ATTACHMENT 2

2650

WORST CASE LOAD PROFILE

BASED ON THE THEORETICAL MAXIMUM

EQUIPMENT THAT

COULD START SIMULTANEOUSLY

Using the 2D650 Battery Load Profiles developed in Attachment 1, determine the maximum load profiles that could occur if all equipment that could start simultaneously did in fact start simultaneously for the following time segments. This approach is being used to assure that variations in the timing of the MOVs are enveloped by the Technical Specification.

LOAD SEGMENTS

0 - 60 seconds

1 - 10 minutes

10 - 30 minutes

30 - 240 minutes

1 - 5 minutes (Station Blackout)

5 - 6 minutes (Station Blackout)

6 - 10 minutes (Station Blackout)

The composite 2D650 Battery Load Profile for all modes of operation, including Station Blackout, is shown in Table 7 - 1.

1.0 LARGE BREAK LOCA PROFILE

The Table A2 - 1 shows the maximum possible 2D650 Battery Load Profile for a LARGE BREAK LOCA with all equipment starting simultaneously.

1.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

1.11 HV-E51-2F045 inrush amperes are not used since HV-E51-2F045 MUST BE out of Locked Rotor before HV-E51-2F013 can be started.

1.12 HV-E51-2F010 inrush amperes are not used since HV-E51-2F031 MUST BE closed before HV-E51-2F010 can operate. This prevents simultaneous starting with the other equipment.

1.13 HV-E41-2F079 inrush amperes are not used since Reactor Pressure MUST drop to 105.5 psi before HV-E41-2F079 can operate. This occurs after all the equipment in this load segment has started.

1.2 1 - 10 Minute

All the equipment in this load segment is assumed to operate simultaneously.

1.3 10 - 30 Minute

All the equipment in this load segment is assumed to operate simultaneously.

1.4 30 - 240 Minute

All the equipment in this load segment is assumed to operate simultaneously.

2.0 LARGE BREAK LOCA RCIC IN PRESSURE CONTROL PROFILE

The Table A2 - 2 shows the maximum possible 2D650 Battery Load Profile for a LARGE BREAK LOCA RCIC IN PRESSURE CONTROL with all equipment starting simultaneously.

2.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

2.11 HV-E51-2F010 inrush amperes are not used since HV-E51-2F031 MUST BE closed before HV-E51-2F010 can operate. This prevents simultaneous starting with the other equipment.

2.12 HV-E41-2F079 inrush amperes are not used since Reactor Pressure MUST drop to 105.5 psi before HV-E41-2F079 can operate. This occurs after all the equipment in this load segment has started.

2.2 1 - 10 Minute

All the equipment in this load segment is assumed to operate simultaneously.

2.3 10 - 30 Minute

All the equipment in this load segment is assumed to operate simultaneously.

2.4 30 - 240 Minute

All the equipment in this load segment is assumed to operate simultaneously.

3.0 SMALL BREAK LOCA PROFILE

The Table A2 - 3 shows the potential maximum possible 2D650 Battery Load Profile for a SMALL BREAK LOCA with all equipment starting simultaneously.

3.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

3.11 HV-E51-2F045 inrush amperes are not use since HV-E51-2F045 MUST BE out of Locked Rotor before HV-E51-2F013 can be started.

3.12 HV-E51-2F010 inrush amperes are not used since HV-E51-2F031 MUST BE closed before HV-E51-2F010 can operate. This prevents simultaneous starting with the other equipment.

3.2 1 - 10 Minute 

All the equipment in this load segment is assumed to operate simultaneously.

3.3 10 - 30 Minute

All the equipment in this load segment is assumed to operate simultaneously.

3.4 30 - 240 Minute

All the equipment in this load segment is assumed to operate simultaneously.

4.0 SMALL BREAK LOCA RCIC IN PRESSURE CONTROL PROFILE

The Table A2 - 4 shows the maximum possible 2D650 Battery Load Profile for a SMALL BREAK LOCA RCIC IN PRESSURE CONTROL with all equipment starting simultaneously.

4.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

4.12 HV-E51-2F010 inrush amperes are not used since HV-E51-2F031 MUST BE closed before HV-E51-2F010 can operate. This prevents simultaneous starting with the other equipment.

4.2 1 - 10 Minute

All the equipment in this load segment is assumed to operate simultaneously.

4.3 10 - 30 Minute

All the equipment in this load segment is assumed to operate simultaneously.

4.4 30 - 240 Minute

All the equipment in this load segment is assumed to operate simultaneously.

5.0 STATION BLACKOUT PROFILE

The Table A2 - 5 shows the maximum possible 2D650 Battery Load Profile for a STATION BLACKOUT with all equipment starting simultaneously.

5.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

5.11 HV-E51-2F045 inrush amperes are not used since HV-E51-2F045 MUST BE out of Locked Rotor before HV-E51-2F013 can be started.

5.2 1 - 5 Minute

All the equipment in this load segment operates simultaneously.

5.3 5 - 6 Minute

All the equipment in this load segment operates simultaneously.

5.4 6 - 10 Minute

All the equipment in this load segment operates simultaneously.

5.3 10 - 30 Minute

All the equipment in this load segment operates simultaneously.

5.4 30 - 240 Minute

All the equipment in this load segment operates simultaneously.

EQUIPMENT	MCC		0 -60s		1-10 MIN		10-30 MIN		30-240MIN					
HV-E51-2F045	2D254		8		0		0		0					
HV-E51-2F013	2D254		42.2		42.2		0		0					
HV-E51-2F046	2D254		7.8		0		0		0					
FV-E51-2F019	2D254		26.4		0		0		0					
2P219	2D254		22.9		11.2		11.2		11.2					
2D288	2D288		120		120		120		120					
HV-E51-2F031	2D254		4		0		0		0					
HV-E51-2F010	2D254		0		4		0		0					
2P220	2D254		24		13.4		13.4		13.4					
HV-E41-2F079	2D254		0		0		0		0					
HV-E51-2F062	2D254		0		10.3		0		0					
HV-E51-2F008	2D254		0		14.1		0		0					
TOTAL			255.3		215.2		144.6		144.6					
2D288			120		120		120		120					
2D254			135.3		95.2		24.6		24.6					

EQUIPMENT	MCC		0 -60s		1 - 10 MIN		10-30 MIN		30-240MIN					
HV-E51-2F045	2D254		0		0		0		0					
HV-E51-2F013	2D254		42.2		42.2		0		0					
HV-E51-2F046	2D254		0		0		0		0					
FV-E51-2F019	2D254		0		0		0		0					
2P219	2D254		11.2		11.2		11.2		11.2					
HV-E51-2F022	2D254		34.6		0		0		0					
2D288	2D288		120		120		120		120					
[illegible]031	2D254		4		0		0		0					
[illegible]0	2D254		0		4		0		0					
2P220	2D254		24		13.4		13.4		13.4					
HV-E41-2F079	2D254		0		0		0		0					
HV-E51-2F062	2D254		0		10.3		0		0					
HV-E51-2F008	2D254		0		14.1		0		0					
TOTAL			236		215.2		144.8		144.6					
2D288			120		120		120		120					
2D254			116		95.2		24.6		24.6					

EQUIPMENT	MCC		0 - 60s		1 - 10 MIN		10-30 MIN		30-240MIN					
HV-E51-2F045	2D254		8		0		0		0					
HV-E51-2F013	2D254		42.2		0		0		0					
HV-E51-2F046	2D254		7.8		0		0		0					
FV-E51-2F019	2D254		26.4		0		0		0					
2P219	2D254		22.9		11.2		11.2		11.2					
2D288	2D288		120		120		120		120					
HV-E51-2F031	2D254		4		0		0		0					
HV-E51-2F010	2D254		0		4		0		0					
2P220	2D254		24		13.4		13.4		13.4					
HV-E41-2F079	2D254		0		0		0		0					
HV-E51-2F062	2D254		0		0		0		0					
HV-E51-2F008	2D254		0		0		0		0					
TOTAL			255.3		148.6		144.6		144.6					
2D288			120		120		120		120					
2D254			135.3		28.6		24.6		24.6					

SMALL BREAK LOCA RCIC IN PRESSURE CONTROL - 2D850 LOAD PROFILE
CURRENT CALCULATED AT 250 VDC

EQUIPMENT	MCC		0 - 60s		1 - 10 MIN		10-30 MIN		30-240MIN
HV-E51-2F045	2D254		0		0		0		0
HV-E51-2F013	2D254		42.2		0		0		0
HV-E51-2F046	2D254		0		0		0		0
FV-E51-2F019	2D254		0		0		0		0
2P219	2D254		11.2		11.2		11.2		11.2
HV-E51-2F022	2D254		34.6		0		0		0
2D288	2D288		120		120		120		120
HV-E51-2F031	2D254		4		0		0		0
HV-E51-2F010	2D254		0		4		0		0
2P220	2D254		24		13.4		13.4		13.4
HV-E41-2F079	2D254		0		0		0		0
HV-E51-2F062	2D254		0		0		0		0
HV-E51-2F008	2D254		0		0		0		0
TOTAL			236		148.6		144.6		144.6
2D288			120		120		120		120
2D254			116		28.6		24.6		24.6

EQUIPMENT	MCC	0 -60s	1 - 5 MIN	5 - 6 MIN	6 - 10 MIN	10-30 MIN	30-240MIN
HV-E51-2F045	2D254	8	42.2	8	0	0	0
HV-E51-2F013	2D254	42.2	42.2	42.2	0	0	0
HV-E51-2F046	2D254	7.8	7.8	7.8	0	0	0
FV-E51-2F019	2D254	26.4	0	26.4	0	0	0
2P219	2D254	22.9	11.2	11.2	11.2	11.2	11.2
HV-E51-2F031	2D254	0	0	0	0	0	0
HV-E51-2F010	2D254	0	0	0	0	0	0
2P220	2D254	24	13.4	24	13.4	13.4	13.4
HV-E41-2F079	2D254	0	0	0	0	0	0
HV-E51-2F062	2D254	0	0	0	0	0	0
HV-E51-2F008	2D254	0	0	0	0	0	0
2D288	2D288	120	120	120	120	120	120
TOTAL		251.3	236.8	239.6	144.6	144.6	144.6
2D288		120	120	120	120	120	120
2D254		131.3	116.8	119.6	24.6	24.6	24.6

ATTACHMENT 3

2D650

AMPERE-HOURS

2D650 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE LARGE BREAK LOCA

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
256	355	1	5.9
216	300	10	50.9
145	201	30	117.9
145	201	240	821.4

2D650 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE LARGE BREAK LOCA HPCI IN PRESSURE CONTROL

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
236	328	1	5.5
216	300	10	50.5
145	201	30	117.5
145	201	240	821.0

* Corrected Load = (Temperature Correction)(Age Correction)

= (1.11)(1.25) = 1.3875

Temperature Correction = 1.11 for 60°F(From IEEE 485)

Age Correction = 1.25 (IEEE 485)

2D650 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE SMALL BREAK LOCA

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
256	355	1	5.9
149	207	10	37.0
145	201	30	104.0
145	201	240	807.5

2D650 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE SMALL BREAK LOCA RCIC IN PRESSURE CONTROL

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
236	328	1	5.5
149	207	10	36.6
145	201	30	103.6
145	201	240	807.1

* Corrected Load = (Temperature Correction)(Age Correction)

= (1.11)(1.25) = 1.3875

Temperature Correction = 1.11 for 60°F(From IEEE 485)

Age Correction = 1.25 (IEEE 485)

2D650 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE STATION BLACKOUT

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
251	348	1	5.8
237	329	5	27.7
240	333	6	33.3
145	201	30	113.7
145	201	240	817.2

2D650 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE PROPOSED TECHNICAL SPECIFICATION

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
270	375	1	6.3
245	340	10	57.3
155	216	30	129.3
155	216	240	885.3

* Corrected Load = (Temperature Correction)(Age Correction)

= (1.11)(1.25) = 1.3875

Temperature Correction = 1.11 for 60°F (From IEEE 485)

Age Correction = 1.25 (IEEE 485)

2D650 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE EXISTING TECHNICAL SPECIFICATION

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
458	636	1	10.6
251	349	10	63.0
251	349	30	179.3
251	349	240	1400.8

* Corrected Load = (Temperature Correction)(Age Correction)

= (1.11)(1.25) = 1.3875

Temperature Correction = 1.11 for 60°F(From IEEE 485)

Age Correction = 1.25 (IEEE 485)

ATTACHMENT 4

2D650

MINIMUM BATTERY TERMINAL

VOLTAGE

1D650
CALCULATE
MINIMUM REQUIRED BATTERY TERMINAL VOLTAGE

The minimum required battery terminal voltage is the voltage required at the END OF DISCHARGE to support the connected load per IEEE 485-1978. This voltage is the minimum Technical Specification voltage requirement.

1.0 The Resistance between the Battery, Load Center and MCCs are:

Battery to Load Center = 0.0029 Ω (From E-AAA-255)

Load Center to 2D254 = 0.0149 Ω (From E-AAA-255)

Load Center to 2D288 = 0.023 Ω (From E-AAA-255)

2.0 Determine the voltage at the Load Center while maintaining 210 VDC at the MCCs for the END OF DISCHARGE Load Segment of Battery 2D650 (30 -240 Minutes).

2.1 **2D254**

The Proposed Technical Specification Profile for the 30 - 240 minute segment is 155 amperes. The largest calculated Class 1E load on 2D254 is 24.6 A (From Attachment 2) and the largest calculated battery load profile is 144.6 amperes (From Attachment 2). The 10.4 ampere differences between the two profiles is added to the Class 1E MCC 2D254.

I_{2D254} = 24.6 A + 10.4 A

V_{LC} = 210 + V_{DROP} = 210 + (0.0149)(35) = 210.5 V

2.2 **2D288**

The Proposed Technical Specification Profile for the 30 - 240 minute segment is 155 amperes. The largest calculated load on 2D288 is 120 A (From Attachment 2) and the largest calculated battery load profile is 144.6 amperes (From Attachment 2). The 10.4 ampere differences between the two profiles is added to the 2D288.

I_{2D288} = (120A + 10.4A) = 130.4 A

V_{LC} = 210 + V_{DROP} = 210 + (0.023)(130.4) = 213.0 V

3.0 Determine the Battery Terminal Voltage to maintain 210 VDC at the MCCs for the END OF DISCHARGE Load Segment of Battery 2D650.

Use the Load Center voltage required to maintain 210 V at 2D288 since this voltage requires the higher battery voltage.

$V_{BATTERY} = V_{LC} + V_{Drop\ Batt\ to\ LC}$

$I = 155\ A$

$V_{BATTERY} = 213.0\ V + (155)(0.0027)$

$= \mathbf{213.5\ V}$

4.0 Determine the Volts per cell that must be used in sizing the Class 1E 120 cell battery in order to maintain a battery voltage of 213.5 at END OF DISCHARGE.

VPC = 213.5/120 = 1.779

USE 1.78 VPC

ATTACHMENT 2

2D660

WORST CASE LOAD PROFILE

BASED ON THE THEORETICAL MAXIMUM

EQUIPMENT THAT

COULD START SIMULTANEOUSLY

Using the 2D660 Battery Load Profiles developed in Attachment 1, determine the maximum load profiles that could occur if all equipment that could start simultaneously did in fact start simultaneously for the following time segments. This approach is being used to assure that variations in the timing of the MOVs are enveloped by the Technical Specification.

LOAD SEGMENTS

0 - 60 seconds

1 - 10 minutes 

10 - 30 minutes

30 - 240 minutes

1 - 5 minutes (Station Blackout) 

5 - 6 minutes (Station Blackout)

6 - 10 minutes (Station Blackout)

The composite 2D660 Battery Load Profile for all modes of operation, including Station Blackout, is shown in Table 7 - 1.

1.0 LARGE BREAK LOCA PROFILE

The Table A2 - 1 shows the maximum possible 2D660 Battery Load Profile for a LARGE BREAK LOCA with all equipment starting simultaneously.

1.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

1.11 HV-E41-2F001 inrush amperes are not use since HV-E41-2F001 MUST BE out of Locked Rotor before HV-E41-2F006 can be started.

1.12 HV-B21-2F019 inrush amperes are not use since HV-B21-2F019 starts on Reactor Low Level-1 signal while the equipment that starts simultaneously starts on Reactor Low Level-2.

1.13 HV-E41-2F012 inrush amperes are not used since HV-E41-2F012 starts on HPCI Turbine High Steam Pressure which occurs after the equipment that starts simultaneously has started.

1.14 HV-E41-2F075 and HV-E41-2F003 inrush amperes are not used since Reactor Pressure MUST drop to 105.5 psi before HV-E41-2F075 and HV-E41-2F003 can operate. This occurs after all the equipment in this load segment has started.

1.2 1 - 10 Minute

1.21 HV-E41-2F042 and HV-E41-2F004 inrush amperes are not used since the maximum loading in this time segment occurs due to the inrush current when HV-E41-2F003 is seating. This valve seating cannot occur simultaneously with staring HV-E41-2F042 and HV-E41-2F004 because of the stroke time of HV-E41-2F003.

1.3 10 - 30 Minute

All the equipment in this load segment is assumed to operate simultaneously.

1.4 30 - 240 Minute

All the equipment in this load segment is assumed to operate simultaneously.

2.0 LARGE BREAK LOCA HPCI IN PRESSURE CONTROL PROFILE

The Table A2 - 2 shows the maximum possible 2D660 Battery Load Profile for a LARGE BREAK LOCA RCIC IN PRESSURE CONTROL with all equipment starting simultaneously.

2.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

2.11 HV-B21-2F019 inrush amperes are not use since HV-B21-2F019 starts on Reactor Low Level-1 signal while the equipment that starts simultaneously starts on Reactor Low Level-2.

2.12 HV-E41-2F003 inrush amperes are not used since Reactor Pressure MUST drop to 105.5 psi before HV-E41-2F003 can operate. This occurs after all the equipment in this load segment has started.

2.2 1 - 10 Minute

2.21 HV-E41-2F042 and HV-E41-2F004 inrush amperes are not used since the maximum loading in this time segment occurs due to the inrush current when HV-E41-2F003 is seating. This valve seating cannot occur simultaneously with staring HV-E41-2F042 and HV-E41-2F004 because of the stroke time of HV-E41-2F003.

2.3 10 - 30 Minute

All the equipment in this load segment is assumed to operate simultaneously.

2.4 30 - 240 Minute

All the equipment in this load segment is assumed to operate simultaneously.

3.0 SMALL BREAK LOCA PROFILE

The Table A2 - 3 shows the potential maximum possible 2D660 Battery Load Profile for a SMALL BREAK LOCA with all equipment starting simultaneously.

3.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

3.11 HV-E41-2F001 inrush amperes are not use since HV-E41-2F001 MUST BE out of Locked Rotor before HV-E41-2F006 can be started.

3.13 HV-E41-2F012 inrush amperes are not used since HV-E41-2F012 starts on HPCI Turbine High Steam Pressure which occurs after the equipment that starts simultaneously has started.

3.2 1 - 10 Minute

All the equipment in this load segment is assumed to operate simultaneously.

3.3 10 - 30 Minute

All the equipment in this load segment is assumed to operate simultaneously.

3.4 30 - 240 Minute

All the equipment in this load segment is assumed to operate simultaneously.

4.0 SMALL BREAK LOCA HPCI IN PRESSURE CONTROL PROFILE

The Table A2 - 4 shows the maximum possible 2D660 Battery Load Profile for a SMALL BREAK LOCA RCIC IN PRESSURE CONTROL with all equipment starting simultaneously.

4.1 0 - 60 seconds

All the equipment in this load segment is assumed to operate simultaneously.

4.2 1 - 10 Minute

All the equipment in this load segment is assumed to operate simultaneously.

4.3 10 - 30 Minute

All the equipment in this load segment is assumed to operate simultaneously.

4.4 30 - 240 Minute

All the equipment in this load segment is assumed to operate simultaneously.

5.0 STATION BLACKOUT PROFILE

The Table A2 - 5 shows the maximum possible 2D660 Battery Load Profile for a STATION BLACKOUT with all equipment starting simultaneously.

5.1 0 - 60 seconds

During this load segment the following equipment cannot be operated simultaneously with the others loads.

5.11 HV-E41-2F001 inrush amperes are not use since HV-E41-2F001 MUST BE out of Locked Rotor before HV-E41-2F006 can be started.

5.12 HV-E41-2F012 inrush amperes are not used since HV-E41-2F012 starts on HPCI Turbine High Steam Pressure which occurs after the equipment that starts simultaneously has started.

5.2 1 - 5 Minute

All the equipment in this load segment operates simultaneously.

5.3 5 - 6 Minute

5.31 HV-E41-2F011 inrush amperes are not use since HV-E41-2F011 MUST BE manually opened before the other equipment started in this time segment can start.

5.4 6 - 10 Minute

All the equipment in this load segment operates simultaneously.

5.3 10 - 30 Minute

All the equipment in this load segment operates simultaneously.

5.4 30 - 240 Minute

All the equipment in this load segment operates simultaneously.

EQUIPMENT	MCC	0 -60s	1 - 10 MIN	10-30MIN	30-240MIN
HV-E41-2F001	2D264	18	0	0	0
HV-E41-2F006	2D264	205.5	0	0	0
HV-E41-2F059	2D264	2.8	2.8	0	0
HV-E41-2F075	2D264	0	0	0	0
HV-E51-2F084	2D264	0	0	0	0
HV-E41-2F012	2D264	0	0	0	0
HV-E41-2F042	2D264	19.3	2.1	0	0
HV-E41-2F004	2D264		2.1	0	0
HV-E41-2F003	2D264	65	83.9	0	0
2P213	2D274	65	0	0	0
2P216	2D274	11	8	8	8
HV-B21-2F019	2D274	0	0	0	0
HV-G33-2F004	2D274	38.2	0	0	0
2P215	2D274	23	11.4	11.4	11.4
2D289	2D289	120	120	120	120
TOTAL		567.8	228.3	137.4	137.4
2D289		120	120	120	120
2D264		310.6	90.9	0	0
2D274		137.2	17.4	17.4	17.4

EQUIPMENT	MCC		0 -60s		1 - 10 MIN		10-30 MIN		30-240MIN						
HV-E41-2F001	2D264		0		0		0		0						
HV-E41-2F006	2D264		205.5		0		0		0						
HV-E41-2F059	2D264		0		2.8		0		0						
HV-E41-2F075	2D264		0		0		0		0						
HV-E51-2F084	2D264		0		0		0		0						
HV-E41-2F012	2D264		0		0		0		0						
HV-E41-2F042	2D264		19.3		2.1		0		0						
HV-E41-2F004	2D264		0		2.1		0		0						
HV-E41-2F011	2D264		108.7		0		0		0						
HV-E41-2F003	2D264		0		83.9		0		0						
2P213	2D274		0		0		0		0						
HV-E41-2F008	2D274		164.5		0		0		0						
2P216	2D274		6		6		6		6						
HV-B21-2F019	2D274		0		0		0		0						
HV-G33-2F004	2D274		38.2		0		0		0						
2P215	2D274		23		11.4		11.4		11.4						
2D289	2D289		120		120		120		120						
TOTAL			685.2		228.3		137.4		137.4						
2D289			120		120		120		120						
2D264			333.5		90.9		0		0						
2D274			231.7		17.4		17.4		17.4						

EQUIPMENT	MCC		0 - 60s		1 - 10 MIN		10-30 MIN		30-240MIN						
HV-E41-2F001	2D264		18		0		0		0						
HV-E41-2F006	2D264		205.5		0		0		0						
HV-E41-2F059	2D264		2.8		0		0		0						
HV-E41-2F075	2D264		0		0		0		0						
HV-E51-2F084	2D264		0		0		0		0						
HV-E41-2F012	2D264		0		0		0		0						
HV-E41-2F042	2D264		19.3		2.1		0		0						
HV-E41-2F004	2D264		0		19.3		0		0						
HV-E41-2F003	2D264		0		0		0		0						
2P213	2D274		65		0		0		0						
2P216	2D274		11		6		6		6						
HV-B21-2F019	2D274		0		0		0		0						
HV-G33-2F004	2D274		0		0		0		0						
2P215	2D274		23		11.4		11.4		11.4						
2D289	2D289		120		120		120		120						
TOTAL			464.6		158.8		137.4		137.4						
2D289			120		120		120		120						
2D264			245.6		21.4		0		0						
2D274			99		17.4		17.4		17.4						

EQUIPMENT	MCC		0 -60 s		1 - 10 MIN		10-30 MIN		30-240MIN						
HV-E41-2F001	2D264		0		0		0		0						
HV-E41-2F006	2D264		205.5		0		0		0						
HV-E41-2F059	2D264		0		0		0		0						
HV-E41-2F075	2D264		0		0		0		0						
HV-E51-2F084	2D264		0		0		0		0						
HV-E41-2F012	2D264		0		0		0		0						
HV-E41-2F042	2D264		19.3		2.1		0		0						
HV-E41-2F004	2D264		0		19.3		0		0						
HV-E41-2F011	2D264		108.7		0		0		0						
HV-E41-2F003	2D264		0		0		0								
2P213	2D274		0		0		0		0						
2P216	2D274		6		6		6		6						
HV-B21-2F019	2D274		0		0		0		0						
HV-G33-2F004	2D274		0		0		0		0						
2P215	2D274		23		11.4		11.4		11.4						
HV-E41-2F008	2D274		164.5		0		0		0						
2D289	2D289		120		120		120		120						
TOTAL			647		158.8		137.4		137.4						
2D289			120		120		120		120						
2D264			333.5		21.4		0		0						
2D274			193.5		17.4		17.4		17.4						

EQUIPMENT	MCC		0 - 60s		1 - 5 MIN		5 - 6 MIN		6-10 MIN		10-30 MIN		30-240MIN		
HV-E41-2F001	2D264		18		0		0		0		0				
HV-E41-2F006	2D264		205.5		205.5		0		0		0				
HV-E41-2F059	2D264		2.8		2.8		0.7		0		0				
HV-E41-2F075	2D264		0		0		0		0		0				
HV-E51-2F084	2D264		0		0		0		0		0				
HV-E41-2F012	2D264		0		0		38.2		0		0				
HV-E41-2F042	2D264		0		0		0		0		0				
HV-E41-2F004	2D264		0		0		0		0		0				
HV-E41-2F011	2D264		0		0		0		0		0				
HV-E41-2F003	2D264		0		0		0		0		0				
2P213	2D274		65		0		65		0		0				
2P216	2D274		11		6		6		6		6				
HV-B21-2F019	2D274		26.4		0		0		0		0				
HV-G33-2F004	2D274		38.2		0		0		0		0				
HV-E41-2F008	2D274		0		0		164.5		0		0				
2P215	2D274		23		11.4		11.4		11.4		11.4				
2D289	2D289		120		120		120		120		120				
TOTAL			509.9		345.7		405.8		137.4		137.4				
2D289			120		120		120		120		120				
2D264			226.3		208.3		38.9		0		0				
2D274			163.6		17.4		246.9		17.4		17.4				

ATTACHMENT 3

2D660

AMPERE-HOURS

The AMPERE-HOURS 2D660 is required to deliver are calculated using the load profiles from Attachment 2. This assures variations in the timing of the MOVs are enveloped.

2D660 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE LARGE BREAK LOCA

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875*	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
568	788	1	13.1
229	318	10	60.8
138	192	30	124.8
138	192	240	796.8

2D660 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE LARGE BREAK LOCA HPCI IN PRESSURE CONTROL

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875*	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
686	952	1	15.9
229	318	10	63.6
138	192	30	127.6
138	192	240	799.6

* Corrected Load = (Temperature Correction)(Age Correction)

= (1.11)(1.25) = 1.3875

Temperature Correction = 1.11 for 60°F(From IEEE 485)

Age Correction = 1.25 (IEEE 485)

2D660 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE SMALL BREAK LOCA

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875*	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
465	645	1	10.8
159	221	10	44.0
138	192	30	108.0
138	192	240	780.0

2D660 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE SMALL BREAK LOCA HPCI IN PRESSURE CONTROL

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875*	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
647	898	1	15.0
159	221	10	48.2
138	192	30	112.2
138	192	240	784.2

* Corrected Load = (Temperature Correction)(Age Correction)

= (1.11)(1.25) = 1.3875

Temperature Correction = 1.11 for 60°F(From IEEE 485)

Age Correction = 1.25 (IEEE 485)

2D660 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE STATION BLACKOUT

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
510	708	1	11.8
346	480	5	43.8
406	564	6	53.2
138	192	30	130.0
138	192	240	802.0

2D660 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE PROPOSED TECHNICAL SPECIFICATION

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
700	972	1	16.2
410	569	10	101.6
150	208	30	171.0
150	208	240	899.0

* Corrected Load = (Temperature Correction)(Age Correction)

= (1.11)(1.25) = 1.3875

Temperature Correction = 1.11 for 60°F(From IEEE 485)

Age Correction = 1.25 (IEEE 485)

2D660 BATTERY VOLTAGE AT THE END OF 4 HOURS AT RATED CURRENT AND VOLTAGE EXISTING TECHNICAL SPECIFICATION

(1) Actual Load (AMPS)	(2) Corrected Load (AMPS) (1) X 1.3875*	(3) Elapsed Time (Min)	(4) Total AMP-HRS Removed
1119	1553	1	25.9
244	339	10	76.7
244	339	30	189.7
244	339	120	698.2
244	339	240	1376.2

* Corrected Load = (Temperature Correction)(Age Correction)

= (1.11)(1.25) = 1.3875

Temperature Correction = 1.11 for 60°F(From IEEE 485)

Age Correction = 1.25 'IEEE 485)

ATTACHMENT 4

2D660

MINIMUM BATTERY TERMINAL

VOLTAGE

2D660
CALCULATE
MINIMUM REQUIRED BATTERY TERMINAL VOLTAGE

The minimum required battery terminal voltage is the voltage required at the END OF DISCHARGE to support the connected load per IEEE 485-1978. This voltage is the minimum Technical Specification voltage requirement.

1.0 The Resistance between the Load Center and MCCs are:

Battery to Load Center	=	0.0024 Ω (From E-AAA-255)
Load Center to 2D264	=	0.0097 Ω (From E-AAA-255)
Load Center to 2D274	=	0.0082 Ω (From E-AAA-255)
Load Center to 2D289	=	0.0156 Ω (From E-AAA-255)

2.0 Determine the voltage at the Load Center while maintaining 210 VDC at the MCCs for the END OF DISCHARGE Load Segment of Battery 2D660 (30 -240 Minutes).

2.1 **2D264**

The Proposed Technical Specification Profile for the 30 - 240 minute segment is 150 amperes. The largest calculated Class 1E load on 2D264 is 0 A (From Attachment 2) and the largest calculated battery load profile is 137.4 amperes (From Attachment 2). The 12.6 ampere differences between the two profiles is added to the Class 1E MCC 2D264.

I_{2D264} = 12.6 A

V_{LC} = 210 + V_{DROP} = 210 + (0.0097)(12.6) = 210.2 V

2.2 **2D274**

The Proposed Technical Specification Profile for the 30 - 240 minute segment is 150 amperes. The largest calculated Class 1E load on 2D274 is 17.4 A (From Attachment 2) and the largest calculated battery load profile is 137.4 amperes (From Attachment 2). The 12.6 ampere differences between the two profiles is added to the Class 1E MCC 2D274.

I_{2D274} = 12.6 A + 17.4 A = 30 A

V_{LC} = 210 + V_{DROP} = 210 + (0.0082)(30) = 210.3 V

2.3 **2D289**

The Proposed Technical Specification Profile for the 30 - 240 minute segment is 150 amperes. The largest calculated load on 2D289 is 120 A (From Attachment 2) and the largest calculated battery load profile is 137.4 amperes (From Attachment 2). The 12.6 ampere differences between the two profiles is added to the 2D289.

I_{2D289} = (120A + 12.6A) = 132.6 A

V_{LC} = 210 + V_{DROP} = 210 + (0.0156)(132.6) = 212.1 V

3.0 Determine the Battery Terminal Voltage to maintain 210 VDC at the MCCs for the END OF DISCHARGE Load Segment of Battery 2D660.

Use the Load Center voltage required to maintain 210 V at 2D289 since this voltage requires the higher battery voltage.

$V_{BATTERY}$ = V_{LC} + $V_{Drop\ Batt\ to\ LC}$

I = 150 A

$V_{BATTERY}$ = 212.1 V + (150)(0.0024)

= **212.5 V**

4.0 Determine the Volts per cell that must be used in sizing the Class 1E 120 cell battery in order to maintain a battery voltage of 213.8 at END OF DISCHARGE.

VPC = 212.5/120 = 1.7708

USE 1.78 VPC