

Power System Study
for the
Clark County School
District – Career and
Technical Center
Las Vegas, Nevada

Response to Short Circuit Study
Submittal Comments

Power Quality Technical Services, Inc.
683 Scenic Tierra Lane
Henderson, NV 89015

Engineering Services (702) 204-5211

Prepared by:
Joe Dietrich, Jr., P.E.
Electrical Engineer

January 20, 2006

Response to Submittal Comments (Power System Study):

MSA Submittal Comments (01/05/06)

- a) *Revise calculations based on transformers with an impedance of at least 5%. Coordinate exact impedance with transformer re-submittal.*

The short circuit study was re-performed using transformer impedance of 5% for the 225kVA rated transformers. The impedances of the smaller transformers were not changed as they did not adversely affect the results of the short circuit study.

- b) *Various panels, “THED” breaker is rated up to 65KAIC at 277V. Adjust calculation set points and recalculate violations.*

The short circuit study was re-performed using single phase THED breakers with 65KAIC rating at 277V.

- c) *Panel “2LA1B” is submitted with THHQB breakers rated at 22KIAC. Adjust breaker in calculation.*

The short circuit study was re-performed using THHQB breakers on panel 2LA1B.

- d) *Distribution panel “5HDPA” is submitted with 65KAIC.*

The Bill of Material dated 07/27/2005 indicated this board was rated 42KAIC. A newer Bill of Material has been supplied and reflects 65KAIC. The latter value has been used in the Short Circuit Study.

MSA Submittal Comments (01/06/06)

A. *The following AIC ratings for panelboards shall be revised as well as the breakers within the panel to be fully rated per the results of the Power System Study*

<i>Panel</i>	<i>Ratings</i>
1HA1C	22KAIC
5HA1A	42KAIC
5HA1B	42KAIC
5HA1C	42KAIC
5HA1D	42KAIC
5HA1E	42KAIC
6HA1A	42KAIC
6HA1B	42KAIC
6HA1C	42KAIC
9HA2A	42KAIC
9HA2B	42KAIC
2EH1	42KAIC
2EL1	Main Primary Breaker 42KAIC minimum

The short circuit study has been re-performed using updated panel AIC ratings per the submittal comments specifications.

Summary and Recommendations

Based on the specification changes by MSA Engineering, all switchboards, panelboards, and MCC's were found to be properly rated (or not in "VIOLATION").

It should be pointed out that the THQB breakers in four panels (3LB1A, 3LBC1A, 3LBC1B, and 3LBC1C) are in "VIOLATION" by less than 0.5% during ground fault calculations. At first glance, it is not apparent why the fault duty calculation for the branch circuit breakers is higher than the duty rating of the panelboard itself. However, in review of the methodology used for calculating fault current (per the ANSI Standard) reveals that X/R ratios and Power Factor considerations (based on KAIC *test* ratings of breakers) can have a significant impact on the equipment duty rating results when cable lengths are short (between a source and test point). Essentially, the X/R ratio is calculated higher for panelboard than the breaker itself.

It was after this research that a sensitivity analysis was performed to determine the impact of cable lengths on the THQB breaker and panelboard duty ratings. It was found that by increasing the cable length by one foot, the THQB breakers were no longer found to be in VIOLATION. And, as an aside, the breaker required duty rating was found to match the panelboard duty rating at a feeder cable length of approximately 25' (this is the point where the panelboard X/R ratio matches the breaker's default value.

Generally, it is recommended to select the next higher KAIC rating for panelboards and breakers that are determined to have a calculated duty rating requirement that is close to (within 10% of) the actual manufacturer's equipment interrupting duty rating. Therefore it is suggested (though not absolutely necessary) to increase the equipment KAIC ratings of 3LB1A, 3LBC1A, 3LBC1B, and 3LBC1C from 10KAIC to 14KAIC. The reason given for "not absolutely necessary" is that actual construction cable lengths may vary, and since the sensitivity report indicated a change in length of only one foot was sufficient to bring these devices out of "VIOLATION".

E Sheet 5.01

Summary of Equipment Fault Duty Ratings

Project Name: CCSD Career & Tech Center E-Sh 5.01

Comment: Three Phase Fault - Summary Equipment Duty Report

EQUIPMENT DUTY VIOLATION AND WARNING DETAILED REPORTS

Driving Point Voltage (P.U.) = 1.00000

Equipment				Ratings			Duties		Comments
ID	Manufacturer / Style	Test Standard	1/2 Cycle Interrupting (kA)	Interrupting (kA)	Cyc	1/2 Cycle Interrupting kA (%)	Interrupting kA (%)		
3LB1A	Area: 1 Zone: 1 Bus kV: 0.21 kV								
B 3LB1A-FDR	GE /THQB	ANSI-SYM	10.00			9.82(-1.8%)		Warning	
3LB1A	/	ANSI-SYM	10.00			9.22(-7.8%)		Warning	
3LBC1A	Area: 1 Zone: 1 Bus kV: 0.21 kV								
B 3LBC1A-FDR	GE /THQB	ANSI-SYM	10.00			9.82(-1.8%)		Warning	
3LBC1A	/	ANSI-SYM	10.00			9.22(-7.8%)		Warning	
3LBC1B	Area: 1 Zone: 1 Bus kV: 0.21 kV								
B 3LBC1B-FDR	GE /THQB	ANSI-SYM	10.00			9.82(-1.8%)		Warning	
3LBC1B	/	ANSI-SYM	10.00			9.22(-7.8%)		Warning	
3LBC1C	Area: 1 Zone: 1 Bus kV: 0.21 kV								
B 3LBC1C-FDR	GE /THQB	ANSI-SYM	10.00			9.82(-1.8%)		Warning	
3LBC1C	/	ANSI-SYM	10.00			9.22(-7.8%)		Warning	

Project Name: CCSD Career & Tech Center E-Sh 5.01
 Comment: Ground Fault - Summary Equipment Duty Report

EQUIPMENT DUTY VIOLATION AND WARNING DETAILED REPORTS
 Driving Point Voltage (P.U.) = 1.00000

Equipment				Ratings			Duties		Comments
ID	Manufacturer / Style	Test Standard	1/2 Cycle Interrupting (kA)	Interrupting (kA)	Cyc	1/2 Cycle Interrupting kA (%)	Interrupting kA (%)		
3LB1A	Area: 1 Zone: 1 Bus kV: 0.21 kV								
B 3LB1A-FDR	GE /THQB	ANSI-SYM	10.00			10.03(0.3%)		VIOLATION	
3LB1A	/	ANSI-SYM	10.00			9.65(-3.5%)		Warning	
3LBC1A	Area: 1 Zone: 1 Bus kV: 0.21 kV								
B 3LBC1A-FDR	GE /THQB	ANSI-SYM	10.00			10.03(0.3%)		VIOLATION	
3LBC1A	/	ANSI-SYM	10.00			9.65(-3.5%)		Warning	
3LBC1B	Area: 1 Zone: 1 Bus kV: 0.21 kV								
B 3LBC1B-FDR	GE /THQB	ANSI-SYM	10.00			10.03(0.3%)		VIOLATION	
3LBC1B	/	ANSI-SYM	10.00			9.65(-3.5%)		Warning	
3LBC1C	Area: 1 Zone: 1 Bus kV: 0.21 kV								
B 3LBC1C-FDR	GE /THQB	ANSI-SYM	10.00			10.03(0.3%)		VIOLATION	
3LBC1C	/	ANSI-SYM	10.00			9.65(-3.5%)		Warning	

E Sheet 5.02

Summary of Equipment Fault Duty Ratings

Project Name: CCSD Career & Tech Center E-Sh 5.02
 Comment: Three Phase Fault - Summary Equipment Duty Report

EQUIPMENT DUTY VIOLATION AND WARNING DETAILED REPORTS
 Driving Point Voltage (P.U.) = 1.00000

Equipment				Ratings			Duties		Comments
ID	Manufacturer / Style	Test Standard		1/2 Cycle Interrupting (kA)	Interrupting (kA)	Cyc	1/2 Cycle Interrupting kA (%)	Interrupting kA (%)	
5LB1A	Area: 1 Zone: 1	Bus kV: 0.21 kV							
B 5LB1A-FDR	GE /THQB	ANSI-SYM		10.00			9.60 (-4.0%)		Warning
5LB1A	/	ANSI-SYM		10.00			9.15 (-8.5%)		Warning
5LBC1A	Area: 1 Zone: 1	Bus kV: 0.21 kV							
B 5LBC1A-FDR	GE /THQB	ANSI-SYM		10.00			9.60 (-4.0%)		Warning
5LBC1A	/	ANSI-SYM		10.00			9.15 (-8.5%)		Warning
5LBC1B	Area: 1 Zone: 1	Bus kV: 0.21 kV							
B 5LBC1B-FDR	GE /THQB	ANSI-SYM		10.00			9.60 (-4.0%)		Warning
5LBC1B	/	ANSI-SYM		10.00			9.15 (-8.5%)		Warning

Project Name: CCSD Career & Tech Center E-Sh 5.02

Comment: Ground Fault - Summary Equipment Duty Report

EQUIPMENT DUTY VIOLATION AND WARNING DETAILED REPORTS

Driving Point Voltage (P.U.) = 1.00000

Equipment				Ratings			Duties		Comments
ID	Manufacturer / Style	Test Standard		1/2 Cycle Interrupting (kA)	Interrupting (kA)	Cyc	1/2 Cycle Interrupting kA (%)	Interrupting kA (%)	
5LB1A	Area: 1 Zone: 1	Bus kV: 0.21 kV							
B 5LB1A-FDR	GE /THQB	ANSI-SYM		10.00			9.08 (-9.2%)		Warning
5LB1A	/	ANSI-SYM		10.00			9.03 (-9.7%)		Warning
5LBC1A	Area: 1 Zone: 1	Bus kV: 0.21 kV							
B 5LBC1A-FDR	GE /THQB	ANSI-SYM		10.00			9.08 (-9.2%)		Warning
5LBC1A	/	ANSI-SYM		10.00			9.03 (-9.7%)		Warning
5LBC1B	Area: 1 Zone: 1	Bus kV: 0.21 kV							
B 5LBC1B-FDR	GE /THQB	ANSI-SYM		10.00			9.08 (-9.2%)		Warning
5LBC1B	/	ANSI-SYM		10.00			9.03 (-9.7%)		Warning