



Consulting Report Main Circuit Breaker Testing 1 Shore Circle, Sparkle Bay, CA For Altair

Introduction

The office building located at 1 Shore Circle, Sparkle Bay, CA has experienced a number of main circuit breakers operations (trips) whenever either of the two roof top chillers is turned-on. PowerCET Corporation was contacted to assist in determining if the breaker tripping was the result of equipment (chiller) problems, electrical wiring issues or circuit breaker problems.

Methodology

A Dranetz-BMI PP4300 equipped with a Multi-DAQ Taskcard and 3000A flexible current probes was connected to the load side of the main 2000A breaker located in the basement area adjacent to the elevators. (Note: The voltage probes were connected to the line (utility) side of the breaker to maintain synchronization for the power monitor.)

The PP4300 was programmed as follows:

Multi-DAQ Instrument configuration

 Site/Filename = 1 Shore Circle
 Measured From = 06/14/2004 10:30:25
 Measured To = 06/14/2004 10:41:32
 Configuration = 4 WIRE / 3 PROBE
 Monitoring Type = STANDARD PQ
 Nominal Voltage = 277.0 V
 Nominal Current = 146.3 A
 Nominal Frequency = 60.0 Hz

Trigger Response Setups

 Pre-trigger length = 9 cycles
 Post-trigger length = 60 cycles
 On Voltage Trigg = Record all active
 voltage and current channels
 On Current Trigg = Record all active
 voltage and current channels + D
 After recording = REARM

Limit Setups

Voltages	AV	BV	CV	DV
High:	304.7	304.7	304.7	0.0
Low:	249.3	249.3	249.3	0.0
Wave:	19.4	19.4	19.4	0.0
Crest:	470.9	470.9	470.9	0.0

Currents	AI	BI	CI	DI
High:	500.0	500.0	500.0	100.0
Low:	0.0	0.0	0.0	0.0
Wave:	400.0	400.0	400.0	100.0
Crest:	0.0	0.0	0.0	0.0

Two separate tests were performed, one with each chiller being cycled.

Key Findings

Test #1

Figure 1 is the voltage and current waveform associated with the initial test—amperage scale in Figure 1 represents peak current levels and not RMS. The current waveforms document the breaker operation

approximately 50 milli-seconds after turn-on of the chiller. Figure 2 is the time plot data showing a maximum RMS current of 860A on phase B.

Phase A in Figure 2 does not appear to have any in-rush (start-up) current and may indicate a problem with this chiller.

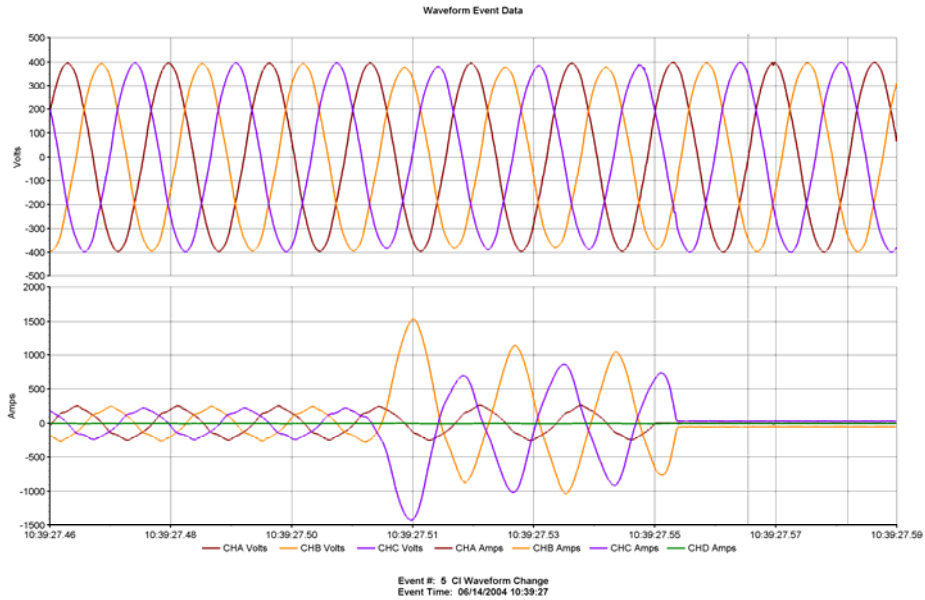


Figure 1 – Voltage and current waveforms from initial chiller turn-on test. Breaker opens approximately 50ms after turn-on of chiller.

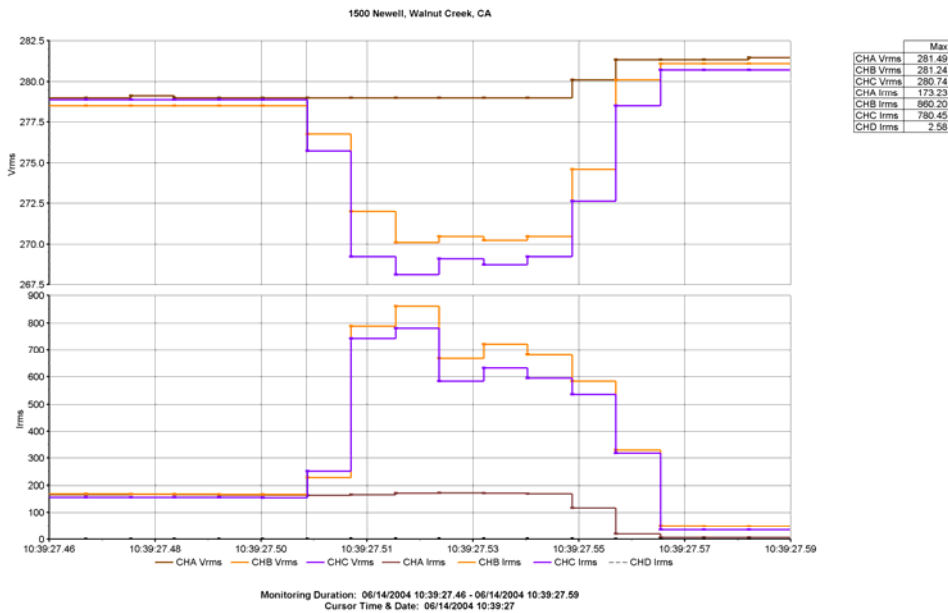


Figure 2 – Voltage and current RMS time plot data from initial chiller turn-on test. Maximum current was approximately 860A RMS on phase B.

Test #2

Figures 3 and 4 show the waveform and time plot data from the second chiller test. Note in this case there is consistent inrush on all 3-phases. The maximum current for the second test was approximately 936A RMS on phase C.

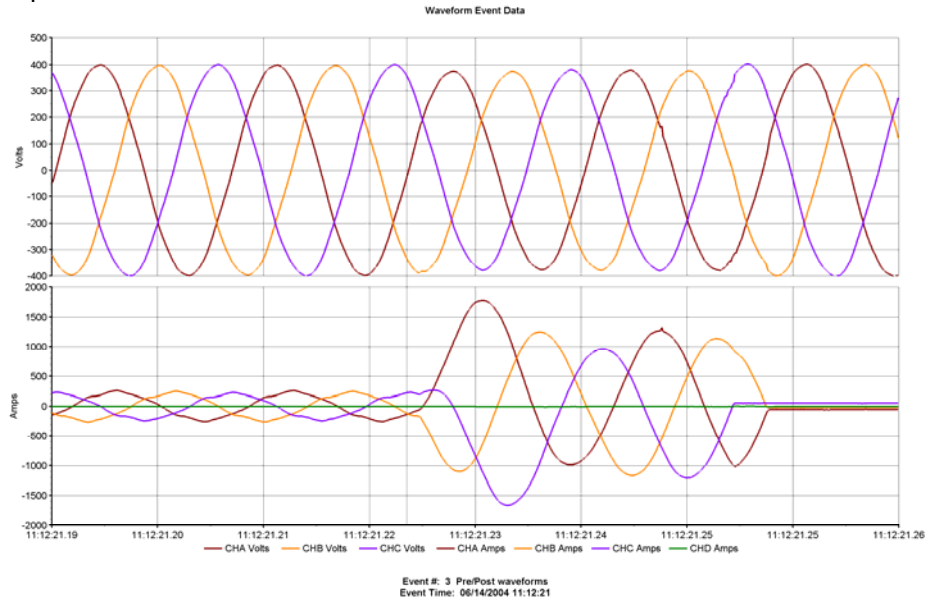


Figure 3 - Voltage and current waveforms from second chiller turn-on test. Breaker opens approximately 32ms after turn-on of chiller.

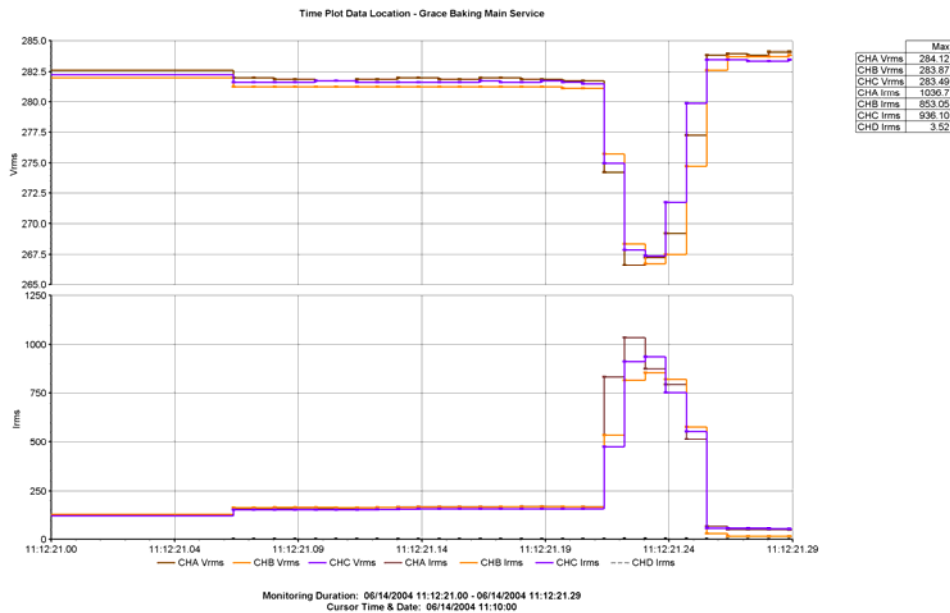


Figure 4 - Voltage and current RMS time plot data from second chiller turn-on test. Maximum current was approximately 936A RMS on phase C.

Figure 5 shows the voltage and current waveform envelop as the main breaker was reset after the initial chiller test. There is a second current inrush that occurs approximately 1-second after the reset of the breaker. This most likely some of the building's equipment with a time delay after restoral of power.

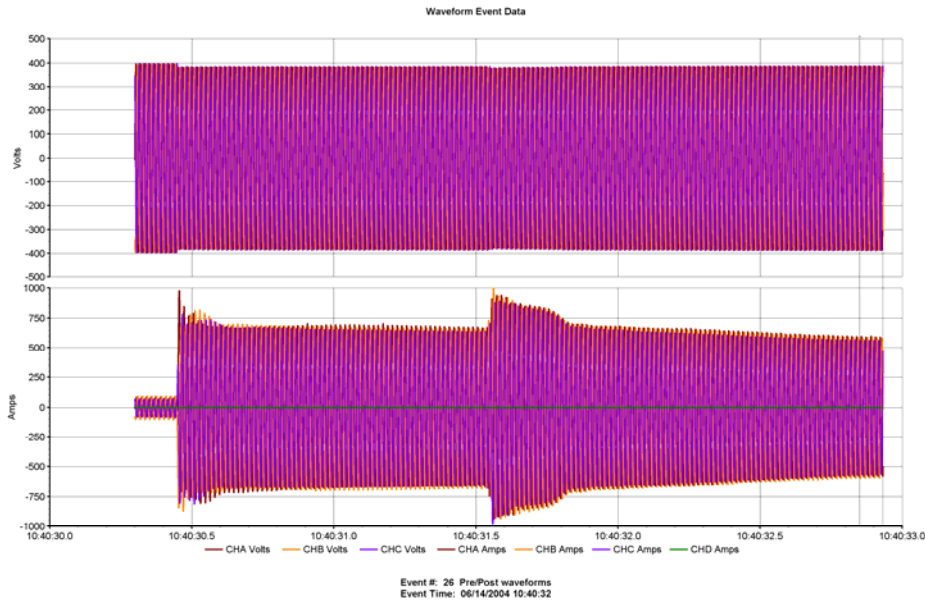


Figure 5 – Waveform envelop showing reset of circuit breaker followed by additional loads being cycled on approximately 1-second after breaker is reset. (Note: Date is from initial chiller test activity.)

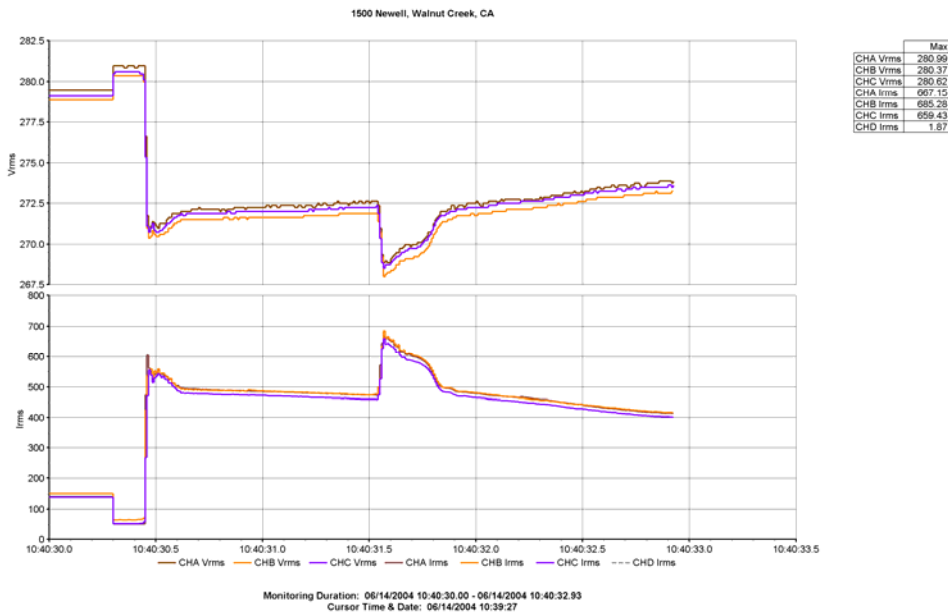


Figure 6 - Voltage and current RMS time plot from Figure 6. Maximum current was approximately 685A RMS on phase B. Breaker did NOT trip under these conditions—chiller was not cycled during this period.

Photo 1 is a picture of the main 2000A breaker currently installed at 1 Shore Circle, Sparkle Bay, CA.



Photo 1- Main 2000A curcuit breaker.

Photo 2 shows the name plate for the main 2000A breaker in Photo 1.



Photo 2 - Main 2000A breaker name plate.

Photo 3 shows the adjustment controls for the main 2000A breaker. The **Ground Fault Trip** is set for a 0.3-second (300ms, 18-cycle) delay with a **Pick-up Amperes** setting of 800A. The cover panel sticker in Photo 4 shows that the **Pick-up Amperes** setting was set to 400A on 7/23/2002.

The Short Time Trip level, Photo 3, is set at 8. To obtain the actual ampere rating the continuous Amp Rating (probably 80% of the 2000A) is multiplied by the setting. The setting of 8 most likely corresponds to an ampere setting of 12,800A. (Note: Detailed specifications of the breaker were not available for this report.)



Photo 3 - Main 2000A breaker ground fault and short time trip settings.

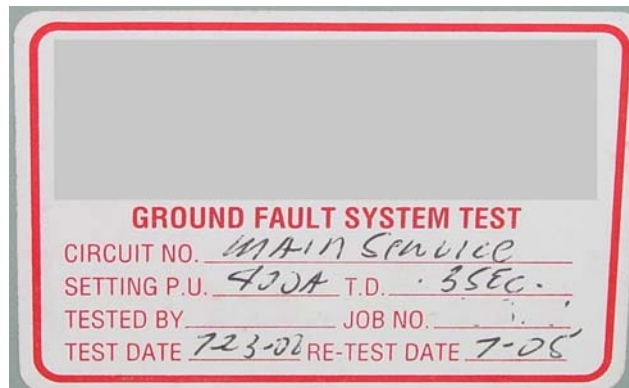


Photo 4 - Panel cover sticker for main 2000A breaker showing settings and date of last test/calibration.

Recommendations

1. The chiller cycled during the initial test should be tested and inspected. Current waveforms indicate that there may be a single-phasing condition—refer to Figure 1—as no inrush current was recorded on phase A. The chiller cycled during the second test appears to be normal—refer to Figure 3.
2. Current levels recorded during the two chiller tests should not be sufficient to trip the main circuit breaker. The existing breaker should be tested (calibrated) and replaced if it can not be adjusted (repaired) in the field.
3. It appears that the Pick-up Amperes setting for the ground fault section of the breaker was adjusted sometime after testing completed on 7/23/2002. Ground fault settings should be verified and the circuit breaker readjusted to the correct setting.
4. A battery powered emergency light should be installed in the main power room.

Summary

The nominal load on the building during the tests, with the chillers off, was approximately 170A per phase which seems quite low. The amperage recorded at the end of the initial test, Figures 5 and 6 show a much larger current in the 400 to 500 ampere range. There is only 2-seconds of data and it may simply be inrush associated with equipment in the building restarting.

[Note: The 2000A breaker was replaced 2-days later and there have been no other reported problems.]

Report prepared by:

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