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Detroit Edison
A DTE Energy Company

10 CFR 50.90

August 16, 2007
NRC-07-0043

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington D C 20555-0001

References: 1) Fermi 2
NRC Docket No. 50-341
NRC License No. NPF-43

2) Detroit Edison Letter to NRC, "Proposed License Amendment to Revise the Minimum Emergency Diesel Generator Voltage in Technical Specification 3.8.1 Surveillance Requirements," NRC-07-0012, dated March 19, 2007

3) NRC Letter to Detroit Edison, "Fermi, Unit 2 – Request for Additional Information Related to Proposed License Amendment to Revise the Minimum Emergency Diesel Generator Voltage in Technical Specification 3.8.1 Surveillance Requirements (TAC No. MD4930)," dated July 3, 2007

Subject: Response to NRC Request for Additional Information Regarding the Proposed License Amendment to Revise the Minimum Emergency Diesel Generator Voltage in Technical Specification 3.8.1 Surveillance Requirements

On March 19, 2007, Detroit Edison requested NRC approval of a proposed license amendment to revise the minimum Emergency Diesel Generator (EDG) output voltage acceptance criterion in Technical Specifications (TS) 3.8.1, "AC Sources – Operating," Surveillance Requirements (SRs) 3.8.1.2, 3.8.1.7, 3.8.1.10, 3.8.1.11, 3.8.1.14 and 3.8.1.17 (Reference 2).

On July 3, 2007, the NRC requested additional information regarding the proposed license amendment (Reference 3).

Enclosure 1 to this letter provides responses to the NRC questions.

A001

NRR

Detroit Edison reviewed the analysis of significant hazards consideration published in the Federal Register (FR) on April 24, 2007. The discussion and conclusion of no significant hazards consideration provided in the FR Notice are not affected by this response.

The following commitment is being made in this letter:

> Detroit Edison will maintain administrative controls to ensure that the acceptance criteria for EDG surveillance voltage verification account for potential measurement uncertainty.

In accordance with 10 CFR 50.91, a copy of this letter, with enclosures, is being provided to the designated Michigan State Official.

Should you have any questions or require additional information, please contact Mr. Ronald W. Gaston of my staff at (734) 586-5197.

Sincerely,

Enclosures:

1. Response to NRC Questions
2. Copy of Requested Calculations
3. Legend for DC-5003, Table 2
4. TSR-35236

cc: NRC Project Manager
NRC Resident Office
Reactor Projects Chief, Branch 4, Region III
Regional Administrator, Region III
Supervisor, Electric Operators,
Michigan Public Service Commission

I, Joseph H. Plona, do hereby affirm that the foregoing statements are based on facts and circumstances which are true and accurate to the best of my knowledge and belief.

Joseph H. Plona

JOSEPH H. PLONA
Site Vice President - Nuclear Generation

On this 16th day of August, 2007 before me personally appeared Joseph H. Plona, being first duly sworn and says that he executed the foregoing as his free act and deed.

CYNTHIA A. WISNIEWSKI
NOTARY PUBLIC, STATE OF MI
COUNTY OF WAYNE
MY COMMISSION EXPIRES Mar 30, 2013
ACTING IN COUNTY OF Monroe

Cynthia A. Wisniewski

Notary Public

ENCLOSURE 1
to NRC-07-0043

FERMI 2 NRC DOCKET NO. 50-341
OPERATING LICENSE NO. NPF-43

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE REQUEST TO REVISE THE MINIMUM VOLTAGE FOR EMERGENCY DIESEL GENERATOR SURVEILLANCE TESTING IN TS 3.8.1

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION

Response to NRC Questions

Question 1:

Provide the calculations (issued on February 13, 2007) referenced in Section 3.4 of Attachment 1 of the license amendment request dated March 19, 2007. Provide a brief description of how drift, measurement uncertainty, and margin are accounted for in the calculations that support that the EDG output voltage is sufficient for the required loads.

Response

The Design Calculation (DC) referenced in Section 3.4 of Attachment 1 to Reference 1 is DC-5003, Volume I, Revision G. The current revision level of this DC is Revision H. Revision H did not affect Case Study 16 which verified that an EDG Division I output voltage of 3873 volts provides sufficient terminal voltage to required Emergency Safety Feature (ESF) equipment to operate under worst case accident conditions. Therefore, since Revision G of this DC has been superseded, Revision H is provided in Enclosure 2. Attachment P to the calculation titled, "Case Study 16 – All EDGs 0 – 10 Min Voltage at TS Minimum," dated February 7, 2007, is also provided in Enclosure 2. Other Attachments to the calculation are not provided since they do not pertain to the question.

Table 2 of DC-5003, Volume I, delineates available load terminal voltage after load start. The Table demonstrates that greater than 90% terminal voltage is available to all the ESF loads. A legend for use with Table 2 of DC-5003, Volume I, is provided in Enclosure 3 with definitions of the Table column headings.

Drift, measurement uncertainty and margin have been evaluated in Appendix 1 to DC-5003, Volume I. Appendix 1 is added to DC-5003, Volume I, through Technical Service Request (TSR)-35236, Revision 0, which has been posted against the DC and will be incorporated into the design calculation at a later date. The TSR is provided in Enclosure 4. Allowance for drift, measurement uncertainty and margin as evaluated in Appendix 1 to DC-5003, Volume I, will be included in the acceptance criteria used in the surveillance procedures to ensure that verification of EDG voltage is conservative in comparison with the required TS value.

Detroit Edison will maintain administrative controls to ensure that the acceptance criteria for EDG surveillance voltage verification account for potential measurement uncertainty.

As previously stated in Reference 2, a review of Division I EDG testing records over the past three years indicates no recorded output voltage below 4000 volts; therefore, the current non-conservative TS value has not resulted in a challenge to plant safety and the capability of Division I EDGs to safely support reactor shutdown and the mitigation of accident consequences.

Question 2

Provide the analyses, if different from the calculations referenced in No. 1 above, that support that the minimum required EDG output voltage is enveloped by the proposed minimum testing voltage and that the EDG output voltage will start and accelerate all required loads in the required times without any adverse effects (such as a motor tripping on overcurrent).

Response

The requested analyses are contained in the same design calculation provided in Enclosure 2. This design calculation demonstrates that, at an actual EDG output voltage of 3873 volts, greater than 90% terminal voltage is available to all required ESF equipment for starting. This voltage level is sufficient to start and accelerate motor loads in the required times without any adverse effects (e.g. motor tripping on overcurrent).

ENCLOSURE 2
to NRC-07-0043

FERMI 2 NRC DOCKET NO. 50-341
OPERATING LICENSE NO. NPF-43

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE REQUEST TO REVISE THE MINIMUM VOLTAGE FOR EMERGENCY DIESEL GENERATOR SURVEILLANCE TESTING IN TS 3.8.1

Design Calculations DC-5003, Volume I, Revision H (38 pages)
& Attachment P (43 pages)

DESIGN CALCULATION COVER SHEET

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PART 1: DESIGN CALCULATION IDENTIFICATION			
A) Design Calculation Number DC-5003		B) Volume Number I	
C) Revision H	D) PIS Number R3100	E) QA Level [ ] Non-Q [X] 1 [ ] 1M	
F) ASME Code Classification [X] NA		G) Certification Required [ ] Yes [X] No	
H) Lead Discipline Electrical		I) Incorporation Code F	
J) Title Emergency Diesel Generator Loads Calculation			
K) Design Change Documents Incorporated (Number and Revision) None			
L) Design Calculations Superseded (Number and Revision) DC-5003, Vol. 1, Revision G			
M) Revision Summary See Page 2			
N) Review of Assumptions, Methods, and Inputs Completed [X] Yes Comments: 1. Reviewed assumptions for correctness. 2. Reviewed calculation method for correctness of approach and consistency with Current philosophy. 3. Reviewed input from other calculation sources for correctness. [ ] N/A Justification:			
O) PPRNs are required: [ ] Yes [X] No Issuing DCD _____ [X] N/A			

PART 2: PREPARATION, REVIEW, AND APPROVAL		
A) Prepared By Sign J. South		Date 2-29-07
B) Checked By Sign J. Hulderman		Date 2-28-07
C) Verified By Sign J. Hulderman		Date 2-28-07
D) Approved By Sign		Date 2/28/07

Not Decommissioning Related

DTC: TPMMES DSN: MES15001 Rev. 3 P1/1 File: 1703.22 Approved:11-29-06 Issued:12-01-06
DTC: TDPCAS ☐ TDPELE ☒ TDPINC ☐ TDPMEC ☐
DSN: DC-5003 Rev:H File: 1801 IP: I 02/28/07
VOL 1

Revision Summary:

1. Assumption 12 was revised to add additional conservatism to this Design Calculation.
2. As a result of changing Assumption 12, Cases 9-13 were revised, Table 6 was revised, the Results and the Margins were updated to reflect these changes
3. Changes incorporated per Revision H of DC-5003 will not be identified per a revision bar due to issuance as a .pdf file.

TABLE OF CONTENTS

PURPOSE OF THE CALCULATION

The purpose of this calculation is twofold. The first is to define all predicted loads on the Emergency Diesel Generators (EDGs) for loss of off-site power and Loss of Coolant Accident (LOCA). Predicted loads include both those automatically sequenced to the respective EDG and loads the operators would normally expect to add to the EDGs through manual operation for extended shutdown cooling per the UFSAR. Other manual loads can be added by the operator if capacity of the respective EDG is available.
The second purpose of this calculation is to demonstrate adequate voltage is available to the EDG loads when the EDG output voltage is at the TS minimum voltage for EDG operability.

SUMMARY OF THE RESULT

This calculation demonstrates that the EDG's have sufficient capacity for the postulated loads during the Design Basis Accident. It also demonstrates that there is adequate voltage available to the EDG loads when the EDG output voltage is at the TS minimum voltage for EDG operability. See Table 1 for EDG loading. Table 2 lists the ESF bus voltages for 5003_Case_16, with the EDG output voltages at 3873 VAC for Division 1 and 3628 VAC for Division 2. This was done for CARD 06-25497 which required a formal calculation to determine minimum voltages required for EDG operability. All motors have sufficient voltage available to start and run.

Revision G	EDG11 (kW)	EDG12 (kW)	EDG13 (kW)	EDG14 (kW)	LIMIT (kW)
0-10 Min	2726	2959	2684	2949	3135
10 Min - 7 Days	2840	1731	2812	1776	2850
Revision H					
0-10 Min	2726	2959	2684	2949	3135
10 Min - 7 Days	2840	2625	2812	2612	2850
Delta					
0-10 Min	-0	0	0	0	
10 Min - 7 Days	0	-894	0	-836	
Margin to 3135	0-10 Min				
Revision G	409	176	451	186	
Revision H	409	176	451	186	
Margin to 2850	10 Min - 7 Days				
Revision G	10	1119	38	1074	
Revision H	10	225	38	238	

CALCULATIONAL METHOD

The official existing model of Fermi 2 in ETAP (DTC:TDPELE, DSN:ETAP Vol. 1, Rev. 0) was used. The equipment identified in this Design Calculation was added to Loading Category 9 (Accident) and the loading was adjusted to be as close to the loading as assumed by this Design Calculation or slightly larger. Table 4 shows the equipment powered from the EDGs. A new Configuration was created in the official existing model of Fermi 2 in ETAP to model the EDG's as operating in the Swing mode. 16 Revisions were created in the model, each revision designed to model a certain postulated scenario as shown in table 3.

Case 16 was performed using revision 5003_Case_16, with the EDG output voltages at 3873 VAC for Division 1 and 3628 VAC for Division 2.

A load flow calculation was then performed using the ETAP software to determine the amount of loading on each EDG. The load flow calculation also determined losses, voltage drops, power factors, etc. The summarized results are shown in Tables 1 and 2. The individual load flow reports are attachments to this calculation.

The following study case parameters were used for the load flow calculations. PowerStation default values were used for parameters not mentioned in the table. The same parameters were used for the Running Voltage at Maximum Offsite Voltage comparison.

Parameters Used in the Load Flow Study Cases	
Parameter	**Value**
Method	Newton Raphson
Max Iterations	5
Precision	0.001
Loading Category	Category 9 - Accident
Bus Voltages - Initial Condition	Use Bus Voltages
Update	Initial Bus Voltages
Configuration	DC-5003
Revisions	5003_Case_1 thru 5003_Case_16

The Newton-Raphson method formulates and iteratively solves the load flow equation where bus real power and reactive power mismatch vectors between specified value and calculated value, respectively. The delta voltage and difference represents bus voltage angle and magnitude vectors in an incremental form. These values represent a matrix called a Jacobian matrices.

The Newton-Raphson method possesses a unique quadratic convergence characteristic. It usually has a very fast convergence speed compared to other load flow calculation methods. It also has the advantage that the convergence criteria are specified to ensure convergence for bus real power and reactive power mismatches. This criterion gives you direct control of the accuracy you want to specify for the load flow solution. The convergence criteria for the Newton-Raphson method are typically set to 0.001 MW and Mvar.

The Newton-Raphson method is highly dependent on the bus voltage initial values. A careful selection of bus voltage initial values is strongly recommended. Before running load flow using the Newton-Raphson method, ETAP PowerStation makes a few Gauss-Seidel iterations to establish a set of sound initial values for the bus voltages.

The Newton-Raphson method is recommended for use with any system as a first choice.

Until revision G of this Design Calculation, all powered MOV's were assumed to be moving for the first 10 minutes. Revision G changed this assumption and reviewed the function of the MOV's to determine which MOV's would be required to reposition for the Design Basis Accident on which this Design Calculation is based. Table 5 lists the MOV's which are powered from the EDGs and the basis for MOV movement. All MOV's which were assumed to move during the first 10 minutes are assumed to move for the entire 10 minutes. This results in a simpler calculation and is a conservative assumption.

Cases 1 through 8 and 16 were ran assuming automatic actions only. No manually added loads were added. Loads which had multiple power supplies were assumed to be on the normal power supply unless that power supply was lost, in which case, the alternate power supply was used, if available. Table 6 specifies the equipment line-ups used for cases 9 through 15.

Fermi 2 Emergency Diesel Generators are Colt Industries, Fairbanks-Morse. The generators are air-cooled, 80 percent power factor, 4160V, 60Hz, with a rating of 4063 kVA at a temperature rise not exceeding ANSI Standard ME-I (1972) at ambient temperature of 140°F. The EDG rooms of the RHR Complex are designed for 122°F ambient per Sargent and Lundy Design Calculation VD-001. The generator stator coils are vacuum-pressure impregnated to provide resistance to moisture and contaminants.

Emergency Diesel Generators

The individual rating of each EDG is:

a. Continuous	2850 KW	(2.850 MW)
b. Short-time rating	3135 KW	(3.315 MW)
c. 2000 HR	3100 KW	(3.100 MW)
d. 300 HR	3250 KW	(3.250 MW)
e. 30 Minute	3500 KW	(3.500 MW)

The rating of the EDGs is based on vendor documents. (See Attachments Q, R, and S.)

The short-time rating is based on allowing ten percent (10%) over the continuous rating for two (2) hours out of a twenty-four (24) hour period, without exceeding the manufacturer's design limits and without reducing the maintenance interval established for the continuous rating.

The total load on each EDG for all conditions calculated should be within the short-time rating of the diesel generator (3135KW) in compliance with Paragraph C.2 of Regulatory Guide 1.9 Revision 2 and Item 3.7.2 of IEEE Standard 387-1977. Per UFSAR 9.5.4.1, the EDG Fuel Oil

tanks were sized on the basis of continuous operation of the diesel generators for 7 days at continuous load of 2850 kW.

The Emergency Diesel Generator System consists of completely redundant electrical power source for the Engineered Safety Feature Systems (ESF). The ESF systems are designed and controlled so that on a loss of the normal off-site power source, ESF buses will be cleared from the off-site power source, and then re-connected to and energized by the onsite AC Emergency Diesel Generators (EDGs). The reconnection of ESF loads is sequentially controlled to restore proper equipment for safe reactor shutdown and radioactivity containment, and to limit the transient responses on system voltages and protection. Non-essential loads are shed on loss of off-site power and prohibited from automatic re-connection to the diesel generator. Maintenance ties are provided to allow servicing and for emergency crossover purposes. Selective bus and load position fault protection is provided to ensure proper isolation of faulted lines or components with minimal impact on the remainder of plant operation.

Certain electrical buses, designated as "system service" buses, are provided with appropriate Switchgear to allow them to be manually connected to the EDGs for additional plant power in emergency events. The system service buses are generally designed to balance the loads between the 120 kV and 345 kV systems. System service buses are provided with individual bus and load position fault protection similar to the ESS buses, and are located in various plant buildings. Refer to 6SD721-2500-1 for EDG's and off-site power one-line diagram.

Automatic Digital Load Sequencers

The Emergency Diesel Generator System contains automatic digital load sequencing system which function to automatically restore important ESF reactor cooling, containment cooling, and related auxiliary loads to the EDGs in a time sequence over the first ten (10) minutes of a postulated design basis accident. The loads which are restored are calculated to ensure that the EDGs do not become overloaded during this period.

The sequencer ensures that the addition of large inductive loads is properly coordinated (timed), so that specified voltage and frequency fluctuation limits are maintained, and operating equipment continues to function properly.

Under normal conditions the Engineered Safety Feature Systems are energized from the off-site power. Under the abnormal conditions the automatic operation of the Emergency Diesel Generators is initiated. The abnormal conditions are summarized as follows:

- Loss of off-site power (LOP) without LOCA.
- Bus or cable fault.
- LOCA with no loss of off-site, power (LOP).
- Loss of off-site power (LOP) before LOCA which include a simultaneous occurrence of LOP and a LOCA, and occurrence of a LOCA after LOP and after its related sequencing is completed and an occurrence of a LOCA after a LOP but during its related sequencing.
- LOCA before loss of off-site power.
- Degraded off-site voltage.

Manual Operation Following Automatic Operations

The events following actuation of the onsite Emergency AC Power System are divided into two time periods; the time period up to approximately ten (10) minutes after a loss of off-site power and the time period thereafter, until power is restored. The ECCS and other ESF equipment required in the first ten (10) minute period are sequenced, restored and operated automatically. After ten (10) minutes, the reactor operator must manually control the RHR system to provide containment cooling at a rate sufficient to prevent over pressurization and overheating. Equipment used for scenario of long term decay heat removal in UFSAR is analyzed in this Calculation. Manual action for other scenarios can not be given based on myriad combinations and operator response to symptoms. The control of EDG's load is dependent on trained operator and provision for adequate information for EDG loading. Other miscellaneous ESF equipment will be started over the next several hours. In addition, a single failure of any ESF system, including a loss of divisional pair of Emergency Diesel Generators, could occur requiring additional operator interaction.

To assist the operator in evaluating the EDGs ability to accept additional load, each EDG is provided with a meter on the auxiliary power mimic panels. Below each meter are indicating display lights for the major manually connected EDG loads.

Listings of the manually connected loads for EDG 11 through 14 are found in the tables and are described as follows:

1. Containment Cooling Loads (UFSAR 6.2.2.3)

The first manually initiated operation that is required is containment cooling, using the RHR system and RHR service water system. To adequately cool the containment after a LOCA, a minimum of one (1) RHR pump, one (1) RHR heat exchanger, two (2) RHR cooling tower fans and two (2) RHR service water pumps must be placed in service along with proper valve alignment of the RHR system. Containment cooling must be initiated within thirty (30) minutes from the time of LOCA. If less than the minimum containment cooling is operated or is not placed in service within 30 minutes, the required Net Positive Suction Head (NPSH) margin of the ECCS pumps may not be maintained. Under these conditions, the ECCS pump performance may be degraded.

2. DC Battery Chargers (UFSAR 8.3.2.1-1, 8.3.2.2-1. 8.3.2.2-4)

The 260/130 volt ESF batteries have three (3) chargers for each division. The 48/24 volt batteries are supplied with two chargers each. Each 260 volt battery consists of two (2) 130V batteries in series, with each 130 volt battery having its own charger. In addition, one spare charger can be switched to charge either 130 volt battery in its division. On loss of off-site AC power, there is no automatic restoration of the chargers to the ESF batteries supplying the DC power to the various ESF loads. The batteries are sized to operate four (4) hours without chargers. The operator will be required to manually re-energize the 130 volt and 24 volt chargers from the EDG system sometime soon after containment cooling is initiated (approximately thirty (30) minutes).

3. Thermal Recombiners (UFSAR 6.2.5.2-4)

Following a LOCA, the primary means of controlling combustible gas concentration in the primary containment is the Thermal Recombiner System (TRS). The TRS is designed to control the primary containment hydrogen and oxygen concentration below a combustible limit. The TRS is manually started. Initiation of the TRS can occur any time after a LOCA up to a maximum time based on primary containment pre-accident oxygen concentration. This system is not required if a LOCA has not occurred. The TRS is redundant, with one recombiner in Division I from EDG 12, and one in Division II from EDG 14.

The NRC amended 10 CFR 50.44, "Standards for Combustible Gas Control System in Light-Water-Cooled Power Reactors" on October 16, 2003, to eliminate the requirements for hydrogen recombiners. The hydrogen recombiner Technical Specification requirements were subsequently removed by License Amendment 159, dated March 15, 2004.

4. CCHVAC Chillers and Heaters

The control center HVAC Chillers and heaters do not automatically restart when the CCHVAC is initiated by the automatic load sequencer. Operators must momentarily place the chiller CMC switch to the Off- Reset and then back to Auto to reset the oil pressure switch trip seal -in. The remainder of the CCHVAC automatically starts and provides ventilation, but no cooling.

ASSUMPTIONS

1. Load data used in this calculation are based on DC-ETAP (Electrical Transient and Analysis Program), DC-6186 Vol.1 and design calculation 2116, Revision C and/or approved design documents (MCC Frontal Drawing, One Line Diagram etc.).

2. The load for HVAC Fan Motors is assumed at 100% of the nameplate

3. Motor operated valve loads are neglected due to the short time running of the motors for most cases. However, the load for MOVs are considered for 0-10 minutes mode since many MOVs receive LOCA signal and change state at the same time, which adds considerable load on EDGs.

4. The loads for EDG auxiliary equipment skid R1600S046, R1600S047, R1600S048, R1600S049 (for EDGs 11, 12, 13, and 14) is based on operating the fuel oil standby pump which require 1.3 KW. The remaining load which consists of standby jacket coolant circulating pump, standby lube oil circulating pump and keep warm heaters are standby loads and also they are locked out when the EDG runs.

5. The dual speed drywell cooling fan (two (2) per Division) normally run on high speed, but shift to low speed following a loss of coolant accident. The other ten (10) drywell cooling fans are single speed and automatically stop in the event of a LOCA.

6. No credit is taken for operator action in the first ten minutes of the accident.

7. After 10 minutes operator action is required to manually initiate loads such as RHRSW, CCHVAC, etc. The operators are trained not to exceed the rating of the EDG's and have sufficient instrumentation available not to do so.

8. After 10 minutes the operators will take action to limit the flow of the RHR and Core Spray Systems to within the ratings of the system, therefore run out conditions after 10 minutes are not credible.

9. Per the System Operating Procedure, only one side of RHRSW and MDCT fans will be used at a time.

10. Per the System Operating Procedure, only one side of CCHVAC and heaters will be used at a time.

11. Per the System Operating Procedure, if both trains of SBGT are running, one train should be shutdown. It will be assumed that the operators will operate the train of SBGT on the same side as the operating CCHVAC train.

12. Per UFSAR 6.3.2.1, " After the first 10 minutes following the initiation of operation of the ECCS, and in the event of an active or passive component failure in the ECCS or its essential support system, long-term core and containment cooling is provided by any one LPCI or core spray loop delivering water to the RPV and by one residual heat removal (RHR) pump supported by one RHR heat exchanger with 100 percent service water flow." However, to demonstrate EDG adequacy, all available ECCS pumps will be shown as operating with the exception of the associated RHR pump of the loop in Torus Cooling.

13. The CCHVAC chiller requires a maximum loading of 113 KVA while the four CCHVAC heaters require a maximum loading of 156 KVA (4 x 39 KVA apiece). Since the air will need to be either heated or cooled but not both, only one of these loads will be required at a time. To be conservative the four CCHVAC heater loading of 156 KVA will be used.

14. Per UFSAR 15.0.3.2.1 "Most events postulated for consideration are the results of single equipment failures or single operator errors that have been postulated during any normal or planned mode of plant operation." Therefore only one equipment failure need be assumed for any scenario.

15. Per CARD 05-26681 an allowance for the allowed frequency variations of +/- 2% was added. The allowance was determined by using the relationship of speed to input power cubed (1.02 cubed) to arrive at an allowance of 6.1208 %. This allowance was then multiplied by the largest motor load on any EDG of 2484 kW to arrive at an allowance of 152.04 kW. The largest motor load is on EDG11 during scenarios 12, 13 and 15.

16. The battery chargers are sized to completely recharge a fully discharged battery within 24 hours. Per DC-0213, the batteries at Fermi 2 are never fully discharged, therefore the time period the battery chargers are taking full rated AC power is less than 24 hours. However for this calculation it will be assumed the battery chargers are at full rated AC power for the 10 minute to 7 day time period (conservative assumption).

DETAILS OF THE CALCULATION

1. RHR Pumps Load Calculation:

Drawing 6M721-5690, Rev. E (process schedules for RHR pumps) General Electric letter TDEC- 1663 dated December 13, 1972 (Attachments UFSAR Section 6.3.2.15, and pump-motor data (Attachment T) are used to determine the flow in RHR pumps for each mode. The data shown on "GE" letter (Attachment U) is used to determine the flow since it is more conservative than drawing 6M721-5690 Rev. E.

UFSAR Section 6.3.2.15 is used to determine the flow in LPCI logic failure mode (Mode E below).

The modes of operation for RHR pumps are as follows:

A. Four pumps running.	9,000 GPM
B. Three pumps running, accident w/recirc. line break inside 1 and strainer 50% plugged	10,900 GPM
C. Two pumps running, accident w/recirc. line break inside 1 with strainer 50% plugged with (0 psig)	14,000 GPM
D. Shutdown cooling after blowdown to main condenser	10,000 GPM
E. Four pumps pumping into both loops with one loop broken (single failure)	14,800 GPM

Vendor test data, motor data and pump characteristics (shown in Attachment T) were used to calculate the electrical load for Pump A, B and C (2000 HP). The following equations are the basis of calculating the input power to RHR motors:

$$\text{Pump Efficiency} = \frac{\text{Water Horsepower}}{\text{Brake Horsepower}}$$

$$\text{Motor Efficiency} = \frac{\text{Brake Horse Power (BHP)}}{\text{Input Power to Motor}}$$

For example, RHR pump operating in Mode (E) above with flow of 14800 GPM, by extrapolating the curve shown on Attachment (T) BHP = 2103

$$\text{Input Power to Motor} = \frac{\text{BHP}}{\text{Motor Efficiency}}$$

$$\text{Input Power to Motor} = \frac{2103}{.932} = 2257 \text{ HP} \qquad \text{(Motor Eff. curve, Att. T)}$$

1 (HP) = 0.746 (KW)

Input Power in (KW) = 2257 x 0.746 = 1684 KW

Water HP = BHP x Pump Eff. = 2103 x 64% = 1346 HP

Pump Eff. is determined from RHR pump curves.

The same type of analysis was used to calculate the electrical load of Pump D (2250 HP). Vendor test data, motor data and pump characteristics (shown in Attachment T) were used to calculate the electrical load for pump D (2250 HP).

The following equations are the basis of calculating the input power to RHR motors:

$$\text{Pump Efficiency} = \frac{\text{Water Horse Power}}{\text{Brake Horse Power (BHP)}}$$

$$\text{Motor Efficiency} = \frac{\text{Brake Horse Power (BHP)}}{\text{Input Power to Motor}}$$

For example, RHR pump operating in mode (E) above with flow of 14,800 GPM, by extrapolating the curve shown on Attachment (T), BHP = 2103.

$$\text{Input power to motor} = \frac{\text{BHP}}{\text{Motor Efficiency}}$$

$$\text{Input power to motor} = \frac{2103}{.94} = 2237 \text{ HP}$$
(From motor data sheet, Attachment W)

Water HP = BHP x Pump Eff. = 2103 x 64% = 1346 HP

Pump Efficiency is determined from RHR pump curves.

This concludes that the new RHR motor for Pump D, 2250 HP will have less electrical input power than RHR motors for Pump A, B and C.

The same calculation for Mode A, B, C and D show that the new RHR motor for Pump D will result in electrical power input as follows:

Mode A: 1389 KW
Mode B: 1508 KW
Mode C: 1631 KW
Mode D: 1441 KW
Mode E: 1669 KW

For consistency a conservative approach was used. By assuming the electrical power impact for motor "D" is the same like A, B and C.

Therefore the data result shown on the Table A (below), was not revised and the total load on EDG 14 was not impacted.

This calculation is done for 9,000 GPM, 10,900 GPM, 14,000 GPM and 14,800 GPM flow for RHR pumps. The data for motor efficiency is calculated by using curve for motor data on Attachment "T" (full load = 13,000 GPM) Attachment U.

TABLE A

RHR PUMPS DATA RESULTS

MODE	FLOW (GPM)	WATER HP	PUMP EFF.	BHP	MOTOR EFF.	HP INPUT	KW INPUT
A	9,000	1,435	82.0%	1,750	93.0%	1,882	1,404
B	10,900	1,558	82.0%	1,900	93.0%	2,043	1,525
C	14,000	1,433	69.7%	2,055	93.2%	2,205	1,645
D	10,000	1,515	83.5%	1,815	93.0%	1,952	1,456
E	14,800	1,346	64.0%	2,103	93.2%	2,257	1,684

Core Spray Pump Load Calculation:

UFSAR Figure 6.3-7 Sheet 2, General Electric letter TDEC-1663 dated December 13, 1972 (Attachment E) and pump motor data (Attachment D) are used to determine the flow in core spray pumps for each mode. The data shown on "GE" letter is used to determine the flow since it is more conservative except for single pump runout, a flow of 4300 GPM is used per the pump characteristic (Attachment D) for 743 BHP.

The mode of operation for core spray pump are as follows:

A. Paired Pump rated 3175 GPM
B. Paired Pump runout 3950 GPM
C. Unpaired Pump runout 4300 GPM

The data for core spray motor loading is shown in Table B below:

TABLE B

CORE SPRAY PUMPS DATA RESULTS							
MODE	**FLOW (GPM)**	**WATER HP**	**PUMP EFF.**	**BHP**	**MOTOR EFF.**	**HP INPUT**	**KW INPUT**
A	3,175	550	82.0%	670	93.0%	721	538
B	3,950	589	79.5%	740	93.5%	792	591
C	4,300	578	76.0%	760	93.5%	813	607

The percent loading for the RHR pump motors and the Core Spray pump motors was varied in ETAP to match the above kW loadings. When, due to limitations in the model, it was impossible to exactly match the above kW loadings, the closest loading to the above loading was used as long as it was in the conservative direction (I.e.: Higher loading).

REFERENCES:

A) NRC Regulatory Guide 1.9 Revision 2
B) NRC Regulatory Guide 1.108 Revision 1
C) IEEE 387-1977, Standard Criteria for Diesel Generator
D) UFSAR 8.3.1.1.8
E) Technical Specification 3.8 - EDGs Surveillance Requirements
F) Design Instruction No. 98 Revision C - Emergency Diesel Generator System.
G) Specification 3071-19 Revision 0 - Emergency Standby Diesel Generator
H) Design Calculation 2116 Revision C - Bus Loading
I) Letter to Colt Industry regarding short-time rating of the diesel generator units, EF2-51619 Revision 0 (See Attachment Q)
J) Colt Industry response on short-time rating for the diesel generator units dated 01/08/81 (See Attachment R).
K) Diesel Generators, Load Profile and Load Sequencing Test Results EF2-72306 Revision 0.
L) EDG Loading Sequence Drawings 6I721-2714-35 Revision K and 6I721-2714-36 Revision K.
M) SOP 23.203, CORE SPRAY SYSTEM
N) SOP 23.702, EQUIPMENT AND FLOOR DRAINAGE SYSTEM
O) SOP 23.628.02, ENGINEERED SAFETY FEATURES ACTUATION INSTRUMENTATION (RPS AND ECCS)
P) SOP 23.406, PRIMARY CONTAINMENT NITROGEN INERTING AND PURGE SYSTEM
Q) SOP 23.427, PRIMARY CONTAINMENT ISOLATION SYSTEM
R) SOP 23.406, PRIMARY CONTAINMENT NITROGEN INERTING AND PURGE SYSTEM
S) SOP 23.127, REACTOR BUILDING CLOSED COOLING WATER/EMERGENCY EQUIPMENT COOLING WATER SYSTEM
T) SOP 23.205, RESIDUAL HEAT REMOVAL SYSTEM
U) SOP 23.138.01, REACTOR RECIRCULATION SYSTEM

V) SOP 23.707, REACTOR WATER CLEAN UP
W) SOP 23.409, THERMAL RECOMBINER SYSTEM
X) SOP 23.144, TORUS WATER MANAGEMENT SYSTEM

Known calculations used as design input - ETAP Vol. I, Rev. 0

Known calculations that use this calculation for input - DC-0547 Vol. I, DC-0550 Vol. I, DC-0182 Vol. 1, 3 and 6, DC-5804 Vol. I

Table 1

			Loading				With Frequency Allowance			
			EDG11	EDG12	EDG13	EDG14	EDG11	EDG12	EDG13	EDG14
Revision	**Failure**	**Time**	MW	MW	MW	MW	MW	MW	MW	MW
5003_Case_1	None	0-10 min	2.263	2.508	2.243	2.747	2.416	2.661	2.396	2.900
5003_Case_2	EDG11	0-10 min	OOS	2.741	2.372	2.635	OOS	2.894	2.525	2.788
5003_Case_3	EDG12	0-10 min	2.484	OOS	2.249	2.635	2.637	OOS	2.402	2.788
5003_Case_4	EDG13	0-10 min	2.414	2.660	OOS	2.705	2.567	2.813	OOS	2.858
5003_Case_5	EDG14	0-10 min	2.414	2.660	2.451	OOS	2.567	2.813	2.604	OOS
5003_Case_6	EDG11&12	0-10 min	OOS	OOS	2.484	2.761	OOS	OOS	2.637	2.914
5003_Case_7	EDG13&14	0-10 min	2.526	2.773	OOS	OOS	2.679	2.926	OOS	OOS
5003_Case_8	RHR Runout	0-10 min	2.573	2.806	2.531	2.796	2.726	2.959	2.684	2.949
5003_Case_9	None	10 min +	2.687	1.578	2.294	2.459	2.84	1.731	2.447	2.612
5003_Case_10	EDG11	10 min +	OOS	2.472	2.658	1.623	OOS	2.625	2.811	1.776
5003_Case_11	EDG12	10 min +	2.324	OOS	2.659	1.623	2.477	OOS	2.812	1.776
5003_Case_12	EDG13	10 min +	2.687	1.578	OOS	2.459	2.840	1.731	OOS	2.612
5003_Case_13	EDG14	10 min +	2.687	1.578	2.302	OOS	2.840	1.731	2.455	OOS
5003_Case_14	EDG11&12	10 min +	OOS	OOS	2.659	1.623	OOS	OOS	2.812	1.776
5003_Case_15	EDG13&14	10 min +	2.687	1.578	OOS	OOS	2.840	1.731	OOS	OOS
5003_Case_16	EDG Low Voltage	0-10 min	2.280	2.677	2.268	2.506	2.433	2.83	2.421	2.659

TABLE 2

Load ID	Category	Losses		% Voltage			% Vd	% Vd
					Terminal on			
		kW	kVAR	Bus	Bus kV	Load kV	Operating	Starting
RHR Pump D	Ind. Motor	0.1	0.0	87.20	87.18	90.67	0.02	87.13
RHR PMP A	Ind. Motor	2.5	2.1	92.91	92.72	96.43	0.19	91.97
SPRY PMP A	Ind. Motor	0.8	0.3	92.91	92.77	96.48	0.14	92.40
RHR PMP C	Ind. Motor	2.4	2.0	92.91	92.73	96.44	0.18	91.99
SPRY PMP C	Ind. Motor	0.7	0.3	92.91	92.78	96.49	0.12	92.44
RHR PMP B	Ind. Motor	2.3	1.9	87.02	86.86	90.33	0.16	86.32
SPRY PMP B	Ind. Motor	0.5	0.2	87.02	86.93	90.41	0.08	86.74
RHR PMP D	Ind. Motor	2.3	1.9	87.01	86.85	90.32	0.16	86.16
SPRY PMP D	Ind. Motor	0.6	0.2	87.01	86.92	90.40	0.09	86.72
T4100B002	Ind. Motor	0.0	0.0	94.59	94.32	98.42	0.28	93.44
T4100B003	Ind. Motor	0.0	0.0	94.59	94.57	98.69	0.02	94.51
T4100B043	Ind. Motor	0.1	0.0	94.59	93.59	97.66	1.00	90.78
T4100B021	Ind. Motor	0.1	0.0	94.52	93.96	98.04	0.57	92.54
T4100B029	Ind. Motor	0.1	0.0	94.52	93.39	97.45	1.13	89.96
T4700C001	Ind. Motor	0.1	0.0	93.68	93.21	93.21	0.47	90.90
T4100C008	Ind. Motor	0.0	0.0	94.50	94.06	98.15	0.43	92.14
T4100C007	Ind. Motor	0.0	0.0	94.50	94.07	98.16	0.43	92.15
EECWS PMP(N)	Ind. Motor	1.9	0.6	96.32	94.25	98.35	2.08	88.67
T4100B007	Ind. Motor	0.0	0.0	95.81	95.76	99.92	0.05	95.65
T4100B016	Ind. Motor	0.0	0.0	95.81	95.42	99.57	0.39	93.64
T4100B028	Ind. Motor	0.0	0.0	95.81	95.75	99.91	0.06	95.35
T4100C031	Ind. Motor	0.1	0.0	95.81	95.45	99.60	0.37	94.46
T4100B009A	Ind. Motor	0.0	0.0	95.81	95.78	99.95	0.03	95.61
T4100C041	Ind. Motor	0.0	0.0	95.81	95.59	99.75	0.22	94.89
T4100C047	Ind. Motor	0.2	0.0	95.81	94.78	98.91	1.03	92.68
T4100C053	Ind. Motor	0.0	0.0	95.81	95.74	99.90	0.07	95.34
T4100B018	Ind. Motor	0.6	0.1	96.08	93.52	97.59	2.56	87.60
T4100B034	Ind. Motor	0.0	0.0	96.08	95.47	99.62	0.61	93.51
T4100B036	Ind. Motor	0.1	0.0	96.08	94.56	98.67	1.52	88.81
T5000C002A	Ind. Motor	0.0	0.0	96.08	95.48	99.63	0.60	93.63
T4700C002	Ind. Motor	0.1	0.0	95.62	95.19	99.33	0.43	92.78
T4100B020	Ind. Motor	0.1	0.0	99.54	98.87	103.17	0.67	96.92
T4100B022	Ind. Motor	0.1	0.0	99.54	98.62	102.90	0.93	95.54
T4100B030	Ind. Motor	0.1	0.0	99.54	98.67	102.96	0.87	95.04
T4700C003	Ind. Motor	0.1	0.0	99.20	98.93	103.23	0.27	97.03
T4100C010	Ind. Motor	0.0	0.0	99.49	99.15	103.46	0.34	97.59
T4100C009	Ind. Motor	0.0	0.0	99.49	99.16	103.47	0.33	97.62

TABLE 2

Load ID	Category	Losses		% Voltage			% Vd	% Vd
					Terminal on			
		kW	kVAR	Bus	Bus kV	Load kV	Operating	Starting
R3001C005	Ind. Motor	0.2	0.0	92.07	91.60	95.58	0.47	90.40
R3000D001	Ind. Motor	0.0	0.0	92.07	91.84	95.83	0.23	90.96
R3001C001	Ind. Motor	0.0	0.0	92.07	91.89	95.88	0.19	91.25
X4103C001	Ind. Motor	0.0	0.0	92.07	91.94	95.94	0.13	91.67
R3001C003	Ind. Motor	0.0	0.0	92.07	91.91	95.90	0.17	91.34
X4103C017	Ind. Motor	0.1	0.0	92.07	91.45	95.42	0.63	90.04
X4103C021	Ind. Motor	0.0	0.0	92.07	92.00	96.00	0.08	91.61
X4103C010	Ind. Motor	0.0	0.0	92.07	91.98	95.98	0.10	91.62
X4103C009	Ind. Motor	0.0	0.0	92.07	91.96	95.95	0.12	91.52
X4103C002	Ind. Motor	0.1	0.0	92.07	91.80	95.79	0.27	91.24
ESSW Pump A	Ind. Motor	0.6	0.2	91.92	91.34	95.31	0.58	89.66
R3001C006	Ind. Motor	0.2	0.0	91.78	91.36	95.33	0.42	90.32
R3000D002	Ind. Motor	0.0	0.0	91.78	91.57	95.55	0.21	90.76
R3000C002	Ind. Motor	0.0	0.0	91.78	91.63	95.62	0.15	91.13
X4103C003	Ind. Motor	0.0	0.0	91.78	91.66	95.64	0.12	91.40
R3000C004	Ind. Motor	0.0	0.0	91.78	91.63	95.62	0.15	91.14
X4103C022	Ind. Motor	0.0	0.0	91.78	91.72	95.70	0.06	91.39
X4103C018	Ind. Motor	0.1	0.0	91.78	91.22	95.19	0.56	89.98
X4103C012	Ind. Motor	0.0	0.0	91.78	91.72	95.70	0.06	91.48
X4103C011	Ind. Motor	0.0	0.0	91.78	91.71	95.70	0.07	91.45
X4103C004	Ind. Motor	0.0	0.0	91.78	91.55	95.53	0.23	91.08
R3001C007	Ind. Motor	0.2	0.0	97.72	97.32	101.55	0.40	96.13
R3000D003	Ind. Motor	0.0	0.0	97.72	97.46	101.70	0.26	96.32
R3001C009	Ind. Motor	0.0	0.0	97.72	97.50	101.74	0.22	96.65
X4103C005	Ind. Motor	0.0	0.0	97.72	97.57	101.81	0.15	97.20
R3001C011	Ind. Motor	0.0	0.0	97.72	97.50	101.74	0.22	96.64
X4103C023	Ind. Motor	0.0	0.0	97.72	97.65	101.89	0.07	97.21
X4103C019	Ind. Motor	0.1	0.0	97.72	97.17	101.40	0.55	95.70
X4103C014	Ind. Motor	0.0	0.0	97.72	97.62	101.86	0.10	97.18
X4103C013	Ind. Motor	0.0	0.0	97.72	97.61	101.85	0.11	97.12
X4103C006	Ind. Motor	0.0	0.0	97.72	97.51	101.74	0.21	96.99
ESSW Pump B	Ind. Motor	0.4	0.2	97.23	96.82	101.03	0.41	95.11
R3001C008	Ind. Motor	0.4	0.1	97.10	96.24	100.43	0.86	93.68
R3000D004	Ind. Motor	0.0	0.0	97.10	97.10	101.33	0.00	97.10
R3001C010	Ind. Motor	0.0	0.0	97.10	96.92	101.13	0.18	96.20
X4103C007	Ind. Motor	0.0	0.0	97.10	96.96	101.18	0.14	96.63
R3001C012	Ind. Motor	0.0	0.0	97.10	96.91	101.13	0.19	96.17

TABLE 2

Load ID	Category	Losses		% Voltage			% Vd	% Vd
		kW	kVAR	Bus	Terminal on Bus kV	Terminal on Load kV	Operating	Starting
X4103C024	Ind. Motor	0.0	0.0	97.10	97.06	101.28	0.05	96.84
X4103C020	Ind. Motor	0.1	0.0	97.10	96.51	100.71	0.59	94.96
X4103C016	Ind. Motor	0.0	0.0	97.10	97.02	101.24	0.08	96.59
X4103C015	Ind. Motor	0.0	0.0	97.10	97.03	101.25	0.07	96.72
X4103C008	Ind. Motor	0.0	0.0	97.10	96.88	101.09	0.22	96.20
EECWS PMP(S)	Ind. Motor	0.3	0.1	98.61	98.27	102.54	0.35	97.22
T5000C002B	Ind. Motor	0.0	0.0	98.54	98.54	98.54	0.00	98.52
T4100B004	Ind. Motor	0.0	0.0	98.54	98.23	102.50	0.31	97.12
T4100B005	Ind. Motor	0.0	0.0	98.54	98.26	102.53	0.29	97.25
T4100B044	Ind. Motor	0.0	0.0	98.54	98.45	102.73	0.09	97.88
T4100B035	Ind. Motor	0.0	0.0	98.40	98.20	102.47	0.21	97.28
T4100B019	Ind. Motor	0.3	0.0	98.40	97.03	101.25	1.37	93.57
T4100B037	Ind. Motor	0.0	0.0	98.40	97.99	102.25	0.41	96.34
T4700C004	Ind. Motor	0.1	0.0	98.10	97.81	102.07	0.29	96.10
T4100B006	Ind. Motor	0.2	0.0	98.19	97.60	101.85	0.59	96.38
T4100B017	Ind. Motor	0.0	0.0	98.19	97.97	102.23	0.22	97.08
T4100B027	Ind. Motor	0.0	0.0	98.19	98.15	102.42	0.04	97.99
T4100C030	Ind. Motor	0.1	0.0	98.19	97.79	102.04	0.40	96.61
T4100B008A	Ind. Motor	0.0	0.0	98.19	98.14	102.41	0.05	97.86
T4100C040	Ind. Motor	0.0	0.0	98.19	97.91	102.17	0.28	96.97
T4100C048	Ind. Motor	0.1	0.0	98.19	97.83	102.08	0.36	96.98
C4101S002	St. Load	0.7	0.1	99.29	97.75	102.00	1.54	0.00
R1700S016A	St. Load	0.4	0.0	94.50	93.05	93.05	1.45	0.00
R1700S016B	St. Load	0.3	0.0	99.49	98.40	98.40	1.09	0.00
SECURITY #2	St. Load	0.8	0.3	94.50	93.07	93.07	1.42	0.00
SGTS 1 DISC	St. Load	0.4	0.1	96.32	95.68	95.68	0.64	0.00
SGTS 2 DISC	St. Load	0.3	0.1	98.61	98.08	98.08	0.53	0.00
T4100D011A	St. Load	0.2	0.0	95.81	94.12	94.12	1.69	0.00
T4100D011B	St. Load	0.1	0.0	98.19	97.08	97.08	1.11	0.00
T5101S006	St. Load	0.0	0.0	94.59	94.47	94.47	0.13	0.00
T5101S007	St. Load	0.1	0.0	98.54	98.26	98.26	0.28	0.00
T5101S008	St. Load	0.0	0.0	94.59	94.39	94.39	0.20	0.00
T5101S009	St. Load	0.0	0.0	98.54	98.30	98.30	0.25	0.00
UPS INVERT	St. Load	0.6	0.2	99.77	98.54	98.54	1.23	0.00
XFMR 5KVA(1)	St. Load	0.0	0.0	92.07	91.92	91.92	0.15	0.00
XFMR 5KVA(2)	St. Load	0.0	0.0	91.78	91.63	91.63	0.15	0.00
XFMR 5KVA(3)	St. Load	0.0	0.0	97.72	97.56	97.56	0.16	0.00

TABLE 2

Load ID	Category	Losses kW	Losses kVAR	% Voltage Bus	% Voltage Terminal on Bus kV	% Voltage Terminal on Load kV	% Vd Operating	% Vd Starting
XFMR 5KVA(4)	St. Load	0.0	0.0	97.10	96.95	96.95	0.16	0.00
XFMR 30KVA-1	St. Load	0.3	0.0	92.07	91.08	91.08	1.00	0.00
XFMR 30KVA-2	St. Load	0.2	0.0	97.72	97.00	97.00	0.72	0.00
B3105F031A	MOV	0.3	0.0	93.71	91.78	95.77	1.93	83.72
E1150F007A	MOV	0.0	0.0	94.52	93.25	97.30	1.27	88.53
E1150F007B	MOV	0.0	0.0	99.54	98.25	102.52	1.30	93.43
E1150F015B	MOV	0.2	0.0	94.38	93.73	97.80	0.65	91.15
E1150F017A	MOV	0.6	0.1	94.38	93.31	97.37	1.07	88.13
E2150F005A	MOV	0.5	0.0	96.08	92.77	96.80	3.31	79.67
E2150F005B	MOV	0.2	0.0	98.40	97.15	101.37	1.25	91.76
E2150F031A	MOV	0.0	0.0	94.52	93.44	97.50	1.08	90.66
E2150F031B	MOV	0.0	0.0	99.54	98.34	102.62	1.20	95.25
G1154F018	MOV	0.0	0.0	98.40	96.22	100.41	2.18	89.99
G3352F001	MOV	0.0	0.0	94.52	93.69	97.76	0.83	91.06
G3352F220	MOV	0.0	0.0	99.54	98.59	102.88	0.95	95.65
P4400F601A	MOV	0.0	0.0	96.08	95.42	99.57	0.66	93.80
P4400F603A	MOV	0.0	0.0	96.08	95.38	99.52	0.70	93.65
P4400F603B	MOV	0.1	0.0	98.40	97.40	101.63	1.00	93.02
P4400F604	MOV	0.0	0.0	98.40	96.78	100.99	1.63	93.13
P4400F605A	MOV	0.0	0.0	96.08	94.85	98.98	1.23	92.08
P4400F605B	MOV	0.0	0.0	98.40	97.11	101.33	1.29	94.19
P4400F606A	MOV	0.0	0.0	96.08	94.83	98.96	1.25	91.59
P4400F606B	MOV	0.0	0.0	98.40	97.04	101.26	1.37	93.73
P4400F608	MOV	0.0	0.0	98.40	96.60	100.80	1.80	91.02
P4400F613	MOV	0.0	0.0	94.59	93.35	97.41	1.24	88.74
P4400F614	MOV	0.0	0.0	96.08	94.24	98.33	1.85	87.03
T4901F601	MOV	0.0	0.0	94.52	92.64	96.66	1.88	86.83
T4901F602	MOV	0.0	0.0	99.51	98.01	102.28	1.50	92.79

TABLE 3

Revision	Failure	Time	Comment	RHR (Kw)	CS (Kw)	Attachment
5003_Case_1	None	0-10 min	Disable alternate supplies	1404	538	A
5003_Case_2	EDG11	0-10 min	MPU1 transfers to EDG12	1525	607/538	B
5003_Case_3	EDG12	0-10 min	72CF transfers to EDG14	1525	607/538	C
5003_Case_4	EDG13	0-10 min	Disable alternate supplies	1525	538/607	D
5003_Case_5	EDG14	0-10 min	MPU2 transfers to EDG13	1525	538/607	E
5003_Case_6	EDG11&12	0-10 min	72CF transfers to EDG14	1645	538	F
5003_Case_7	EDG13&14	0-10 min		1645	538	G
5003_Case_8	RHR Runout	0-10 min		1684	538	H
5003_Case_9	None	10 min +		1404	538	I
5003_Case_10	EDG11	10 min +	MPU1 transfers to EDG12	1404	538	J
5003_Case_11	EDG12	10 min +	72CF transfers to EDG14	1404	538	K
5003_Case_12	EDG13	10 min +	Disable alternate supplies	1404	538	L
5003_Case_13	EDG14	10 min +	MPU2 transfers to EDG13	1404	538	M
5003_Case_14	EDG11&12	10 min +	72CF transfers to EDG14	1404	538	N
5003_Case_15	EDG13&14	10 min +		1404	538	O
5003_Case_16	EDG Low Voltage	10 min +		1404	538	P

TABLE 4

LOAD	PIS #	BUS	COMMENT
RHR SERVICE WATER PUMP "A"	E1151C001A	11EA-EA2	Manual load
RHR SERVICE WATER PUMP "C"	*E1151C001C*	*12EB-EB2*	*Manual load*
RHR SERVICE WATER PUMP B	E1151C001B	13EC-EC2	Manual load
RHR SERVICE WATER PUMP "D"	E1151C001D	14ED-ED2	Manual load
CORE SPRAY PUMP "A"	E2101C001A	64B-B10	85% loading
RHR PUMP "A"	E1102C002A	64B-B5	89% loading
CORE SPRAY PUMP "C"	E2101C001C	64C-C10	85% loading
RHR PUMP C	E1102C002C	64C-C5	88% loading
CORE SPRAY PUMP B	E2101C001B	65E-E10	85% loading
RHR PUMP "B"	E1102C002B	65E-E5	89% loading
CORE SPRAY PUMP D	E2101C001D	65F-F10	85% loading
RHR PUMP D	E1102C002D	65F-F5	79% loading
DIV. 1 SWGR RM. #1 ESS CLG. FAN "A"	T4100B002	72B-2A , 1B	
DIV. 1 SWGR RM. #1 ESS CLG. FAN "B"	T4100B003	72B-2A , 1C	
DIV. I MAIN CONTROL ROOM EMERGENCY CTG. & COMM. FEED	T5101S008	72B-2A , 1D	
NORMAL FEED FOR DIV.1 120V AC I&C POWER	R3101S001	72B-2A , 1E	
BATTERY CHARGING AREA COOLING UNIT "A"	T4100B043	72B-2A , 2A	
EMERGENCY LTG. FEED 2ND FLOOR SWGR.	T5101S006	72B-2A , 2D	
INSTRUMENT BATTERY CHARGER A-1	R3200S023A	72B-2A , 3C	Has CR1 relay, requires manual action to restart
BATTERY CHARGER 2A-1	R3200S020A	72B-2A , 3D	Has CR1 relay, requires manual action to restart
CONTROL AIR COMP. NORTH	P5002D001	72B-3A , 1A	
REACTOR DRYWELL COOLING 2 SPEED FAN MIXING FAN	T4700C001	72B-3A , 1A-R	goes to low speed following a LOCA; 75% loading
Rx BUILDING AIR COMPRESSOR ROOM EEC FAN	T4100B029	72B-3A , 2B	
CORE SPRAY EE COOLER FAN # 2	T4100B021	72B-3A, 2D	
AUX. BLDG. BATTERY ROOM #1 EXHAUST FAN # 1	T4100C007	72B-4C , 1C	
DISTRIBUTION PANEL 72B-4C-1 30 KVA TRANS.	R1700S016A	72B-4C , 1C-R	
PLANT SECURITY FEED #2		72B-4C , 2C-R	

TABLE 4

LOAD	PIS #	BUS	COMMENT
AUX. BLDG. BATTERY ROOM #1 EXHAUST FAN # 2	T4100C008	72B-4C , 2D-R	
STAND BY GAS TREATMENT SYSTEM #1		72C- 4D	
SUPPLY FAN	T4100B007	72C-2A , 1A-R	
EQUIPMENT ROOM FAN COOLING UNIT	T4100B028	72C-2A , 1B-R	
MAIN CONT. ROOM RECIRC. EMER. MAKEUP FILTER FAN	T4100C047	72C-2A , 1C	
STANDBY GAS TREATMENT ESS. COOLING UNIT FAN	T4100B016	72C-2A , 1C-R	
CHILLED WATER PUMP	T4100C041	72C-2A , 1D	
SUPPLY FAN HEATER	T4100B007A	72C-2A , 2A	Has CR1 relay, requires manual action to restart
SUPPLY FAN HEATER	T4100B007C	72C-2A , 2A-R	Has CR1 relay, requires manual action to restart
SUPPLY FAN HEATER	T4100B007B	72C-2A , 2B	Has CR1 relay, requires manual action to restart
SUPPLY FAN HEATER	T4100B007D	72C-2A , 2B-R	Has CR1 relay, requires manual action to restart
CHILLED COMP OIL PUMP	T4100B009A	72C-2A , 2C-R	
EMERGENCY AIR FILTER INLET AIR HEATER	T4100D011A	72C-2A , 2D	
AUX. BUILDING CABLE TRAY COOLING FAN	T4100C053	72C-2A , 2D-R	
MAIN CONTROL ROOM A/C RETURN AIR FAN	T4100C031	72C-2A, 1B	
H2O2 DIV. I SAMPLE PUMP	T5002C002A	72C-3A , 10A	
BATTERY CHARGER 2A-2	R3200S020B	72C-3A , 10E	Has CR1 relay, requires manual action to restart
STANDBY FEED FOR DIV. I 120 VAC I&C CONT. POWER	R3101S001	72C-3A , 1C	alternate source; 27% loading to match loading of MPU 1
THERMAL RECOMBINER ROOM EEC FAN	T4100B036	72C-3A , 2A	
RHR EMERG. EQUIP. COOLER FAN # 1	T4100B018	72C-3A , 3A	
EECW PUMP ROOM EMERGENCY EQUIP COOLER FAN	T4100B034	72C-3A , 9A	
INSTRUMENT BATTERY CHARGER	R3200S023B	72C-3A , 9B	Has CR1 relay, requires manual action to restart
REACTOR DRYWELL COOLING 2 SPEED FAN	T4700C002	72C-3A , 9C	goes to low speed following a LOCA: 75%
EECW PUMP "A"	P4400C001A	72C-3D	
CHILLER COMPRESSOR	T4100B009	72C-4B	Has CR1 relay, requires manual action to restart
SECURITY UPS SYSTEM	R1700S011C	72E-2A	50% LOADING
REACTOR DRYWELL COOLING 2 SPEED MIXING FAN	T4700C003	72E-5A , 1A	goes to low speed following a LOCA; 75% loading

TABLE 4

LOAD	PIS #	BUS	COMMENT
CONTROL ROOM COMPRESSOR (SOUTH)	P5002D002	72E-5A , 2A	
Rx BUILDING AIR COMPRESSOR ROOM EEC FAN	T4100B030	72E-5A , 2D	
DIV. II 120 VAC I&C STANDBY FEED	R3101S002	72E-5A , 3D	alternate source; 24% loading to match loading of MPU 2
CORE SPRAY EEC FAN #1	T4100B020	72E-5A , 4C-R	
HPCI EMERGENCY . EQUIPMENT COOLER FAN	T4100B022	72E-5A , 4D-R	
BATTERY CHARGER (INSTRUMENT) B-1	R3200S024A	72E-5A , 5A	Has CR1 relay, requires manual action to restart
BATTERY CHARGER 2B-1	R3200S021A	72E-5A , 5B	Has CR1 relay, requires manual action to restart
480-120/208V , 30 KVA BOP RESTORABLE XFMR "B"	R1700S016B	72E-5B , 2A	
BATTERY ROOM #2 EXHAUST FAN #2	T4100C010	72E-5B , 2B-R	
BATTERY ROOM #2 EXHAUST FAN #1	T4100C009	72E-5B , 2C	
STAND BY LIQUID CONTROL STORAGE TANK "B" HEATER	C4101S002	72E-5B , 2C-R	
EDG #11 FUEL OIL TRANSFORMER PUMP "A"	R3001C001	72EA -2C , 1B	1 pump operates intermittently to maintain day tank level
MD COOLING TOWER FAN H/L SPEED	E1156C001A	72EA-2A	Manual load
PUMP ROOM VENT SUPPLY FAN	X4103C017	72EA-2C , 3B	
EDG #11 FUEL OIL TRANSFORMER PUMP "B"	R3001C003	72EA-2C , 1C	1 pump operates intermittently to maintain day tank level
EDG #11 AIR COMPRESSOR "A"	R3001D001	72EA-2C , 1D	
EDG 11 SERVICE WATER PUMP "A"	R3001C005	72EA-2C , 1E	
SWGR ROOM VENT SUPPLY FAN	X4103C009	72EA-2C , 2A	
EDG #11 OIL STORAGE ROOM EXHAUST FAN	X4103C021	72EA-2C , 3A	
EDG ROOM VENT SUPPLY FAN	X4103C001	72EA-2C , 3C	
EDG ROOM VENT SUPPLY FAN	X4103C002	72EA-2C , 3D	
SWGR ROOM VENT SUPPLY FAN	X4103C010	72EA-2C , 4A	
5 KVA , 480 - 240/120 V TRANS.		72EA-2C , 4D	
30 KVA , 480 - 480/277 V TRANS.		72EA-2C , 5E	
MD COOLING TOWER FAN H/L SPEED	E1156C001C	72EB-2B	Manual load
EMERGENCY EQUIPMENT SERVICE WATER PUMP "A"	P4500C002A	72EB-2C	
EDG 12 FUEL OIL TRANSFORMER PUMP A	R3001C002	72EB-2D , 1B	1 pump operates intermittently to maintain day tank level

TABLE 4

LOAD	PIS #	BUS	COMMENT
EDG 12 FUEL OIL TRANSFORMER PUMP B	R3001C004	72EB-2D , 1C	1 pump operates intermittently to maintain day tank level
EDG 12 AIR COMPRESSOR "C"	R3001D002	72EB-2D , 1D	
EDG 12 SERVICE WATER PUMP "C"	R3001C006	72EB-2D , 1E	
SWGR ROOM VENT SUPPLY FAN	X4103C011	72EB-2D , 2A	
PUMP ROOM VENT SUPPLY FAN	X4103C018	72EB-2D , 3B	
EDG ROOM SUPPLY FAN	X4103C003	72EB-2D , 3C	
EDG ROOM SUPPLY FAN	X4103C004	72EB-2D , 3D	
SWGR. ROOM VENT SUPPLY FAN	X4103C012	72EB-2D , 4A	
480 - 240/120V TRANSFORMER		72EB-2D , 4D	
EDG 12 OIL STORAGE ROOM EX. FAN	X4103C022	72EB-D , 3A	
MD COOLING TOWER FAN H/L SPEED	E1156C001B	72EC-2B	Manual load
EDG # 13 FUEL OIL TRANSFORMER PUMP "A"	R3001C009	72EC-2C , 1B	1 pump operates intermittently to maintain day tank level
EDG # 13 FUEL OIL TRANSFORMER PUMP "B"	R3001C011	72EC-2C , 1C	1 pump operates intermittently to maintain day tank level
EDG 13 SERVICE WATER PUMP B	R3001C007	72EC-2C , 1E	
SWGR ROOM VENT SUPPLY FAN	X4103C013	72EC-2C , 2A	
EDG AIR COMPRESSOR B	R3001D003	72EC-2C , 2D	
EDG 13 OIL STORAGE ROOM VENT SUPPLY FAN	X4103C023	72EC-2C , 3A	
PUMP ROOM VENT SUPPLY FAN	X4103C019	72EC-2C , 3B	
EDG ROOM VENT SUPPLY FAN	X4103C005	72EC-2C , 3C	
EDG ROOM VENT SUPPLY FAN	X4103C006	72EC-2C , 3D	
SWGR ROOM VENT SUPPLY FAN	X4103C014	72EC-2C , 4A	
5 KVA 480 - 240/120V TRANSFORMER		72EC-2C , 4D	
30 KVA , 480 - 480/277 TRANSFORMER		72EC-2C , 5E	
MD COOLING TOWER FAN H/L SPEED	E1156C001D	72ED-2B	Manual load
EMERG. EQUIPMENT SERVICE WATER PUMP B	P4500C002B	72ED-2C	
EDG 14 FUEL OIL TRANSFORMER PUMP A	R3001C010	72ED-2D , 1B	1 pump operates intermittently to maintain day tank level
EDG 14 FUEL OIL TRANSFORMER PUMP B	R3001C012	72ED-2D , 1C	1 pump operates intermittently to maintain day tank level

TABLE 4

LOAD	PIS #	BUS	COMMENT
EDG 14 AIR COMPRESSOR "D"	R3001D004	72ED-2D , 1D	
EDG 14 SERVICE WATER PUMP "D"	R3001C008	72ED-2D , 1E	
SWGR ROOM VENT SUPPLY FAN	X4103C015	72ED-2D , 2A	
EDG 14 OIL STORAGE ROOM VENT SUPPLY FAN	X4103C024	72ED-2D , 3A	
PUMP ROOM VENT SUPPLY FAN	X4103C020	72ED-2D , 3B	
EDG ROOM VENT SUPPLY FAN	X4103C007	72ED-2D , 3C	
EDG ROOM VENT SUPPLY FAN	X4103C008	72ED-2D , 3D	
SWGR ROOM VENT SUPPLY FAN	X4103C016	72ED-2D , 4A	
5 KVA TRANSFORMER		72ED-2D , 4D	
DIV. II MAIN CONT. ROOM EMER. LIGHTING & COMM. SYSTEM	T5101S009	72F-2A , 1A	
SWGR. ROOM #2 ESS. COOLING UNIT FAN "A"	T4100B004	72F-2A , 1B	
SWGR ROOM #2 ESS. COOLING FAN "B"	T4100B005	72F-2A , 1C	
DIV. II 120 VAC I&C NORMAL FEED	R3101S002	72F-2A , 1D	
H2O2 MONITOR SAMPLE PUMP DIV.II	T5000C002B	72F-2A , 2A	
EMERGENCY LTG. FEED 3RD FLOOR SWGR.	T5101S007	72F-2A , 2C	
BATTERY CHARGING COOLER UNIT FAN "B"	T4100B044	72F-2A , 3B	
BATTERY CHARGER B-2	R3200S024B	72F-2A , 3C	Has CR1 relay, requires manual action to restart
BATTERY CHARGER 2B-2	R3200S021B	72F-2A , 3D	Has CR1 relay, requires manual action to restart
STAND BY GAS TREATMENT #2	R1600S005B	72F-3A	
EECW PUMP B	P4400C001B	72F-3B	
EECW PUMP ROOM EE COOLER FAN	T4100B035	72F-4A , 1A-R	
THERMAL RECOMBINER ROOM EEC FAN	T4100B037	72F-4A , 1B-R	
REACTOR DRYWELL COOLING 2 SPEED MIXING FAN	T4700C004	72F-4A , 2A-R	goes to low speed following a LOCA; 75% loading
RHR EMERGENCY EQUIPMENT COOLER FAN #2	T4100B019	72F-4A , 5A-R	
CHILLER COMPRESSOR	T4100B008	72F-4C	Has CR1 relay, requires manual action to restart
SUPPLY FAN	T4100B006	72F-5A , 1A-R	

TABLE 4

LOAD	PIS #	BUS	COMMENT
RETURN AIR FAN	T4100C030	72F-5A , 1B	
EQUIPMENT ROOM FAN COOLING UNIT	T4100B027	72F-5A , 1B-R	
MAIN CONTROL ROOM RECIRC EMERGENCY FILTER FAN	T4100C048	72F-5A , 1C	
STAND BY GAS TREATMENT ROOM #2 ESS. COOLING UNIT FAN	T4100B017	72F-5A , 1C-R	
CHILLED WATER PUMP	T4100C040	72F-5A , 1D	
SUPPLY FAN HEATER	T4100B006A	72F-5A , 2A	Has CR1 relay, requires manual action to restart
SUPPLY FAN HEATER	T4100B006C	72F-5A , 2A-R	Has CR1 relay, requires manual action to restart
SUPPLY FAN HEATER	T4100B006D	72F-5A , 2B-R	Has CR1 relay, requires manual action to restart
EMERGENCY AIR FILTER INTAKE	T4100D011B	72F-5A , 2C	
CHILLER OIL PUMP	T4100B008A	72F-5A , 2CR	
SUPPLY FAN HEATER	T4100B006B	72F-5A, 2B	Has CR1 relay, requires manual action to restart

TABLE 5

PIS NO.	NAME	Normal Position	Cause of movement	Bus
B3105F031A	**RR PMP "A" DISCH MOV**	**Open**	**LPCI Inj**	**72CF**
MOV in Non-selected loop closes, MOV in selected loop remains open				
B3105F031B	**RR PMP "B" DISCH MOV**	**Open**	**LPCI Inj**	**72CF**
MOV in Non-selected loop closes, MOV in selected loop remains open				
E1150F003A	**RHR DIV1 HX "A" OUTLET MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI, is throttled after 10 min to control injection				
E1150F003B	**RHR DIV2 HX "B" OUTLET MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI, is throttled after 10 min to control injection				
E1150F004A	**RHR DIV1 PUMP "A" SUPR POOL SUCT ISO MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI				
E1150F004B	**RHR DIV2 PUMP "B" SUPR POOL SUCT ISO MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI				
E1150F004C	**RHR DIV1 PUMP "C" SUPR POOL SUCT ISO MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI				
E1150F004D	**RHR DIV2 PUMP "D" SUPR POOL SUCT ISO MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI				
E1150F006A	**RHR DIV1 PUMP "A" S/D COOLING ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed for LPCI				
E1150F006B	**RHR DIV2 PUMP "B" S/D COOLING ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed for LPCI				
E1150F006C	**RHR DIV1 PUMP "C" S/D COOLING ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed for LPCI				

TABLE 5

PIS NO.	NAME	Normal Position	Cause of movement	Bus
E1150F006D	**RHR DIV2 PUMP "D" S/D COOLING ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed for LPCI				
E1150F007A	**RHR DIV1 PUMPS "A" & "C" MIN FLOW MOV**	**Open**	**LPCI Inj**	**72B-3A**
Closes at greater than 3000 GPM flow				
E1150F007B	**RHR DIV2 PUMPS "B" & "D" MIN FLOW MOV**	**Open**	**LPCI Inj**	**72E-5A**
Closes at greater than 3000 GPM flow				
E1150F009	**RHR DIV1 & 2 S/D COOLING INBD CNTM ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed for LPCI				
E1150F010	**RHR DIV1 & 2 CROSS-TIE ISO MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI				
E1150F015A	**RHR DIV1 LPCI INBD ISO MOV**	**Closed**	**LPCI Inj**	**72CF**
Non-selected loop both inboard and outboard MOV close, selected loop inboard opens at 461 PSIG				
E1150F015B	**RHR DIV2 LPCI INBD ISO MOV**	**Closed**	**LPCI Inj**	**72CF**
Non-selected loop both inboard and outboard MOV close, selected loop inboard opens at 461 PSIG				
E1150F016A	**RHR DIV1 DRYWELL SPRAY OTBD ISO MOV**	**Closed**	**No Movement**	
Opened for Containment Sprays, requires operator action after 10 min				
E1150F016B	**RHR DIV2 DRYWELL SPRAY OTBD ISO MOV**	**Closed**	**No Movement**	
Opened for Containment Sprays, requires operator action after 10 min				
E1150F017A	**RHR DIV1 LPCI MOV**	**Open**	**LPCI Inj**	**72CF**
Non-selected loop both inboard and outboard MOV close, selected loop inboard opens at 461 PSIG				
E1150F017B	**RHR DIV2 LPCI MOV**	**Open**	**LPCI Inj**	**72CF**
Non-selected loop both inboard and outboard MOV close, selected loop inboard opens at 461 PSIG				

TABLE 5

PIS NO.	NAME	Normal Position	Cause of movement	Bus
E1150F021A	**RHR DIV1 DRYWELL SPRAY INBD ISO MOV**	**Closed**	**No Movement**	
Opened for Containment Sprays, requires operator action after 10 min				
E1150F021B	**RHR DIV2 DRYWELL SPRAY INBD ISO MOV**	**Closed**	**No Movement**	
Opened for Containment Sprays, requires operator action after 10 min				
E1150F022	**RHR RPV HEAD SPRAY INBD CNTM ISO MOV**	**Closed**	**No Movement**	
Discharge line has been disconnected				
E1150F024A	**RHR DIV1 CNTM COOLING/TEST ISO MOV**	**Closed**	**No Movement**	
Opened for Torus Cooling/Containment Sprays, requires operator action after 10 min				
E1150F024B	**RHR DIV2 CNTM COOLING/TEST ISO MOV**	**Closed**	**No Movement**	
Opened for Torus Cooling/Containment Sprays, requires operator action after 10 min				
E1150F027A	**RHR DIV1 SUPR POOL CNTM SPRAY INBD CNTM ISO MOV**	**Closed**	**No Movement**	
Opened for Containment Sprays, requires operator action after 10 min				
E1150F027B	**RHR DIV2 SUPR POOL CNTM SPRAY INBD CNTM ISO MOV**	**Closed**	**No Movement**	
Opened for Containment Sprays, requires operator action after 10 min				
E1150F028A	**RHR DIV1 SUPR POOL CNTM SPRAY TEST ISO MOV**	**Closed**	**No Movement**	
Opened for Torus Cooling/Containment Sprays, requires operator action after 10 min				
E1150F028B	**RHR DIV2 SUPR POOL CNTM SPRAY/TEST ISO MOV**	**Closed**	**No Movement**	
Opened for Torus Cooling/Containment Sprays, requires operator action after 10 min				
E1150F047A	**RHR DIV1 HX "A" INLET ISO MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI				

TABLE 5

PIS NO.	NAME	Normal Position	Cause of movement	Bus
E1150F047B	**RHR DIV2 HX "B" INLET ISO MOV**	**Open**	**No Movement**	
Normally open, stays open for LPCI				
E1150F048A	**RHR DIV1 HX "A" BYPASS MOV**	**Open**	**LPCI Inj**	**72C-3A**
MOV goes full open on LPCI Injection signal				
E1150F048B	**RHR DIV2 HX "B" BYPASS MOV**	**Open**	**LPCI Inj**	**72F-4A**
MOV goes full open on LPCI Injection signal				
E1150F068A	**RHR DIV1 HX "A" SERVICE WATER OUTLET ISO MOV**	**Closed**	**No Movement**	
Part or RHRSW, a manual system used after 10 min				
E1150F068B	**RHR DIV2 HX "B" SERVICE WATER OUTLET ISO MOV**	**Closed**	**No Movement**	
Part or RHRSW, a manual system used after 10 min				
E1150F073	**RHR DIV2 RHRSW TO RHR CROSSTIE ISO MOV**	**Closed**	**No Movement**	
Used as a alternative injection system per EOPs, requires manual movement after 10 min				
E1150F075	**RHR DIVISION. 2 RHRSW TO RHR CROSSTIE ISO MOV**	**Closed**	**No Movement**	
Used as a alternative injection system per EOPs, requires manual movement after 10 min				
E2150F004A	**CS DIV1 OTBD ISO MOV**	**Open**	**No Movement**	
Remains open on core spray injection				
E2150F004B	**CS DIV2 OTBD ISO MOV**	**Open**	**No Movement**	
Remains open on core spray injection				
E2150F005A	**CS DIV1 INBD ISO MOV**	**Closed**	**CS Inj**	**72C-3A**
Opens on core spray injection				
E2150F005B	**CS DIV2 INBD ISO MOV**	**Closed**	**CS Inj**	**72F-4B**
Opens on core spray injection				

TABLE 5

PIS NO.	NAME	Normal Position	Cause of movement	Bus
E2150F015A	**CS DIV1 PUMP FLOW TEST ISO MOV**	**Closed**	**No Movement**	
Remains closed on core spray injection				
E2150F015B	**CS DIV2 PUMP FLOW TEST ISO MOV**	**Closed**	**No Movement**	
Remains closed on core spray injection				
E2150F031A	**CS DIV1 MIN FLOW/RECIRC ISO MOV**	**Open**	**CS Inj**	**72B-3A**
Closes at greater than 775 GPM flow				
E2150F031B	**CS DIV2 MIN FLOW/RECIRC ISO MOV**	**Open**	**CS Inj**	**72E-5A**
Closes at greater than 775 GPM flow				
E2150F036A	**CS DIV1 SUCT FROM SUPR CHAMBER ISO MOV**	**Open**	**No Movement**	
Remains open on core spray injection				
E2150F036B	**CS DIV2 SUCT FROM SUPR CHAMBER ISO MOV**	**Open**	**No Movement**	
Remains open on core spray injection				
E4150F002	**HPCI TURBINE STEAM SUPPLY INBOARD CONTAINMENT ISO MOV**	**Open**	**No Movement**	
Required to stay open for HPCI operation				
E5150F007	**RCIC TURB STM SPLY INBD CNTM ISO MOV**	**Open**	**No Movement**	
Required to stay open for RCIC operation				
G1154F018	**RW DW EQUIP DRN AREA SUMP PMP C006A & C006B WC TNK INBOARD CNTM ISO MOV**	**Open**	**Group 13**	**72F-4A**
Closes on a Group 13 isolation due to High Drywell Pressure				
G3352F001	**RWCU INBOARD CNTM ISO MOV**	**Open**	**Group 10**	**72B-3A**
Closes on a Group 10 isolation due to Low Reactor Level				
G3352F220	**RWCU DIV2 CNTM ISO MOV**	**Open**	**Group 11**	**72E-5A**
Closes on a Group 11 isolation due to Low Reactor Level				

TABLE 5

PIS NO.	NAME	Normal Position	Cause of movement	Bus
G5100F600	**TWM TORUS DRN AZ-112-30 INBOARD ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed, closes on Group 12 Isolation				
G5100F601	**TWM TORUS DRN AZ-112-30 OTBD ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed, closes on Group 12 Isolation				
G5100F602	**TWM TORUS DRN AZ-292-30 INBOARD ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed, closes on Group 12 Isolation				
G5100F603	**TWM TORUS DRN AZ-292-30 OTBD ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed, closes on Group 12 Isolation				
G5100F604	**TWM TO RESIDUAL HEAT REMOVAL (RHR) TEST LINE INBOARD ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed, closes on Group 12 Isolation				
G5100F605	**TWM TO RESIDUAL HEAT REMOVAL (RHR) TEST LINE OTBD ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed, closes on Group 12 Isolation				
G5100F606	**TWM TO CORE SPRAY (CS) TEST LINE INBOARD ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed, closes on Group 12 Isolation				
G5100F607	**TWM TO CORE SPRAY (CS) TEST LINE OTBD ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed, closes on Group 12 Isolation				
P4400F601A	**RBCCW DIV1 RTRN ISO MOV**	**Open**	**EECW**	**72C-3A**
Closes on EECW initiation				
P4400F601B	**RBCCW DIV2 RTRN ISO MOV**	**Open**	**EECW**	**72F-4A**
Closes on EECW initiation				
P4400F602A	**EECW DIV1 M/U WTR TANK A001 OUTLET ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed on EECW initiation				

TABLE 5

PIS NO.	NAME	Normal Position	Cause of movement	Bus
P4400F602B	**EECW DIV2 M/U WTR TANK A002 OUTLET ISO MOV**	**Closed**	**No Movement**	
Normally closed, stays closed on EECW initiation				
P4400F603A	**RBCCW DIV1 SPLY ISO MOV**	**Open**	**EECW**	**72C-3A**
Closes on EECW initiation				
P4400F603B	**RBCCW DIV2 SPLY ISO MOV**	**Open**	**EECW**	**72F-4A**
Closes on EECW initiation				
P4400F604	**EECW DIV2 SPLY TO CRD PUMPS ISO MOV**	**Open**	**EECW**	**72F-4A**
Closes on EECW initiation				
P4400F605A	**EECW DIV1 SPLY TO RB EQUIP SUMP HX G1101B002A ISO MOV**	**Open**	**EECW**	**72C-3A**
Closes on EECW initiation				
P4400F605B	**EECW DIV2 SPLY TO RB EQUIP SUMP HX G1101B002B ISO MOV**	**Open**	**EECW**	**72F-4A**
Closes on EECW initiation				
P4400F606A	**EECW DIV1 DW SPLY OUTBOARD ISO MOV**	**Open**	**EECW**	**72C-3A**
Closes on EECW initiation if High Drywell Pressure also exists				
P4400F606B	**EECW DIV2 SPLY TO DW EQUIP OUTBOARD ISO MOV**	**Open**	**EECW**	**72F-4A**
Closes on EECW initiation if High Drywell Pressure also exists				
P4400F607A	**EECW DIV1 DW RTRN OUTBOARD ISO MOV**	**Open**	**No Movement**	
Normally open, remains open				
P4400F607B	**EECW DIV2 DW EQUIP OUTBOARD RTRN ISO MOV**	**Open**	**No Movement**	
Normally open, remains open				
P4400F608	**EECW DIV2 SPLY TO DW SUMP HX ISO MOV**	**Open**	**EECW**	**72F-4A**
Closes on EECW initiation				
P4400F613	**EECW DIV1 SPLY TO BATT ROOM SPACE COOLER T4100B033 ISO MOV**	**Open**	**EECW**	**72B-2A**
Closes on EECW initiation				

TABLE 5

PIS NO.	NAME	Normal Position	Cause of movement	Bus
P4400F614	**EECW DIV1 SPLY TO DW PENETRATION COOLERS ISO MOV**	**Open**	**EECW**	**72C-3A**
Closes on EECW initiation				
P4400F616	**EECW DIV1 DW EQUIP INBOARD RTRN ISO MOV**	**Open**	**No Movement**	
Normally open, remains open				
T4803F601	**CAC N2 INERTING DW AIR PURGE INLET SPLY MOV**	**Closed**	**No Movement**	
Normally closed, closes on a Group 14 Isolation				
T4803F602	**CAC N2 INERTING DW INBD EXH ISO MOV**	**Closed**	**No Movement**	
Normally closed, closes on a Group 14 Isolation				
T4804F603B	**CAC H2 RECOMB DIV2 H2 CTRL DW SUCT ISO**	**Closed**	**No Movement**	
Normally closed, Thermal Recombiners are a manually operated system				
T4804F605B	**CAC H2 RECOMB DIV2 DW OTBD SUCT ISO MOV**	**Closed**	**No Movement**	
Normally closed, Thermal Recombiners are a manually operated system				
T4901F601	**PC PNEU DIV1 INST N2 INERTING SPLY INBD PC ISO MOV**	**Open**	**Group 18**	**72B-3A**
Normally Open, closes on a Group 18 Isolation				
T4901F602	**COMPR AIR PC PNEU DIV2 INST N2 INERTING SPY INBRD PC ISO MOV**	**Open**	**Group 18**	**72E-5A**
Normally Open, closes on a Group 18 Isolation				

TABLE 6

			Case 9	Case 10	Case 11	Case 12	Case 13	Case 14	Case 15
			All EDGs	EDG11 OOS	EDG12 OOS	EDG13 OOS	EDG14 OOS	Div 1 OOS	Div 2 OOS
RHR SERVICE WATER PUMP "A"	E1151C001A	11EA-EA2	On		Off	On	On		On
RHR SERVICE WATER PUMP "C"	E1151C001C	12EB-EB2	On	Off		On	On		On
MD COOLING TOWER FAN H/L SPEED	E1156C001A	72EA-2A	On		Off	On	On		On
MD COOLING TOWER FAN H/L SPEED	E1156C001C	72EB-2B	On	Off		On	On		On
RHR PUMP "A"	E1102C002A	64B-B5	On		Off	On	On		On
RHR PUMP C	E1102C002C	64C-C5	Off	On		Off	Off		Off
CORE SPRAY PUMP "A"	E2101C001A	64B-B10	On		Off	On	On		On
CORE SPRAY PUMP "C"	E2101C001C	64C-C10	On	On		On	On		On
STANDBY FEED FOR DIV. I 120 VAC I&C CONT. POWER	R3101S001	72C-3A , 1C	On	On		Off	Off		Off
STAND BY GAS TREATMENT SYSTEM #1		72C- 4D	On	Off		On	On		On
SUPPLY FAN HEATER	T4100B007A	72C-2A , 2A	On	Off		On	On		On
SUPPLY FAN HEATER	T4100B007C	72C-2A , 2A-R	On	Off		On	On		On
SUPPLY FAN HEATER	T4100B007B	72C-2A , 2B	On	Off		On	On		On
SUPPLY FAN HEATER	T4100B007D	72C-2A , 2B-R	On	Off		On	On		On
CHILLER COMPRESSOR	T4100B009	72C-4B	Off	Off		Off	Off		Off
RHR SERVICE WATER PUMP B	E1151C001B	13EC-EC2	Off	On	On		Off	On	
RHR SERVICE WATER PUMP "D"	E1151C001D	14ED-ED2	Off	On	On	Off		On	
MD COOLING TOWER FAN H/L SPEED	E1156C001B	72EC-2B	Off	On	On		Off	On	
MD COOLING TOWER FAN H/L SPEED	E1156C001D	72ED-2B	Off	On	On	Off		On	
RHR PUMP "B"	E1102C002B	65E-E5	On	On	On		On	On	
RHR PUMP D	E1102C002D	65F-F5	On	Off	Off	On		Off	
CORE SPRAY PUMP B	E2101C001B	65E-E10	On	On	On		On	On	
CORE SPRAY PUMP D	E2101C001D	65F-F10	On	On	On	On		On	
DIV. II 120 VAC I&C STANDBY FEED	R3101S002	72E-5A , 3D	Off	Off	Off		On	Off	
STAND BY GAS TREATMENT #2	R1600S005B	72F-3A	Off	On	On	Off		On	
TABLE 6			Case 9	Case 10	Case 11	Case 12	Case 13	Case 14	Case 15

			All EDGs	EDG11 OOS	EDG12 OOS	EDG13 OOS	EDG14 OOS	Div 1 OOS	Div 2 OOS
SUPPLY FAN HEATER	T4100B006A	72F-5A , 2A	Off	On	On	Off		On	
SUPPLY FAN HEATER	T4100B006C	72F-5A , 2A-R	Off	On	On	Off		On	
SUPPLY FAN HEATER	T4100B006D	72F-5A , 2B-R	Off	On	On	Off		On	
SUPPLY FAN HEATER	T4100B006B	72F-5A, 2B	Off	On	On	Off		On	
CHILLER COMPRESSOR	T4100B008	72F-4C	Off	Off	Off	Off		Off	Off

Electrical Transient Analyzer Program

Load Flow Analysis

Loading Category (9): Accident

Generation Category (7): Accident

Load Diversity Factor: None

	Swing	V-Control	Load	Total
Number of Buses:	4	0	77	81

	XFMR2	XFMR3	Reactor	Line/Cable	Impedance	Tie PD	Total
Number of Branches:	12	0	0	59	0	6	77

Method of Solution: Newton-Raphson Method

Maximum No. of Iteration: 5

Precision of Solution: 0.001000

System Frequency: 60 Hz

Unit System: English

Project Filename: FERMI_2E

Output Filename: S:\Elec Working\ETAP Working\EDGsCase16.lfr

Adjustments

Tolerance	Apply Adjustments	Individual /Global	Percent
Transformer Impedance:	Yes	Individual	
Reactor Impedance:	Yes	Individual	
Overload Heater Resistance:	No		
Transmission Line Length:	No		
Cable Length:	No		

Temperature Correction	Apply Adjustments	Individual /Global	Degree C
Transmission Line Resistance:	Yes	Individual	
Cable Resistance:	Yes	Individual	

Bus Input Data

Bus			Initial Voltage		Load							
					Constant kVA		Constant Z		Constant I		Generic	
ID	kV	Sub-sys	% Mag.	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar
BUS 11EA	4.160	1	100.0	0.0								
BUS 11EA-N	4.160	1	100.0	0.0								
BUS 12EB	4.160	2	100.0	0.0								
BUS 12EB-N	4.160	2	100.0	0.0								
BUS 13EC	4.160	3	100.0	0.0								
BUS 13EC-N	4.160	3	100.0	0.0								
BUS 14ED	4.160	4	100.0	0.0								
BUS 14ED-N	4.160	4	100.0	0.0								
BUS 64B	4.160	1	100.0	0.0	1.957	0.941						
BUS 64C	4.160	2	100.0	0.0	1.956	0.900						
BUS 65E	4.160	3	87.0	0.0	1.957	0.941						
BUS 65F	4.160	4	100.0	0.0	1.955	0.899						
BUS 72B	0.480	1	100.0	0.0								
BUS 72B-2A	0.480	1	100.0	0.0	0.014	0.009	0.041	0.020				
BUS 72B-3A	0.480	1	100.0	0.0	0.035	0.021	0.006	0.004				
BUS 72B-3AN5	0.480	1	100.0	0.0	0.020	0.012						
BUS 72B-3AN6	0.480	1	100.0	0.0								
BUS 72B-3AN7	0.480	1	100.0	0.0								
BUS 72B-4C	0.480	1	100.0	0.0	0.002	0.002	0.084	0.013				
BUS 72B-4CN1	0.480	1	100.0	0.0								
BUS 72B-4CN2	0.480	1	100.0	0.0								
BUS 72B-4CN3	0.480	1	100.0	0.0								
BUS 72B-4CN4	0.480	1	100.0	0.0								
BUS 72C	0.480	2	100.0	0.0	0.083	0.038	0.057	0.035				
BUS 72C-2A	0.480	2	100.0	0.0	0.083	0.050	0.167	0.000				
BUS 72C-3A	0.480	2	100.0	0.0	0.030	0.019	0.042	0.011				
BUS 72C-3AN4	0.480	2	100.0	0.0								
BUS 72C-3AN5	0.480	2	100.0	0.0	0.020	0.012						
BUS 72C-3AN6	0.480	2	100.0	0.0								
BUS 72C-F	0.480	2	100.0	0.0			0.067	0.050				
BUS 72C-FN1	0.480	2	100.0	0.0			0.011	0.008				
BUS 72C-FN2	0.480	2	100.0	0.0								
BUS 72E	0.480	3	100.0	0.0			0.040	0.030				
BUS 72E-5A	0.480	3	100.0	0.0	0.051	0.032	0.003	0.002				

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus			Initial Voltage		Load							
					Constant kVA		Constant Z		Constant I		Generic	
ID	kV	Sub-sys	% Mag.	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar
BUS 72E-5AN2	0.480	3	100.0	0.0								
BUS 72E-5AN3	0.480	3	100.0	0.0	0.020	0.012						
BUS 72E-5AN4	0.480	3	100.0	0.0								
BUS 72E-5B	0.480	3	100.0	0.0	0.003	0.002	0.027	0.013				
BUS 72E-5BN1	0.480	3	100.0	0.0								
BUS 72E-5BN2	0.480	3	100.0	0.0								
BUS 72E-5BN3	0.480	3	100.0	0.0								
BUS 72E-5BN4	0.480	3	100.0	0.0								
BUS 72E-5BN5	0.480	3	100.0	0.0								
BUS 72E-5BN6	0.480	3	100.0	0.0			0.043	0.014				
BUS 72EA	0.480	1	100.0	0.0								
BUS 72EA-2C	0.480	1	100.0	0.0	0.092	0.053	0.031	0.015				
BUS 72EA-N	0.480	2	100.0	0.0								
BUS 72EB	0.480	2	100.0	0.0	0.086	0.039						
BUS 72EB-2D	0.480	2	100.0	0.0	0.090	0.053	0.004	0.002				
BUS 72EB-N	0.480	2	100.0	0.0								
BUS 72EC	0.480	3	100.0	0.0								
BUS 72EC-2C	0.480	3	100.0	0.0	0.090	0.053	0.031	0.015				
BUS 72EC-N	0.480	4	100.0	0.0								
BUS 72ED	0.480	4	100.0	0.0	0.086	0.039						
BUS 72ED-2D	0.480	4	100.0	0.0	0.090	0.053	0.004	0.002				
BUS 72ED-N	0.480	4	100.0	0.0								
BUS 72F	0.480	4	100.0	0.0	0.081	0.037	0.057	0.035				
BUS 72F-2A	0.480	4	100.0	0.0	0.014	0.010	0.040	0.020				
BUS 72F-4A	0.480	4	100.0	0.0	0.027	0.018	0.021	0.015				
BUS 72F-4AN7	0.480	4	100.0	0.0								
BUS 72F-4AN8	0.480	4	100.0	0.0	0.020	0.012						
BUS 72F-5A	0.480	4	100.0	0.0	0.085	0.046	0.012	0.000				
BUS 72F-N1	0.480	2	100.0	0.0								
E.D.G 11-N	4.160	1	93.1	0.0								
E.D.G. 12-N	4.160	2	93.1	0.0								
E.D.G. 13-N	4.160	3	87.2	0.0								
E.D.G. 14-N	4.160	4	87.2	0.0								
MPU-1-XFMR	0.480	1	100.2	-8.0			0.011	0.000				
MPU-2-XFMR	0.480	4	99.6	-5.0			0.010	0.000				
XFMR 72B-HV	4.160	1	100.0	0.0								

DC-5003 Vol. 1 - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus			Initial Voltage		Load							
					Constant kVA		Constant Z		Constant I		Generic	
ID	kV	Sub-sys	% Mag.	Ang.	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar
XFMR 72C-HV	4.160	2	100.0	0.0								
XFMR 72EA-HV	4.160	1	100.0	0.0								
XFMR 72EB-HV	4.160	2	100.0	0.0								
XFMR 72EC-HV	4.160	3	100.0	0.0								
XFMR 72EC-LV	0.480	3	100.0	0.0								
XFMR 72ED-HV	4.160	4	100.0	0.0								
XFMR 72ED-LV	0.480	4	100.0	0.0								
XFMR 72E-HV	4.160	3	100.0	0.0								
XFMR 72E-LV	0.480	3	100.0	0.0								
XFMR 72F-HV	4.160	4	100.0	0.0								
XFMR 72F-LV	0.480	4	100.0	0.0								
Total Number of Buses: 81					8.948	4.302	0.811	0.304	0.000	0.000	0.000	0.000

Generation Bus				Voltage		Generation			Mvar Limits	
ID	kV	Type	Sub-sys	% Mag.	Angle	MW	Mvar	% PF	Max	Min
E.D.G. 11-N	4.160	Swing	1	93.1	0.0					
E.D.G. 12-N	4.160	Swing	2	93.1	0.0					
E.D.G. 13-N	4.160	Swing	3	87.2	0.0					
E.D.G. 14-N	4.160	Swing	4	87.2	0.0					
						0.000	0.000			

Line/Cable Input Data

Line/Cable			Ohms or Siemens/1000 ft per Conductor (Cable) or per Phase (Line)						
			Length						
ID	Library	Size	Adj. (ft)	% Tol.	#/Phase	T (°C)	R	X	Y
200007A,B-1P	5.0NCUS3	500	1.0	0.0	1	90	9.900000	8.259999	
200008-1P	5.0NCUS3	350	1.0	0.0	1	90	7.150000	4.420000	
200011A,B-1P	5.0NCUS3	500	1.0	0.0	1	90	8.800000	7.340000	
200012-2P	5.0NCUS3	350	1.0	0.0	1	90	6.400000	3.950000	
200022A,B-2P	5.0NCUS3	500	1.0	0.0	1	90	9.440001	7.900000	
200023-2P	5.0NCUS3	350	1.0	0.0	1	90	5.000000	3.100000	
200026A,B-2P	5.0NCUS3	500	1.0	0.0	1	90	8.660000	7.240000	
200027-2P	5.0NCUS3	350	1.0	0.0	1	90	2.700000	1.670000	
200562-1P	0.6NCUN3	350	1.0	0.0	1	90	4.400000	2.340000	
200565-1P	0.6NCUN3	500	1.0	0.0	1	90	7.710000	5.600000	
200570A,B-0P	0.6NCUN3	350	1.0	0.0	1	90	6.440000	3.430000	
200580-1P	0.6MCUN3	350	1.0	0.0	1	90	48.500000	16.340000	
200582-1P	0.6NCUN3	500	1.0	0.0	1	90	8.650001	6.280000	
200583A,B-1P	0.6NCUN3	350	1.0	0.0	1	90	5.950000	3.760000	
200598A,B-0P	0.6NCUN3	350	1.0	0.0	1	90	8.110000	4.320000	
200602A,B-0P	0.6NCUN3	350	1.0	0.0	1	90	7.450000	3.960000	
200612-2P	0.6NCUN3	500	1.0	0.0	1	90	1.920000	1.390000	
200614-2P	0.6NCUN3	500	1.0	0.0	1	90	4.940000	3.590000	
200616-2P	0.6NCUN3	500	1.0	0.0	1	90	7.350000	5.340000	
200881A-C-2P	0.6NCUN3	500	1.0	0.0	1	90	0.070000	0.040000	
201269 -1P	0.6MCUN3	2	37.0	0.0	1	75	0.202000	0.044800	
201303,4-1P	0.6MCUN3	8	1.0	0.0	1	40	61.860000	1.050000	
201313,4-1P	0.6MCUN3	8	1.0	0.0	1	40	61.860000	1.050000	
201689 -2P	0.6MCUN3	2	18.0	0.0	1	75	0.169000	0.044800	
209784,7-1P	0.6MCUN3	8	1.0	0.0	1	40	23.000000	1.020000	
212779A-C-2P	0.6MCUN3	8	1.0	0.0	1	90	26.400000	7.360000	
212780,1-2P	0.6MCUN3	8	1.0	0.0	1	90	7.920000	0.900000	
212791A,B-2P	0.6MCUN3	8	1.0	0.0	1	90	30.220000	4.270000	
212796,7-2P	0.6MCUN3	8	1.0	0.0	1	90	1.420000	0.180000	
212801A,B-1P	0.6MCUN3	8	1.0	0.0	1	90	86.400000	7.570000	
212813,4-0P	0.6MCUN3	8	1.0	0.0	1	90	7.600000	0.870000	
212821A,B-1P	0.6MCUN3	8	1.0	0.0	1	90	44.500000	5.800000	
212843,4-0P	0.6MCUN3	8	1.0	0.0	1	90	7.600000	0.870000	
212853,8-0P	0.6MCUN3	8	1.0	0.0	1	90	3.500000	0.400000	

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Line/Cable	Ohms or Siemens/1000 ft per Conductor (Cable) or per Phase (Line)								
			Length						
ID	Library	Size	Adj. (ft)	% Tol.	#/Phase	T (°C)	R	X	Y
212863.8-0P	0.6MCUN3	8	1.0	0.0	1	90	3.500000	0.400000	
212873.4-0P	0.6MCUN3	8	1.0	0.0	1	90	3.800000	0.440000	
212950.1-0P	0.6MCUN3	8	1.0	0.0	1	90	7.600000	0.800000	
212953.4-0P	0.6MCUN3	8	1.0	0.0	1	90	3.800000	0.440000	
212956.7-0P	0.6MCUN3	8	1.0	0.0	1	90	3.500000	0.400000	
212994.5-0P	0.6MCUN3	8	1.0	0.0	1	90	7.600000	0.870000	
212997.8-1P	0.6MCUN3	8	1.0	0.0	1	90	2.670000	0.350000	
214005-SC	0.6MCUN3	8	1.0	0.0	1	40	72.789990	1.240000	
214013-SC	0.6MCUN3	8	1.0	0.0	1	40	72.789990	1.240000	
214712-0P	0.6MCUN3	8	1.0	0.0	1	90	10.700000	0.650000	
220555A,B	5.0NCUS3	500	1.0	0.0	2	90	0.730000	0.580000	
220560A,B	5.0NCUS3	500	1.0	0.0	2	90	1.420000	1.150000	
220565A,B-2P	5.0NCUS3	500	1.0	0.0	2	90	0.600000	0.470000	
220570A,B-2P	5.0NCUS3	500	1.0	0.0	1	90	0.520000	0.410000	
221150-1P	5.0NCUS3	4/0	1.0	0.0	1	90	6.000000	2.490000	
221160-1P	5.0NCUS3	4/0	1.0	0.0	1	90	6.660000	2.760000	
221170-2P	5.0NCUS3	4/0	1.0	0.0	1	90	6.260000	2.600000	
221180-2P	5.0NCUS3	4/0	1.0	0.0	1	90	7.050000	2.930000	
221240-1P	0.6NCUN3	350	1.0	0.0	1	90	3.030000	1.610000	
221260A,B-1P	5.0NCUS3	350	1.0	0.0	2	90	0.037500	0.037500	
221290-1P	0.6NCUN3	350	1.0	0.0	1	90	2.460000	1.310000	
221310-2P	0.6NCUN3	350	1.0	0.0	1	90	2.460000	1.310000	
221330A,B-2P	5.0NCUS3	350	1.0	0.0	2	90	0.037500	0.037500	
221360-2P	0.6NCUN3	350	1.0	0.0	1	90	2.340000	1.250000	
234282-2P	0.6MCUN3	8	1.0	0.0	1	40	156.820000	2.700000	

Line / Cable resistances are listed at the specified temperatures.

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

2-Winding Transformer Input Data

Transformer	Rating					Z Variation			% Tap Setting		Adjusted	Phase Shift	
ID	MVA	Prim. kV	Sec. kV	% Z	X/R	+ 5%	- 5%	% Tol.	Prim.	Sec.	% Z	Type	Angle
REG_72E	1.500	0.480	0.480	2.96	13.35	0	0	0	0	0	2.9600	Std Pos. Seq.	0.0
REG_72EC	0.750	0.480	0.480	4.76	7.25	0	0	0	0	0	4.7600	Std Pos. Seq.	0.0
REG_72ED	0.750	0.480	0.480	4.76	7.25	0	0	0	0	0	4.7600	Std Pos. Seq.	0.0
REG_72F	1.500	0.480	0.480	2.96	13.35	0	0	0	0	0	2.9600	Std Pos. Seq.	0.0
XFMR 72B	1.500	4.160	0.480	7.82	6.33	0	0	0	-2.500	0	7.8200	Std Pos. Seq.	0.0
XFMR 72C	1.500	4.160	0.480	7.80	6.50	0	0	0	-5.000	0	7.8000	Std Pos. Seq.	0.0
XFMR 72E	1.500	4.160	0.480	8.05	6.39	0	0	0	-5.000	0	8.0500	Std Pos. Seq.	0.0
XFMR 72EA	0.750	4.160	0.480	5.76	3.60	0	0	0	0	0	5.7600	Std Pos. Seq.	0.0
XFMR 72EB	0.750	4.160	0.480	5.67	3.52	0	0	0	0	0	5.6700	Std Pos. Seq.	0.0
XFMR 72EC	0.750	4.160	0.480	5.58	3.50	0	0	0	-2.500	0	5.5800	Std Pos. Seq.	0.0
XFMR 72ED	0.750	4.160	0.480	5.59	3.54	0	0	0	-2.500	0	5.5900	Std Pos. Seq.	0.0
XFMR 72F	1.500	4.160	0.480	7.79	6.18	0	0	0	-5.000	0	7.7900	Std Pos. Seq.	0.0

2-Winding Transformer Load Tap Changer (LTC) Settings

Transformer	Connected Buses ("*" LTC Side)		Transformer Load Tap Changer Setting					
ID	Primary Bus ID	Secondary Bus ID	% Min. Tap	% Max. Tap	% Step	Regulated Bus ID	% V	kV
REG_72E	XFMR 72E-LV	* BUS 72E	-10.00	10.00	0.625	BUS 72E	100.00	0.480
REG_72EC	* XFMR 72EC-LV	BUS 72EC	-10.00	10.00	0.625	BUS 72EC	100.00	0.480
REG_72ED	* XFMR 72ED-LV	BUS 72ED	-10.00	10.00	0.625	BUS 72ED	100.00	0.480
REG_72F	XFMR 72F-LV	* BUS 72F	-10.00	10.00	0.625	BUS 72F	100.00	0.480

Branch Connections

CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
REG_72E	2W XFMR	XFMR 72E-LV	BUS 72E	19.38	258.72	259.45	
REG_72EC	2W XFMR	XFMR 72EC-LV	BUS 72EC	102.61	743.96	751.00	
REG_72ED	2W XFMR	XFMR 72ED-LV	BUS 72ED	114.02	826.62	834.45	
REG_72F	2W XFMR	XFMR 72F-LV	BUS 72F	19.38	258.72	259.45	
XFMR 72B	2W XFMR	XFMR 72B-HV	BUS 72B	91.51	579.24	586.42	
XFMR 72C	2W XFMR	XFMR 72C-HV	BUS 72C	86.66	563.30	569.93	
XFMR 72E	2W XFMR	XFMR 72E-HV	XFMR 72E-LV	103.64	662.26	670.32	
XFMR 72EA	2W XFMR	XFMR 72EA-HV	BUS 72EA	237.14	853.71	886.04	
XFMR 72EB	2W XFMR	XFMR 72EB-HV	BUS 72EB	238.35	838.99	872.19	
XFMR 72EC	2W XFMR	XFMR 72EC-HV	XFMR 72EC-LV	262.01	917.04	953.74	
XFMR 72ED	2W XFMR	XFMR 72ED-HV	XFMR 72ED-LV	259.74	919.47	955.45	
XFMR 72F	2W XFMR	XFMR 72F-HV	XFMR 72F-LV	103.61	640.34	648.67	
200007A,B-1P	Cable	BUS 11EA-N	BUS 64B	6.60	5.51	8.60	
200008-1P	Cable	BUS 64B	XFMR 72B-HV	4.77	2.95	5.60	
200011A,B-1P	Cable	BUS 12EB-N	BUS 64C	5.87	4.89	7.64	
200012-2P	Cable	BUS 64C	XFMR 72C-HV	4.27	2.63	5.01	
200022A,B-2P	Cable	BUS 13EC-N	BUS 65E	7.17	6.00	9.35	
200023-2P	Cable	BUS 65E	XFMR 72E-HV	3.80	2.36	4.47	
200026A,B-2P	Cable	BUS 14ED-N	BUS 65F	6.58	5.50	8.58	
200027-2P	Cable	BUS 65F	XFMR 72F-HV	2.05	1.27	2.41	
200562-1P	Cable	BUS 72B	BUS 72B-2A	220.32	117.17	249.54	
200565-1P	Cable	BUS 72B	BUS 72B-3A	386.07	280.41	477.16	
200570A,B-0P	Cable	BUS 72B	BUS 72B-4C	322.47	171.75	365.36	
200580-1P	Cable	BUS 72C	BUS 72C-F	2428.57	818.20	2562.70	
200582-1P	Cable	BUS 72C	BUS 72C-2A	433.14	314.46	535.25	
200583A,B-1P	Cable	BUS 72C	BUS 72C-3A	297.94	188.28	352.44	
200598A,B-0P	Cable	BUS 72E	BUS 72E-5A	462.80	246.52	524.36	
200602A,B-0P	Cable	BUS 72E	BUS 72E-5B	425.13	225.98	481.46	
200612-2P	Cable	BUS 72F	BUS 72F-2A	109.56	79.32	135.26	
200614-2P	Cable	BUS 72F	BUS 72F-4A	281.90	204.86	348.48	
200616-2P	Cable	BUS 72F	BUS 72F-5A	419.43	304.73	518.44	
200881A-C-2P	Cable	BUS 72F-N1	BUS 72C-F	3.51	2.00	4.04	
201269 -1P	Cable	BUS 72B-2A	MPU-1-XFMR	374.25	83.00	383.34	
201303,4-1P	Cable	BUS 72B-3A	BUS 72B-3AN6	3097.56	52.58	3098.00	
201313,4-1P	Cable	BUS 72B-3A	BUS 72B-3AN7	3097.56	52.58	3098.00	
201689 -2P	Cable	BUS 72F-2A	MPU-2-XFMR	173.59	46.02	179.59	
209784,7-1P	Cable	BUS 72C-3A	BUS 72C-3AN6	1151.69	51.08	1152.83	

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CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
212779A-C-2P	Cable	BUS 72E-5AN2	BUS 72E-5AN3	1506.52	420.00	1563.97	
212780.1-2P	Cable	BUS 72E-5A	BUS 72E-5AN2	451.95	51.36	454.86	
212791A,B-2P	Cable	BUS 72F-4AN7	BUS 72F-4AN8	1724.50	243.67	1741.63	
212796.7-2P	Cable	BUS 72F-4A	BUS 72F-4AN7	81.03	10.27	81.68	
212801A,B-1P	Cable	BUS 72B-3A	BUS 72B-3AN5	4326.36	379.06	4342.94	
212813.4-0P	Cable	BUS 72B-4C	BUS 72B-4CN2	380.56	43.56	383.05	
212821A,B-1P	Cable	BUS 72C-3AN4	BUS 72C-3AN5	2228.28	290.43	2247.12	
212843.4-0P	Cable	BUS 72B-4C	BUS 72B-4CN4	380.56	43.56	383.05	
212853.8-0P	Cable	BUS 72E-5B	BUS 72E-5BN1	199.73	22.83	201.03	
212863.8-0P	Cable	BUS 72E-5B	BUS 72E-5BN2	199.73	22.83	201.03	
212873.4-0P	Cable	BUS 72E-5B	BUS 72E-5BN4	216.85	25.11	218.30	
212950.1-0P	Cable	BUS 72B-4C	BUS 72B-4CN1	380.56	40.06	382.66	
212953.4-0P	Cable	BUS 72E-5B	BUS 72E-5BN5	216.85	25.11	218.30	
212956.7-0P	Cable	BUS 72E-5B	BUS 72E-5BN3	199.73	22.83	201.03	
212994.5-0P	Cable	BUS 72B-4C	BUS 72B-4CN3	380.56	43.56	383.05	
212997.8-1P	Cable	BUS 72C-3A	BUS 72C-3AN4	133.70	17.53	134.84	
214005-SC	Cable	BUS 72C-FN2	BUS 72C-FN1	3644.86	62.09	3645.39	
214013-SC	Cable	BUS 72C-F	BUS 72C-FN2	3644.86	62.09	3645.39	
214712-0P	Cable	BUS 72E-5B	BUS 72E-5BN6	610.60	37.09	611.72	
220555A,B	Cable	E.D.G. 11-N	BUS 11EA	0.24	0.19	0.31	
220560A,B	Cable	E.D.G. 12-N	BUS 12EB	0.47	0.38	0.61	
220565A,B-2P	Cable	E.D.G. 13-N	BUS 13EC	0.23	0.18	0.29	
220570A,B-2P	Cable	E.D.G. 14-N	BUS 14ED	0.40	0.31	0.50	
221150-1P	Cable	BUS 11EA	XFMR 72EA-IIV	4.00	1.66	4.33	
221160-1P	Cable	BUS 12EB	XFMR 72EB-IIV	4.44	1.84	4.81	
221170-2P	Cable	BUS 13EC	XFMR 72EC-IIV	4.76	1.98	5.15	
221180-2P	Cable	BUS 14ED	XFMR 72ED-IIV	5.36	2.23	5.80	
221240-1P	Cable	BUS 72EA	BUS 72EA-2C	151.72	80.62	171.81	
221260A,B-1P	Cable	BUS 72EA-N	BUS 72EB-N	0.94	0.94	1.33	
221290-1P	Cable	BUS 72EB	BUS 72EB-2D	123.18	65.60	139.56	
221310-2P	Cable	BUS 72EC	BUS 72EC-2C	140.38	74.76	159.04	
221330A,B-2P	Cable	BUS 72EC-N	BUS 72ED-N	1.07	1.07	1.51	
221360-2P	Cable	BUS 72ED	BUS 72ED-2D	133.53	71.33	151.39	
234282-2P	Cable	BUS 72E-5A	BUS 72E-5AN4	8948.93	154.08	8950.26	
11EA-EA4	Tie Breakr	BUS 11EA-N	BUS 11EA				
12EB-EB4	Tie Breakr	BUS 12EB-N	BUS 12EB				
13EC-EC4	Tie Breakr	BUS 13EC-N	BUS 13EC				
14ED-ED4	Tie Breakr	BUS 14ED-N	BUS 14ED				
72EB-1C	Tie Breakr	BUS 72EB	BUS 72EB-N				

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CKT/Branch		Connected Bus ID		% Impedance, Pos. Seq., 100 MVA Base			
ID	Type	From Bus	To Bus	R	X	Z	Y
72ED-1C	Tie Breakr	BUS 72ED	BUS 72ED-N				

Equipment Cable Input Data

Equipment Cable	Equipment		Ohms or Siemens/1000 ft per Conductor									O/L Heater	
					Length							Resistance	
ID	ID	Type	Library	Size	Adj. (ft)	% Tol	#/ph	T (°C)	R	X	Y	Adj.(ohm)	% Tol
213810A,B-1P	B2103F016	MOV	0.6MCUN3	8	1.0	0.0	1	171	789.76000	11.34000	.0000000	7.5300	0.0
214940-2C	B2103F600	MOV	0.6MCUN3	8	1.0	0.0	1	40	331.13000	5.76000	.0000000	.3620	0.0
214014A-C-SC	B3105F031A	MOV	0.6MCUN3	8	1.0	0.0	1	171	398.21000	13.42000	.0000000	.0229	0.0
214008,9-SC	B3105F031B	MOV	0.6MCUN3	8	1.0	0.0	1	171	362.50000	12.78000	.0000000	.0150	0.0
214710-0P	C4101S002	Stat. Load	0.6MCUN3	8	1.0	0.0	1	90	80.00000	9.40000	.0000000	.0000	0.0
214680-0P	C4103C001A	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	74.62000	13.40000	.0000000	.0000	0.0
214690-0P	C4103C001B	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	78.70000	14.12000	.0000000	.0000	0.0
214740-0P	C7102S001A	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	83.72000	10.00000	.0000000	.0000	0.0
214760-0P	C7102S001B	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	45.27000	5.23000	.0000000	.0000	0.0
214270-1C	E1150F003A	MOV	0.6MCUN3	8	1.0	0.0	1	40	272.91000	5.00000	.0000000	.0121	0.0
214280-2C	E1150F003B	MOV	0.6MCUN3	8	1.0	0.0	1	40	256.54000	4.78000	.0000000	.0131	0.0
214230-1C	E1150F004A	MOV	0.6MCUN3	8	1.0	0.0	1	40	464.00000	8.20000	.0000000	.0152	0.0
214240-2C	E1150F004B	MOV	0.6MCUN3	8	1.0	0.0	1	40	342.00000	6.13000	.0000000	.0152	0.0
214250-1C	E1150F004C	MOV	0.6MCUN3	8	1.0	0.0	1	40	456.70000	8.20000	.0000000	.0152	0.0
214260-2C	E1150F004D	MOV	0.6MCUN3	8	1.0	0.0	1	40	440.30000	7.90000	.0000000	.0152	0.0
214190-1C	E1150F006A	MOV	0.6MCUN3	8	1.0	0.0	1	40	447.57000	8.10000	.0000000	.0188	0.0
214200-2C	E1150F006B	MOV	0.6MCUN3	8	1.0	0.0	1	40	251.08000	4.56000	.0000000	.0188	0.0
214210-1C	E1150F006C	MOV	0.6MCUN3	8	1.0	0.0	1	40	610.00000	11.12000	.0000000	.0188	0.0
214220-2C	E1150F006D	MOV	0.6MCUN3	8	1.0	0.0	1	40	530.00000	9.70000	.0000000	.0230	0.0
214480-1C	E1150F007A	MOV	0.6MCUN3	8	1.0	0.0	1	40	420.30000	7.35000	.0000000	3.7900	0.0
214490-2C	E1150F007B	MOV	0.6MCUN3	8	1.0	0.0	1	40	282.00000	5.00000	.0000000	3.7900	0.0
214540A,B-1P	E1150F009	MOV	0.6MCUN3	8	1.0	0.0	1	171	273.69000	10.00000	.0000000	.0047	0.0
214410-SC	E1150F010	MOV	0.6MCUN3	8	1.0	0.0	1	40	336.60000	6.03000	.0000000	.0089	0.0
214580-SP	E1150F015A	MOV	0.6MCUN3	8	1.0	0.0	1	40	66.00000	4.57000	.0000000	.0063	0.0
214590-SP	E1150F015B	MOV	0.6MCUN3	8	1.0	0.0	1	40	53.75000	3.60000	.0000000	.0063	0.0
214620-1P	E1150F016A	MOV	0.6MCUN3	8	1.0	0.0	1	40	114.20000	5.00000	.0000000	.0188	0.0
214630-2P	E1150F016B	MOV	0.6MCUN3	8	1.0	0.0	1	40	71.82000	3.51000	.0000000	.0250	0.0
214600-SP	E1150F017A	MOV	0.6MCUN3	8	1.0	0.0	1	40	55.80000	5.40000	.0000000	.0023	0.0
214610-SP	E1150F017B	MOV	0.6MCUN3	8	1.0	0.0	1	40	54.35000	5.30000	.0000000	.0023	0.0
214640-1C	E1150F021A	MOV	0.6MCUN3	8	1.0	0.0	1	40	620.40000	11.75000	.0000000	.0152	0.0
214650-2C	E1150F021B	MOV	0.6MCUN3	8	1.0	0.0	1	40	276.55000	4.81000	.0000000	.0700	0.0
214660A,B-1P	E1150F022	MOV	0.6MCUN3	8	1.0	0.0	1	171	768.33000	11.20000	.0000000	.0188	0.0
214420-1P	E1150F024A	MOV	0.6MCUN3	8	1.0	0.0	1	40	145.80000	6.30000	.0000000	.0030	0.0
214430-2P	E1150F024B	MOV	0.6MCUN3	8	1.0	0.0	1	40	43.80000	4.14000	.0000000	.0030	0.0
214380-2C	E1150F026B	MOV	0.6MCUN3	8	1.0	0.0	1	40	223.80000	3.80000	.0000000	.9840	0.0
214440-1C	E1150F027A	MOV	0.6MCUN3	8	1.0	0.0	1	40	322.03000	5.50000	.0000000	.2950	0.0
214450-2C	E1150F027B	MOV	0.6MCUN3	8	1.0	0.0	1	40	230.00000	4.00000	.0000000	.2950	0.0
214460-1C	E1150F028A	MOV	0.6MCUN3	8	1.0	0.0	1	40	345.70000	6.00000	.0000000	.0150	0.0
214470-2C	E1150F028B	MOV	0.6MCUN3	8	1.0	0.0	1	40	274.73000	4.80000	.0000000	.0288	0.0
214500-1C	E1150F047A	MOV	0.6MCUN3	8	1.0	0.0	1	40	254.71000	4.56000	.0000000	.0181	0.0
214510-2C	E1150F047B	MOV	0.6MCUN3	8	1.0	0.0	1	40	293.00000	5.50000	.0000000	.0181	0.0
214520-1P	E1150F048A	MOV	0.6MCUN3	8	1.0	0.0	1	40	266.47000	12.44000	.0000000	.0016	0.0
214530-2P	E1150F048B	MOV	0.6MCUN3	8	1.0	0.0	1	40	40.22000	1.76000	.0000000	.0023	0.0

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Equipment Cable	Equipment		Ohms or Siemens/1000 ft per Conductor									O/L Heater	
					Length							Resistance	
ID	ID	Type	Library	Size	Adj. (ft)	% Tol	#/ph	T (°C)	R	X	Y	Adj.(ohm)	% Tol
214290-1C	E1150F068A	MOV	0.6MCUN3	8	1.0	0.0	1	40	300.20000	5.45000	.0000000	.0348	0.0
214300-2C	E1150F068B	MOV	0.6MCUN3	8	1.0	0.0	1	40	364.00000	6.55000	.0000000	.0350	0.0
214350-2C	E1150F073	MOV	0.6MCUN3	8	1.0	0.0	1	40	174.66000	3.17000	.0000000	.1050	0.0
214360-2C	E1150F075	MOV	0.6MCUN3	8	1.0	0.0	1	40	165.57000	3.00000	.0000000	.1050	0.0
216235-1C	E1150F601A	MOV	0.6MCUN3	8	1.0	0.0	1	40	220.15000	4.00000	.0000000	2.5400	0.0
216225-2C	E1150F601B	MOV	0.6MCUN3	8	1.0	0.0	1	40	314.70000	5.60000	.0000000	3.0600	0.0
216240-1C	E1150F602A	MOV	0.6MCUN3	8	1.0	0.0	1	40	262.00000	4.70000	.0000000	4.7200	0.0
216230-2C	E1150F602B	MOV	0.6MCUN3	8	1.0	0.0	1	40	211.05000	3.73000	.0000000	2.9500	0.0
216200-1C	E1150F603A	MOV	0.6MCUN3	8	1.0	0.0	1	40	271.10000	5.00000	.0000000	.1050	0.0
216185-2C	E1150F603B	MOV	0.6MCUN3	8	1.0	0.0	1	40	183.76000	3.24000	.0000000	.1050	0.0
216205-1C	E1150F604A	MOV	0.6MCUN3	8	1.0	0.0	1	40	385.70000	7.00000	.0000000	.0510	0.0
216190-2C	E1150F604B	MOV	0.6MCUN3	8	1.0	0.0	1	40	331.13000	5.95000	.0000000	.0510	0.0
216210-1C	E1150F605A	MOV	0.6MCUN3	8	1.0	0.0	1	40	440.30000	8.00000	.0000000	.0510	0.0
216195-2C	E1150F605B	MOV	0.6MCUN3	8	1.0	0.0	1	40	327.50000	6.00000	.0000000	.0510	0.0
201630A,B-2P	E1150F608	MOV	0.6MCUN3	8	1.0	0.0	1	171	93.25999	5.03000	.0000000	.0048	0.0
214215-1P	E1150F611A	MOV	0.6MCUN3	8	1.0	0.0	1	40	160.17000	7.00000	.0000000	.0063	0.0
214245-2P	E1150F611B	MOV	0.6MCUN3	8	1.0	0.0	1	40	100.00000	4.34000	.0000000	.0063	0.0
212530-1C	E2150F004A	MOV	0.6MCUN3	8	1.0	0.0	1	40	629.52000	11.00000	.0000000	.0093	0.0
212540-2C	E2150F004B	MOV	0.6MCUN3	8	1.0	0.0	1	40	250.00000	4.30000	.0000000	.0093	0.0
212550-1C	E2150F005A	MOV	0.6MCUN3	8	1.0	0.0	1	40	707.75000	12.50000	.0000000	.0115	0.0
212560-2C	E2150F005B	MOV	0.6MCUN3	8	1.0	0.0	1	40	250.00000	4.30000	.0000000	.0115	0.0
212510-1C	E2150F015A	MOV	0.6MCUN3	8	1.0	0.0	1	40	76.41000	1.36000	.0000000	.0440	0.0
212520-2C	E2150F015B	MOV	0.6MCUN3	8	1.0	0.0	1	40	367.52000	6.43000	.0000000	.0440	0.0
212590-1C	E2150F031A	MOV	0.6MCUN3	8	1.0	0.0	1	40	187.40000	3.42000	.0000000	2.5400	0.0
212600-2C	E2150F031B	MOV	0.6MCUN3	8	1.0	0.0	1	40	340.23000	5.90000	.0000000	2.5400	0.0
212570-1C	E2150F036A	MOV	0.6MCUN3	8	1.0	0.0	1	40	451.22000	8.17000	.0000000	.0700	0.0
212580-2C	E2150F036B	MOV	0.6MCUN3	8	1.0	0.0	1	40	380.26000	6.87000	.0000000	.0700	0.0
209780A,B-1P	E4150F002	MOV	0.6MCUN3	8	1.0	0.0	1	171	462.78000	21.00000	.0000000	.0092	0.0
214720A,B-2P	E5150F007	MOV	0.6MCUN3	8	1.0	0.0	1	171	458.00000	7.00000	.0000000	.0027	0.0
200460-1P	EECWS PMP(N)	Ind. Motor	0.6MCUN3	4/0	1.0	0.0	1	90	48.18000	16.29000	.0000000	.0000	0.0
220470-0P	EECWS PMP(S)	Ind. Motor	0.6MCUN3	4/0	1.0	0.0	1	90	8.45000	2.81000	.0000000	.0000	0.0
221280-1P	ESSW Pump A	Ind. Motor	0.6MCUN3	4/0	1.0	0.0	1	90	12.36000	4.15000	.0000000	.0000	0.0
221350-2P	ESSW Pump B	Ind. Motor	0.6MCUN3	4/0	1.0	0.0	1	90	8.62000	4.64000	.0000000	.0000	0.0
215067-2P	G1154F018	MOV	0.6MCUN3	8	1.0	0.0	1	171	536.45000	7.42000	.0000000	4.7200	0.0
235050A,B-2P	G1154F600	MOV	0.6MCUN3	8	1.0	0.0	1	171	536.45000	7.42000	.0000000	7.5300	0.0
212410A,B-1P	G3352F001	MOV	0.6MCUN3	8	1.0	0.0	1	171	412.24000	6.06000	.0000000	.1050	0.0
201323-2P	G3352F220	MOV	0.6MCUN3	8	1.0	0.0	1	40	424.38000	15.30000	.0000000	1.0700	0.0
218470-1C	G5100F600	MOV	0.6MCUN3	8	1.0	0.0	1	40	582.21000	10.73000	.0000000	2.9500	0.0
218550-2C	G5100F601	MOV	0.6MCUN3	8	1.0	0.0	1	40	285.60000	5.23000	.0000000	2.9500	0.0
218460-1C	G5100F602	MOV	0.6MCUN3	8	1.0	0.0	1	40	750.00000	14.00000	.0000000	2.9500	0.0
218530-2C	G5100F603	MOV	0.6MCUN3	8	1.0	0.0	1	40	500.34000	9.43000	.0000000	2.9500	0.0
218480-1C	G5100F604	MOV	0.6MCUN3	8	1.0	0.0	1	40	384.00000	6.70000	.0000000	3.7900	0.0
218560-2C	G5100F605	MOV	0.6MCUN3	8	1.0	0.0	1	40	398.40000	7.23000	.0000000	3.7900	0.0
218490-1C	G5100F606	MOV	0.6MCUN3	8	1.0	0.0	1	40	613.14000	11.40000	.0000000	7.5300	0.0
218570-2C	G5100F607	MOV	0.6MCUN3	8	1.0	0.0	1	40	287.46000	5.00000	.0000000	9.2500	0.0
216890-2C	N1100F607	MOV	0.6MCUN3	8	1.0	0.0	1	40	587.67000	10.80000	.0000000	.1503	0.0
216900-2C	N1100F608	MOV	0.6MCUN3	8	1.0	0.0	1	40	587.67000	10.80000	.0000000	.0150	0.0

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Equipment Cable	Equipment		Ohms or Siemens/1000 ft per Conductor									O/L Heater	
					Length							Resistance	
ID	ID	Type	Library	Size	Adj. (ft)	% Tol	#/ph	T (°C)	R	X	Y	Adj.(ohm)	% Tol
216910-2C	N1100F609	MOV	0.6MCUN3	8	1.0	0.0	1	40	587.67000	10.80000	.0000000	.0150	0.0
216920-2C	N1100F610	MOV	0.6MCUN3	8	1.0	0.0	1	40	587.67000	10.80000	.0000000	.0150	0.0
211500-1C	P4400F601A	MOV	0.6MCUN3	8	1.0	0.0	1	40	384.00000	7.12000	.0000000	1.3300	0.0
211510-2C	P4400F601B	MOV	0.6MCUN3	8	1.0	0.0	1	40	350.00000	6.03000	.0000000	.3160	0.0
211520-1C	P4400F602A	MOV	0.6MCUN3	8	1.0	0.0	1	40	771.40000	14.70000	.0000000	2.9500	0.0
211530-2C	P4400F602B	MOV	0.6MCUN3	8	1.0	0.0	1	40	136.45000	2.67000	.0000000	1.8800	0.0
211540-1C	P4400F603A	MOV	0.6MCUN3	8	1.0	0.0	1	40	174.66000	3.03000	.0000000	1.6600	0.0
211550-2C	P4400F603B	MOV	0.6MCUS3	12	158.0	0.0	1	40	1.92827	.04000	.0000237	.3820	0.0
211560-2C	P4400F604	MOV	0.6MCUN3	8	1.0	0.0	1	40	556.74000	9.78000	.0000000	6.1500	0.0
211570-1C	P4400F605A	MOV	0.6MCUN3	8	1.0	0.0	1	40	458.50000	8.20000	.0000000	4.7200	0.0
211580-2C	P4400F605B	MOV	0.6MCUN3	8	1.0	0.0	1	40	604.05000	10.81000	.0000000	4.7200	0.0
211590-1C	P4400F606A	MOV	0.6MCUN3	8	1.0	0.0	1	40	358.40000	6.26000	.0000000	3.0600	0.0
211600-2C	P4400F606B	MOV	0.6MCUN3	8	1.0	0.0	1	40	434.80000	7.50000	.0000000	3.0600	0.0
211620-2C	P4400F607A	MOV	0.6MCUN3	8	1.0	0.0	1	40	300.00000	5.15000	.0000000	.0000	0.0
211610-1C	P4400F607B	MOV	0.6MCUN3	8	1.0	0.0	1	40	338.41000	5.87000	.0000000	3.0600	0.0
211630A,B-2P	P4400F608	MOV	0.6MCUN3	8	1.0	0.0	1	171	495.93000	6.90000	.0000000	3.7900	0.0
201220-1C	P4400F613	MOV	0.6MCUN3	8	1.0	0.0	1	40	400.00000	7.00000	.0000000	3.7900	0.0
201670A,B-1P	P4400F614	MOV	0.6MCUN3	8	1.0	0.0	1	171	666.50000	10.00000	.0000000	9.2500	0.0
220340A,B-2P	P4400F615	MOV	0.6MCUN3	8	1.0	0.0	1	171	362.26000	5.22000	.0000000	2.5400	0.0
220330A,B-1P	P4400F616	MOV	0.6MCUN3	8	1.0	0.0	1	171	556.86000	8.78000	.0000000	2.9500	0.0
213750-1P	P5002D001	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	50.20000	6.00000	.0000000	.0000	0.0
213760-2P	P5002D002	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	46.00000	5.38000	.0000000	.0000	0.0
209045-1P	R1600S046	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	26.70000	3.23000	.0000000	.0000	0.0
209055-1P	R1600S047	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	23.10000	2.77000	.0000000	.0000	0.0
209065-2P	R1600S048	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	25.00000	3.00000	.0000000	.0000	0.0
209075-2P	R1600S049	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	27.56000	3.27000	.0000000	.0000	0.0
200040-0P	R1700S016A	Stat. Load	0.6MCUN3	8	1.0	0.0	1	90	130.00000	5.00000	.0000000	.0000	0.0
200042-0P	R1700S016B	Stat. Load	0.6MCUN3	8	1.0	0.0	1	90	92.50000	3.45000	.0000000	.0000	0.0
216980-1P	R3000C002	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	245.20000	3.70000	.0000000	.0000	0.0
217000-1P	R3000C004	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	241.00000	3.63000	.0000000	.0000	0.0
215885-1P	R3000D001	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	111.23000	4.17000	.0000000	.0000	0.0
215890-1P	R3000D002	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	102.00000	3.87000	.0000000	.0000	0.0
215895-2P	R3000D003	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	130.00000	5.00000	.0000000	.0000	0.0
215900-2P	R3000D004	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	.11123	.00425	.0000000	.0000	0.0
216970-1P	R3001C001	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	307.60000	4.64000	.0000000	.0000	0.0
216990-1P	R3001C003	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	275.30000	4.10000	.0000000	.0000	0.0
217415-1P	R3001C005	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	22.00000	4.06000	.0000000	.0000	0.0
217420-1P	R3001C006	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	20.00000	3.41000	.0000000	.0000	0.0
217425-2P	R3001C007	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	20.00000	3.52000	.0000000	.0000	0.0
217430-2P	R3001C008	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	42.70000	8.20000	.0000000	.0000	0.0
217435-2P	R3001C009	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	378.50000	5.82000	.0000000	.0000	0.0
217440-2P	R3001C010	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	320.47000	5.00000	.0000000	.0000	0.0
217445-2P	R3001C011	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	380.70000	5.85000	.0000000	.0000	0.0
217450-2P	R3001C012	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	331.23000	5.11000	.0000000	.0000	0.0
201510-1P	R3200S020B	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	167.52000	13.00000	.0000000	.0000	0.0
201230-1P	R3200S020C	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	77.35999	6.00000	.0000000	.0000	0.0
201823-2P	R3200S021C	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	44.10000	3.44000	.0000000	.0000	0.0

Equipment Cable	Equipment		Ohms or Siemens/1000 ft per Conductor									O/L Heater	
					Length							Resistance	
ID	ID	Type	Library	Size	Adj (ft)	% Tol	#/ph	T (°C)	R	X	Y	Adj.(ohm)	% Tol
201527-1C	R3200S023B	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	105.50000	16.00000	.0000000	.0000	0.0
220030-1P	RHR PMP A	Ind. Motor	5.0NCUS3	500	1.0	0.0	1	90	15.35000	12.71000	.0000000	.0000	0.0
220040-2P	RHR PMP B	Ind. Motor	5.0NCUS3	500	1.0	0.0	1	90	12.11000	10.09000	.0000000	.0000	0.0
220050-1P	RHR PMP C	Ind. Motor	5.0NCUS3	500	1.0	0.0	1	90	14.85000	12.36000	.0000000	.0000	0.0
220060-2P	RHR PMP D	Ind. Motor	5.0NCUS3	500	1.0	0.0	1	90	12.62000	10.48000	.0000000	.0000	0.0
201710-0P	SECURITY #2	Stat. Load	0.6MCUN3	8	1.0	0.0	1	90	60.51000	25.12000	.0000000	.0000	0.0
200567-1P	SGTS 1 DISC	Stat. Load	0.6NCUN3	4/0	1.0	0.0	1	90	22.56000	7.37000	.0000000	.0000	0.0
200613-2P	SGTS 2 DISC	Stat. Load	0.6NCUN3	4/0	1.0	0.0	1	90	18.16000	5.89000	.0000000	.0000	0.0
220070-1P	SPRY PMP A	Ind. Motor	5.0NCUS3	4/0	1.0	0.0	1	90	33.62000	14.27000	.0000000	.0000	0.0
220080-2P	SPRY PMP B	Ind. Motor	5.0NCUS3	4/0	1.0	0.0	1	90	19.58000	8.18000	.0000000	.0000	0.0
220090-1P	SPRY PMP C	Ind. Motor	5.0NCUS3	4/0	1.0	0.0	1	90	30.83000	13.01000	.0000000	.0000	0.0
220100-2P	SPRY PMP D	Ind. Motor	5.0NCUS3	4/0	1.0	0.0	1	90	20.50000	8.56000	.0000000	.0000	0.0
212000-1P	T4100B002	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	125.00000	4.60000	.0000000	.0000	0.0
212010-1P	T4100B003	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	8.50000	.35000	.0000000	.0000	0.0
212020-2P	T4100B004	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	147.00000	5.63000	.0000000	.0000	0.0
212030-2P	T4100B005	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	134.15000	5.10000	.0000000	.0000	0.0
217050-2P	T4100B006	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	36.33000	3.05000	.0000000	.0000	0.0
217060-1P	T4100B007	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	3.36000	.30000	.0000000	.0000	0.0
201430-1P	T4100B007A	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	20.20000	1.80000	.0000000	.0000	0.0
201440-1P	T4100B007B	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	20.20000	1.80000	.0000000	.0000	0.0
201450-1P	T4100B007C	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	20.20000	1.80000	.0000000	.0000	0.0
201460-1P	T4100B007D	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	20.20000	1.80000	.0000000	.0000	0.0
201990-2P	T4100B008A	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	273.15000	4.30000	.0000000	.0000	0.0
201470-1P	T4100B009A	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	167.76000	2.52000	.0000000	.0000	0.0
212040-1P	T4100B016	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	277.45000	4.20000	.0000000	.0000	0.0
212050-2P	T4100B017	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	165.60000	2.52000	.0000000	.0000	0.0
216130-1P	T4100B018	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	291.60000	22.80000	.0000000	.0000	0.0
216140-2P	T4100B019	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	162.80000	12.76000	.0000000	.0000	0.0
209680-2P	T4100B020	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	110.00000	6.07000	.0000000	.0000	0.0
212670-1P	T4100B021	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	87.56000	5.10000	.0000000	.0000	0.0
209609-2P	T4100B022	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	275.10000	10.45000	.0000000	.0000	0.0
201940-2P	T4100B027	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	71.00000	1.05000	.0000000	.0000	0.0
201420-1P	T4100B028	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	120.45000	1.74000	.0000000	.0000	0.0
201320-1P	T4100B029	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	510.00000	7.51000	.0000000	.0000	0.0
201410-2P	T4100B030	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	492.50000	7.33000	.0000000	.0000	0.0
216170-1P	T4100B034	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	281.70000	4.66000	.0000000	.0000	0.0
216180-2P	T4100B035	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	107.54000	1.78000	.0000000	.0000	0.0
201490-1P	T4100B036	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	780.70000	12.90000	.0000000	.0000	0.0
201890-2P	T4100B037	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	215.10000	3.56000	.0000000	.0000	0.0
240556-1P	T4100B043	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	464.58000	6.80000	.0000000	.0000	0.0
240557-2P	T4100B044	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	107.54000	1.78000	.0000000	.0000	0.0
209570-1P	T4100C007	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	866.80000	12.52000	.0000000	.0000	0.0
209580-1P	T4100C008	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	873.24000	12.63000	.0000000	.0000	0.0
209590-2P	T4100C009	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	595.80000	8.70000	.0000000	.0000	0.0
209620-2P	T4100C010	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	604.40000	8.88000	.0000000	.0000	0.0
217130-2P	T4100C030	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	42.72000	3.60000	.0000000	.0000	0.0
217120-1P	T4100C031	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	37.67000	3.12000	.0000000	.0000	0.0

DC-5003 Vol. 1 - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Equipment Cable	Equipment		Ohms or Siemens/1000 ft per Conductor									O/L Heater	
					Length							Resistance	
ID	ID	Type	Library	Size	Adj. (ft)	% Tol	#/ph	T (°C)	R	X	Y	Adj.(ohm)	% Tol
217140-2P	T4100C040	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	85.75000	3.26000	.0000000	.0000	0.0
217150-1P	T4100C041	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	66.23000	2.50000	.0000000	.0000	0.0
217260-1P	T4100C047	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	121.43000	10.25000	.0000000	.0000	0.0
217170-2P	T4100C048	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	43.20000	5.40000	.0000000	.0000	0.0
204950-1P	T4100C053	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	150.00000	2.20000	.0000000	.0000	0.0
218610-1P	T4100D011A	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	344.70000	13.66000	.0000000	.0000	0.0
218600-2P	T4100D011B	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	219.06000	8.77000	.0000000	.0000	0.0
220890-2C	T4100F600	MOV	0.6MCUN3	8	1.0	0.0	1	40	498.50000	8.54000	.0000000	.0000	0.0
220880-1C	T4100F601	MOV	0.6MCUN3	8	1.0	0.0	1	40	831.47000	14.25000	.0000000	.1790	0.0
212800A,B-1P	T4700C001	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	47.00000	7.08000	.0000000	.0000	0.0
212820A,B-1P	T4700C002	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	44.50000	5.80000	.0000000	.0000	0.0
212778A-C-2P	T4700C003	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	26.40000	7.36000	.0000000	.0000	0.0
212790A,B-2P	T4700C004	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	30.22000	4.27000	.0000000	.0000	0.0
212815A,B-0P	T4700C005	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	56.00000	7.70000	.0000000	.0000	0.0
212810A,B-0P	T4700C006	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	51.56000	7.54000	.0000000	.0000	0.0
212835A,B-0P	T4700C007	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	46.50000	5.89000	.0000000	.0000	0.0
212828A-C-1P	T4700C008	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	7.60000	.87000	.0000000	.0000	0.0
212840A,B-0P	T4700C009	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	45.15000	5.62000	.0000000	.0000	0.0
212850A,B-0P	T4700C010	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	20.00000	2.70000	.0000000	.0000	0.0
212860A-0P	T4700C011	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	11.00000	1.25000	.0000000	.0000	0.0
212865A,B-0P	T4700C012	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	24.20000	3.67000	.0000000	.0000	0.0
212870A,B-0P	T4700C013	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	24.30000	3.70000	.0000000	.0000	0.0
212855A,B-0P	T4700C014	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	21.70000	3.24000	.0000000	.0000	0.0
201300A,B-1P	T4803F601	MOV	0.6MCUN3	8	1.0	0.0	1	171	535.52000	7.67000	.0000000	.0694	0.0
201310A,B-1P	T4803F602	MOV	0.6MCUN3	8	1.0	0.0	1	171	648.00000	10.00000	.0000000	.0694	0.0
201350-1C	T4804F601A	MOV	0.6MCUN3	8	1.0	0.0	1	40	398.45000	6.77000	.0000000	3.7900	0.0
201645-2C	T4804F601B	MOV	0.6MCUN3	8	1.0	0.0	1	40	434.84000	7.62000	.0000000	3.7900	0.0
201360-1C	T4804F602A	MOV	0.6MCUN3	8	1.0	0.0	1	40	453.00000	8.10000	.0000000	5.5100	0.0
201650-2C	T4804F602B	MOV	0.6MCUN3	8	1.0	0.0	1	40	118.26000	2.10000	.0000000	4.4300	0.0
201495-1C	T4804F603A	MOV	0.6MCUN3	8	1.0	0.0	1	40	757.00000	13.44000	.0000000	1.6600	0.0
201885-2C	T4804F603B	MOV	0.6MCUN3	8	1.0	0.0	1	40	538.55000	9.56000	.0000000	.0000	0.0
201370-1C	T4804F604A	MOV	0.6MCUN3	8	1.0	0.0	1	40	398.45000	6.77000	.0000000	3.7900	0.0
201655-2C	T4804F604B	MOV	0.6MCUN3	8	1.0	0.0	1	40	434.84000	7.62000	.0000000	.0000	0.0
201520-1C	T4804F605A	MOV	0.6MCUN3	8	1.0	0.0	1	40	400.00000	7.75000	.0000000	.0000	0.0
201880-2C	T4804F605B	MOV	0.6MCUN3	8	1.0	0.0	1	40	538.55000	9.56000	.0000000	.0000	0.0
201330-1C	T4804F606A	MOV	0.6MCUN3	8	1.0	0.0	1	40	453.03000	8.05000	.0000000	1.6600	0.0
201660-2C	T4804F606B	MOV	0.6MCUN3	8	1.0	0.0	1	40	136.45000	2.46000	.0000000	.0000	0.0
201290A,B-1P	T4901F601	MOV	0.6MCUN3	8	1.0	0.0	1	171	364.00000	5.51000	.0000000	11.5000	0.0
234268-2P	T4901F602	MOV	0.6MCUN3	8	1.0	0.0	1	40	31.20000	.53000	.0000000	7.9500	0.0
201560-1P	T5000C002A	Ind. Motor	0.6NCUN3	8	1.0	0 0	1	90	464.57000	7.70000	.0000000	.0000	0.0
Cable47	T5000C002B	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	3.36000	.30000	.0000000	.0000	0.0
201280-1P	T5101S006	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	10.82000	1.30000	.0000000	.0000	0.0
201780-2P	T5101S007	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	22.72000	2.77000	.0000000	.0000	0.0
201240-1P	T5101S008	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	32.57000	8.20000	.0000000	.0000	0.0
201790-2P	T5101S009	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	41.65000	2.30000	.0000000	.0000	0.0
201720-0P	UPS INVERT	Stat. Load	0.6NCUN1	4/0	1.0	0.0	1	90	54.77000	22.74000	.0000000	.0000	0.0
209085-1P	X4103C001	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	19.00000	1.47000	.0000000	.0000	0.0

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Equipment Cable	Equipment		Ohms or Siemens/1000 ft per Conductor									O/L Heater	
					Length							Resistance	
ID	ID	Type	Library	Size	Adj. (ft)	% Tol	#/ph	T (°C)	R	X	Y	Adj.(ohm)	% Tol
209090-1P	X4103C002	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	39.00000	3.26000	.0000000	.0000	0.0
209095-1P	X4103C003	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	20.00000	1.56000	.0000000	.0000	0.0
209100-1P	X4103C004	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	33.00000	2.75000	.0000000	.0000	0.0
209105-2P	X4103C005	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	23.00000	1.80000	.0000000	.0000	0.0
209110-2P	X4103C006	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	32.30000	2.67000	.0000000	.0000	0.0
209115-2P	X4103C007	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	21.20000	1.70000	.0000000	.0000	0.0
211165-2P	X4103C008	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	33.30000	2.77000	.0000000	.0000	0.0
211170-1P	X4103C009	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	80.70000	3.07000	.0000000	.0000	0.0
211175-1P	X4103C010	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	66.23000	2.47000	.0000000	.0000	0.0
211180-1P	X4103C011	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	48.40000	1.83000	.0000000	.0000	0.0
211185-1P	X4103C012	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	44.15000	1.66000	.0000000	.0000	0.0
211190-2P	X4103C013	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	82.36000	3.15000	.0000000	.0000	0.0
213355-2P	X4103C014	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	73.87000	2.80000	.0000000	.0000	0.0
213360-2P	X4103C015	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	52.60000	2.00000	.0000000	.0000	0.0
213365-2P	X4103C016	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	62.00000	2.30000	.0000000	.0000	0.0
213735-1P	X4103C017	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	170.60000	6.24000	.0000000	.0000	0.0
213740-1P	X4103C018	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	151.13000	5.54000	.0000000	.0000	0.0
213745-2P	X4103C019	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	158.80000	6.00000	.0000000	.0000	0.0
213845-2P	X4103C020	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	170.00000	6.30000	.0000000	.0000	0.0
213850-1P	X4103C021	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	79.00000	3.00000	.0000000	.0000	0.0
213855-1P	X4103C022	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	67.00000	2.53000	.0000000	.0000	0.0
213860-2P	X4103C023	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	82.36000	3.15000	.0000000	.0000	0.0
213865-2P	X4103C024	Ind. Motor	0.6NCUN3	8	1.0	0.0	1	90	52.60000	2.00000	.0000000	.0000	0.0
217090A-1P	XFMR 30KVA-1	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	90.80000	5.00000	.0000000	.0000	0.0
217100A-2P	XFMR 30KVA-2	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	61.40000	3.40000	.0000000	.0000	0.0
Cable331	XFMR 5KVA(1)	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	78.70000	10.00000	.0000000	.0000	0.0
Cable454	XFMR 5KVA(2)	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	78.70000	10.00000	.0000000	.0000	0.0
Cable452	XFMR 5KVA(3)	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	78.70000	10.00000	.0000000	.0000	0.0
Cable559	XFMR 5KVA(4)	Stat. Load	0.6NCUN3	8	1.0	0.0	1	90	78.70000	10.00000	.0000000	.0000	0.0

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LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	kV	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	% Tap
BUS 11EA	4.160	3.873	0.0	0	0	0	0	E.D.G. 11-N	-2.280	-1.092	376.9	90.2	
								XFMR 72EA-IIV	0.120	0.067	20.5	87.2	
								BUS 11EA-N	2.161	1.025	356.5	90.3	
BUS 11EA-N	4.160	3.873	0.0	0	0	0	0	BUS 64B	2.161	1.025	356.5	90.3	
								BUS 11EA	-2.161	-1.025	356.5	90.3	
BUS 12EB	4.160	3.872	0.0	0	0	0	0	E.D.G. 12-N	-2.677	-1.234	439.5	90.8	
								XFMR 72EB-IIV	0.181	0.097	30.6	88.1	
								BUS 12EB-N	2.496	1.136	408.9	91.0	
BUS 12EB-N	4.160	3.872	0.0	0	0	0	0	BUS 64C	2.496	1.136	408.9	91.0	
								BUS 12EB	-2.496	-1.136	408.9	91.0	
BUS 13EC	4.160	3.628	0.0	0	0	0	0	E.D.G. 13-N	-2.268	-1.123	402.8	89.6	
								XFMR 72EC-IIV	0.121	0.070	22.3	86.5	
								BUS 13EC-N	2.147	1.053	380.5	89.8	
BUS 13EC-N	4.160	3.628	0.0	0	0	0	0	BUS 65E	2.147	1.053	380.5	89.8	
								BUS 13EC	-2.147	-1.053	380.5	89.8	
BUS 14ED	4.160	3.628	0.0	0	0	0	0	E.D.G. 14-N	-2.506	-1.209	442.9	90.1	
								XFMR 72ED-IIV	0.182	0.100	33.1	87.6	
								BUS 14ED-N	2.324	1.109	409.9	90.3	
BUS 14ED-N	4.160	3.628	0.0	0	0	0	0	BUS 65F	2.324	1.109	409.9	90.3	
								BUS 14ED	-2.324	-1.109	409.9	90.3	
BUS 64B	4.160	3.865	0.0	0	0	1.957	0.941	BUS 11EA-N	-2.157	-1.022	356.5	90.4	
								XFMR 72B-IIV	0.199	0.081	32.2	92.7	
BUS 64C	4.160	3.865	0.0	0	0	1.956	0.900	BUS 12EB-N	-2.491	-1.133	408.9	91.0	
								XFMR 72C-IIV	0.535	0.233	87.2	91.7	
BUS 65E	4.160	3.620	0.0	0	0	1.957	0.941	BUS 13EC-N	-2.143	-1.049	380.5	89.8	
								XFMR 72E-IIV	0.186	0.108	34.3	86.4	
BUS 65F	4.160	3.620	0.0	0	0	1.955	0.899	BUS 14ED-N	-2.320	-1.105	409.9	90.3	
								XFMR 72F-IIV	0.366	0.206	66.9	87.1	
BUS 72B	0.480	0.454	-0.6	0	0	0	0	BUS 72B-2A	0.061	0.027	84.8	91.4	
								BUS 72B-3A	0.061	0.037	90.6	85.4	
								BUS 72B-4C	0.077	0.014	99.7	98.4	
								XFMR 72B-IIV	-0.199	-0.078	271.8	93.1	
BUS 72B-2A	0.480	0.454	-0.6	0	0	0.051	0.027	BUS 72B	-0.061	-0.027	84.8	91.4	
								MPU-1-XFMR	0.010	0.000	12.7	99.9	
BUS 72B-3A	0.480	0.453	-0.7	0	0	0.041	0.025	BUS 72B	-0.061	-0.037	90.6	85.4	
								BUS 72B-3AN6	0.000	0.000	0.0	0.0	

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Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	kV	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	% Tap
								BUS 72B-3AN7	0.000	0.000	0.0	0.0	
								BUS 72B-3AN5	0.020	0.012	30.0	85.3	
BUS 72B-3AN5	0.480	0.449	-0.4	0	0	0.020	0.012	BUS 72B-3A	-0.020	-0.012	30.0	85.1	
BUS 72B-3AN6	0.480	0.453	-0.7	0	0	0	0	BUS 72B-3A	0.000	0.000	0.0	0.0	
BUS 72B-3AN7	0.480	0.453	-0.7	0	0	0	0	BUS 72B-3A	0.000	0.000	0.0	0.0	
BUS 72B-4C	0.480	0.453	-0.7	0	0	0.077	0.014	BUS 72B	-0.077	-0.014	99.7	98.4	
								BUS 72B-4CN2	0.000	0.000	0.0	0.0	
								BUS 72B-4CN4	0.000	0.000	0.0	0.0	
								BUS 72B-4CN1	0.000	0.000	0.0	0.0	
								BUS 72B-4CN3	0.000	0.000	0.0	0.0	
BUS 72B-4CN1	0.480	0.453	-0.7	0	0	0	0	BUS 72B-4C	0.000	0.000	0.0	0.0	
BUS 72B-4CN2	0.480	0.453	-0.7	0	0	0	0	BUS 72B-4C	0.000	0.000	0.0	0.0	
BUS 72B-4CN3	0.480	0.453	-0.7	0	0	0	0	BUS 72B-4C	0.000	0.000	0.0	0.0	
BUS 72B-4CN4	0.480	0.453	-0.7	0	0	0	0	BUS 72B-4C	0.000	0.000	0.0	0.0	
BUS 72C	0.480	0.461	-1.6	0	0	0.135	0.070	BUS 72C-F	0.071	0.052	110.4	80.9	
								BUS 72C-2A	0.237	0.051	303.4	97.7	
								BUS 72C-3A	0.089	0.041	122.5	90.6	
								XFMR 72C-HV	-0.532	-0.214	717.9	92.7	
BUS 72C-2A	0.480	0.456	-1.9	0	0	0.235	0.050	BUS 72C	-0.235	-0.050	303.4	97.8	
BUS 72C-3A	0.480	0.460	-1.6	0	0	0.069	0.029	BUS 72C	-0.088	-0.041	122.5	90.6	
								BUS 72C-3AN6	0.000	0.000	0.0	0.0	
								BUS 72C-3AN4	0.020	0.012	29.4	85.2	
BUS 72C-3AN4	0.480	0.460	-1.6	0	0	0	0	BUS 72C-3AN5	0.020	0.012	29.4	85.2	
								BUS 72C-3A	-0.020	-0.012	29.4	85.2	
BUS 72C-3AN5	0.480	0.458	-1.5	0	0	0.020	0.012	BUS 72C-3AN4	-0.020	-0.012	29.4	85.1	
BUS 72C-3AN6	0.480	0.460	-1.6	0	0	0	0	BUS 72C-3A	0.000	0.000	0.0	0.0	
BUS 72C-F	0.480	0.452	-1.2	0	0	0.060	0.044	BUS 72C	-0.070	-0.051	110.4	80.5	
								BUS 72F-N1	0.000	0.000	0.0	0.0	
								BUS 72C-FN2	0.010	0.007	15.4	81.1	
BUS 72C-FN1	0.480	0.449	-0.9	0	0	0.010	0.007	BUS 72C-FN2	-0.010	-0.007	15.4	80.9	
BUS 72C-FN2	0.480	0.451	-1.1	0	0	0	0	BUS 72C-FN1	0.010	0.007	15.4	81.0	
								BUS 72C-F	-0.010	-0.007	15.4	81.0	
BUS 72E	0.480	0.478	-0.9	0	0	0.039	0.029	BUS 72E-5A	0.074	0.047	106.2	84.7	
								BUS 72E-5B	0.071	0.028	92.6	93.0	
								XFMR 72E-LV	-0.185	-0.104	256.5	87.1	10.000
BUS 72E-5A	0.480	0.476	-0.9	0	0	0.054	0.034	BUS 72E	-0.074	-0.047	106.2	84.7	
								BUS 72E-5AN2	0.020	0.012	28.3	85.1	
								BUS 72E-5AN4	0.000	0.000	0.6	80.7	

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Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	kV	Ang	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	% Tap
BUS 72E-5AN2	0.480	0.476	-0.9	0	0	0	0	BUS 72E-5AN3	0.020	0.012	28.3	85.1	
								BUS 72E-5A	-0.020	-0.012	28.3	85.1	
BUS 72E-5AN3	0.480	0.475	-0.8	0	0	0.020	0.012	BUS 72E-5AN2	-0.020	-0.012	28.3	85.0	
BUS 72E-5AN4	0.480	0.476	-0.9	0	0	0	0	BUS 72E-5A	0.000	0.000	0.6	80.7	
BUS 72E-5B	0.480	0.477	-0.9	0	0	0.029	0.014	BUS 72E	-0.071	-0.028	92.6	93.0	
								BUS 72E-5BN1	0.000	0.000	0.0	60.9	
								BUS 72E-5BN2	0.000	0.000	0.0	60.9	
								BUS 72E-5BN4	0.000	0.000	0.0	60.8	
								BUS 72E-5BN5	0.000	0.000	0.0	60.8	
								BUS 72E-5BN3	0.000	0.000	0.0	60.9	
								BUS 72E-5BN6	0.042	0.014	53.8	95.1	
BUS 72E-5BN1	0.480	0.477	-0.9	0	0	0	0	BUS 72E-5B	0.000	0.000	0.0	60.9	
BUS 72E-5BN2	0.480	0.477	-0.9	0	0	0	0	BUS 72E-5B	0.000	0.000	0.0	60.9	
BUS 72E-5BN3	0.480	0.477	-0.9	0	0	0	0	BUS 72E-5B	0.000	0.000	0.0	60.9	
BUS 72E-5BN4	0.480	0.477	-0.9	0	0	0	0	BUS 72E-5B	0.000	0.000	0.0	60.8	
BUS 72E-5BN5	0.480	0.477	-0.9	0	0	0	0	BUS 72E-5B	0.000	0.000	0.0	60.8	
BUS 72E-5BN6	0.480	0.476	-0.9	0	0	0.042	0.014	BUS 72E-5B	-0.042	-0.014	53.8	95.1	
BUS 72EA	0.480	0.443	-0.5	0	0	0	0	BUS 72EA-2C	0.119	0.066	177.5	87.6	
								XFMR 72EA-HV	-0.119	-0.066	177.5	87.6	
BUS 72EA-2C	0.480	0.442	-0.5	0	0	0.119	0.066	BUS 72EA	-0.119	-0.066	177.5	87.6	
BUS 72EA-N	0.480	0.441	-0.7	0	0	0	0	BUS 72EB-N	0.000	0.000	0.0	0.0	
BUS 72EB	0.480	0.441	-0.7	0	0	0.086	0.039	BUS 72EB-2D	0.094	0.055	142.0	86.5	
								XFMR 72EB-HV	-0.180	-0.094	265.6	88.7	
								BUS 72EB-N	0.000	0.000	0.0	0.0	
BUS 72EB-2D	0.480	0.441	-0.7	0	0	0.094	0.054	BUS 72EB	-0.094	-0.054	142.0	86.5	
BUS 72EB-N	0.480	0.441	-0.7	0	0	0	0	BUS 72EA-N	0.000	0.000	0.0	0.0	
								BUS 72EB	0.000	0.000	0.0	0.0	
BUS 72EC	0.480	0.470	-0.9	0	0	0	0	BUS 72EC-2C	0.121	0.067	169.7	87.3	
								XFMR 72EC-LV	-0.121	-0.067	169.7	87.3	
BUS 72EC-2C	0.480	0.469	-0.9	0	0	0.120	0.067	BUS 72EC	-0.120	-0.067	169.7	87.3	
BUS 72EC-N	0.480	0.467	-1.4	0	0	0	0	BUS 72ED-N	0.000	0.001	0.9	-11.2	
BUS 72ED	0.480	0.467	-1.4	0	0	0.086	0.039	BUS 72ED-2D	0.094	0.055	135.1	86.5	
								XFMR 72ED-LV	-0.180	-0.094	251.5	88.7	
								BUS 72ED-N	0.000	0.000	0.3	32.1	
BUS 72ED-2D	0.480	0.466	-1.4	0	0	0.094	0.055	BUS 72ED	-0.094	-0.055	135.1	86.5	
BUS 72ED-N	0.480	0.467	-1.4	0	0	0	0	BUS 72EC-N	0.000	-0.001	0.9	-11.2	
								BUS 72ED	0.000	0.000	0.3	32.1	
BUS 72F	0.480	0.473	-1.7	0	0	0.136	0.071	BUS 72F-2A	0.063	0.029	84.6	91.0	

DC-5003 Vol. 1 - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	kV	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	% Tap
								BUS 72F-4A	0.067	0.045	98.4	83.0	
								BUS 72F-5A	0.097	0.047	131.1	90.1	
								XFMR 72F-LV	-0.363	-0.191	500.9	88.5	10.000
BUS 72F-2A	0.480	0.473	-1.7	0	0	0.054	0.028	BUS 72F	-0.063	-0.029	84.6	91.0	
								MPU-2-XFMR	0.010	0.000	11.6	100.0	
BUS 72F-4A	0.480	0.472	-1.7	0	0	0.047	0.033	BUS 72F	-0.067	-0.045	98.4	83.0	
								BUS 72F-4AN7	0.020	0.012	28.6	85.1	
BUS 72F-4AN7	0.480	0.472	-1.7	0	0	0	0	BUS 72F-4AN8	0.020	0.012	28.6	85.1	
								BUS 72F-4A	-0.020	-0.012	28.6	85.1	
BUS 72F-4AN8	0.480	0.471	-1.6	0	0	0.020	0.012	BUS 72F-4AN7	-0.020	-0.012	28.6	85.1	
BUS 72F-5A	0.480	0.471	-1.7	0	0	0.096	0.046	BUS 72F	-0.096	-0.046	131.1	90.2	
BUS 72F-N1	0.480	0.452	-1.2	0	0	0	0	BUS 72C-F	0.000	0.000	0.0	0.0	
* E.D.G 11-N	4.160	3.873	0.0	2.280	1.093	0	0	BUS 11EA	2.280	1.093	376.9	90.2	
* E.D.G 12-N	4.160	3.873	0.0	2.677	1.234	0	0	BUS 12EB	2.677	1.234	439.5	90.8	
* E.D.G. 13-N	4.160	3.628	0.0	2.268	1.123	0	0	BUS 13EC	2.268	1.123	402.8	89.6	
* E.D.G. 14-N	4.160	3.628	0.0	2.507	1.209	0	0	BUS 14ED	2.507	1.209	442.9	90.1	
MPU-1-XFMR	0.480	0.454	-0.7	0	0	0.010	0.000	BUS 72B-2A	-0.010	0.000	12.7	99.9	
MPU-2-XFMR	0.480	0.473	-1.7	0	0	0.010	0.000	BUS 72F-2A	-0.010	0.000	11.6	100.0	
XFMR 72B-HV	4.160	3.865	0.0	0	0	0	0	BUS 64B	-0.199	-0.081	32.2	92.7	
								BUS 72B	0.199	0.081	32.2	92.7	-2.500
XFMR 72C-HV	4.160	3.863	0.0	0	0	0	0	BUS 64C	-0.535	-0.233	87.2	91.7	
								BUS 72C	0.535	0.233	87.2	91.7	-5.000
XFMR 72EA-HV	4.160	3.872	0.0	0	0	0	0	BUS 11EA	-0.120	-0.067	20.5	87.2	
								BUS 72EA	0.120	0.067	20.5	87.2	
XFMR 72EB-HV	4.160	3.872	0.0	0	0	0	0	BUS 12EB	-0.181	-0.097	30.6	88.1	
								BUS 72EB	0.181	0.097	30.6	88.1	
XFMR 72EC-HV	4.160	3.627	0.0	0	0	0	0	BUS 13EC	-0.121	-0.070	22.3	86.5	
								XFMR 72EC-LV	0.121	0.070	22.3	86.5	-2.500
XFMR 72EC-LV	0.480	0.425	-0.5	0	0	0	0	BUS 72EC	0.121	0.069	188.5	86.9	-10.000
								XFMR 72EC-HV	-0.121	-0.069	188.5	86.9	
XFMR 72ED-HV	4.160	3.627	0.0	0	0	0	0	BUS 14ED	-0.182	-0.100	33.1	87.6	
								XFMR 72ED-LV	0.182	0.100	33.1	87.6	-2.500
XFMR 72ED-LV	0.480	0.423	-0.8	0	0	0	0	BUS 72ED	0.181	0.096	279.4	88.2	-10.000
								XFMR 72ED-HV	-0.181	-0.096	279.5	88.2	
XFMR 72E-HV	4.160	3.620	0.0	0	0	0	0	BUS 65E	-0.186	-0.108	34.3	86.4	
								XFMR 72E-LV	0.186	0.108	34.3	86.4	-5.000
XFMR 72E-LV	0.480	0.436	-0.6	0	0	0	0	BUS 72E	0.185	0.105	282.1	86.9	
								XFMR 72E-HV	-0.185	-0.105	282.2	86.9	

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus		Voltage		Generation		Load		Load Flow					XFMR
ID	kV	kV	Ang.	MW	Mvar	MW	Mvar	ID	MW	Mvar	Amp	% PF	% Tap
XFMR 72F-HV	4.160	3.619	0.0	0	0	0	0	BUS 65F	-0.365	-0.206	66.9	87.1	
								XFMR 72F-LV	0.365	0.206	66.9	87.1	-5.000
XFMR 72F-LV	0.480	0.433	-1.2	0	0	0	0	BUS 72F	0.364	0.195	551.0	88.1	
								XFMR 72F-HV	-0.364	-0.195	551.0	88.1	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

# Indicates a bus with a load mismatch of more than 0.1 MVA

LOAD FLOW REPORT
Panel / 3-Phase, 1-Phase Systems

Bus/Panel/Phase Adapter				Voltage			Load*		Load Flow							XFMR
ID	kV	Phase	Type	Phase	% Mag	Ang.	kW	kvar	CKT	ID	Phase	kW	kvar	Amp	%PF	% Tap
SPFdr11	0.480	3	PA	AN	94.49	-0.7	0	0		MPU-1-XFMR	AN	0.010	-0.001	0.0	-99.8	
				BN	94.49	-120.7	0	0			BN	0.006	0.008	0.0	55.8	
				CN	94.49	119.3	0	0			CN					
										MPU-1-XFMR-1	AN	-0.010	0.001	0.0	-99.8	-5.000
											BN	-0.006	-0.008	0.0	55.8	
MPU-1-DIST-1	0.120	1	P	AN	98.24	0.6	0	0		BusMPU11	AN					
				BN	98.24	-121.9	0	0			BN					
Busxfmr11	0.120	1	Bus	AN	98.24	0.6	0	0		MPU-1-XFMR-1	AN					
				BN	98.24	-121.9	0	0			BN					
										Cab11	AN					
											BN					
BusMPU11	0.120	1	Bus	AN	98.24	0.6	0	0		Cab11	AN					
				BN	98.24	-121.9	0	0			BN					
										MPU-1-DIST-1	AN					
											BN					
SPFdr12	0.480	3	PA	AN	94.49	-0.7	0	0		MPU-1-XFMR	AN					
				BN	94.49	-120.7	0	0			BN	-4.3	2.4	18.8	-87.6	
				CN	94.49	119.3	0	0			CN	-4.2	-2.6	18.8	85.5	
										MPU-1-XFMR-2	BN	4.3	-2.4	18.8	-87.6	-5.000
											CN	4.2	2.6	18.8	85.5	
MPU-1-DIST-2	0.120	1	P	BN	101.59	-119.1	0	0		BusMPU12	BN	-4.3	2.2	63.2	-88.9	
				CN	100.54	116.7	0	0			CN	-4.2	-2.3	63.2	87.9	
									2	204036-1C	BN	0.110	-0.058	1.6	-88.6	
									2		CN	0.109	0.058	1.6	88.2	
									3	204037-1C	BN	2.8	-1.4	40.9	-89.0	
									3		CN	2.7	1.5	40.9	87.8	
									4	204033-1C	BN	0.675	-0.350	10.0	-88.7	
									4		CN	0.662	0.357	10.0	88.0	
									7	204041 -1C	BN	0.720	-0.375	10.6	-88.7	
									7		CN	0.708	0.380	10.6	88.1	
H21-P561	0.120	1	P	BN	109.72	-119.2	0.1	-0.1		Bus561	BN	-0.110	0.058	1.6	-88.5	
				CN	108.54	116.7	0.1	0.1			CN	-0.108	-0.058	1.6	88.2	
H21P557	0.120	1	P	BN	102.60	-121.8	2.5	-1.4		Bus557	BN	-2.5	1.4	40.9	-86.7	
				CN	100.65	118.6	2.5	1.5			CN	-2.5	-1.5	40.9	86.1	
H21-P559	0.120	1	P	BN	107.68	-119.9	0.7	-0.4		Bus559	BN	-0.655	0.352	10.0	-88.1	
				CN	106.28	117.2	0.6	0.4			CN	-0.643	-0.355	10.0	87.6	
H11P901	0.130	1	P	BN	99.61	-119.9	0.7	-0.4		Bus901	BN	-0.701	0.377	10.6	-88.0	
				CN	98.29	117.2	0.7	0.4			CN	-0.689	-0.378	10.6	87.7	

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus/Panel/Phase Adapter				Voltage			Load*		Load Flow							XFMR
ID	kV	Phase	Type	Phase	% Mag	Ang.	kW	kvar	CKT	ID	Phase	kW	kvar	Amp	%PF	% Tap
Busxfmr12	0.120	1	Bus	BN	98.25	-120.1	0	0		MPU-1-XFMR-2	BN	-4.3	2.3	71.6	-88.1	
				CN	97.28	117.7	0	0			CN	-4.2	-2.4	71.6	87.0	
										Cab12	BN	4.3	-2.3	71.6	-88.1	
											CN	4.2	2.4	71.6	87.0	
BusVR12	0.120	1	Bus	BN	98.14	-120.1	0	0		Cab12	BN	-4.3	2.3	71.6	-88.1	
				CN	97.13	117.8	0	0			CN	-4.2	-2.4	71.6	87.0	
										R3101S010B VLTG. REG.-1	BN	4.3	-2.3	71.6	-88.1	-4.400
											CN	4.2	2.4	71.6	87.0	
BusMPU12	0.130	1	Bus	BN	101.59	-119.1	0	0		R3101S010B VLTG. REG.-1	BN	-4.3	2.2	63.2	-88.9	
				CN	100.54	116.7	0	0			CN	-4.2	-2.3	63.2	87.9	
										MPU-1-DIST-2	BN	4.3	-2.2	63.2	-88.9	
											CN	4.2	2.3	63.2	87.9	
Bus561	0.120	1	Bus	BN	109.72	-119.2	0	0	2	204036-1C	BN	-0.110	0.058	1.6	-88.5	
				CN	108.54	116.7	0	0	2		CN	-0.108	-0.058	1.6	88.2	
										II21-P561	BN	0.110	-0.058	1.6	-88.5	
											CN	0.108	0.058	1.6	88.2	
Bus557	0.120	1	Bus	BN	102.60	-121.8	0	0	3	204037-1C	BN	-2.5	1.4	40.9	-86.7	
				CN	100.65	118.6	0	0	3		CN	-2.5	-1.5	40.9	86.1	
										II21P557	BN	2.5	-1.4	40.9	-86.7	
											CN	2.5	1.5	40.9	86.1	
Bus559	0.120	1	Bus	BN	107.68	-119.9	0	0	4	204033-1C	BN	-0.655	0.352	10.0	-88.1	
				CN	106.28	117.2	0	0	4		CN	-0.643	-0.355	10.0	87.6	
										II21-P559	BN	0.655	-0.352	10.0	-88.1	
											CN	0.643	0.355	10.0	87.6	
Bus901	0.130	1	Bus	BN	99.61	-119.9	0	0	7	204041 -1C	BN	-0.701	0.377	10.6	-88.0	
				CN	98.29	117.2	0	0	7		CN	-0.689	-0.378	10.6	87.7	
										H11P901	BN	0.701	-0.377	10.6	-88.0	
											CN	0.689	0.378	10.6	87.7	
SPFdr13	0.480	3	PA	AN	94.49	-0.7	0	0		MPU-1-XFMR	AN	-0.725	-0.425	3.2	86.3	
				BN	94.49	-120.7	0	0			BN					
				CN	94.49	119.3	0	0			CN	-0.731	0.416	3.2	-86.9	
										MPU-1-XFMR-3	AN	0.725	0.425	3.2	86.3	-5.000
											CN	0.731	-0.416	3.2	-86.9	
MPU-1-DISTR-3	0.120	1	P	AN	101.87	-3.1	0	0		BusMPU13	AN	-0.725	-0.383	11.1	88.4	
				CN	102.05	121.6	0	0			CN	-0.729	0.377	11.1	-88.8	
									2	204042 -1C	AN	0.725	0.383	11.1	88.4	
									2		CN	0.729	-0.377	11.1	-88.8	
H11P900	0.120	1	P	AN	98.97	-2.5	0.7	0.4		Bus900	AN	-0.699	-0.380	11.1	87.9	
				CN	99.44	120.7	0.7	-0.4			CN	-0.704	0.380	11.1	-88.0	
Busxmfr13	0.120	1	Bus	AN	98.08	-2.0	0	0		MPU-1-XFMR-3	AN	-0.725	-0.402	12.2	87.4	
				CN	98.25	120.5	0	0			CN	-0.730	0.396	12.2	-87.9	
										Cab13	AN	0.725	0.402	12.2	87.4	
											CN	0.730	-0.396	12.2	-87.9	

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus/Panel/Phase Adapter				Voltage			Load*		Load Flow							XFMR
ID	kV	Phase	Type	Phase	% Mag	Ang.	kW	kvar	CKT	ID	Phase	kW	kvar	Amp	%PF	% Tap
BusVR13	0.120	1	Bus	AN	98.06	-2.0	0	0		Cab13	AN	-0.725	-0.402	12.2	87.4	
				CN	98.23	120.5	0	0			CN	-0.729	0.396	12.2	-87.9	
										R3101S010A VLTG REG.	AN	0.725	0.402	12.2	87.4	-4.800
											CN	0.729	-0.396	12.2	-87.9	
BusMPU13	0.125	1	Bus	AN	101.87	-3.1	0	0		R3101S010A VLTG REG.	AN	-0.725	-0.383	11.1	88.4	
				CN	102.05	121.6	0	0			CN	-0.729	0.377	11.1	-88.8	
										MPU-1-DISTR-3	AN	0.725	0.383	11.1	88.4	
											CN	0.729	-0.377	11.1	-88.8	
Bus900	0.125	1	Bus	AN	98.97	-2.5	0	0	2	204042 -1C	AN	-0.699	-0.380	11.1	87.9	
				CN	99.44	120.7	0	0	2		CN	-0.704	0.380	11.1	-88.0	
										H11P900	AN	0.699	0.380	11.1	87.9	
											CN	0.704	-0.380	11.1	-88.0	
SPFdr21	0.480	3	PA	AN	98.51	-1.7	0	0		MPU-2-XFMR	AN	-0.795	0.455	3.4	-86.8	
				BN	98.51	-121.7	0	0			BN	-0.792	-0.461	3.4	86.4	
				CN	98.51	118.3	0	0			CN					
										MPU-2-XFMR-1	AN	0.795	-0.455	3.4	-86.8	-5.000
											BN	0.792	0.461	3.4	86.4	
MPU-2-DISTR-1	0.120	1	P	AN	102.41	-0.6	0	0		BusMPU21	AN	-0.794	0.434	12.8	-87.8	
				BN	102.23	-123.0	0	0			BN	-0.791	-0.437	12.8	87.5	
									7	204053 -1C	AN	0.794	-0.434	12.8	-87.8	
									7		BN	0.791	0.437	12.8	87.5	
H11P902	0.120	1	P	AN	101.26	-1.0	0.8	-0.4		Bus12	AN	-0.782	0.435	12.8	-87.4	
				BN	100.94	-122.7	0.8	0.4			BN	-0.779	-0.435	12.8	87.3	
Busxmfr21	0.120	1	Bus	AN	102.43	-0.6	0	0		MPU-2-XFMR-1	AN	-0.794	0.434	12.8	-87.8	
				BN	102.26	-123.0	0	0			BN	-0.791	-0.437	12.8	87.5	
										Cab21	AN	0.794	-0.434	12.8	-87.8	
											BN	0.791	0.437	12.8	87.5	
BusMPU21	0.120	1	Bus	AN	102.41	-0.6	0	0		Cab21	AN	-0.794	0.434	12.8	-87.8	
				BN	102.23	-123.0	0	0			BN	-0.791	-0.437	12.8	87.5	
										MPU-2-DISTR-1	AN	0.794	-0.434	12.8	-87.8	
											BN	0.791	0.437	12.8	87.5	
Bus12	0.120	1	Bus	AN	101.26	-1.0	0	0	7	204053 -1C	AN	-0.782	0.435	12.8	-87.4	
				BN	100.94	-122.7	0	0	7		BN	-0.779	-0.435	12.8	87.3	
										H11P902	AN	0.782	-0.435	12.8	-87.4	
											BN	0.779	0.435	12.8	87.3	
SPFdr22	0.480	3	PA	AN	98.51	-1.7	0	0		MPU-2-XFMR	AN					
				BN	98.51	-121.7	0	0			BN	-3.4	1.9	14.1	-87.3	
				CN	98.51	118.3	0	0			CN	-3.3	-2.0	14.1	85.8	
										MPU-2-XFMR-2	BN	3.4	-1.9	14.1	-87.3	-5.000
											CN	3.3	2.0	14.1	85.8	

DC-5003 Vol. 1 - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus/Panel/Phase Adapter				Voltage			Load*		Load Flow							XFMR
ID	kV	Phase	Type	Phase	% Mag	Ang.	kW	kvar	CKT	ID	Phase	kW	kvar	Amp	%PF	% Tap
MPU-2-DISTR-2	0.120	1	P	BN	102.85	-120.8	0	0		BusMPU22	BN	-3.3	1.8	51.0	-88.1	
				CN	102.15	116.7	0	0			CN	-3.3	-1.8	51.0	87.3	
									2	204054 -2C	BN	0.100	-0.054	1.5	-87.9	
									2		CN	0.099	0.055	1.5	87.5	
									3	204055-2C	BN	2.6	-1.4	39.7	-88.2	
									3		CN	2.6	1.4	39.7	87.2	
									4	204051 -2C	BN	0.639	-0.347	9.8	-87.9	
									4		CN	0.632	0.350	9.8	87.5	
II21P562	0.120	1	P	BN	106.79	-120.9	0.1	-0.1		Bus562	BN	-0.100	0.054	1.5	-87.8	
				CN	106.02	116.7	0.1	0.1			CN	-0.099	-0.055	1.5	87.4	
II21P558	0.120	1	P	BN	101.53	-123.0	2.4	-1.4		Bus558	BN	-2.4	1.4	39.7	-86.3	
				CN	100.16	118.2	2.4	1.4			CN	-2.4	-1.4	39.7	85.8	
II21P560	0.120	1	P	BN	106.32	-121.1	0.6	-0.3		Bus560	BN	-0.632	0.347	9.8	-87.6	
				CN	105.50	116.9	0.6	0.3			CN	-0.625	-0.349	9.8	87.3	
Busxmfr22	0.120	1	Bus	BN	102.55	-120.8	0	0		MPU-2-XFMR-2	BN	-3.3	1.8	53.4	-88.1	
				CN	101.91	116.8	0	0			CN	-3.3	-1.8	53.4	87.2	
										Cab22	BN	3.3	-1.8	53.4	-88.1	
											CN	3.3	1.8	53.4	87.2	
BusVR22	0.120	1	Bus	BN	102.46	-120.9	0	0		Cab22	BN	-3.3	1.8	53.4	-88.0	
				CN	101.80	116.8	0	0			CN	-3.3	-1.8	53.4	87.2	
										R3101S011B VLTG. REG.	BN	3.3	-1.8	53.4	-88.0	-0.500
											CN	3.3	1.8	53.4	87.2	
BusMPU22	0.125	1	Bus	BN	102.85	-120.8	0	0		R3101S011B VLTG. REG.	BN	-3.3	1.8	51.0	-88.1	
				CN	102.15	116.7	0	0			CN	-3.3	-1.8	51.0	87.3	
										MPU-2-DISTR-2	BN	3.3	-1.8	51.0	-88.1	
											CN	3.3	1.8	51.0	87.3	
Bus562	0.120	1	Bus	BN	106.79	-120.9	0	0	2	204054 -2C	BN	-0.100	0.054	1.5	-87.8	
				CN	106.02	116.7	0	0	2		CN	-0.099	-0.055	1.5	87.4	
										II21P562	BN	0.100	-0.054	1.5	-87.8	
											CN	0.099	0.055	1.5	87.4	
Bus558	0.120	1	Bus	BN	101.53	-123.0	0	0	3	204055-2C	BN	-2.4	1.4	39.7	-86.3	
				CN	100.16	118.2	0	0	3		CN	-2.4	-1.4	39.7	85.8	
										II21P558	BN	2.4	-1.4	39.7	-86.3	
											CN	2.4	1.4	39.7	85.8	
Bus560	0.120	1	Bus	BN	106.32	-121.1	0	0	4	204051 -2C	BN	-0.632	0.347	9.8	-87.6	
				CN	105.50	116.9	0	0	4		CN	-0.625	-0.349	9.8	87.3	
										II21P560	BN	0.632	-0.347	9.8	-87.6	
											CN	0.625	0.349	9.8	87.3	
SPFdr23	0.480	3	PA	AN	98.51	-1.7	0	0		MPU-2-XFMR	AN	-0.611	-0.415	2.7	82.7	
				BN	98.51	-121.7	0	0			BN					
				CN	98.51	118.3	0	0			CN	-0.665	0.321	2.7	-90.0	
										MPU-2-XFMR-3	AN	0.611	0.415	2.7	82.7	-5.000
											CN	0.665	-0.321	2.7	-90.0	

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus/Panel/Phase Adapter				Voltage			Load*		Load Flow							XFMR
ID	kV	Phase	Type	Phase	% Mag	Ang.	kW	kvar	CKT	ID	Phase	kW	kvar	Amp	%PF	% Tap
MPU-2-DISTR-3	0.120	1	P	AN	102.65	-3.1	0	0		BusMPU23	AN	-0.612	-0.394	9.8	84.1	
				CN	102.80	119.6	0	0			CN	-0.663	0.303	9.8	-91.0	
									2	204060 -2C	AN	0.612	0.394	9.8	84.1	
									2		CN	0.663	-0.303	9.8	-91.0	
H11P903	0.120	1	P	AN	105.95	-2.9	0.6	0.4		Bus14	AN	-0.604	-0.393	9.8	83.8	
				CN	106.13	119.3	0.7	-0.3			CN	-0.655	0.303	9.8	-90.7	
Busxfmr23	0.120	1	Bus	AN	102.29	-3.0	0	0		MPU-2-XFMR-3	AN	-0.612	-0.396	10.3	84.0	
				CN	102.42	119.5	0	0			CN	-0.663	0.304	10.3	-90.9	
										Cab23	AN	0.612	0.396	10.3	84.0	
											CN	0.663	-0.304	10.3	-90.9	
BusVR23	0.120	1	Bus	AN	102.26	-3.0	0	0		Cab23	AN	-0.612	-0.396	10.3	84.0	
				CN	102.40	119.4	0	0			CN	-0.663	0.304	10.3	-90.9	
										R3101S011A VLTG. REG.	AN	0.612	0.396	10.3	84.0	-0.500
											CN	0.663	-0.304	10.3	-90.9	
BusMPU23	0.125	1	Bus	AN	102.65	-3.1	0	0		R3101S011A VLTG. REG.	AN	-0.612	-0.394	9.8	84.1	
				CN	102.80	119.6	0	0			CN	-0.663	0.303	9.8	-91.0	
										MPU-2-DISTR-3	AN	0.612	0.394	9.8	84.1	
											CN	0.663	-0.303	9.8	-91.0	
Bus14	0.120	1	Bus	AN	105.95	-2.9	0	0	2	204060 -2C	AN	-0.604	-0.393	9.8	83.8	
				CN	106.13	119.3	0	0	2		CN	-0.655	0.303	9.8	-90.7	
										H11P903	AN	0.604	0.393	9.8	83.8	
											CN	0.655	-0.303	9.8	-90.7	

Type: P=Panel, PA=Phase Adapter

* For panel it indicates internal loads and directly connected loads. Connected panel loads are not included.
For bus it indicates directly connected loads. Connected panel loads are not included.

DC-5003 Vol. 1 - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus Loading Summary Report

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Percent Loading
BUS 11EA	4.160	738.0	0	0	0	0	0	0	0	0	2.528	90.2	376.9	51.1
BUS 11EA-N	4.160		0	0	0	0	0	0	0	0	2.391	90.3	356.5	
BUS 12EB	4.160	738.0	0	0	0	0	0	0	0	0	2.947	90.8	439.5	59.5
BUS 12EB-N	4.160		0	0	0	0	0	0	0	0	2.742	91.0	408.9	
BUS 13EC	4.160	738.0	0	0	0	0	0	0	0	0	2.531	89.6	402.8	54.6
BUS 13EC-N	4.160		0	0	0	0	0	0	0	0	2.391	89.8	380.5	
BUS 14ED	4.160	738.0	0	0	0	0	0	0	0	0	2.783	90.1	442.9	60.0
BUS 14ED-N	4.160		0	0	0	0	0	0	0	0	2.575	90.3	409.9	
BUS 64B	4.160	1200.0	1.957	0.941	0	0	0	0	0	0	2.387	90.4	356.5	29.7
BUS 64C	4.160	1200.0	1.956	0.900	0	0	0	0	0	0	2.737	91.0	408.9	34.1
BUS 65E	4.160	3000.0	1.957	0.941	0	0	0	0	0	0	2.386	89.8	380.5	12.7
BUS 65F	4.160	1200.0	1.955	0.899	0	0	0	0	0	0	2.570	90.3	409.9	34.2
BUS 72B	0.480	1800.0	0	0	0	0	0	0	0	0	0.214	93.1	271.8	15.1
BUS 72B-2A	0.480	238.0	0.014	0.009	0.037	0.018	0	0	0	0	0.067	91.4	84.8	35.6
BUS 72B-3A	0.480	340.0	0.035	0.021	0.005	0.004	0	0	0	0	0.071	85.4	90.6	26.6
BUS 72B-3AN5	0.480		0.020	0.012	0	0	0	0	0	0	0.023	85.1	30.0	
BUS 72B-3AN6	0.480		0	0	0	0	0	0	0	0	0	0.0	0.0	
BUS 72B-3AN7	0.480		0	0	0	0	0	0	0	0	0	0.0	0.0	
BUS 72B-4C	0.480	428.0	0.002	0.002	0.075	0.012	0	0	0	0	0.078	98.4	99.7	23.3
BUS 72B-4CN1	0.480		0	0	0	0	0	0	0	0	0	99.4	0.0	
BUS 72B-4CN2	0.480		0	0	0	0	0	0	0	0	0	99.4	0.0	
BUS 72B-4CN3	0.480		0	0	0	0	0	0	0	0	0	99.4	0.0	
BUS 72B-4CN4	0.480		0	0	0	0	0	0	0	0	0	99.4	0.0	
BUS 72C	0.480	1800.0	0.083	0.038	0.052	0.032	0	0	0	0	0.574	92.7	717.9	39.9
BUS 72C-2A	0.480	340.0	0.083	0.050	0.151	0	0	0	0	0	0.240	97.8	303.4	89.2
BUS 72C-3A	0.480	520.0	0.030	0.019	0.039	0.010	0	0	0	0	0.098	90.6	122.5	23.6
BUS 72C-3AN4	0.480		0	0	0	0	0	0	0	0	0.023	85.2	29.4	
BUS 72C-3AN5	0.480		0.020	0.012	0	0	0	0	0	0	0.023	85.1	29.4	
BUS 72C-3AN6	0.480		0	0	0	0	0	0	0	0	0	0.0	0.0	
BUS 72C-F	0.480	600.0	0	0	0.060	0.044	0	0	0	0	0.086	80.5	110.4	18.4
BUS 72C-FN1	0.480		0	0	0.010	0.007	0	0	0	0	0.012	80.9	15.4	
BUS 72C-FN2	0.480		0	0	0	0	0	0	0	0	0.012	81.0	15.4	
BUS 72E	0.480	1800.0	0	0	0.039	0.029	0	0	0	0	0.212	87.1	256.5	14.3
BUS 72E-5A	0.480	428.0	0.051	0.032	0.003	0.002	0	0	0	0	0.088	84.7	106.2	24.8
BUS 72E-5AN2	0.480		0	0	0	0	0	0	0	0	0.023	85.1	28.3	
BUS 72E-5AN3	0.480		0.020	0.012	0	0	0	0	0	0	0.023	85.0	28.3	

DC-5003 Vol. 1 - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					Percent
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Loading
BUS 72E-5AN4	0.480		0	0	0	0	0	0	0	0	0.001	80.7	0.6	
BUS 72E-5B	0.480	428.0	0.002	0.002	0.026	0.013	0	0	0	0	0.076	93.0	92.6	21.6
BUS 72E-5BN1	0.480		0	0	0	0	0	0	0	0	0	60.9	0.0	
BUS 72E-5BN2	0.480		0	0	0	0	0	0	0	0	0	60.9	0.0	
BUS 72E-5BN3	0.480		0	0	0	0	0	0	0	0	0	60.9	0.0	
BUS 72E-5BN4	0.480		0	0	0	0	0	0	0	0	0	60.8	0.0	
BUS 72E-5BN5	0.480		0	0	0	0	0	0	0	0	0	60.8	0.0	
BUS 72E-5BN6	0.480		0	0	0.042	0.014	0	0	0	0	0.044	95.1	53.8	
BUS 72EA	0.480	900.0	0	0	0	0	0	0	0	0	0.136	87.6	177.5	19.7
BUS 72EA-2C	0.480	238.0	0.092	0.053	0.027	0.013	0	0	0	0	0.136	87.6	177.5	74.6
BUS 72EA-N	0.480		0	0	0	0	0	0	0	0	0	0.0	0.0	
BUS 72EB	0.480	900.0	0.086	0.039	0	0	0	0	0	0	0.203	88.7	265.6	29.5
BUS 72EB-2D	0.480	600.0	0.090	0.053	0.004	0.002	0	0	0	0	0.108	86.5	142.0	23.7
BUS 72EB-N	0.480		0	0	0	0	0	0	0	0	0	0.0	0.0	
BUS 72EC	0.480	900.0	0	0	0	0	0	0	0	0	0.138	87.3	169.7	18.9
BUS 72EC-2C	0.480	238.0	0.090	0.053	0.030	0.014	0	0	0	0	0.138	87.3	169.7	71.3
BUS 72EC-N	0.480		0	0	0	0	0	0	0	0	0.001	11.2	0.9	
BUS 72ED	0.480	900.0	0.086	0.039	0	0	0	0	0	0	0.204	88.7	251.7	28.0
BUS 72ED-2D	0.480	238.0	0.090	0.053	0.004	0.002	0	0	0	0	0.109	86.5	135.1	56.8
BUS 72ED-N	0.480		0	0	0	0	0	0	0	0	0	53.9	0.4	
BUS 72F	0.480	1800.0	0.081	0.037	0.055	0.034	0	0	0	0	0.411	88.5	500.9	27.8
BUS 72F-2A	0.480	340.0	0.014	0.010	0.039	0.019	0	0	0	0	0.069	91.0	84.6	24.9
BUS 72F-4A	0.480	340.0	0.027	0.018	0.020	0.015	0	0	0	0	0.080	83.0	98.4	28.9
BUS 72F-4AN7	0.480		0	0	0	0	0	0	0	0	0.023	85.1	28.6	
BUS 72F-4AN8	0.480		0.020	0.012	0	0	0	0	0	0	0.023	85.1	28.6	
BUS 72F-5A	0.480	340.0	0.085	0.046	0.011	0	0	0	0	0	0.107	90.2	131.1	38.5
BUS 72F-N1	0.480		0	0	0	0	0	0	0	0	0	0.0	0.0	
E.D.G. 11-N	4.160		0	0	0	0	0	0	0	0	2.529	90.2	376.9	
E.D.G. 12-N	4.160		0	0	0	0	0	0	0	0	2.948	90.8	439.5	
E.D.G. 13-N	4.160		0	0	0	0	0	0	0	0	2.531	89.6	402.8	
E.D.G. 14-N	4.160		0	0	0	0	0	0	0	0	2.783	90.1	442.9	
MPU-1-XFMR	0.480	40.0	0	0	0.010	0	0	0	0	0	0.010	99.9	12.7	31.8
MPU-2-XFMR	0.480	40.0	0	0	0.010	0	0	0	0	0	0.010	100.0	11.6	29.1
XFMR 72B-HV	4.160	303.0	0	0	0	0	0	0	0	0	0.215	92.7	32.2	10.6
XFMR 72C-HV	4.160	303.0	0	0	0	0	0	0	0	0	0.583	91.7	87.2	28.8
XFMR 72EA-HV	4.160	216.0	0	0	0	0	0	0	0	0	0.137	87.2	20.5	9.5
XFMR 72EB-HV	4.160	216.0	0	0	0	0	0	0	0	0	0.206	88.1	30.6	14.2
XFMR 72EC-HV	4.160	216.0	0	0	0	0	0	0	0	0	0.140	86.5	22.3	10.3

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic					
ID	kV	Rated Amp	MW	Mvar	MW	Mvar	MW	Mvar	MW	Mvar	MVA	% PF	Amp	Percent Loading
XFMR 72EC-LV	0.480	900.0	0	0	0	0	0	0	0	0	0.139	86.9	188.5	20.9
XFMR 72ED-HV	4.160	216.0	0	0	0	0	0	0	0	0	0.208	87.6	33.1	15.3
XFMR 72ED-LV	0.480	900.0	0	0	0	0	0	0	0	0	0.205	88.2	279.5	31.1
XFMR 72E-HV	4.160	303.0	0	0	0	0	0	0	0	0	0.215	86.4	34.3	11.3
XFMR 72E-LV	0.480	1800.0	0	0	0	0	0	0	0	0	0.213	86.9	282.2	15.7
XFMR 72F-HV	4.160	303.0	0	0	0	0	0	0	0	0	0.420	87.1	66.9	22.1
XFMR 72F-LV	0.480	1800.0	0	0	0	0	0	0	0	0	0.413	88.1	551.1	30.6

* Indicates operating load of a bus exceeds the bus critical limit (% of the Continuous Ampere rating).

# Indicates operating load of a bus exceeds the bus marginal limit (% of the Continuous Ampere rating).

Branch Loading Summary Report

CKT / Branch		Cable & Reactor			Transformer				
						Loading (input)		Loading (output)	
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (MVA)	MVA	%	MVA	%
201269 -1P	Cable	54.00	12.72	23.56					
201689 -2P	Cable	54.00	11.63	21.53					
REG_72E	Transformer				1.500	0.213	14.2	0.212	14.2
REG_72EC	Transformer				0.750	0.139	18.5	0.138	18.4
REG_72ED	Transformer				0.750	0.205	27.3	0.203	27.1
REG_72F	Transformer				1.500	0.413	27.5	0.411	27.4
XFMR 72B	Transformer				1.500	0.215	14.4	0.214	14.3
XFMR 72C	Transformer				1.500	0.583	38.9	0.574	38.3
XFMR 72E	Transformer				2.000	0.215	10.7	0.213	10.6
XFMR 72EA	Transformer				1.000	0.137	13.7	0.136	13.6
XFMR 72EB	Transformer				0.750	0.206	27.4	0.203	27.1
XFMR 72EC	Transformer				1.000	0.140	14.0	0.139	13.9
XFMR 72ED	Transformer				0.750	0.208	27.7	0.205	27.3
XFMR 72F	Transformer				1.500	0.420	28.0	0.413	27.5

* Indicates a branch with operating load exceeding the branch capability.

Branch Losses Summary Report

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
220555A,B	-2.280	-1.092	2.280	1.093	0.2	0.1	93.1	93.1	0.01
221150-1P	0.120	0.067	-0.120	-0.067	0.0	0.0	93.1	93.1	0.01
200007A,B-1P	2.161	1.025	-2.157	-1.022	3.8	3.1	93.1	92.9	0.19
220560A,B	-2.677	-1.234	2.677	1.234	0.4	0.3	93.1	93.1	0.02
221160-1P	0.181	0.097	-0.181	-0.097	0.0	0.0	93.1	93.1	0.01
200011A,B-1P	2.496	1.136	-2.491	-1.133	4.4	3.7	93.1	92.9	0.19
220565A,B-2P	-2.268	-1.123	2.268	1.123	0.1	0.1	87.2	87.2	0.01
221170-2P	0.121	0.070	-0.121	-0.070	0.0	0.0	87.2	87.2	0.01
200022A,B-2P	2.147	1.053	-2.143	-1.049	4.1	3.4	87.2	87.0	0.19
220570A,B-2P	-2.506	-1.209	2.507	1.209	0.3	0.2	87.2	87.2	0.01
221180-2P	0.182	0.100	-0.182	-0.100	0.0	0.0	87.2	87.2	0.01
200026A,B-2P	2.324	1.109	-2.320	-1.105	4.4	3.6	87.2	87.0	0.19
200008-1P	0.199	0.081	-0.199	-0.081	0.0	0.0	92.9	92.9	0.01
200012-2P	0.535	0.233	-0.535	-0.233	0.1	0.1	92.9	92.9	0.03
200023-2P	0.186	0.108	-0.186	-0.108	0.0	0.0	87.0	87.0	0.01
200027-2P	0.366	0.206	-0.365	-0.206	0.0	0.0	87.0	87.0	0.01
200562-1P	0.061	0.027	-0.061	-0.027	0.1	0.1	94.7	94.5	0.15
200565-1P	0.061	0.037	-0.061	-0.037	0.2	0.1	94.7	94.4	0.31
200570A,B-0P	0.077	0.014	-0.077	-0.014	0.2	0.1	94.7	94.4	0.25
XFMR 72B	-0.199	-0.078	0.199	0.081	0.4	2.6	94.7	92.9	1.78
201269 -1P	0.010	0.000	-0.010	0.000	0.0	0.0	94.5	94.5	0.03
201303,4-1P							94.4	94.4	
201313,4-1P							94.4	94.4	
212801A,B-1P	0.020	0.012	-0.020	-0.012	0.2	0.0	94.4	93.5	0.84
212813,4-0P							94.4	94.4	0.00
212843,4-0P							94.4	94.4	0.00
212950,1-0P							94.4	94.4	0.00
212994,5-0P							94.4	94.4	0.00
200580-1P	0.071	0.052	-0.070	-0.051	1.8	0.6	96.1	94.2	1.94
200582-1P	0.237	0.051	-0.235	-0.050	2.4	1.7	96.1	95.1	1.07
200583A,B-1P	0.089	0.041	-0.088	-0.041	0.3	0.2	96.1	95.8	0.31
XFMR 72C	-0.532	-0.214	0.535	0.233	2.8	18.3	96.1	92.9	3.27
209784,7-1P							95.8	95.8	
212997,8-1P	0.020	0.012	-0.020	-0.012	0.0	0.0	95.8	95.8	0.03
212821A,B-1P	0.020	0.012	-0.020	-0.012	0.1	0.0	95.8	95.4	0.43

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

CKT / Branch	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop
ID	MW	Mvar	MW	Mvar	kW	kvar	From	To	in Vmag
200881A-C-2P							94.2	94.2	
214013-SC	0.010	0.007	-0.010	-0.007	0.1	0.0	94.2	93.9	0.33
214005-SC	-0.010	-0.007	0.010	0.007	0.1	0.0	93.5	93.9	0.33
200598A,B-0P	0.074	0.047	-0.074	-0.047	0.3	0.1	99.6	99.2	0.35
200602A,B-0P	0.071	0.028	-0.071	-0.028	0.2	0.1	99.6	99.3	0.28
REG_72E	-0.185	-0.104	0.185	0.105	0.1	1.1	99.6	90.8	8.80
212780,1-2P	0.020	0.012	-0.020	-0.012	0.0	0.0	99.2	99.2	0.07
234282-2P	0.000	0.000	0.000	0.000	0.0	0.0	99.2	99.2	0.03
212779A-C-2P	0.020	0.012	-0.020	-0.012	0.1	0.0	99.2	98.9	0.27
212853,8-0P	0.000	0.000	0.000	0.000	0.0	0.0	99.3	99.3	0.00
212863,8-0P	0.000	0.000	0.000	0.000	0.0	0.0	99.3	99.3	0.00
212873,4-0P	0.000	0.000	0.000	0.000	0.0	0.0	99.3	99.3	0.00
212953,4-0P	0.000	0.000	0.000	0.000	0.0	0.0	99.3	99.3	0.00
212956,7-0P	0.000	0.000	0.000	0.000	0.0	0.0	99.3	99.3	0.00
214712-0P	0.042	0.014	-0.042	-0.014	0.1	0.0	99.3	99.1	0.20
221240-1P	0.119	0.066	-0.119	-0.066	0.3	0.2	92.3	92.1	0.22
XFMR 72EA	-0.119	-0.066	0.120	0.067	0.4	1.6	92.3	93.1	0.80
221260A,B-1P							91.9	91.9	
221290-1P	0.094	0.055	-0.094	-0.054	0.1	0.1	91.9	91.8	0.14
XFMR 72EB	-0.180	-0.094	0.181	0.097	1.0	3.5	91.9	93.1	1.15
221310-2P	0.121	0.067	-0.120	-0.067	0.2	0.1	97.9	97.7	0.17
REG_72EC	-0.121	-0.067	0.121	0.069	0.2	1.3	97.9	88.6	9.30
221330A,B-2P	0.000	0.001	0.000	-0.001	0.0	0.0	97.2	97.2	0.00
221360-2P	0.094	0.055	-0.094	-0.055	0.1	0.1	97.2	97.1	0.13
REG_72ED	-0.180	-0.094	0.181	0.096	0.4	2.7	97.2	88.2	9.03
200612-2P	0.063	0.029	-0.063	-0.029	0.0	0.0	98.6	98.5	0.07
200614-2P	0.067	0.045	-0.067	-0.045	0.1	0.1	98.6	98.4	0.22
200616-2P	0.097	0.047	-0.096	-0.046	0.4	0.3	98.6	98.2	0.42
REG_72F	-0.363	-0.191	0.364	0.195	0.3	4.1	98.6	90.1	8.48
201689 -2P	0.010	0.000	-0.010	0.000	0.0	0.0	98.5	98.5	0.01
212796,7-2P	0.020	0.012	-0.020	-0.012	0.0	0.0	98.4	98.4	0.01
212791A,B-2P	0.020	0.012	-0.020	-0.012	0.1	0.0	98 4	98.1	0.29
XFMR 72EC	0.121	0.070	-0.121	-0.069	0.5	1.8	87.2	88.6	1.40
XFMR 72ED	0.182	0.100	-0.181	-0.096	1.1	3.9	87.2	88.2	1.03
XFMR 72E	0.186	0.108	-0.185	-0.105	0.5	2.9	87.0	90.8	3.79
XFMR 72F	0.365	0.206	-0.364	-0.195	1.7	10.8	87.0	90.1	3.11
					34.8	73.4			

Equipment Cable and Heater Losses Summary Report

Connected Load		Cable/Heater		Losses		% Voltage				
							Terminal on		% Vd	% Vst
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
RHR PMP A	Ind. Motor	220030-1P	5.0NCUS3	2.5	2.1	92.91	92.72	96.43	0.19	91.97
SPRY PMP A	Ind. Motor	220070-1P	5.0NCUS3	0.8	0.3	92.91	92.77	96.48	0.14	92.40
RHR PMP C	Ind. Motor	220050-1P	5.0NCUS3	2.4	2.0	92.90	92.72	96.43	0.18	91.98
SPRY PMP C	Ind. Motor	220090-1P	5.0NCUS3	0.7	0.3	92.90	92.77	96.48	0.12	92.43
RHR PMP B	Ind. Motor	220040-2P	5.0NCUS3	2.3	1.9	87.02	86.86	90.33	0.16	86.32
SPRY PMP B	Ind. Motor	220080-2P	5.0NCUS3	0.5	0.2	87.02	86.93	90.41	0.08	86.74
RHR PMP D	Ind. Motor	220060-2P	5.0NCUS3	2.3	1.9	87.01	86.85	90.32	0.16	86.16
SPRY PMP D	Ind. Motor	220100-2P	5.0NCUS3	0.6	0.2	87.01	86.92	90.40	0.09	86.73
T4100B002	Ind. Motor	212000-1P	0.6NCUN3	0.0	0.0	94.53	94.25	98.34	0.28	93.37
T4100B003	Ind. Motor	212010-1P	0.6NCUN3	0.0	0.0	94.53	94.51	98.62	0.02	94.44
T4100B043	Ind. Motor	240556-1P	0.6NCUN3	0.1	0.0	94.53	93.52	97.59	1.00	90.71
T4100B021	Ind. Motor	212670-1P	0.6NCUN3	0.1	0.0	94.37	93.80	97.88	0.57	92.39
T4100B029	Ind. Motor	201320-1P	0.6NCUN3	0.1	0.0	94.37	93.36	97.42	1.01	90.13
P5002D001	Ind. Motor	213750-1P	0.6NCUN3	0.1	0.0	94.37	93.94	98.02	0.43	92.98
T4700C001	Ind. Motor	212800A,B-1P	0.6NCUN3	0.1	0.0	93.53	93.05	93.05	0.47	90.75
T4700C008	Ind. Motor	212828A-C-1P	0.6NCUN3			94.43	94.43	98.53	0.00	0.00
T4100C008	Ind. Motor	209580-1P	0.6NCUN3	0.0	0.0	94.43	94.00	98.08	0.43	92.07
T4100C007	Ind. Motor	209570-1P	0.6NCUN3	0.0	0.0	94.43	94.00	98.09	0.43	92.09
C7102S001A	Ind. Motor	214740-0P	0.6NCUN3			94.43	94.43	94.43	0.00	0.00
C4103C001A	Ind. Motor	214680-0P	0.6NCUN3			94.43	94.43	98.53	0.00	0.00
T4700C005	Ind. Motor	212815A,B-0P	0.6NCUN3			94.43	94.43	98.53	0.00	0.00
T4700C006	Ind. Motor	212810A,B-0P	0.6NCUN3			94.43	94.43	98.53	0.00	0.00
T4700C007	Ind. Motor	212835A,B-0P	0.6NCUN3			94.43	94.43	98.53	0.00	0.00
T4700C009	Ind. Motor	212840A,B-0P	0.6NCUN3			94.43	94.43	98.53	0.00	0.00
EECWS PMP(N)	Ind. Motor	200460-1P	0.6MCUN3	1.9	0.6	96.14	94.06	98.15	2.08	88.50
T4100B007	Ind. Motor	217060-1P	0.6NCUN3	0.0	0.0	95.07	95.01	99.15	0.05	94.90
T4100B016	Ind. Motor	212040-1P	0.6NCUN3	0.0	0.0	95.07	94.67	98.79	0.39	92.91
T4100B028	Ind. Motor	201420-1P	0.6NCUN3	0.0	0.0	95.07	95.00	99.13	0.06	94.61
T4100C031	Ind. Motor	217120-1P	0.6NCUN3	0.1	0.0	95.07	94.70	98.82	0.37	93.72
T4100B009A	Ind. Motor	201470-1P	0.6NCUN3	0.0	0.0	95.07	95.04	99.17	0.03	94.87
T4100C041	Ind. Motor	217150-1P	0.6NCUN3	0.0	0.0	95.07	94.84	98.97	0.22	94.15
T4100C047	Ind. Motor	217260-1P	0.6NCUN3	0.3	0.0	95.07	94.03	98.12	1.04	91.96
T4100C053	Ind. Motor	204950-1P	0.6NCUN3	0.0	0.0	95.07	94.99	99.12	0.07	94.60
T4100B018	Ind. Motor	216130-1P	0.6NCUN3	0.7	0.1	95.83	93.26	97.32	2.57	87.37

Equipment Cable and Heater Losses Summary Report

Connected Load		Cable/Heater		Losses		% Voltage			% Vd	% Vst
							Terminal on			
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
T4100B034	Ind. Motor	216170-1P	0.6NCUN3	0.0	0.0	95.83	95.27	99.42	0.55	93.13
T4100B036	Ind. Motor	201490-1P	0.6NCUN3	0.1	0.0	95.83	94.30	98.40	1.53	88.57
T5000C002A	Ind. Motor	201560-1P	0.6NCUN3	0.0	0.0	95.83	95.23	99.37	0.60	93.38
T4700C002	Ind. Motor	212820A,B-1P	0.6NCUN3	0.1	0.0	95.37	94.93	99.06	0.43	92.54
P5002D002	Ind. Motor	213760-2P	0.6NCUN3	0.2	0.0	99.24	98.69	102.98	0.55	97.15
T4100B020	Ind. Motor	209680-2P	0.6NCUN3	0.1	0.0	99.24	98.57	102.85	0.68	96.63
T4100B022	Ind. Motor	209609-2P	0.6NCUN3	0.1	0.0	99.24	98.31	102.59	0.93	95.25
T4100B030	Ind. Motor	201410-2P	0.6NCUN3	0.1	0.0	99.24	98.37	102.65	0.87	94.76
T4700C003	Ind. Motor	212778A-C-2P	0.6NCUN3	0.1	0.0	98.90	98.63	102.92	0.27	96.73
T4100C010	Ind. Motor	209620-2P	0.6NCUN3	0.0	0.0	99.31	98.97	103.28	0.34	97.42
T4100C009	Ind. Motor	209590-2P	0.6NCUN3	0.0	0.0	99.31	98.98	103.28	0.33	97.44
C7102S001B	Ind. Motor	214760-0P	0.6NCUN3			99.31	99.31	99.31	0.00	0.00
C4103C001B	Ind. Motor	214690-0P	0.6NCUN3			99.31	99.31	103.63	0.00	0.00
T4700C010	Ind. Motor	212850A,B-0P	0.6NCUN3			99.31	99.31	103.63	0.00	0.00
T4700C011	Ind. Motor	212860A-0P	0.6NCUN3			99.31	99.31	103.63	0.00	0.00
T4700C012	Ind. Motor	212865A,B-0P	0.6NCUN3			99.31	99.31	103.63	0.00	0.00
T4700C013	Ind. Motor	212870A,B-0P	0.6NCUN3			99.31	99.31	103.63	0.00	0.00
T4700C014	Ind. Motor	212855A,B-0P	0.6NCUN3			99.31	99.31	103.63	0.00	0.00
R3001C005	Ind. Motor	217415-1P	0.6NCUN3	0.2	0.0	92.07	91.60	95.58	0.47	90.40
R3000D001	Ind. Motor	215885-1P	0.6NCUN3	0.0	0.0	92.07	91.84	95.83	0.23	90.96
R3001C001	Ind. Motor	216970-1P	0.6NCUN3	0.0	0.0	92.07	91.89	95.88	0.19	91.25
X4103C001	Ind. Motor	209085-1P	0.6NCUN3	0.0	0.0	92.07	91.94	95.94	0.13	91.67
R3001C003	Ind. Motor	216990-1P	0.6NCUN3	0.0	0.0	92.07	91.91	95.90	0.17	91.34
X4103C017	Ind. Motor	213735-1P	0.6NCUN3	0.1	0.0	92.07	91.45	95.42	0.63	90.04
X4103C021	Ind. Motor	213850-1P	0.6NCUN3	0.0	0.0	92.07	92.00	96.00	0.08	91.61
X4103C010	Ind. Motor	211175-1P	0.6NCUN3	0.0	0.0	92.07	91.98	95.98	0.10	91.62
X4103C009	Ind. Motor	211170-1P	0.6NCUN3	0.0	0.0	92.07	91.96	95.95	0.12	91.52
X4103C002	Ind. Motor	209090-1P	0.6NCUN3	0.1	0.0	92.07	91.80	95.79	0.27	91.24
ESSW Pump A	Ind. Motor	221280-1P	0.6MCUN3	0.6	0.2	91.92	91.34	95.31	0.58	89.66
R3001C006	Ind. Motor	217420-1P	0.6NCUN3	0.2	0.0	91.78	91.36	95.33	0.42	90.32
R3000D002	Ind. Motor	215890-1P	0.6NCUN3	0.0	0.0	91.78	91.56	95.55	0.21	90.76
R3000C002	Ind. Motor	216980-1P	0.6NCUN3	0.0	0.0	91.78	91.63	95.61	0.15	91.13
X4103C003	Ind. Motor	209095-1P	0.6NCUN3	0.0	0.0	91.78	91.66	95.64	0.12	91.39
R3000C004	Ind. Motor	217000-1P	0.6NCUN3	0.0	0.0	91.78	91.63	95.62	0.15	91.14

Equipment Cable and Heater Losses Summary Report

Connected Load		Cable/Heater		Losses		% Voltage				
							Terminal on		% Vd	% Vst
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
X4103C022	Ind. Motor	213855-1P	0.6NCUN3	0.0	0.0	91.78	91.71	95.70	0.06	91.39
X4103C018	Ind. Motor	213740-1P	0.6NCUN3	0.1	0.0	91.78	91.22	95.19	0.56	89.98
X4103C012	Ind. Motor	211185-1P	0.6NCUN3	0.0	0.0	91.78	91.71	95.70	0.06	91.48
X4103C011	Ind. Motor	211180-1P	0.6NCUN3	0.0	0.0	91.78	91.71	95.70	0.07	91.45
X4103C004	Ind. Motor	209100-1P	0.6NCUN3	0.0	0.0	91.78	91.55	95.53	0.23	91.08
R3001C007	Ind. Motor	217425-2P	0.6NCUN3	0.2	0.0	97.73	97.33	101.56	0.40	96.14
R3000D003	Ind. Motor	215895-2P	0.6NCUN3	0.0	0.0	97.73	97.47	101.71	0.26	96.33
R3001C009	Ind. Motor	217435-2P	0.6NCUN3	0.0	0.0	97.73	97.51	101.75	0.22	96.66
X4103C005	Ind. Motor	209105-2P	0.6NCUN3	0.0	0.0	97.73	97.60	101.84	0.13	97.26
R3001C011	Ind. Motor	217445-2P	0.6NCUN3	0.0	0.0	97.73	97.51	101.75	0.22	96.66
X4103C023	Ind. Motor	213860-2P	0.6NCUN3	0.0	0.0	97.73	97.66	101.90	0.07	97.22
X4103C019	Ind. Motor	213745-2P	0.6NCUN3	0.1	0.0	97.73	97.18	101.41	0.55	95.71
X4103C014	Ind. Motor	213355-2P	0.6NCUN3	0.0	0.0	97.73	97.63	101.87	0.10	97.19
X4103C013	Ind. Motor	211190-2P	0.6NCUN3	0.0	0.0	97.73	97.62	101.86	0.11	97.13
X4103C006	Ind. Motor	209110-2P	0.6NCUN3	0.0	0.0	97.73	97.52	101.76	0.21	97.00
ESSW Pump B	Ind. Motor	221350-2P	0.6MCUN3	0.4	0.2	97.25	96.83	101.04	0.41	95.12
R3001C008	Ind. Motor	217430-2P	0.6NCUN3	0.4	0.1	97.12	96.25	100.44	0.86	93.69
R3000D004	Ind. Motor	215900-2P	0.6NCUN3	0.0	0.0	97.12	97.12	101.34	0.00	97.11
R3001C010	Ind. Motor	217440-2P	0.6NCUN3	0.0	0.0	97.12	96.93	101.15	0.18	96.22
X4103C007	Ind. Motor	209115-2P	0.6NCUN3	0.0	0.0	97.12	96.99	101.21	0.12	96.68
R3001C012	Ind. Motor	217450-2P	0.6NCUN3	0.0	0.0	97.12	96.93	101.14	0.19	96.19
X4103C024	Ind. Motor	213865-2P	0.6NCUN3	0.0	0.0	97.12	97.07	101.29	0.05	96.85
X4103C020	Ind. Motor	213845-2P	0.6NCUN3	0.1	0.0	97.12	96.52	100.72	0.59	94.97
X4103C016	Ind. Motor	213365-2P	0.6NCUN3	0.0	0.0	97.12	97.03	101.25	0.08	96.61
X4103C015	Ind. Motor	213360-2P	0.6NCUN3	0.0	0.0	97.12	97.04	101.26	0.07	96.73
X4103C008	Ind. Motor	211165-2P	0.6NCUN3	0.0	0.0	97.12	96.89	101.11	0.22	96.21
EECWS PMP(S)	Ind. Motor	220470-0P	0.6MCUN3	0.3	0.1	98.60	98.25	102.52	0.35	97.20
T5000C002B	Ind. Motor	Cable47	0.6NCUN3	0.0	0.0	98.53	98.52	98.52	0.00	98.50
T4100B004	Ind. Motor	212020-2P	0.6NCUN3	0.0	0.0	98.53	98.21	102.48	0.31	97.11
T4100B005	Ind. Motor	212030-2P	0.6NCUN3	0.0	0.0	98.53	98.24	102.51	0.29	97.23
T4100B044	Ind. Motor	240557-2P	0.6NCUN3	0.0	0.0	98.53	98.43	102.71	0.09	97.87
T4100B035	Ind. Motor	216180-2P	0.6NCUN3	0.0	0.0	98.38	98.18	102.44	0.21	97.26
T4100B019	Ind. Motor	216140-2P	0.6NCUN3	0.3	0.0	98.38	97.01	101.22	1.37	93.55
T4100B037	Ind. Motor	201890-2P	0.6NCUN3	0.0	0.0	98.38	97.97	102.23	0.41	96.31

Equipment Cable and Heater Losses Summary Report

Connected Load		Cable/Heater		Losses		% Voltage				
							Terminal on		% Vd	% Vst
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
T4700C004	Ind. Motor	212790A,B-2P	0.6NCUN3	0.1	0.0	98.08	97.79	102.04	0.29	96.08
T4100B006	Ind. Motor	217050-2P	0.6NCUN3	0.2	0.0	98.18	97.59	101.83	0.59	96.36
T4100B017	Ind. Motor	212050-2P	0.6NCUN3	0.0	0.0	98.18	97.96	102.22	0.22	97.07
T4100B027	Ind. Motor	201940-2P	0.6NCUN3	0.0	0.0	98.18	98.14	102.41	0.04	97.98
T4100C030	Ind. Motor	217130-2P	0.6NCUN3	0.1	0.0	98.18	97.77	102.02	0.40	96.59
T4100B008A	Ind. Motor	201990-2P	0.6NCUN3	0.0	0.0	98.18	98.13	102.39	0.05	97.84
T4100C040	Ind. Motor	217140-2P	0.6NCUN3	0.0	0.0	98.18	97.90	102.15	0.28	96.95
T4100C048	Ind. Motor	217170-2P	0.6NCUN3	0.1	0.0	98.18	97.81	102.07	0.36	96.96
C4101S002	St. Load	214710-0P	0.6MCUN3	0.7	0.1	99.11	97.58	101.82	1.53	0.00
R1600S046	St. Load	209045-1P	0.6NCUN3			92.07	92.07	96.08	0.00	0.00
R1600S047	St. Load	209055-1P	0.6NCUN3			91.78	91.78	95.77	0.00	0.00
R1600S048	St. Load	209065-2P	0.6NCUN3			97.73	97.73	101.98	0.00	0.00
R1600S049	St. Load	209075-2P	0.6NCUN3			97.12	97.12	101.34	0.00	0.00
R1700S016A	St. Load	200040-0P	0.6MCUN3	0.4	0.0	94.43	92.98	92.98	1.45	0.00
R1700S016B	St. Load	200042-0P	0.6MCUN3	0.3	0.0	99.31	98.23	98.23	1.09	0.00
R3200S020B	St. Load	201510-1P	0.6NCUN3	0.4	0.0	95.83	94.10	94.10	1.72	0.00
R3200S020C	St. Load	201230-1P	0.6NCUN3			94.53	94.53	94.53	0.00	0.00
R3200S021C	St. Load	201823-2P	0.6NCUN3			98.53	98.53	98.53	0.00	0.00
R3200S023B	St. Load	201527-1C	0.6NCUN3	0.0	0.0	95.83	94.69	94.69	1.14	0.00
SECURITY #2	St. Load	201710-0P	0.6MCUN3	0.8	0.3	94.43	93.00	93.00	1.42	0.00
SGTS 1 DISC	St. Load	200567-1P	0.6NCUN3	0.4	0.1	96.14	95.50	95.50	0.64	0.00
SGTS 2 DISC	St. Load	200613-2P	0.6NCUN3	0.3	0.1	98.60	98.07	98.07	0.53	0.00
T4100B007A	St. Load	201430-1P	0.6NCUN3	0.1	0.0	95.07	94.74	94.74	0.32	0.00
T4100B007B	St. Load	201440-1P	0.6NCUN3	0.1	0.0	95.07	94.74	94.74	0.32	0.00
T4100B007C	St. Load	201450-1P	0.6NCUN3	0.1	0.0	95.07	94.74	94.74	0.32	0.00
T4100B007D	St. Load	201460-1P	0.6NCUN3	0.1	0.0	95.07	94.74	94.74	0.32	0.00
T4100D011A	St. Load	218610-1P	0.6NCUN3	0.2	0.0	95.07	93.39	93.39	1.68	0.00
T4100D011B	St. Load	218600-2P	0.6NCUN3	0.1	0.0	98.18	97.07	97.07	1.11	0.00
T5101S006	St. Load	201280-1P	0.6NCUN3	0.0	0.0	94.53	94.40	94.40	0.13	0.00
T5101S007	St. Load	201780-2P	0.6NCUN3	0.1	0.0	98.53	98.25	98.25	0.28	0.00
T5101S008	St. Load	201240-1P	0.6NCUN3	0.0	0.0	94.53	94.32	94.32	0.20	0.00
T5101S009	St. Load	201790-2P	0.6NCUN3	0.0	0.0	98.53	98.28	98.28	0.25	0.00
UPS INVERT	St. Load	201720-0P	0.6NCUN1	0.6	0.2	99.59	98.37	98.37	1.23	0.00
XFMR 5KVA(1)	St. Load	Cable331	0.6NCUN3	0.0	0.0	92.07	91.92	91.92	0.15	0.00

Equipment Cable and Heater Losses Summary Report

Connected Load		Cable/Heater		Losses		% Voltage				
							Terminal on		% Vd	% Vst
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
XFMR 5KVA(2)	St. Load	Cable454	0.6NCUN3	0.0	0.0	91.78	91.63	91.63	0.15	0.00
XFMR 5KVA(3)	St. Load	Cable452	0.6NCUN3	0.0	0.0	97.73	97.57	97.57	0.16	0.00
XFMR 5KVA(4)	St. Load	Cable559	0.6NCUN3	0.0	0.0	97.12	96.96	96.96	0.16	0.00
XFMR 30KVA-1	St. Load	217090A-1P	0.6NCUN3	0.3	0.0	92.07	91.08	91.08	1.00	0.00
XFMR 30KVA-2	St. Load	217100A-2P	0.6NCUN3	0.2	0.0	97.73	97.01	97.01	0.72	0.00
B2103F016	MOV	213810A.B-1P	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
B2103F600	MOV	214940-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
B3105F031A	MOV	214014A-C-SC	0.6MCUN3	0.3	0.0	93.53	91.60	95.58	1.93	83.55
B3105F031B	MOV	214008.9-SC	0.6MCUN3			94.19	94.19	98.29	0.00	0.00
E1150F003A	MOV	214270-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F003B	MOV	214280-2C	0.6MCUN3			98.38	98.38	107.33	0.00	0.00
E1150F004A	MOV	214230-1C	0.6MCUN3			94.37	94.37	102.95	0.00	0.00
E1150F004B	MOV	214240-2C	0.6MCUN3			99.24	99.24	108.26	0.00	0.00
E1150F004C	MOV	214250-1C	0.6MCUN3			95.83	95.83	104.54	0.00	0.00
E1150F004D	MOV	214260-2C	0.6MCUN3			98.38	98.38	107.33	0.00	0.00
E1150F006A	MOV	214190-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
E1150F006B	MOV	214200-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
E1150F006C	MOV	214210-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F006D	MOV	214220-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F007A	MOV	214480-1C	0.6MCUN3	0.0	0.0	94.37	93.10	97.14	1.27	88.39
E1150F007B	MOV	214490-2C	0.6MCUN3	0.0	0.0	99.24	97.95	102.21	1.29	93.15
E1150F009	MOV	214540A.B-1P	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F010	MOV	214410-SC	0.6MCUN3			94.19	94.19	98.29	0.00	0.00
E1150F015A	MOV	214580-SP	0.6MCUN3			94.19	94.19	98.29	0.00	0.00
E1150F015B	MOV	214590-SP	0.6MCUN3	0.2	0.0	94.19	93.55	97.61	0.65	90.98
E1150F016A	MOV	214620-1P	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F016B	MOV	214630-2P	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F017A	MOV	214600-SP	0.6MCUN3	0.6	0.1	94.19	93.13	97.18	1.07	87.96
E1150F017B	MOV	214610-SP	0.6MCUN3			94.19	94.19	98.29	0.00	0.00
E1150F021A	MOV	214640-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F021B	MOV	214650-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F022	MOV	214660A.B-1P	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F024A	MOV	214420-1P	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
E1150F024B	MOV	214430-2P	0.6MCUN3			99.24	99.24	103.56	0.00	0.00

Equipment Cable and Heater Losses Summary Report

Connected Load		Cable/Heater		Losses		% Voltage			% Vd	% Vst
							Terminal on			
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
E1150F026B	MOV	214380-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
E1150F027A	MOV	214440-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
E1150F027B	MOV	214450-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
E1150F028A	MOV	214460-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
E1150F028B	MOV	214470-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
E1150F047A	MOV	214500-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F047B	MOV	214510-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F048A	MOV	214520-1P	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F048B	MOV	214530-2P	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F068A	MOV	214290-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E1150F068B	MOV	214300-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F073	MOV	214350-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F075	MOV	214360-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F601A	MOV	216235-1C	0.6MCUN3			92.07	92.07	96.08	0.00	0.00
E1150F601B	MOV	216225-2C	0.6MCUN3			97.73	97.73	101.98	0.00	0.00
E1150F602A	MOV	216240-1C	0.6MCUN3			91.78	91.78	95.77	0.00	0.00
E1150F602B	MOV	216230-2C	0.6MCUN3			97.12	97.12	101.34	0.00	0.00
E1150F603A	MOV	216200-1C	0.6MCUN3			92.07	92.07	96.08	0.00	0.00
E1150F603B	MOV	216185-2C	0.6MCUN3			97.73	97.73	101.98	0.00	0.00
E1150F604A	MOV	216205-1C	0.6MCUN3			92.07	92.07	96.08	0.00	0.00
E1150F604B	MOV	216190-2C	0.6MCUN3			97.73	97.73	101.98	0.00	0.00
E1150F605A	MOV	216210-1C	0.6MCUN3			91.78	91.78	95.77	0.00	0.00
E1150F605B	MOV	216195-2C	0.6MCUN3			97.12	97.12	101.34	0.00	0.00
E1150F608	MOV	201630A,B-2P	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E1150F611A	MOV	214215-1P	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
E1150F611B	MOV	214245-2P	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
E2150F004A	MOV	212530-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E2150F004B	MOV	212540-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
E2150F005A	MOV	212550-1C	0.6MCUN3	0.5	0.0	95.83	92.52	96.55	3.31	79.46
E2150F005B	MOV	212560-2C	0.6MCUN3	0.2	0.0	98.38	97.13	101.35	1.25	91.74
E2150F015A	MOV	212510-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
E2150F015B	MOV	212520-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
E2150F031A	MOV	212590-1C	0.6MCUN3	0.0	0.0	94.37	93.29	97.35	1.08	90.51
E2150F031B	MOV	212600-2C	0.6MCUN3	0.0	0.0	99.24	98.05	102.31	1.20	94.96

Equipment Cable and Heater Losses Summary Report

Connected Load		Cable/Heater		Losses		% Voltage				
							Terminal on		% Vd	% Vst
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
E2150F036A	MOV	212570-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
E2150F036B	MOV	212580-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
E4150F002	MOV	209780A,B-1P	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
E5150F007	MOV	214720A,B-2P	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
G1154F018	MOV	215067-2P	0.6MCUN3	0.0	0.0	98.38	96.20	100.39	2.18	89.97
G1154F600	MOV	235050A,B-2P	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
G3352F001	MOV	212410A,B-1P	0.6MCUN3	0.0	0.0	94.37	93.54	97.60	0.83	90.91
G3352F220	MOV	201323-2P	0.6MCUN3	0.0	0.0	99.24	98.29	102.57	0.95	95.37
G5100F600	MOV	218470-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
G5100F601	MOV	218550-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
G5100F602	MOV	218460-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
G5100F603	MOV	218530-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
G5100F604	MOV	218480-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
G5100F605	MOV	218560-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
G5100F606	MOV	218490-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
G5100F607	MOV	218570-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
N1100F607	MOV	216890-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
N1100F608	MOV	216900-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
N1100F609	MOV	216910-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
N1100F610	MOV	216920-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
P4400F601A	MOV	211500-1C	0.6MCUN3	0.0	0.0	95.83	95.17	99.31	0.66	93.56
P4400F601B	MOV	211510-2C	0.6MCUN3	0.0	0.0	98.38	97.75	102.00	0.63	96.20
P4400F602A	MOV	211520-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
P4400F602B	MOV	211530-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
P4400F603A	MOV	211540-1C	0.6MCUN3	0.0	0.0	95.83	95.13	99.26	0.70	93.40
P4400F603B	MOV	211550-2C	0.6MCUS3	0.1	0.0	98.38	97.38	101.61	1.00	92.99
P4400F604	MOV	211560-2C	0.6MCUN3	0.0	0.0	98.38	96.76	100.96	1.63	93.11
P4400F605A	MOV	211570-1C	0.6MCUN3	0.0	0.0	95.83	94.60	98.71	1.23	91.83
P4400F605B	MOV	211580-2C	0.6MCUN3	0.0	0.0	98.38	97.09	101.31	1.29	94.17
P4400F606A	MOV	211590-1C	0.6MCUN3	0.0	0.0	95.83	94.58	98.69	1.25	91.35
P4400F606B	MOV	211600-2C	0.6MCUN3	0.0	0.0	98.38	97.01	101.23	1.37	93.71
P4400F607A	MOV	211620-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
P4400F607B	MOV	211610-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
P4400F608	MOV	211630A,B-2P	0.6MCUN3	0.0	0.0	98.38	96.58	100.78	1.80	91.00

Equipment Cable and Heater Losses Summary Report

Connected Load		Cable/Heater		Losses		% Voltage				
							Terminal on		% Vd	% Vst
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
P4400F613	MOV	201220-1C	0.6MCUN3	0.0	0.0	94.53	93.29	97.34	1.24	88.67
P4400F614	MOV	201670A,B-1P	0.6MCUN3	0.0	0.0	95.83	93.99	98.07	1.84	86.80
P4400F615	MOV	220340A,B-2P	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
P4400F616	MOV	220330A,B-1P	0.6MCUN3			94.53	94.53	98.63	0.00	0.00
T4100F600	MOV	220890-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
T4100F601	MOV	220880-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
T4803F601	MOV	201300A,B-1P	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
T4803F602	MOV	201310A,B-1P	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
T4804F601A	MOV	201350-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
T4804F601B	MOV	201645-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
T4804F602A	MOV	201360-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
T4804F602B	MOV	201650-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
T4804F603A	MOV	201495-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
T4804F603B	MOV	201885-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
T4804F604A	MOV	201370-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
T4804F604B	MOV	201655-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
T4804F605A	MOV	201520-1C	0.6MCUN3			95.83	95.83	99.99	0.00	0.00
T4804F605B	MOV	201880-2C	0.6MCUN3			98.38	98.38	102.66	0.00	0.00
T4804F606A	MOV	201330-1C	0.6MCUN3			94.37	94.37	98.47	0.00	0.00
T4804F606B	MOV	201660-2C	0.6MCUN3			99.24	99.24	103.56	0.00	0.00
T4901F601	MOV	201290A,B-1P	0.6MCUN3	0.0	0.0	94.37	92.49	96.51	1.88	86.68
T4901F602	MOV	234268-2P	0.6MCUN3	0.0	0.0	99.21	97.72	101.97	1.49	92.52

DC-5003 Vol. I - Attachment P - Case Study 16 - All EDGs 0 - 10 Min Voltage at TS Minimum

Alert Summary Report

	% Alert Settings	
	Critical	
Loading		
Bus	100.0	0.0
Cable	100.0	0.0
Reactor	0.0	0.0
Line	100.0	0.0
Transformer	100.0	0.0
Panel	100.0	0.0
Protective Device	0.0	0.0
Generator	0.0	0.0
Bus Voltage		
OverVoltage	110.0	1000.0
UnderVoltage	0.0	-100.0
Generator Excitation		
OverExcited (Q Max.)	0.0	0.0
UnderExcited (Q Min.)		

Report

ID	Device Type	Rating	Unit	Calculated	%Mag.	Condition

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	MW	Mvar	MVA	% PF
Source (Swing Buses):	9.733	4.659	10.790	90.20 Lagging
Source (Non-Swing Buses):	0.000	0.000	0.000	100.00 Lagging
Total Demand:	9.733	4.659	10.790	90.20 Lagging
Total Motor Load:	8.948	4.301	9.928	90.13 Lagging
Total Static Load:	0.750	0.284		
Apparent Losses:	0.035	0.074		
System Mismatch:	0.001	0.001		

Number of Iterations: 1

ENCLOSURE 3
to NRC-07-0043

FERMI 2 NRC DOCKET NO. 50-341
OPERATING LICENSE NO. NPF-43

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE REQUEST TO REVISE THE MINIMUM VOLTAGE FOR EMERGENCY DIESEL GENERATOR SURVEILLANCE TESTING IN TS 3.8.1

Legend for Use with
Table 2, DC-5003, Volume I, Revision H

Legend for Use with Table 2 of
DC-5003, Volume I, Revision H

Column Heading	Term Definition
Load ID	Load Identification
Category	Type of load (i.e. induction motor, motor operated valve or static load)
Losses kW or kVAR	Losses associated with the cable connection from the bus to the load
% Voltage Bus	Percent Bus voltage prior to the load start at a 4160 volt base or at a 480 volt base
% Voltage Terminal on Bus kv	Percent Bus voltage after load start at a 4160 volt base or a 480 volt base
% Voltage Terminal on Load kv	Percent Load voltage after load start at a 4000 volt base or a 460 volt base
% Vd Operating	Percent Bus voltage drop after the load has started
% Vd Starting	Percent voltage drop during the load start

ENCLOSURE 4
to NRC-07-0043

FERMI 2 NRC DOCKET NO. 50-341
OPERATING LICENSE NO. NPF-43

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION REGARDING THE REQUEST TO REVISE THE MINIMUM VOLTAGE FOR EMERGENCY DIESEL GENERATOR SURVEILLANCE TESTING IN TS 3.8.1

TSR-35236, Revision 0 (13 pages)

TECHNICAL SERVICE REQUEST COVER SHEET

TSR-35236
Rev 0
Page 1 of 13

PART 1: IDENTIFICATION/DESCRIPTION (Initiator)

A) Title (Subject): Revision of DC-5003 Vol. I to include a calculation of EDG instrument tolerances.

B) System PIS Number: R30-00

C) Description of Problem/Proposed Solution: DC-5003 Vol I demonstrates that an adequate voltage is available to the postulated EDG loads after LOOP and LOCA when the EDG output voltages of 3873 VAC for Division 1 and 3628 VAC for Division 2 are maintained. A Licensing Amendment NRC-07-0012 has been submitted to revise the minimum EDG output voltage acceptance criteria in TS 3.8.1 surveillance requirements from 3740 VAC to 3873 VAC. The NRC has requested additional information (RAI dated 7/3/07) on drift, measurement uncertainty, and margin associated with the minimum EDG output voltage calculation.

To address the NRC question it is proposed to perform an assessment of the EDG voltage measurement instrument loop uncertainty due to instrument drift, accuracy, etc. at normal environment. This is required to support minimum EDG output voltage surveillances and will be added to DC-5003 Vol I as an Appendix.

☐ **Continuation Sheet**

D) Initiated By

Print Name: A.M. Khan **Extension** 6-1725

Group/Organization PSE Elec &I/C **Date** 08-10-2007

PART 2: CLASSIFICATION (Dispositioner)

A) QA Level ☒ I ☐ 1M ☐Non-Q	**B) Piping Group** ☐ A ☐ B ☐ C ☐ D ☐ D+ ☒NA	**C) Seismic Category** ☒ I ☐II/I ☐None
D) ISI Component ☐ Yes ☒ No	**E) Technical Specification Component** ☒ Yes ☐ No	**F) EQ Component** ☐ Yes ☒ No
G) Human Factors Applicability ☐ Yes ☒ No	**H) 10CFR50.59 Applicability Determination Form (MLS14001) Attached** ☒ Yes ☐ No ☐ Exempt Approved Reviewer Signature	**I) DVRP Required** ☒ Yes ☐ No

J) Fire Protection Impact	K) Simulator Impact	L) Training Impact	M) Spare Parts Impact	N) Maintenance Rule Impact	O) Lubrication Impact
☐ Yes ☒ No	☐ Yes ☒ No	☒ Yes ☐No	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No

P) Action: ☒ As-Built Notice
☐ Configuration Control

PART 3: DISPOSITION

A) Prepared by **Extension** 6-1076

Print Joe Hulderman **Sign** Joe Hulderman **Date** 8-14-07

B) Checked by **Extension** 6-1725

Print A. M. Khan **Sign** [signature] **Date** 8-14-07

CECO Locked ☐ Yes ☒ N/A CECO Loaded ☐ Yes ☒ N/A CRIMS Locked ☐ Yes ☒ N/A

C) Approved by

Print A. Kleinsorge **Sign** [signature] **Date** 8-14-07

☒ NA PART 4: OSRO APPROVAL

Print _____ **Sign** _____ **Date** _____

ARMS - INFORMATION MANAGEMENT

DSN 35236 Rev 0 DECOM Related: ☐ Yes ☒ No Date _____

DTC ☐ TDTSR ☒ TCTSR File 1801.03 Recipient _____

☐ FIO - O ☐ FIO - C ☐ AFC ☒ ASB - O ☐ ASB - C ☐ CAN

BCDDS TO BE REVISED/POSTED SHEET

PART 3: DISPOSITION

D) BCDDs to be Revised/Posted: [ ] NA

ARMS DTC	ARMS DSN	ARMS Rev	Document Description	Remarks & Affected PIS Numbers
TDPELE	DC-5003 Vol. I	H	EMERGENCY DIESEL GENERATOR LOADS CALCULATIONS	[ ] Continuation Sheet

PART 3: DISPOSITION

References:

1. CARD 06-25497

Description of Change:

Under CARD 06-25497-02 action DC-5003 Vol. I Revision G was issued and contains a voltage analysis at nominal values of 3873 VAC for EDGs 11 and 12 and 3628 VAC for EDGs 13 and 14. At these EDG nominal output voltages all the EDG loads have sufficient voltage to start and run. This revision of DC-5003 Vol.I does not explicitly evaluate the loop uncertainties on the instruments associated with the allowable EDG analyzed degraded voltage. To allow surveillance values to be established instrument uncertainties will be accounted for in this design calculation. A general description is listed below for the revision with a detailed disposition on the following pages.

1. DC-5003 Vol.I: Added Appendix 1 to provide an analyzed method for determining the measurement uncertainty along with accounting for margin on the instrument loops that are used to provide the voltage value.

Justification:

The revisions made to DC-5003 Vol.I uses known valid methods for determining voltmeter loop accuracy. Appendix 1 will contain the analysis of the EDG voltmeter instrumentation that will be used in the surveillances is an analog type K-241 four and ½ inch circular scale labeled as R30R004A(B/C/D). The voltmeter loop consists of two Potential Transformers and Voltmeter. These instrument loops are the bounding case for determining EDG voltmeter loop accuracy and bounds the control room instrument loops for R30R804, R30R814, R30R822 and R30R832 devices. The inclusion of this appendix for analyzing loop accuracy does not impact or affect the original analysis completed that determined the nominal EDG voltage value.

This revision to the design calculation does not change the functional requirements of this calculation. The addition of Appendix 1 does not change the MES02 design input criteria requirements.

Potential impacts on plant procedures:

The following surveillances may require revisions per this TSR: 24.307.01/02/10/11/14/15/30/31/45/46. TSR impact on any other plant programs and procedures will be identified by the PPRN process.

PART 3: DISPOSITION

Document to be Posted: DSN: DC-5003 Vol.I, Rev H page 3:

TABLE OF CONTENTS

Revise to read as shown per TSR-35236 Rev.0

Document to be Posted: DSN: DC-5003 Vol.I, Rev H Add Appendix 1:

APPENDIX 1
MEASUREMENT ACCURACY OF EDG VOLTMETER LOOP

The voltage measurement accuracy for the EDG bus voltage are derived from the following calculation which considered calibration and accuracy of installed equipment following Fermi Setpoint Validation Guideline C1-4180, Revision B. This calculation guideline is based on GE methodology NEDC-31336P-A which has been approved by the NRC.

The voltmeter loop for each EDG consists of two Potential Transformers and one Voltmeter (R30R004A(B/C/D). The plant installed EDG voltmeter instrumentation are an analog type K-241 four and ½ inch circular scale labeled as R30R004A(B/C/D). These voltmeters will be used in the surveillances to validate the voltage level on the EDGs. This instrument loop is the bounding case for determining EDG voltmeter loop accuracy and bounds the control room EDG voltage indicators.

The total error is calculated using the following items:

(A) Channel Instrument Accuracy (LAN): LAN will use the SSRS method of combining loop components vendor accuracy.

(B) Channel Calibration Accuracy (LC): LC will use the SSRS method of combining loop components calibration accuracy.

(C) Channel Drift (LD): LD will use the SSRS method of combining loop components drift.

(D) Operator Readability Error (ORE)

Total Channel Instrument Error (CIE) $= \sqrt{(LAN)^2 + (LC)^2 + (LD)^2 + (ORE)^2}$ @ 1.645 Sigma

The loop to be considered for the signal initiation consists of two potential transformer (PT) and the indicating voltmeter (VM).

Detail calculation:

(A) Channel Instrument Accuracy (LAN) $= \sqrt{(PTa)^2 + (PTb)^2 + (VM)^2}$

PTa = The potential transformer has + 0.3% tolerance of full scale @ 3 Sigma or 15 volt on 5000 volt base (per attached vendor document).

PTb = The potential transformer has + 1.2% tolerance of full scale @ 3 Sigma or 60 volt on 5000 volt base (per attached vendor document).

VM = The Voltmeter has 1.0% tolerance of full scale @ 3 Sigma or 50 volt for 5000 volt base (per attached vendor document)

Therefore:

(A) Channel Instrument Accuracy (LAN) = $2/3^* \sqrt{(15)^2 + (60)^2 + (50)^2}$

(A) Channel Instrument Accuracy (LAN) = **53.02 volts @ 2 Sigma on 5000 volt base**

(B) Channel Calibration Accuracy (LC):

Preventative Maintenance procedure Z107 , Z108, Z109 and Z110 calls for calibration for the EDG voltmeters.

The test equipment consists of:

1. Digital multmeter (VD) range 0-200 volt with accuracy of 0.2% of input + 0.015% of range @ 2 Sigma.

2. Potentiometer to adjust the input voltage; tolerance will not be considered due to the use of the voltmeter to record the input voltage.

(B) Channel Calibration Accuracy (LC) = $\sqrt{V1^2 + V2^2 + Ep^2}$

Where:

V1 = Total error for voltmeter at the input

V2 = Total error for voltmeter at the output

Ep = Procedure error

$V1 = \sqrt{(V)^2 + (Vstd.)^2}$

PART 3: DISPOSITION

Document to be Posted: DSN: DC-5003 Vol.I, Rev H Add Appendix 1:

V = Voltmeter error:

Voltmeter error = 0.2% x 120 + 0.015% x 200 = 0.27 volt @ 3 Sigma

Vstd = Standard error to be applied to the instrument

Vstd = V (conservative assumption)

$V1 = \sqrt{(0.27)^2 + (0.27)^2}$ = **0.382 volt @ 3 Sigma on 120 volt base**

V1 = V2 (same instrument)

Ep = VM (equals vendor error of the meter)

Ep = (1.0%) of span = 1.2 volts @ 3 Sigma on 120 volt base

Therefore: (B) Channel Calibration Accuracy (LC) $= (2/3)*\sqrt{(0.382)^2 + (0.382)^2 + (1.2)^2}$

(B) Channel Calibration Accuracy (LC) = **0.877 volts @ 2 Sigma on 120 volt base or 36.56 volts at 5000 volt base**

(C) Channel Drift (LD): The instrument drift is based on past instrument performance (see attached drift table). The total average drift value is 10 volts. The drift value used will taken as equal to the two times the average value based on past instrument performance.

(C) Channel Drift (LD): = **20.0 volts @ 2 Sigma on 5000 volt base**

(D) Operator Readability Error (ORE)

The voltmeter scaling on meter face is 0 to 5000 volts in 100 volt minor divisions.
Therefore: ORE = ½ of a minor division which is equal to **50 volts @ 2 Sigma.**

Total Channel Instrument Error (CIE) $= (1.645/2) *\sqrt{(A)^2 + (B)^2 + (C)^2 + (D)^2}$

Total Channel Instrument Error (CIE) $= 0.8225 *\sqrt{(53.02)^2 + (36.56)^2 + (20.0)^2 + (50)^2}$

Total Channel Instrument Error (CIE) = **69.05 volts at 5000 volt base**

REFERENCES

1. C1-4180 Setpoint Validation Guidelines
2. GE NEDC- 31336P-A Instrument Setpoint Methodolgy
3. VMC1-223
4. VME8-1.2.5
5. VME8-1.2.7
6. DWG: I-N-2578-06

Conclusion

A review of the instrument devices that provide the voltage indication shows that the voltmeter has an accuracy of 1 % of full scale, the first potential transformer accuracy is 0.3 % of full scale and the second auxiliary potential transformer accuracy is 1.2% of full scale. The instrument drift is taken as equal to the two times the average value based on past instrument performance. Additionally, a value for Operator Readability Error (ORE) is taken as ½ of a minor scale division. Therefore, the Total error (CIE) is approximately 1.381 % of full scale. This is calculated based on the Total error (CIE) as being the Square Root of the Sum of the Squares (SRSS) @ 1.645 Sigma . This Total error (CIE) of approximately 1.381% equates to approximately 69.05 volts (round to 69 volts).

In conclusion, to ensure that the analyzed lowest possible value of 3873 volts is met an additional voltage should be added to account for loop error. This includes the instrument measurement error of 69 volts and a margin of 8 volts. In addition to ensure that the highest possible value of 4580 volts is not exceeded a voltage should be subtracted to account for loop error. This includes the instrument measurement error of 69 volts and a margin of 11 volts.

Based on the above review, the proposed EDG SR minimum voltage acceptance criterion is 3873 volts plus additional voltage to account for drift, readability and measurement uncertainty (69 volts) and to provide additional margin (8 volts). Therefore, the proposed minimum surveillance test value of 3950 volts is sufficient to verify adequacy of the calculated minimum EDG nominal voltage of 3873 volts. In addition, proposed maximum surveillance test value of 4500 volts is sufficient to ensure the calculated maximum EDG nominal voltage of 4580 volts is not exceeded.

PART 3: DISPOSITION

Document to be Posted: DSN: DC-5003 Vol. I, Rev H, Add Appendix 1:

DRIFT TABLE PER PAST PERFORMANCE

	R30R004A					R30R004C		
Work Req.	As Found	As Left	Drift Delta		Work Req.	As Found	As Left	Drift Delta
545970308 03/11/98	4040 V	4040 V	NA		W556970113 04/08/98	4010 V	4010 V	NA
Z107000100 10/31/00	4040 V	4040 V	0		Z108000100 11/07/00	4010 V	4010 V	0
Z107020100 04/30/02	4030 V	4030 V	10		000Z013951 12/05/01	4010 V	4010 V	10
Z107030100 01/27/03	4050 V	4050 V	20		Z108020100 05/07/02	4020 V	4000 V	10
Z107040100 06/23/04	NA	4010 V	New Meter		Z108030100 06/03/03	4000 V	4000 V	0
000Z041210 06/22/04	4000 V	4010 V	10		000Z041211 08/03/04	3990 V	3990 V	New Meter
Z107060100 10/24/05	3950 V	3950 V	60		Z108060100	3960 V	3960 V	30
Z107070100 04/24/07	3960 V		10					
						Average Drift Delta		**10**
	Average Drift Delta		**18**					
	R30R004B					R30R004D		
Work Req.	As Found	As Left	Drift Delta		Work Req.	As Found	As Left	Drift Delta
Z109000100 11/14/00	4000 V	4000 V	NA		Z110020100 5/13/02	4000 V	4000 V	NA
Z109020100 05/21/02	4000 V	4000 V	0		Z110030100 6/18/03	4000 V	4000 V	0
Z109030100 06/10/03	4000 V	4000 V	0		000Z041212 12/06/05	4000 V	4000 V	0
Z109040100 08/15/05	4000 V	4000 V	0		Z110040100 12/06/05	4000 V	4000 V	0
000Z031665 08/15/05	4000 V	4000 V	0		Z110060100 11/14/06	3970 V	3970 V	30
Z109060100 10/02/06	3980 V	3980 V	20					
						Average Drift Delta		**7.5**
	Average Drift Delta		**4**					
Total Average Drift Delta		**10.0**						

PART 3: DISPOSITION

Document to be Posted: DSN: DC-5003 Vol. I, Rev H Add Appendix 1:

From Vendor Manual VME8-1.2.7

Westinghouse I.L. 43-241T

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

—K-241 LINE—
SWITCHBOARD INSTRUMENTS
FOUR AND ONE-HALF INCH CLASSIFICATION
FULL-VIEW CIRCULAR SCALE TYPE

GENERAL

Type K-241 instruments are designed and built to meet or exceed the requirements of American Standard C39.1 for electrical indicating switchboard instruments. The rated accuracy class is one per cent.

CASES

The first letter in the Type designation indicates the form of case used. K = Rectangular Flush Case, Flange mounted.

MECHANISMS

The second letter in the type designation indicates the principle of operation.

X = Permanent magnet moving coil
A = Repulsion-Attraction, moving iron
P = Watt transducer plus X
I = Rotating iron vane
C = Rectifier plus X
F = Iron core electromagnetic

All of the above mechanisms employ the taut

to switchboard drawings if instruments are supplied as part of a switchboard.

Before energizing the instrument, adjust the pointer to zero by means of the zero adjuster at the front of the instrument.

CIRCUIT PRECAUTIONS

CAUTION: Dial and pointer may be at dangerous voltage levels when instrument is energized.

HIGH VOLTAGE OPERATION

All instruments are insulated for 800 volt maximum service.

When voltmeters are used with external resistors on voltages higher than the insulation rating of the instrument, one terminal of the instrument should be grounded.

Ammeters with external shunts must be used with leads having the resistance specified in the

PART 3: DISPOSITION

Document to be Posted: DSN: DC-5003 Vol. I, Rev H Add Appendix 1:

From Vendor Manual VMC1-223 for the following Potential Transformers:

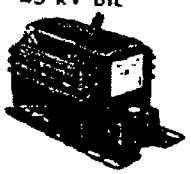
	PIS	Sub-Component
EDG 11	R1400S002A	25
EDG 12	R1400S002B	26
EDG 13	R1400S002C	25
EDG 14	R1400S002D	25

FROM GE POCKET GUIDE GEP-7900C FOR INSTRUMENT TRANSFORMERS

COPY

Indoor Voltage Transformers

Type JVM-2, 2400 Volts
45 kV BIL

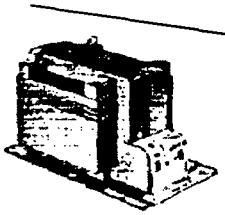


(Unfused Design)

ANSI Accuracy Class:
0.3 thru Burden Y

Thermal Rating:
750 VA with 30C Ambient
500 VA with 55C Ambient

Type JVM-3, 2400 - 4800 Volts
60 kV BIL



(Unfused Design)

ANSI Accuracy Class:
0.3 thru Burden Y

Thermal Rating:
750 VA with 30C Ambient
500 VA with 55C Ambient

① Circuit voltage line-to-line 2400 volts.
② Circuit voltage line-to-line 4160 volts.

Voltage Ratio	Catalog Number	Net Wt. (lb.)	Dimensions in Inches Height	Width	Length
UNFUSED WITH PRIMARY TERMINAL BUSHINGS					
2400:120	762X22G3	30	6 5/8	7	10 7/8
UNFUSED WITH PRIMARY TERMINAL COVER					
2400:120	762X22G4	30	6 13/16	7	10 7/8
WITH ONE PRIMARY FUSE					
2400:120	762X22G2	32	7 3/16	7 1/2	10 7/8
WITH TWO PRIMARY FUSES					
2400:120	762X22G1	33	7 3/16	7 15/16	10 7/8
UNFUSED					
2400:120	643X83	30	5 15/16	6 3/8	10 7/8
4200:120	643X90	30	5 15/16	6 3/8	10 7/8
4800:120	643X95	30	5 15/16	6 3/8	10 7/8
WITH ONE PRIMARY FUSE					
2400:120	763X21G42①	32	7 3/4	6 3/8	10 7/8
2400:120	643X85②	32	7 3/4	6 3/8	10 7/8
4200:120	643X91	32	7 3/4	6 3/8	10 7/8
4800:120	643X96	32	7 3/4	6 3/8	10 7/8
WITH TWO PRIMARY FUSES					
2400:120	763X21G40①	33	7 3/4	6 13/16	10 7/8
2400:120	643X87②	33	7 3/4	6 13/16	10 7/8
4200:120	643X92	33	7 3/4	6 13/16	10 7/8
4800:120	643X97	33	7 3/4	6 13/16	10 7/8

PART 3: DISPOSITION

Document to be Posted: DSN: DC-5003 Vol. I, Rev H Add Appendix 1:

From GE instrument pocket guide GEP-7900D for the following Potential Transformers:

	PIS	Sub-Component
EDG 11	R3000S005	9
EDG 12	R3000S006	9
EDG 13	R3000S007	9
EDG 14	R3000S008	10

Indoor Voltage Transformers

Type JE-27, 69.4 - 600 Volts DRY TYPE

Low-Burden Auxiliary Transformer

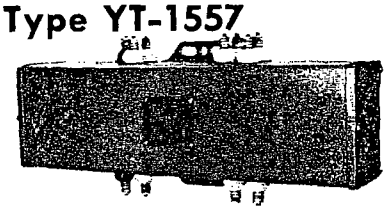
ANSI Accuracy Class:
1.2 thru Burden X

Thermal Rating:
150 VA with 30C Ambient
100 VA with 55C Ambient

Additional ratings are also available.

Voltage Rating	Catalog Number	Net Wt (lb)	Dimensions in Inches Height	Width	Length
69.4:120	760X90G1	9	4	6	5
120:120	760X90G2	9	4	6	5
120:69.4	760X90G3	9	4	6	5
207.8:120	760X90G4	9	4	6	5
240:120	760X90G5	9	4	6	5
288:120	760X90G7	9	4	6	5
300:120	760X90G8	9	4	6	5
480:120	760X90G9	9	4	6	5
600:120	760X90G10	9	4	6	5

Type YT-1557 DRY TYPE



3-phase
Auxiliary Transformer

199/115 Wye Primary Volts① / 115 Delta Secondary Volts	760X99G1	50	$4^{3}/_{8}$	$7^{11}/_{16}$	$18^{7}/_{8}$

①Single-unit 115/66.5 Volts

Type JVA-0, 120 - 600 Volts

10 kV BIL

Can be used indoor or outdoor

UNFUSED					
120:120	760X34G1	16	5	$6^{1}/_{8}$	6
240:120	760X34G2	16	5	$6^{1}/_{8}$	6
288:120	760X34G4	16	5	$6^{1}/_{8}$	6
300:120	760X34G5	16	5	$6^{1}/_{8}$	6
480:120	760X34G6	16	5	$6^{1}/_{8}$	6
600:120	760X34G7	16	5	$6^{1}/_{8}$	6

TSR-35236
Rev. 0
Pg 13

APPLICABILITY DETERMINATION

Part I. Activity Identification (ADM 2.1)

A. Document Being Reviewed: TSR-35236 Revision Number: 0

B. Descriptive Title of Activity:

This TSR adds Appendex 1 that addresses instrument tolerances and accuracies to the evaluation of degraded voltage calculation DC-5003 Vol. I.

Part II. Effect on Operating License (ADM 2.2)

A. If the proposed activity requires a change to the Technical Specifications, Operating License, or the Environmental Protection Plan, process the LCR in accordance with MLS08 and exit this process. An Applicability Determination is not required.

Part III. Regulated Plans and Programs Applicability (ADM 2.3)

A. Is acceptability of the proposed activity governed in whole or in part by requirements set forth by any of the following plans or programs? If not governed by these requirements, GO TO Part IV.

YES
- ☐ QA Plan
- ☐ Physical Security Plan
- ☐ Safeguards Contingency Plan
- ☐ Security Training and Qualification Plan
- ☐ RERP Plan

YES
- ☐ Fire Protection Program
- ☐ COLR
- ☐ ODCM
- ☐ Maintenance Rule
- ☐ Radiation Protection Program

YES
- ☐ ISI-IST Program
- ☐ ISI-NDE Program
- ☐ Environmental Protection Program
- ☐ Other Regulations Apply

B. For each plan or program checked above, list the corresponding License Change Request number if an LCR is required as a result of this activity; or include a brief explanation of how applicable acceptance criteria are met if no LCR is required.

LCR #s _____ _____ _____ ☐ Brief Explanation Included

Part IV. Changes to Procedures that Govern the Conduct of Operations (ADM 2.4)

A. Yes ☐ No ☒ Does the proposed change govern administrative, managerial, or organizational requirements?

B. If the UFSAR is impacted, List LCR# _____

Part V. UFSAR Modifications and Other Exempt Changes (ADM 2.5)

A. Yes ☐ No ☒ Does the proposed activity involve UFSAR modifications exempt from the requirements of 50.59, including UFSAR updates resulting from Part III above?

B. If "YES," list LCR # _____

C. Yes ☐ No ☒ Does the proposed activity involve changes that do not affect the intent or are editorial?

Part VI. 10 CFR 50.59 Applicability (ADM 2.6)

A. Yes ☐ No ☒ Are all aspects of the proposed activity covered by one or more of Parts III through V above?

B. If "NO," initiate a 50.59 Screen and list # 07-0172

Part VII. Signatures

Prepared by: (Print Name) J. S. Dudlets (Sign) J S Dudlets (Date) 08/13/07

Reviewed by: (Print Name) A.M. KHAN (Sign) A M Khan (Date) 8/13/07