup trip circuit.

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 "A" 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 are assumed to be completed within 60 minutes. Since the actions are simple (i.e. opening lighting panel breakers and turning off pumps), it is reasonable to expect that this will occur before 60 minutes into the SBO scenario. This has been reviewed with Operations and they concur that this is a valid statement. This assumption is conservative and appropriate and does not need further verification.

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 10500 bus requires the reclosure of breaker # 10012 and the 4 kV from RSS T3, "through" 10300 to the 10500 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.

Operation of RCIC will 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 rector 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. This is consistent with conversations with Operations Training.

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. 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)).

125V DC Station Battery "A" 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 "A" Sizing & Voltage Drop
Appendix 14
125 V DC Motor Inrush Current Calculation

Short-circuit Characteristics of D-c Motors and Generators

Dec. 4, 1956

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.

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

New page.

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).

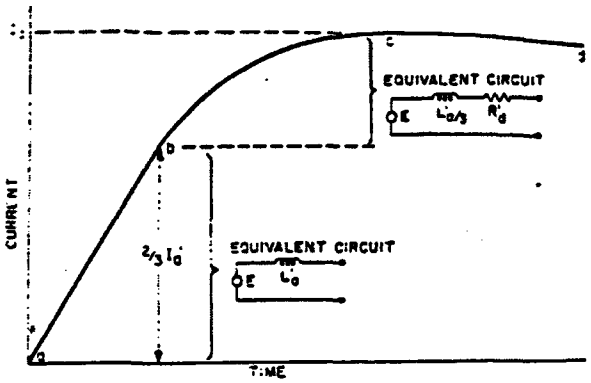


Fig. 1. Typical short-circuit characteristic of d-c motor or generator

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

$$di_a/dt = \frac{\sigma_a\, e_o}{r'_d} \qquad (4)$$

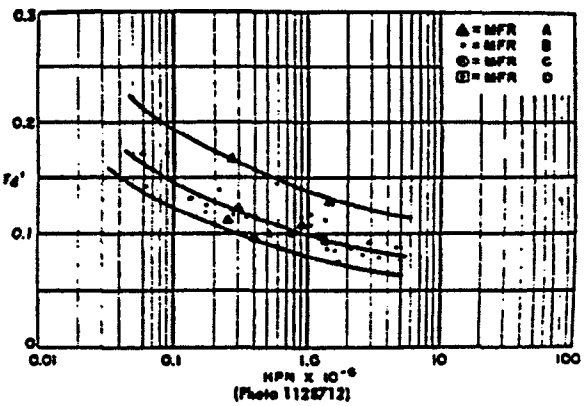
This expression can be written in a more readily usable form by noting that

$$\sigma_a = \frac{r'_d\, 2\pi f}{C_z} \qquad (7)$$

$$C_z = \frac{L'_a\, 2\pi P N_1\, I_a}{2 \times 60 \quad V_1} \qquad (8)$$

and

$$f = \frac{P N_1}{2 \times 60} \qquad (9)$$



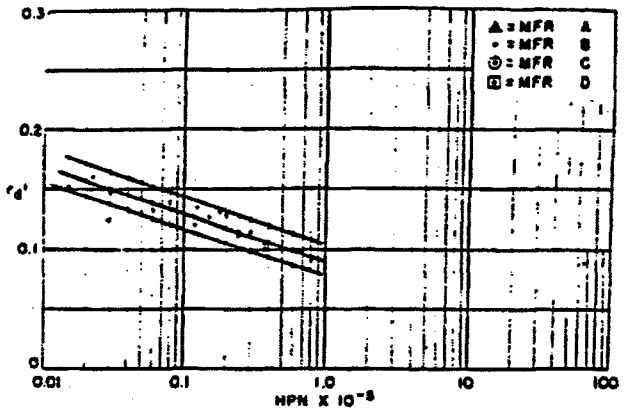
D-c Motor

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

New page.

Short-circuit Characteristics of D-c Motors and Generators

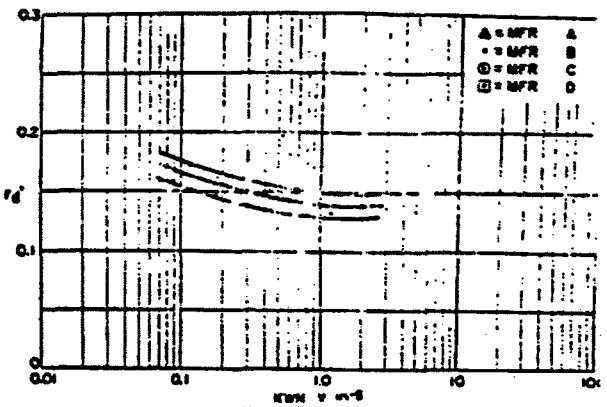


(Photo 1128711)

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

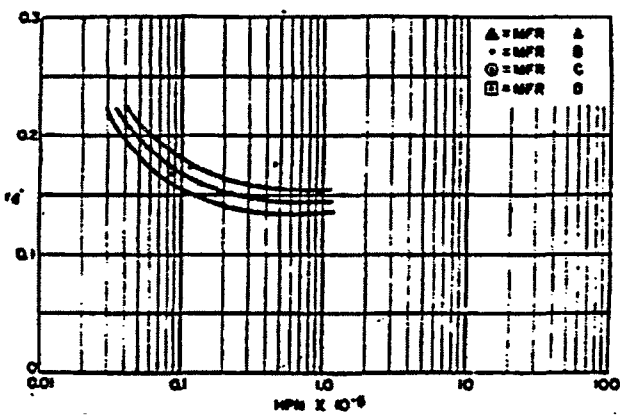


(Photo 1128710)

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

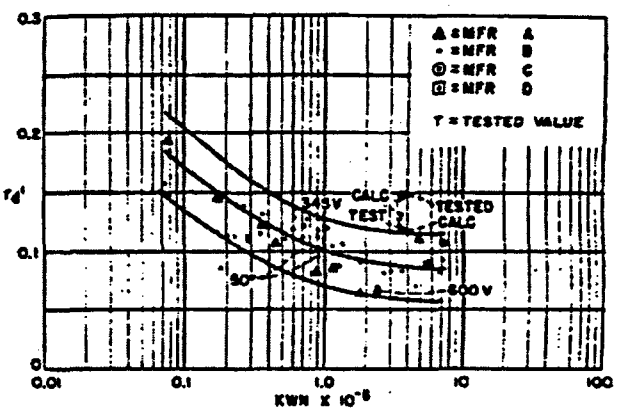


(Photo 1128709)

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)

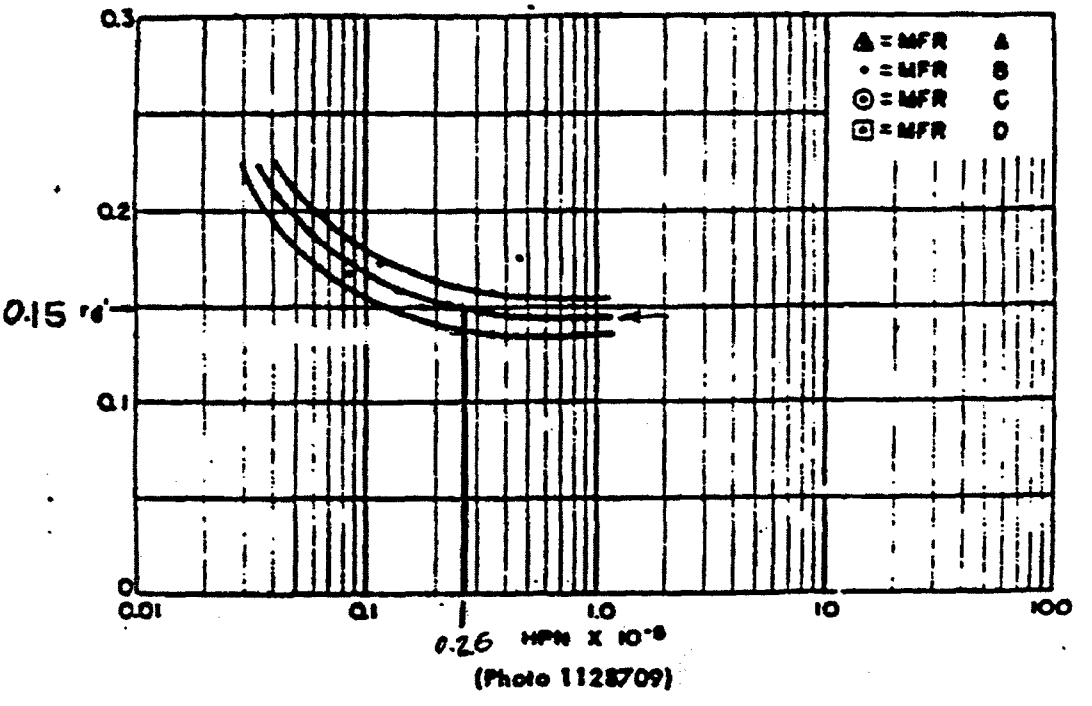
D-c Generator

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-7A(M) Inrush Current

Starter resistor 0-1 sec = 0.54 ohm
125 VDC FLA=58 Amp NEMA Enclosure TEFC 7.5 H. P 3500 RPM
H.P * Speed = 7.5 * 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 Amp
Equivalent motor resistance = 125 VDC / 386Amp = 0.32 ohm
Total inrush current that include starter resistance 0.54 ohm (Ref. drawing. 1.11-257)
125 VDC / (0.54 ohm +0.32 ohm) = 145 Amp
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.



D-c Motor

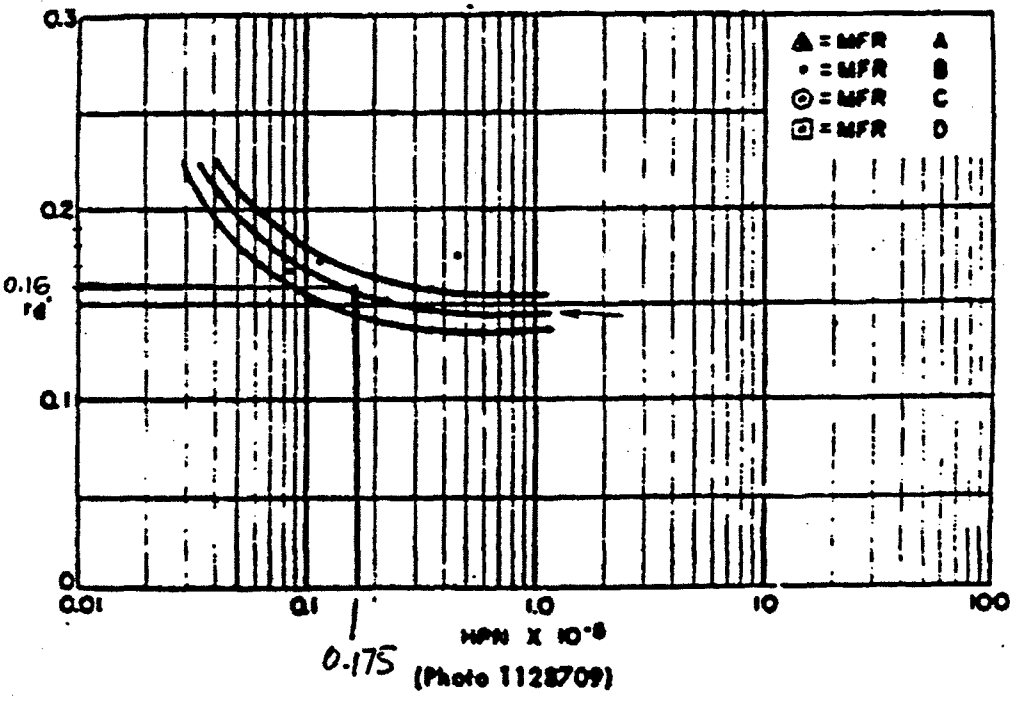
Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	115
Field winding	Shunt or compound wound

Fig. 4. Transient resistance of armature circuit in per-unit vs HPN, of machine

37P-7A Motor Per Unit Transient Effective Resistance

GE Motor 94P-13(M) Inrush Current

20 VDC FLA= 71 Amp NEMA Enclosure TEFC 10 H. P 1750 RPM
H.P * Speed = 10 * 1750 =17500 HPN 17,500 / 100,000 =0.175
From curve (Fig. 4) per unit transient effective resistance = 0.16 pu
Maximum short – circuit current = 71 / 0.16 = 444 Amp
Equivalent motor resistance = 120 VDC/444Amp =0.27 ohm
Total starting resistance in first step is .0.64ohms (0.42 + 0.22) per drawing 1.11-257. After 2 seconds the 0.42ohm resistor is shorted out for the second step. The remaining resistance for the second step is 0.22 ohms and is shorted out after 1 second (total of 3 seconds for starter resistances)
From 0 to 2 seconds the inrush current is 125 V DC / (0.64 ohm + 0.27ohm) =137.3Amp
Since counter EMF has developed after 2 seconds the equivalent motor resistance would be much greater than the calculated 0.27ohms and this methodology is not appropriate for the third second. In any case, 250% of FLA (177.5AMPS) is considerably higher than the calculated value and, therefore, is considered conservative and appropriate for this calculation. Although TIL-914 did not test this motor, the inrush durations last approximately 0.5 to 1 second longer than the timers for similar motors. Therefore, this calculation will use 4 seconds as the duration of the inrush (i.e. 3 seconds total timing circuit plus 1 second for margin).



D-c Motor

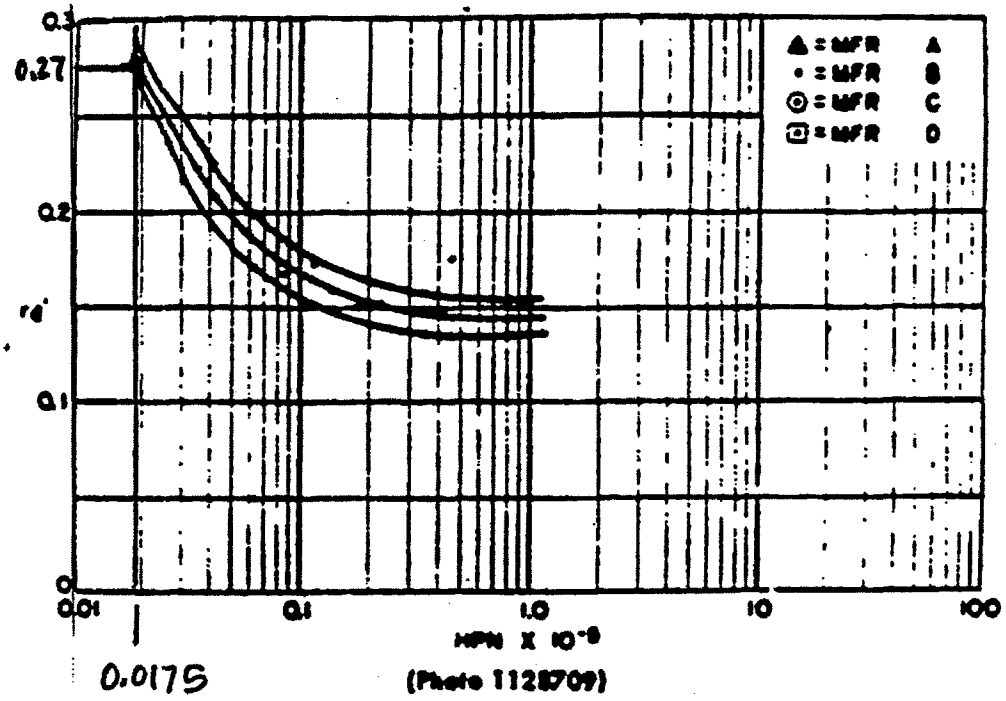
Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	115
Field winding	Shunt or compound wound

Fig. 4. Transient resistance of armature circuit in per-unit vs HPN, of machine

94P-13(M) Motor Per Unit Transient Effective Resistance

GE Motor 02-184P-3A(M) Inrush Current

tarter resistor - none
125 VDC FLA=7.45Amp NEMA Enclosure TENV 1 H. P 1750 RPM
H.P * Speed = 1*1750 =1750 HPN 1750 / 100,000 =0.0175
From curve (Fig. 4) per unit transient effective resistance = 0.27 pu
Maximum short – circuit current = 7.44 Amp / 0.27 pu = 27.5 Amp
Inrush current = 27.5 Amp



D-c Motor

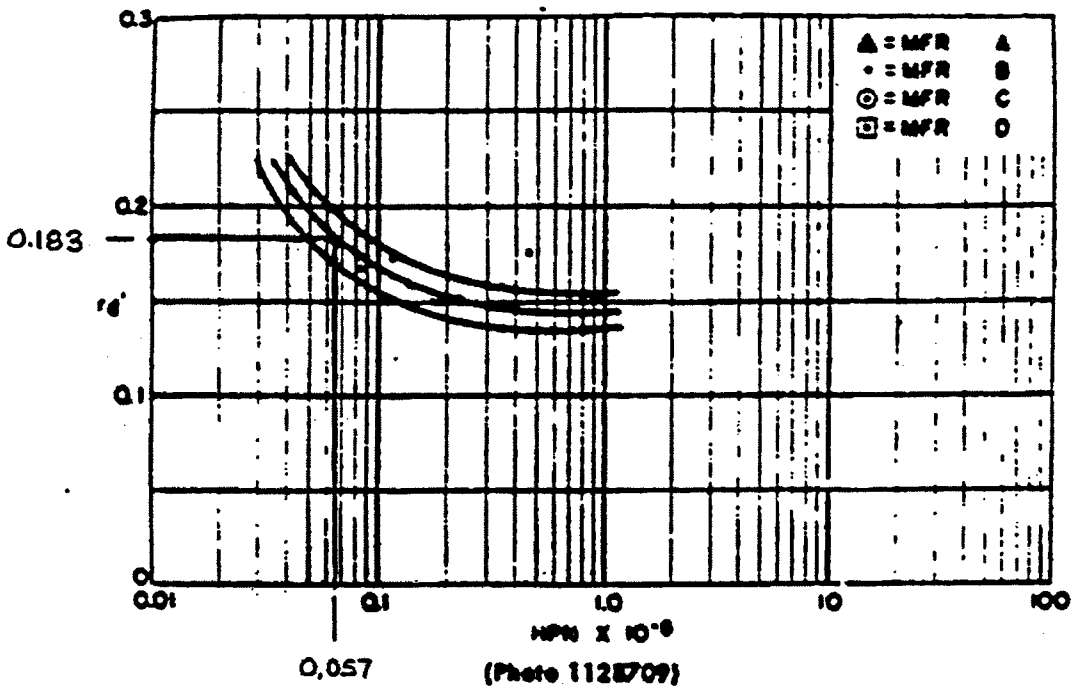
Pole face winding	No
Temp. rise	40 C
Loading	Continuous
Ventilation	Open
Speed	Constant
Volts, rated	115
Field winding	Shunt or compound wound

Fig. 4. Transient resistance of armature circuit in per-unit vs HPN, of machine

02-184P-3A(M) Motor Per Unit Transient Effective Resistance

GE Motor 13P-3A(M) Inrush Current

Starter resistor 0-1 sec = 1.6 ohm
125 VDC FLA=23 Amp NEMA Enclosure DPFG 3 H. P. 1900 RPM
H.P * Speed = 3*1900 = 5700 HPN 5700 / 100,000 =0.057
From curve (Fig. 4) per unit transient effective resistance = 0.183 pu
Maximum short – circuit current = 23 Amp / 0.183 pu = 126 Amp
Equivalent motor resistance = 125 VDC / 126 Amp = 0.99 ohm
Total inrush current that include starter resistance 125 VDC / (1.6 ohm + 0.99 ohm) = 48.2 Amp



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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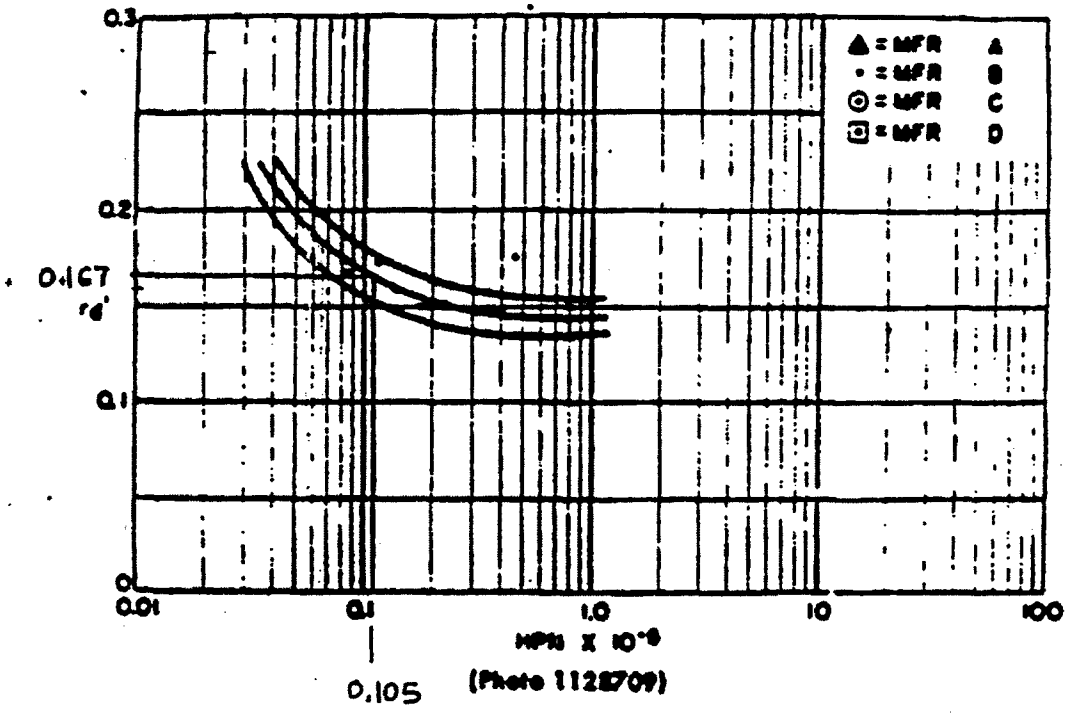
13P-3(M) Motor Per Unit Transient Effective Resistance

GE Motor 13P-4(M) Inrush Current

starter resistor 0-1 sec = 1.6 ohm
125 VDC FLA=21 Amp NEMA Enclosure DPFG 3 H. P. 3500 RPM
H.P * Speed = 3*3500 = 10500 HPN 10500 / 100,000 =0.105
From curve (Fig. 4) per unit transient effective resistance = 0.167 pu
Maximum short – circuit current = 21 Amp / 0.167 pu = 128 Amp
Equivalent motor resistance = 125 VDC / 128 Amp = 0.97 ohm
Total Inrush current that include starter resistance 125 VDC / (1.6 ohm + 0.97 ohm) = 48.6 Amp



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

13P-4(M) Motor Per Unit Transient Effective Resistance

125V DC Station Battery "A" Sizing & Voltage Drop
Appendix 15
RCIC MOV Sequencing

RCIC MOV Sequencing

- 13MOV-131 (RCIC Turbine Steam Inlet Valve) opens on Lo-Lo Reactor Level (126"). 13MOV-131 has approximately a 17.4 second stroke time. 13MOV-131 closes on Reactor High Level (218.2").

- 13MOV-21 (RCIC Pump Discharge Shutoff Valve) opens when 13MOV-131 is off its seat after a Reactor Lo-Lo has been initiated. For LOCA/LOOP, 13MOV-21 receives a closure signal on low reactor pressure (less than 75PSIG). In accordance with GE Report NEDC-31317P (SAFER/GESTR-LOCA), Revision 2, the shortest duration that 75PSIG (89.7PSIA) is reached is approximately 43 seconds after a DBA Suction Line Break (see Figure A-1b.). During an SBO, RCIC is manually controlled via the flow-indicating controller 13FIC-91 and 13MOV-30 to maintain reactor level and, therefore, this valve remains open (see Appendix 12).

- 13MOV-27 (RCIC Pump Min Flow Bypass) opens when the RCIC Pump discharge pressure of 125PSIG has been achieved. Based on a review of past ST-24J surveillance tests this takes approximately 4 seconds from the time 13MOV-131 has been given an open signal. 13MOV-27 has approximately a 4.8 second stroke time. 13MOV-27 will receive an automatic closure signal once RCIC flow has reached 80GPM. Based on reviews of past ST-24J, 80GPM is not reached until approximately 5.1 seconds. This closure signal cannot override the opening signal until the valve has fully opened because of the opening electrical seal-in. Therefore, at approximately 8.8 seconds after a Reactor Lo-Lo level has been received, 13MOV-27 will go closed. Although ST-24J discharges into the CSTs, restricting orifice 13RO-121 is installed in the test line to simulate an actual injection. Actual duration to reach 80 GPM may be faster in testing configuration than into the RPV, however, the open stroke time of the valve will dictate when the closure demand is signaled. Also, 13MOV-27 closes when 13MOV-131 is fully closed unless already closed.

- 13MOV-132 (RCIC Turbine Lube Oil Cooler Water Supply Isolation Valve) opens on Lo-Lo Reactor Level (126"). 13MOV-132 has only manual close control.

- For LOCA/LOOP, 13MOV-16 receives a closure signal on low reactor pressure (less than 75PSIG). In accordance with GE Report NEDC-31317P (SAFER/GESTR-LOCA), Revision 2, the shortest duration that 75PSIG (89.7PSIA) is reached is approximately 43 seconds after a DBA Suction Line Break (see Figure A-1b.). During an SBO, this valve remains open.

- 13MOV-30 is assumed to be opened at 30 minutes during an SBO to assist in reactor water level control. 30 Minutes is chosen because no credit can be taken for manual actions within 30 minutes.

MINOR CALCULATION CHANGE FORM

Calculation No.: JAF-CALC-ELEC-02609 **Revision:** 2

Minor Calculation Change No.: DRN-03-01865

1 Purpose of Change:
Equivalent Change JE-03-112 will replace all obsolete Square D Relays 8501KPD13 relays in EDG 93FPAC, 93ECP-A & 93ECP-C Panels. This MCC will also revised relay 8501KPD13V63 data to Appendix 5

2 SSC affected:
See Attached on Page 2

3 Drawings/Procedures/ Calculations affected
JAF-CALC-ELEC-02609, 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 "A" 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:** 10/8/03
Reviewed by: *	Steve Glover	S. W. Glover	**Date:** 10/8/03
Approved by	Gerry Caccavale	G. Caccavale	**Date:** 10/8/03

- Where the original calculation was design verified, the reviewer signature confirms the latest design verification is still valid.
-

2. **SSC affected :**

@ Panel 93FPAC:

93-TBRX1-1EDGA13
93-TBRX2-1EDGA13
93-VSRX1-1EDGA13
93-VSRX2-1EDGA13
93-GFR-1EDGA13

@ Panel 93ECP-A:

93-TBR-1EDGA12
93-K4-1EDGA12
93-VSR-1EDGA12

@ Panel 93ECP-C:

93-TBR-1EDGC12
93-K4-1EDGC12
93-VSR-1EDGC12

Entergy

125V DC STATION BATTERY "A" SIZING & VOLTAGE DROP
JAF-CALC-ELEC-02609 Rev. 2

Appendix 2
Page 11 of 32
Computed by: A. Barton
Checked by: S. Kim

DRN-03-01865

PANEL 71DC-A4

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	LOTC1	600V SWGR Test Cab	N/A	N/A	N/A	N/A	N/A			II/III	FE-1AH	1
2	93FPAC	Force Paralleling Cntl Pnl										
	TBRX1	Start Tie Brk Control	1.85 sec	120 min	N/A	0.02	125	3	Resistance	I	ESK-11BE	
	TBRX2	Start Tie Brk Permissive	1.85 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD8M	EDG A & C Force Parallel	1.90 sec	120 min	N/A	0.06	125	8	Resistance	I		
	VSRX1	EDG A Start Field Flashing	3.52 sec	120 min	N/A	0.02	125	3	Resistance	I		
	VSRX2	EDG C Start Field Flashing	3.52 sec	120 min	N/A	0.02	125	3	Resistance	I		
	GFR	EDG A & C Field Flashing	3.54 sec	6.6 sec	N/A	0.02	125	3	Resistance	I		
	TD9M	EDG A & C Force Parallel	3.54 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD9X	EDG A & C Force Parallel	6.54 sec	120 min	2.26	0.14	120	N/A	Resistance	I		
		Continuous Control	0 sec	120 min	N/A	0.094	125	11.75	Resistance			
3	HOTC3	4160V Bkr Test	N/A	N/A	N/A	N/A	N/A			II/III	FE-1AH	1
4	M/G EX	Main Gen Excitation	0.1 sec	1 min	2.61	0.44	125		Resistance	II/III	ESK-8DB	5
		Continuous Control	0 sec	120 min	N/A	0.44	125	55	Resistance			
8	Panel HO5	4160V Emerg SWGR Bus	(See details on Sheet Panel HO5)							I	FE-1AM	
11	93ECP-A	EDG "A" Ctrl & Ann										
	K1-1EDGA12	Auto Start	0.1 sec	120 min	2.26	0.15	120	N/A	Resistance	I	ESK-11BA	
	TBR-1EDGA12	Remote Start	1.8 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD6-1EDGA12	Engine Start Interlock	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD7-1EDGA12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	K4-1EDGA12	Loss of Gen Field	3.5 sec	120 min	N/A	0.02	125	3	Resistance	I		
	FFR-1EDGA12	Field Flash	3.56 sec	120 min	1.41	0.14	125	N/A	Resistance	I		
	VSR-1EDGA12	Volt Speed	3.56 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD5-1EDGA12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.06	125	8	Resistance	I	ESK-11BB	
	SOV-1A	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	SOV-2A	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	13	Resistance	I		10
	K2-1EDGA12	Gov. Booster Pump	0.2 sec	1.75 sec	2.10	0.15	125	N/A	Resistance	I		
	ESR40-1EDGA12	40 RPM Speed Relay	0.32 sec	120 min	2.26	0.15	120	N/A	Resistance	I		
	ESR200-1EDGA12	200 RPM Speed Relay	1.75 sec	120 min	2.26	0.14	125	N/A	Resistance			
	ESR400-1EDGA12	400 RPM Speed Relay	3.4 sec	120 min	2.26	0.14	125	N/A	Resistance	I		
	C2-1EDGA12	Fuel Oil Prime Pump	0.2 sec	120 min	2.10	0.15	125	N/A	Resistance	I	ESK-11BC	
	TD10-1EDGA12	Loss of Field	3.52 sec	3.58 sec	N/A	0.06	125	8	Resistance	I		

PANEL 71DC-A4 (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 (Cont'd)	93ECP-A	EDG "A" Ctrl & Ann (Cont'd)										
	TD1-1EDGA12	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.064	125	8	Resistance	I	ESK-11BC	
	ETM-1EDGA12	Run Time Indicator	0.2 sec	120 min	0.50	N/A	120	N/A	VA	I		11
	93GS-5A	EDG "A" Booster Pump Inrush	0.3 sec	1.3 sec	40.00	N/A	115		Resistance	I		2,3
		EDG "A" Booster Pump F.L.	1.3 sec	1.75 sec	N/A	9.00	115	1035	VA			
	93P-4A	EDG "A" Fuel Oil pump Inrush	0.3 sec	1.3 sec	6.64	N/A	120		VA	I		2,3
		EDG "A" Fuel Oil pump F.L.	1.3 sec	120 min	N/A	4.44	120	533	VA			
	ESS-1EDGA12	Speed Switch	0.32 sec	120 min	N/A	0.04	125		Resistance	I		4
	62--1EDGA12	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	12.41	Resistance			
	93EGP-A	Gen "A" Cont Panel										
	EDG "A" FF	EDG "A" Field Flash	3.6 sec	6.6th sec	N/A	41.09	125	5136	Resistance	I	ESK-8HE	9
	K2/VR-1EDGA25	Auto Field Flash	3.58 sec	6.6th sec	N/A	0.14	115	16	Resistance	I	1.12-41	
	TDVR-1EDGA25	Field Shutdown	3.58 sec	6.6th sec	N/A	0.06	125	8	Resistance	I	1.12-41	
	93P/S-A	P/S for EG-M Control	0 sec	120 min	N/A	0.31	125	39.28	VA	I	ESK-8HF	7
		Continuous Control	0 sec	120 min	N/A	0.31	125	38.89	Resistance			8
12	93ECP-C	EDG "C" Ctrl & Ann										
	K1-1EDGC12	Auto Start	0.1 sec	120 min	2.26	0.15	120	N/A	Resistance	I	ESK-11BF	
	TBR-1EDGC12	Remote Start	1.8 sec	120 min	N/A	0.02	125	3	Resistance	I		
	TD6-1EDGC12	Engine Start Interlock	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	TD7-1EDGC12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.06	125	8	Resistance	I		
	K4-1EDGC12	Loss of Gen Field	3.5 sec	120 min	N/A	0.02	125	3	Resistance	I		

Entergy

125V DC STATION BATTERY "A" SIZING and VOLTAGE DROP
JAF-CALC-02609 Rev. 2

Appendix 4
Page 2 of 2
Computed by: A. Barton
Checked by: S. Kim

LOCA w/LOOP

DRN-03-01865

Panel	Load I.D.	Load Description	Period Range: Start Time	Time Period No.: From: To: Start Time: Stop Time	Rated Inrush Current	Rated Current	Rated Voltage	Req'd Min. Voltage LOAD	PICK UP Available Voltage LOCA	Pick up Margin
BATTERY 71SB-1			reset						117.60	
71DC-A4										
02	93FPAC	Force Paralleling Cntl Pnl			N/A	0.08	125	N/A	107.27	N/A
	TBRX1	Start Tie Brk Cnt	1.85 sec	120 min	N/A	0.024	125	93.75	107.26	13.51
	TBRX2	Start Tie Brk Permissive	1.85 sec	120 min	N/A	0.02	125	93.75	107.26	13.51
	TD8M	93EDG A & C Force Parallel	1.90 sec	120 min	N/A	0.064	125	100	107.15	7.15
	VSRX1	93EDG A Start Field Flashing	3.82 sec	120 min	N/A	0.024	125	93.75	107.96	14.31
	VSRX2	93EDG C Start Field Flashing	3.82 sec	120 min	N/A	0.024	125	93.75	107.96	14.31
	GFR	93EDG A & C Field Flashing	3.54 sec	6.6 sec	N/A	0.024	125	93.75	107.93	14.18
	TD8M	93EDG A & C Force Parallel	3.54 sec	120 min	N/A	0.064	125	100	107.63	7.63
	TD8X	93EDG A & C Force Parallel	6.54 sec	120 min	2.26	0.1445	120	75.6	105.96	30.36
04	M/G EX	Main Gen Excitation	0.1 sec	1 min	2.61	6.44	125.00	N/A	104.05	N/A
06		Panel 71HO5						70	117.20	47.20
11	93ECP-A	EDG "A" Cirl & Ann	0 sec	120 min	N/A	0.064	125	N/A	111.10	N/A
	K1-1EDGA12	K1 Auto Start	0.1 sec	120 min	2.3	0.15	120	78.75	103.51	24.76
	TBR-1EDGA12	Remote Start	1.8 sec	120 min	N/A	0.02	125	93.75	105.15	11.40
	TD6-1EDGA12	Engine Start Interlock	1.8 sec	120 min	N/A	0.06	125	100	105.15	5.15
	TD7-1EDGA12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.06	125	100	105.15	5.15
	K4-1EDGA12	Loss of Gen Field	3.5 sec	120 min	N/A	0.02	125	93.75	105.82	12.07
	FFR-1EDGA12	Field Flash	3.56 sec	120 min	1.4	0.14	125	75.6	105.38	29.78
	VSR-1EDGA12	Volt Speed	3.56 sec	120 min	N/A	0.02	125	93.75	105.82	12.07
	TD5-1EDGA12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.06	125	100	110.33	10.33
	SOV-1A	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.10	125	90	110.31	20.31
	SOV-2A	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.10	125	90	110.32	20.32
	K2-1EDGA12	Gov. Booster Pump	0.2 sec	1.75 sec	2.1	0.15	125.00	62.5	110.33	47.83
	ESR40-1EDGA12	40 RPM Speed Relay	0.32 sec	120 min	2.3	0.15	120	78.75	96.58	17.83
	ESR200-1EDGA12	200 RPM Speed Relay	1.75 sec	120 min	2.3	0.14	125	78.75	101.94	23.19
	ESR400-1EDGA12	400 RPM Speed Relay	3.4 sec	120 min	2.3	0.14	125	78.75	105.82	27.07
	C2-1EDGA12	Fuel Oil Prime Pump	0.2 sec	120 min	2.1	0.15	125.00	62.5	110.33	47.83
	TD10-1EDGA12	Loss of Field	3.52 sec	3.58 sec	N/A	0.06	125	100	106.47	6.47
	TD1-1EDGA12	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.06	125	100	106.47	6.47
	ETM-1EDGA12	Run Time Indicator	0.2 sec	120 min	0.5	N/A	120.00	N/A	N/A	N/A
	93GS-5A	EDG "A" Booster Pump	0.3 sec	1.75 sec	40	9.00	115.00	92	96.36	3.36
	93P-4A	EDG "A" Fuel Oil pump	0.3 sec	120 min	6.64	4.44	120.00	96	96.96	0.96
	ESS-1EDGA12	Speed Switch	0.32 sec	120 min	N/A	0.04	125	90	101.94	11.94
	62-1EDGA12	High Circulating Current	3.58 sec	120 min	N/A	0.06	125	100	106.00	6.00
	93EGP-A	Gen "A" Cont Panel	0 sec	120 min			125	N/A	117.25	N/A
	EDG "A" FF	EDG "A" Field Flash	3.6 sec	6.6th sec	N/A	41.00	125	90	101.76	11.76
	K2/VR-1EDGA25	Auto Field Flash	3.58 sec	6.6th sec	N/A	0.14	115	92	107.84	15.84
	TDVR-1EDGA25	Field Shutdown	3.58 sec	6.6th sec	N/A	0.06	125	100	107.84	7.84
	93P/S-A	P/S for EG-M Control	0 sec	120 min	N/A	0.31	125	85	116.97	31.97
12	93ECP-C	EDG "C" Cirl & Ann	0 sec	120 min	N/A	0.15	125	N/A	111.20	N/A
	K1-1EDGC12	Auto Start	0.1 sec	120 min	2.3	0.145	120	78.75	103.60	24.85
	TBR-1EDGC12	Remote Start	1.8 sec	120 min	N/A	0.024	125	93.75	105.44	11.69
	TD6-1EDGC12	Engine Start Interlock	1.8 sec	120 min	N/A	0.064	125	100	105.44	5.44
	TD7-1EDGC12	Engine Start Raw Wtr	1.8 sec	120 min	N/A	0.064	125	100	105.44	5.44
	K4-1EDGC12	Loss of Gen Field	3.5 sec	120 min	N/A	0.024	125	93.75	106.19	12.44
	FFR-1EDGC12	Field Flash	3.56 sec	120 min	1.41	0.14	125	75.6	105.83	30.23
	VSR-1EDGC12	Volt Speed	3.5 sec	120 min	N/A	0.024	125	93.75	106.19	12.44
	TD5-1EDGC12	Diesel Fail to Start	0.2 sec	1.75 sec	N/A	0.064	125	100	105.44	5.44
	SOV-1C	Air Start Right Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	90	110.52	20.52
	SOV-2C	Air Start Left Solenoid	0.2 sec	1.75 sec	N/A	0.104	125	90	110.32	20.32
	K2-1EDGC12	Gov. Booster Pump	0.2 sec	1.75 sec	2.10	0.154	125	62.5	110.55	48.05
	ESR40-1EDGC12	40 RPM Speed Relay	0.32 sec	120 min	2.26	0.145	120	78.5	98.25	19.75
	ESR200-1EDGC12	200 RPM Speed Relay	1.75 sec	120 min	2.26	0.14	125	78.5	98.79	20.29
	ESR400-1EDGC12	400 RPM Speed Relay	3.4 sec	120 min	2.26	0.14	125	78.5	98.79	20.29
	C2-1EDGC12	Fuel Oil Prime Pump	0.2 sec	120 min	2.10	0.154	125	62.5	110.55	48.05
	TD10-1EDGC12	Loss of Field	3.52 sec	3.58 sec	N/A	0.064	125	100	105.44	5.44
	TD1-1EDGC12	Gov. Solenoid TD	0.2 sec	120 min	N/A	0.064	125	100	105.44	5.44
	ETM-1EDGC12	Run Time Indicator	0.2 sec	120 min	0.5	N/A	120	N/A	N/A	N/A
	93GS-5C	EDG "C" Booster Pump	0.3 sec	1.75th sec	40	9.00	115	92	96.95	4.95
	93P-4C	EDG "C" Fuel Oil Pump	0.3 sec	120 min	7	4.44	120.00	96	98.59	2.59
	ESS-1EDGC12	Speed Switch	0.32 sec	120 min	N/A	0.040	125	90	102.69	12.69
	62-1EDGC12	High Circulating Current	3.58 sec	120 min	N/A	0.064	125	100	106.35	6.35
	93EGP-C	Gen "C" Cont Panel	0 sec	120 min			125		102.38	N/A
	EDG "C" FF	EDG "C" Field Flash	3.6 sec	6.6 sec	N/A	41.33	125	90	102.38	12.38
	K2/VR-1EDGC25	Auto Field Flash	3.58 sec	6.6 sec	N/A	0.14	115	92	107.84	15.84
	TDVR-1EDGC25	Field Shutdown	3.58 sec	6.6 sec	N/A	0.06	125	100	107.84	7.84
	93P/S-C	P/S for EG-M Control	0 sec	120 min	N/A	0.36	125	85	116.99	31.99

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125V DC STATION BATTERY "A" SIZING & VOLTAGE DROP

Appendix 6
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
IC28001607	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	II/III
IC2800A1607D3G	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	I
IC2800A1607F3J	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	I
IC28001612	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	II/III
IC2800A1617B3H	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	I
IC2800A1607F3H	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	I
IC2800A1607F3J	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	I
IC28001617AB3H	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	I
IC28001617AB3J	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	I
IC28001617AD3G	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	I
IC2800A501AB23C	GE	See Design Input 2.22 & E-Mail from GE 12/19/01	120	75.60	9.60	I
IC28001621AM3H	GE	See Design Input 2.19 & 2.20	120	78.00	18.00	II/III
IC2800A501AB23C	GE	See Design Input 2.22 & E-Mail from GE 12/19/01	120	75.60	9.60	II/III
IC2820A100BB3J	GE	See Design Input 2.23	120	75.60	24.00	II/III
IC2820A100BB3K	GE	See Design Input 2.23	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
12HFA154E221	GE	G080-1269	125	76.25	76.25	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
700-RTC	Allen-Bradley	JE-03-024	120	96.00	60.00	I
SAM17A	GE	G080-0576	125	62.50	62.50	I

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125V DC STATION BATTERY "A" SIZING & VOLTAGE DROP
JAF-CALC-ELEC-02609 Rev. 2

Appendix 5
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Computed by: A. Barton
Checked by: B. Marks

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PANEL 71DC-A4 for LOCA PICK UP & DROP OUT VOLTAGES (cont'd)

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Ref.	Component Nominal Voltage	Component Pickup Voltage	Component Dropout Voltage	LOCA Pickup Minimum Voltage	LOCA Pickup Margin	LOCA Pickup Pickup Acceptable	LOCA Dropout Minimum Voltage	LOCA Dropout Margin	LOCA Dropout Dropout Acceptable
12	93ECP-C	EDG "C" Ctrl & Ann													
	K1-1EDGC12	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	103.60	24.85	YES	94.98	51.23	YES
	TBR-1EDGC12	Tie Brk	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.44	11.69	YES	101.56	51.56	YES
	TD6-1EDGC12	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	105.44	5.44	YES	101.56	89.06	YES
	TD7-1EDGC12	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	105.44	5.44	YES	101.56	89.06	YES
	K4-1EDGC12	Loss of Gen Field	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	106.19	12.44	YES	101.56	51.56	YES
	FFR-1EDGC12	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	105.83	27.08	YES	101.51	57.76	YES
	VSR-1EDGC12	Volt Speed	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	106.19	12.44	YES	101.56	51.56	YES
	TD5-1EDGC12	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	105.44	5.44	YES	95.43	82.93	YES
	SOV-1C	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	110.52	20.52	YES	95.41	5.41	YES
	SOV-2C	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	110.32	20.32	YES	95.42	5.42	YES
	K2-1EDGC12	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	110.55	48.05	YES	95.43	57.93	YES
	ESR40-1EDGC12	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	98.25	19.50	YES	95.43	51.68	YES
	ESR200-1EDGC12	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	98.79	20.04	YES	101.56	57.81	YES
	ESR400-1EDGC12	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	98.79	20.04	YES	101.56	57.81	YES
	C2-1EDGC12	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	110.55	48.05	YES	95.43	57.93	YES
	TD10-1EDGC12	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	105.44	5.44	YES	106.35	93.85	YES
	TD1-1EDGC12	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	105.44	5.44	YES	95.43	82.93	YES
	93GS-5C	EDG "C" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	96.95	4.95	YES	102.14	N/A	N/A
	93P-4C	EDG "C" Fuel Oil Pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	98.59	2.59	YES	101.37	N/A	N/A
	ESS-1EDGC12	Speed Switch	I	Synchro-Start	ESSB-4AT	Technical Manual M494-0254	100-140	90	90	102.69	12.69	YES	95.42	5.42	YES
	62-1EDGC12	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	106.35	6.35	YES	101.56	89.06	YES
	93EGP-C	Gen "C" Cont Panel													
	EDG "C" FF	EDG "C" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27	125	90	90	102.38	12.38	YES	102.77	12.77	YES
	K2/VR-1EDGC25	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	107.84	15.84	YES	102.38	10.38	YES
	TDVR-1EDGC25	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	107.84	7.84	YES	102.38	89.88	YES
	93P/S-C	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	110-370	85	85	116.99	31.99	YES	95.21	10.21	YES

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PANEL 71DC-A4 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Ref.	Component Nominal Voltage	Component Pickup Voltage	Component Dropout Voltage	LOCA Pickup Minimum Voltage	LOCA Pickup Margin	LOCA Pickup Pickup Acceptable	LOCA Dropout Minimum Voltage	LOCA Dropout Margin	LOCA Dropout Dropout Acceptable
02	93FPAC	Force Paralleling Cntl Pnl													
	TBRX1	Start Tie Brk Control	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	107.26	13.51	YES	102.80	52.80	YES
	TBRX2	Start Tie Brk Permissive	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	107.26	13.51	YES	102.80	52.80	YES
	TD8M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	107.15	7.15	YES	102.80	90.30	YES
	VSRX1	EDG A Start Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	107.96	14.21	YES	102.81	52.81	YES
	VSRX2	EDG C Start Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	107.96	14.21	YES	102.81	52.81	YES
	GFR	EDG A & C Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	107.93	14.18	YES	102.81	52.81	YES
	TD9M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	107.93	7.93	YES	102.81	90.31	YES
	TD9X	EDG A & C Force Parallel	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	105.96	27.21	YES	105.03	61.28	YES
04	M/G EX	Main Gen Excitation	II/III	GE	CR9500A204B13A	E-MAIL from GE 07/10/2000	125	N/A	N/A	2.61	N/A	N/A	N/A	N/A	N/A
08	71HO5	4160V Emerg Bus Close	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	100.79	30.79	YES	100.79	30.79	YES
		4160V Emerg Bus Trip	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	100.79	30.79	YES	100.79	30.79	YES
11	93ECP-A	EDG "A" Ctrl & Ann													
	K1-1EDGA12	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	103.51	24.76	YES	93.43	49.68	YES
	TBR-1EDGA12	Tie Brk	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.15	11.40	YES	101.25	51.25	YES
	TD6-1EDGA12	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	105.15	5.15	YES	101.25	88.75	YES
	TD7-1EDGA12	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	105.15	5.15	YES	101.25	88.75	YES
	K4-1EDGA12	Loss of Gen Field	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.82	12.07	YES	101.25	51.25	YES
	FFR-1EDGA12	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	105.38	26.63	YES	101.19	57.44	YES
	VSR-1EDGA12	Volt Speed	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.82	12.07	YES	101.25	51.25	YES
	TD5-1EDGA12	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	110.33	10.33	YES	93.87	81.37	YES
	SOV-1A	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	110.31	20.31	YES	93.85	3.85	YES
	SOV-2A	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	110.32	20.32	YES	93.86	3.86	YES
	K2-1EDGA12	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	110.33	47.83	YES	93.87	56.37	YES
	ESR40-1EDGA12	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	96.58	17.83	YES	93.87	50.12	YES
	ESR200-1EDGA12	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	101.94	23.19	YES	101.25	57.50	YES
	ESR400-1EDGA12	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	105.82	27.07	YES	101.25	57.50	YES
	C2-1EDGA12	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	110.33	47.83	YES	93.87	56.37	YES
	TD10-1EDGA12	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	106.47	6.47	YES	106.00	93.50	YES
	TD1-1EDGA12	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	106.47	6.47	YES	93.87	81.37	YES
	93GS-5A	EDG "A" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	95.36	3.36	YES	101.38	9.38	YES
	93P-4A	EDG "A" Fuel oil pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	96.98	0.98	YES	101.06	5.06	YES
	ESS-1EDGA12	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	101.94	11.94	YES	93.86	3.86	YES
	62--1EDGA12	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	106.00	6.00	YES	101.25	88.75	YES
	93EGP-A	Gen "A" Cont Panel													
	EDG "A" FF	EDG "A" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27	125	90	90	101.78	11.78	YES	102.18	12.18	YES
	K2/VR-1EDGA25	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	107.84	15.84	YES	101.78	9.78	YES
	TDVR-1EDGA25	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	107.84	7.84	YES	101.78	89.28	YES
	93P/S-A	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	110-370	85	85	116.97	31.97	YES	93.64	8.64	YES

PANEL 71DC-A4 for SBO PICK UP & DROP OUT VOLTAGES

DRN-03-01865

Compt No.	I.D.	Load Description	Q.A. Cat.	MFG	Model No.	Ref.	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 Acceptable
02	93FPAC	Force Paralleling Cntl Pnl													
	TBRX1	Start Tie Brk Control	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.46	11.71	YES	103.11	53.11	YES
	TBRX2	Start Tie Brk Permissive	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.46	11.71	YES	103.11	53.11	YES
	TD8M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	105.46	5.46	YES	103.11	90.61	YES
	VSRX1	EDG A Start Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.46	11.71	YES	103.11	53.11	YES
	VSRX2	EDG C Start Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.46	11.71	YES	103.11	53.11	YES
	CRF	EDG A & C Field Flashing	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	105.46	11.71	YES	103.11	53.11	YES
	TD9M	EDG A & C Force Parallel	I	Agastat	E7014PC	A348-C008	125	100	12.5	105.46	5.46	YES	103.11	90.61	YES
	TD9X	EDG A & C Force Parallel	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 6/10/97	125	78.75	43.75	105.46	26.71	YES	103.11	59.36	YES
04	94GEN-EX	41TC Triping Solenoid	II/III	GE	CR9500A204B13A	E-MAIL from GE 07/10/2000	125	N/A	N/A	105.92	N/A	N/A	96.66	N/A	N/A
08	71HO5	4160V Emerg Bus Close	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	113.57	43.57	YES	N/A	N/A	N/A
		4160V Emerg Bus Trip	I	GE	MC-4.76	JDED-00-0290 10/04/00	125	70	70	113.57	43.57	YES	N/A	N/A	N/A
11	93ECP-A	EDG "A" Ctrl & Ann													
	K1	Auto Start	I	GE	CR2811 Coil 22D135G641	Telecon with GE Dated 06/10/97	125	78.75	43.75	111.70	32.95	YES	96.69	52.94	YES
	TBR	Tie Brk	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	111.70	17.95	YES	96.69	46.69	YES
	TD6	Engine Start Interlock	I	Agastat	E7012PD	A348-C008	125	100	12.5	111.70	11.70	YES	96.69	84.19	YES
	TD7	Engine Start Raw Wtr	I	Agastat	E7012PD	A348-C008	125	100	12.5	111.70	11.70	YES	96.69	84.19	YES
	K4	Loss of Gen Field	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	111.70	17.95	YES	96.69	46.69	YES
	FFR	Field Flash	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	111.70	32.95	YES	96.69	52.94	YES
	VSR	Volt Speed	I	Square D	8501KPD13V63	S345-C006 & App. 8	125	93.75	50	111.70	17.95	YES	96.69	46.69	YES
	TD5	Diesel Fail to Start	I	Agastat	E7014PC	A348-C008	125	100	12.5	111.70	11.70	YES	96.69	84.19	YES
	SOV-1A	Air Start Right Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	111.70	21.70	YES	96.69	6.69	YES
	SOV-2A	Air Start Left Solenoid	I	Graham White	712-015 (SOV)	See MOD D1-98-020	125	90	90	111.70	21.70	YES	96.69	6.69	YES
	K2	Gov. Booster Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	111.70	49.20	YES	96.69	59.19	YES
	ESP40	40 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	111.70	32.95	YES	96.69	52.94	YES
	ESP200	200 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	111.70	32.95	YES	96.69	52.94	YES
	ESP400	400 RPM Speed Relay	I	GE	CR2811 Coil 22D135G441	Telecon with GE Dated 06/10/97	125	78.75	43.75	111.70	32.95	YES	96.69	52.94	YES
	C2	Fuel Oil Prime Pump Relay	I	GE	CR105 Coil 15D21G26	Telecon with GE Dated 04/18/97	125	62.5	37.5	111.70	49.20	YES	96.69	59.19	YES
	TD10	Loss of Field	I	Agastat	E7012PD	A348-C008	125	100	12.5	111.70	11.70	YES	96.69	84.19	YES
	TD1	Gov. Solenoid TD	I	Agastat	E7022PK	A348-C008	125	100	12.5	111.70	11.70	YES	96.69	84.19	YES
	93GS-5A	EDG "A" Gov Booster Pump	I	Carter	GC684	IEEE-946 (80% of nominal)	115	92	92	100.61	8.61	YES	109.59	17.59	YES
	93P-4A	EDG "A" Fuel oil pump	I	Reliance	502674-JW	IEEE-946 (80% of nominal)	120	96	96	96.51	0.51	YES	101.57	5.57	YES
	ESS	Speed Switch	I	Synchro-Start	ESSB-4AT	M494-0254	100-140	90	90	111.70	21.70	YES	96.69	6.69	YES
	62-	High Circulating Current	I	Agastat	E7012PD	A348-C008	125	100	12.5	111.70	11.70	YES	96.69	84.19	YES
	93EGP-A	Gen "A" Cont Panel													
	Field Flash	EDG "A" Field Flash	I	Basler Electric	SBHV	E-mail from Brad Abernathy 6/27	125	90	90	110.76	20.76	YES	110.76	20.76	YES
	K2/VR	Auto Field Flash	I	W	MD120	Instruction Leaflet 15-800-M	115	92	92	110.76	18.76	YES	110.76	18.76	YES
	TDVR	Field Shutdown	I	Agastat	E7012PC	A348-C008	125	100	12.5	110.76	10.76	YES	110.76	98.26	YES
	93P/S-A	P/S for EG-M Control	I	Lambda	JWS-150-48/A	EC JE-00-115	110-370	85	85	117.06	32.06	YES	96.46	11.46	YES

93-AR1-1EDGD12 THRU 93-AR18-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 13Ø/125VDC	ESK-11BT
93-74-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 125VDC	ESK-11BQ
93-ISX-1EDGD12	GE 12HFA151A2H	ESK-11BQ
93-K1-1EDGD12	GE CR2811A257AA COIL-22D1356641 COIL-22D1210641	ESK-11BQ
93-TBR-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 13Ø/125VDC	ESK-11BQ
93-TD6-1EDGD12	AGA E7Ø12PDØØ2 COIL-8837Ø399	ESK-11BQ
93-TD7-1EDGD12	AGA E7Ø12PDØØ2 COIL-8837Ø4ØØ	ESK-11BQ
93-K4-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 13Ø/125VDC	ESK-11BQ
93-FFR-1EDGD12	GE CR2811 COIL-22D1356441	ESK-11BQ
93-VSR-1EDGD12	SQ.D KPD-13 CLASS 85Ø1, 13Ø/125VDC	ESK-11BQ
93-K3-1EDGD12	GE CR2811A257AA COIL-22D1356641 COIL-22D1210641	ESK-11BR
93-TD5-1EDGD12	AGA E7D14PCØØ2 COIL-8837Ø411	ESK-11BR
93-K2-1EDGD12	GE CR1Ø5KØØØBLA COIL-15D2162G	ESK-11BR

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93-ESR40-1EDGD12	GE CR2811 COIL-22D135G641	ESK-11BR
93-ESR200-1EDGD12	GE CR2811 COIL-22D135G641	ESK-11BR
93-ESR460-1EDGD12	GE CR2811 COIL-22D135G641	ESK-11BR
93-C2-1EDGD12	GE CR105K006BLA COIL-15D216G26	ESK-11BS
93-SDR-1EDGD12	GE CR2811 COIL-22D135G641	ESK-11BS
93-SDRX-1EDGD12	SQD KPD-13 CLASS 8501, 120VDC	ESK-11BS
93-32X1-1EDGD12		
93-40X1-1EDGD12		
93-32/SI-1EDGD12		
93-TD10-1EDGD12	AGA E7012TD002 COIL-8837G397	ESK-11BS
93-86X1-1EDGD12	SQD KPD-13 CLASS 8501, 120VDC	
93-TD1-1EDGD12	AGA E7022PK002 COIL-8837G429	
93-62-1EDGD12 (11-10612)	AGA E7012PC	

125V

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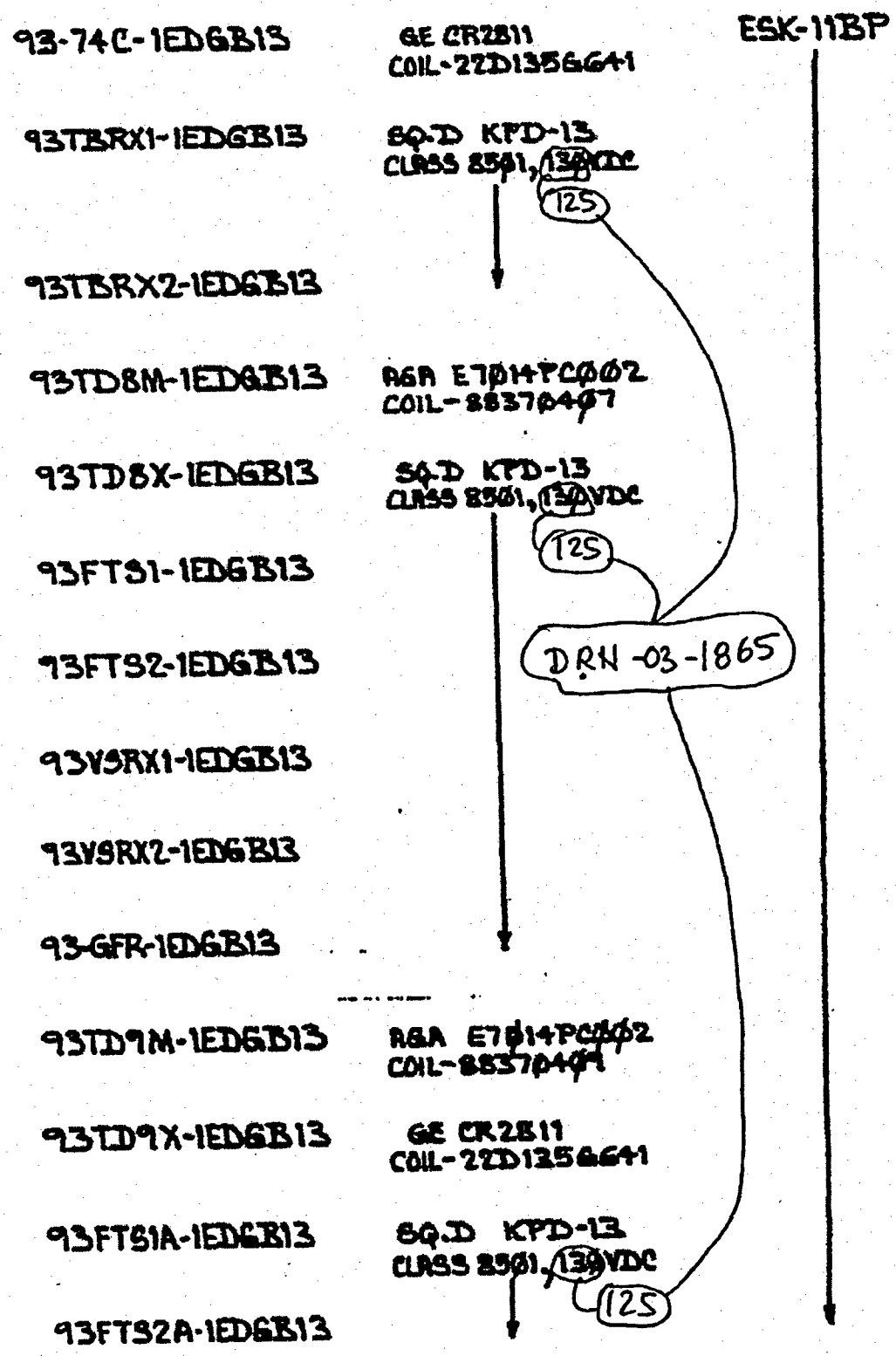
125


93-74C-1EDGB13
GE CR2811
COIL-22D1356G41
ESK-11BP
93TBRX1-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
125
93TBRX2-1EDGB13
93TD8M-1EDGB13
R&A E7014PC002
COIL-8837040 7
93TD8X-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
125
93FTS1-1EDGB13
93FTS2-1EDGB13
DRN-03-1865
93VSRX1-1EDGB13
93VSRX2-1EDGB13
93-GFR-1EDGB13
93TD9M-1EDGB13
R&A E7014PC002
COIL-8837040 7
93TD9X-1EDGB13
GE CR2811
COIL-22D1356G41
93FTS1A-1EDGB13
SQ.D KPD-13
CLASS 8501, 130VDC
125
93FTS2A-1EDGB13

DRN-03-00398

MINOR CALCULATION CHANGE FORM

Calculation No.: JAF-CALC-ELEC-02609 **Revision:** 2

Minor Calculation Change No.: DRN-03-00398

1 Purpose of Change:
Equivalent Change JE-03-024 will replace the 3 Agastat E7012 relays with Allen-Bradley 700-RTC in 4kV SWGR 71HO5 This MCC will also add relay E7012PD data to Appendix 5 SWGR 71HO5 ckt # 1HOEA03.

2 SSC affected:
71-62-3-1HOEAO3, 71-62-4-1HOEAO3, 71-62-5-1HOEAO3.

3 Drawings/Procedures/ Calculations affected
JAF-CALC-ELEC-02609, 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 "A" 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	Steve Glover	Date:	6/19/03
Approved by	Aaric Mitchell	Aaric Mitchell	Date:	6/20/03

- Where the original calculation was design verified, the reviewer signature confirms the latest design verification is still valid.
-

4 kV SWGR 71HO5 (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
H05	71-10550	RHR PP-A 10P-3A (Close)	1 sec	1.1 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I	ESK-5BU	1
		Breaker Charging Motor Inrush	1.1 sec	2.1 sec	N/A	N/A	68	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor F.L.	2.1 sec	6 sec	N/A	N/A	N/A	14	125	N/A	VA			
		RHR PP-A 10P-3A (Trip)	6.2 sec	6.3 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		
		RHR PP-A 10P-3A (Close)	8.2 sec	8.3 sec	N/A	N/A	6	N/A	125	N/A	Resistance	I		
		Breaker Charging Motor Inrush	8.3 sec	9.3 sec	N/A	N/A	68	N/A	125	N/A	Resistance			
		Breaker Charging Motor F.L.	9.3 sec	13.2 sec	N/A	N/A	N/A	14	125	N/A	VA	I		
H05	71-10560	Feed to 600V busses 11500 & 1250	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Resistance	I	ESK-5BE	3
H05	K8-1EDGA00	EDG-A&C Tie Brk Closing Rel	1.9 sec	120 min	4.4 sec	4.5 sec	1.41	0.086	120	10	Resistance	I	ESK-5BD	1
	71-10504	EDGs A & C Tie Breaker(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			
	62-1EDGA02	EDG-A&C Output Brk Closing Re	7 sec	8.2 sec	9.5 sec	10.7 sec	N/A	0.06	125	8	Resistance	I		
	62X-1EDGA0	EDG-A&C Output Brk Closing Re	7 sec	8.2 sec	9.5 sec	10.7 sec	N/A	0.03	125	4	Resistance	I		
	K9-1EDGA00	Gen Tie to EDG-A&C (Trip)	7.3 sec	120 min	9.7 sec	239 min	1.41	0.086	120	10	Resistance	I		
		EDGs A & C Tie Breaker (Trip)	7.3 sec	7.4 sec	9.8 sec	9.9 sec	6	N/A	125	N/A	Resistance	I		5
H05	1HOEA03	Emer Bus 10500 Undervoltage, Load Shedding and Sequencing	0.1 sec	7.2 sec	0.1 sec	239 min 7.2 sec	N/A	~~1.11~~	125	N/A	Resistance	I	ESK-5BS	
H05		Continuous control	0 sec	120 min	0 sec	240 min	N/A	1.22	125	152	Resistance			

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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) 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.

3) This breaker is not automatically actuated as result of LOCA and SBO.

4) 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.

5) 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.

4 kV SWGR 71H05 for LOCA PICK UP & DROP OUT VOLTAGES

Compt No.	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
H05	71-10502	Ctrl Supply EDG-A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.79	27.79	YES	97.79	27.79	YES
	71-10502(Motor)	71-10502 Brk Charging Motor				G080-0631	125	90	90	98.64	8.64	YES	103.26	13.26	YES
H05	71-10510	RHR Serv Wtr Pump 10P-1C	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	112.16	42.16	YES	112.16	42.16	YES
	71-10510(Motor)	71-10510 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.19	14.19	YES	110.95	20.95	YES
	10SOV-101C	RHR Pmp 10P-1C 10SOV-101C	I	ASCO	HC8210C13	E-Mail from ASCO 11/15/01	125	90	90	117.01	27.01	YES	100.63	10.63	YES
H05	71-10512	Ctrl Supply EDG-C Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	98.20	28.20	YES	98.20	28.20	YES
	71-10512(Motor)	71-10512 Brk Charging Motor	I	GE		G080-0631	125	90	90	98.94	8.94	YES	103.33	13.33	YES
H05	71-10514	Tie to Bus 10300 Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	105.34	35.34	YES	105.34	35.34	YES
		Tie to Bus 10300 Close			AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.43	24.43	YES	94.43	24.43	YES
	71-10514(Motor)	71-10514 Brk Charging Motor	I	GE		G080-0631	125	90	90	102.71	12.71	YES	108.90	18.90	YES
H05	71-10520	RHR Serv Wtr Pump 10P-1A	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	100.89	30.89	YES	100.89	30.89	YES
	71-10520(Motor)	71-10520 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.36	14.36	YES	110.91	20.91	YES
	10SOV-101A	RHR Pmp 10P-1A 10SOV-101A	I	ASCO	HC8210C13	E-Mail from ASCO 11/15/01	125	90	90	117.01	27.01	YES	100.63	10.63	YES
H05	71-10530	Core Spray Pmp 14P-1A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	98.37	28.37	YES	98.37	28.37	YES
	71-10530(Motor)	71-10530 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.20	14.20	YES	110.56	20.56	YES
H05	71-10540	RHR Pump 10P-3B Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.93	27.93	YES	97.93	27.93	YES
	71-10540(Motor)	71-10540 Brk Charging Motor	I	GE		G080-0631	125	90	90	104.50	14.50	YES	108.99	18.99	YES
H05	71-10550	RHR Pump 10P-3A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	91.31	21.31	YES	91.31	21.31	YES
H05	71-10550(Motor)	71-10550 Brk Charging Motor	I	GE		G080-0631	125	90	90	98.78	8.78	YES	101.05	11.05	YES
		RHR Pump 10P-3A Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	105.09	35.09	YES	105.09	35.09	YES
		RHR Pump 10P-3A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	88.13	18.13	YES	0.00	-70.00	NO
	71-10550(Motor)	71-10550 Brk Charging Motor	I	GE		G080-0631	125	90	90	101.55	11.55	YES	107.46	17.46	YES
H05	71-10560	Feed to 600V Bus	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
H05	K8-1EDGA002	K8 EDG-A&C Brk Closing Rel	I	GE	CR2811A211G	Telecon with GE Dated 6/10/97	125	81.25	43.75	104.89	23.64	YES	101.40	57.65	YES
	71-10504	EDG Tie A & C Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	89.77	19.77	YES	89.77	19.77	YES
	71-10504(Motor)	71-10504 Brk Charging Motor	I	GE		G080-0631	125	90	90	100.45	10.45	YES	99.43	9.43	YES
	62-1EDGA02	62-1EDGA02 EDG A&C Closing	I	Agastat	E7012PB	A348-C008	125	100	12.5	112.24	12.24	YES	101.42	88.92	YES
	62X-1EDGA02	62X-1EDGA02 EDG A&C Closing	I	GE	12HLA11B12A	G080-0657	125	75	75	112.24	37.24	YES	101.42	26.42	YES
	K9-1EDGA002	K9-1EDGA002 Tie Breeker Trip	I	GE	CR2811A211G	See attached Telecon 6/10/97	125	81.25	43.75	100.43	19.18	YES	101.49	57.74	YES
	71-10504	EDG Tie A & C Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	99.59	29.59	YES	99.59	29.59	YES
H05	1HOEA03	Emer Bus 10500 UV	I	GE	SAM17A	G080-0576	125	62.5	62.5	108.09	45.59	YES	97.66	35.16	YES
			I	GE	12HLA11B12A	G080-0657	125	75	75	108.09	33.09	YES	97.66	22.66	YES
			~~I~~	~~GE~~	~~12HGA11752~~	~~G080-0213~~	~~125~~	~~75~~	~~12.5~~	~~108.09~~	~~33.09~~	~~YES~~	~~97.66~~	~~85.16~~	~~YES~~
			I	Allen-Bradley	700-RTC	JE-03-024	120	70	40	108.09	38.09	YES	97.66	57.66	YES
			~~I~~	~~Agastat~~	~~E7012PB~~	~~A348-C008~~	~~125~~	~~100~~	~~12.5~~	~~108.09~~	~~8.09~~	~~YES~~	~~97.66~~	~~85.16~~	~~YES~~
			I	Agastat	E7012PD	A348-C008	125	100	12.5	108.09	8.09	YES	97.66	85.16	YES
			~~I~~	~~GE~~	~~12HGA151A2F~~	~~G080-0255~~	~~125~~	~~75~~	~~12.5~~	~~108.09~~	~~33.09~~	~~YES~~	~~97.66~~	~~85.16~~	~~YES~~
			I	Brown Boveri	ITE-27N	B455-0002 & Appendix 6	125	70	70	108.09	38.09	YES	97.66	27.66	YES

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4 kV SWGR 71H05 for SBO PICK UP & DROP OUT VOLTAGES

Compt No.	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
H05	71-10502	Ctrl Supply EDG-A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.47	27.47	YES	97.47	27.47	YES
	71-10502(Motor)	71-10502 Brk Charging Motor				G080-0631	125	90	90	97.44	7.44	YES	107.32	17.32	YES
	K10-1EDGA01	K10-1EDGA01 EDG A Egn. Fail	I	GE	CR2811A211G	Telecon with GE dated 6/10/97	125	81.25	43.75	110.92	29.67	YES	100.12	56.37	YES
	71-10502	Ctrl Supply EDG-A Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	94.39	24.39	YES	94.39	24.39	YES
		Ctrl Supply EDG-A Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	99.57	29.57	YES	99.57	29.57	YES
	71-10502(Motor)	71-10502 Brk Charging Motor				G080-0631	125	90	90	105.47	15.47	YES	112.41	22.41	YES
H05	71-10510	RHR SWP 10P-1C Trip	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
H05	71-10512	Ctrl Supply EDG-C Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	97.88	27.88	YES	97.88	27.88	YES
	71-10512(Motor)	71-10512 Brk Charging Motor				G080-0631	125	90	90	97.73	7.73	YES	107.42	17.42	YES
	K10-1EDGC01	K10-1EDGC01 EDG C Egn. Fail	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	111.14	32.39	YES	100.12	56.37	YES
	71-10512	Ctrl Supply EDG-C Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	95.53	25.53	YES	95.53	25.53	YES
H05	71-10514	Tie to Bus 10300	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	105.82	35.82	YES	105.82	35.82	YES
H05	71-10520	RHR Serv Wtr Pump 10P-1A	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
H05	71-10530	Core Spray Pump 14P-1A	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
H05	71-10540	RHR Pump 10P-3B	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
	71-10540(Motor)	71-10540 Brk Charging Motor				G080-0631	125	90	90	N/A	N/A	N/A	N/A	N/A	N/A
H05	71-10550	RHR Pump 10P-3A	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
	71-10550(Motor)	71-10512 Brk Charging Motor				G080-0631	125	90	90	N/A	N/A	N/A	N/A	N/A	N/A
H05	71-10560	Feed to 600V Bus	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
H05	K8-1EDGA002	K8 EDG-A&C Brk Closing Rel	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	112.80	34.05	YES	113.16	69.41	YES
	71-10504	EDG Tie A & C Close	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	96.09	26.09	YES	96.09	26.09	YES
	71-10504(Motor)	71-10504 Brk Charging Motor				G080-0631	125	90	90	104.45	14.45	YES	105.23	15.23	YES
	62-1EDGA02	62-1EDGA02 EDG A&C Closing	I	Agastat	E7012PB	A348-C008	125	100	12.5	111.79	11.79	YES	100.18	87.68	YES
	62X-1EDGA02	62X-1EDGA02 EDG A&C Closing	I	GE	12HLA11B12A	G080-0657	125	75	75	111.79	36.79	YES	100.18	25.18	YES
	K9-1EDGA002	K9-1EDGA002 Tie Breaker Trip	I	GE	CR2811A211G	Telecon with GE Dated 06/10/97	125	78.75	43.75	110.94	32.19	YES	100.13	56.38	YES
	71-10504	EDG Tie A & C Trip	I	GE	AMH-4.76-250-1D	JDED-00-0290 10/04/00	125	70	70	98.96	28.96	YES	98.96	28.96	YES
H05	1H0EA03	Emer Bus 10500 UV	I	GE	SAM17A	G080-0576	125	62.5	62.5	110.04	47.54	YES	97.07	34.57	YES
			I	GE	12HLA11B12A	G080-0657	125	75	75	110.04	35.04	YES	97.07	22.07	YES
			I	GE	12HGA11B2	G080-0213	125	76	13.6	110.04	35.04	YES	97.07	84.57	YES
			I	Allen-Bradley	700-RTC	JE-03-024	120	70	40	110.04	40.04	YES	97.07	57.07	YES
			I	Agastat	E7012PC	A348-C008	125	100	12.5	110.04	10.04	YES	97.07	84.57	YES
			I	Agastat	E7012PD	A348-C008	125	100	12.5	110.04	10.04	YES	97.07	84.57	YES
			I	GE	12HFA151A2E	G080-0235	125	75	12.5	110.04	35.04	YES	97.07	84.57	YES
			I	Brown Boveri	ITE-27N	B455-0002 & Appendix 6	125	70	70	110.04	40.04	YES	97.07	27.07	YES

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