

Electrical Equipment Infrared Survey Project Proposal.



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Service provider: Aitur Group LTD.

Client: ABC Company

Vancouver, BC.

January, 2014

Rick Turdubay,
Certified infrared Thermographer
BSc in Electrical Engineering.



AiturGroup Ltd Thermal Imaging /Infrared Survey Report.

**Thermography Inspection at
ABC Company.**

Address:

**By Rick Turdubay, Certified Infrared Investigator,
B.S. in Electrical Engineering.**

Date:




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GROUP LTD.**

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Phone:604-496-4212

	Thermography Inspection at: ABC Company	Date:
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How Infrared Thermography Works

Infrared imagers “see” the heat radiated from your equipment in real time, just like a video camera sees visible light. In black/white thermograms (pictures of heat), white is hot and black is cold unless stated otherwise. When thermograms are in color, colors in the scene are matched to the reference bar. Colors appearing closer to the top or right of the reference bar indicate higher temperatures. Colors appearing closer to the bottom or left of the reference bar indicate lower temperatures.

Inspection Site Information

Customer	ABC Company
Address	
Contact person	
Phone number	
E-mail address	
Thermographer	Rick Turdubay , Flir Certificate # CON36.....

Information:

Limited Liability, Errors& Omission.

It is client's responsibility to have the recommended 60% or more of a rated electrical load during the 3-4 hours before inspection. Service provider does not warrant or guarantee the accuracy and/ or completeness of the inspection information provided. All conclusions and recommendations are based on the data taken at the time of the inspection and no guarantee regarding additional issues of any anomalies found as a result of any other source present or not present at the time of the investigation are made.

As a result, we suggest that you use the Report Subjective Repair Priority Ratings as a guide but that you investigate and take appropriate corrective actions as soon as possible. No one can predict when a failure will occur. It is agreed that the service provider will not accept any claim from the client and/or third party.

Repair Priority Ratings

Each thermogram is given a Subjective Repair Priority Rating which is based upon your qualified assistant’s opinion of how critical the subject item is to the safe and profitable operation of your overall system. The Inspection Summary section of this report explains how to use this Subjective Repair Priority Rating to help you determine how quickly you need to investigate and correct the potential problem.

Overheating can cause premature deterioration and costly, unplanned failure of your equipment. Overheating connectors, conductors and components will never get better. In fact, the temperature and rate of deterioration will increase with time.

Overview of Fault Rating:		
0: Normal	Temp rise(ΔT) 0-5 °C	No action
1: Low grade	Temp rise (ΔT) 5-10 °C	To be monitored – Plan new inspection
2: Medium grade	Temp rise (ΔT)10-35 °C	Repair at scheduled shut down
3: Severe	Temp rise (Δ T) >35 °C	Repair immediately



Thermography Inspection at:
ABC Company

Date:

Summary of Inspection

Location	Equipment	Fault	Recommendation	Page Number
(Where)	(What)	()	()	

Qimaging.

1. Electrical Room, House Panel	Incoming lugs: 120/208V	-	Load < 3%, not possible to analyze, another survey required	4
2. Electrical Room, House Panel	Incoming lugs: 347/600V	-	Load =0, not possible to analyze, another survey required	5
3. Main Building, Panel -4A	3 Phase breaker	1	To be monitored	6
4. Main Building, Panel -4B	Circuit breakers	1	To be monitored	7
5. Main Building, Panel -2C	Circuit breakers	1	To be monitored	8
6. Main Building, Panel -2A	Circuit breakers	1	To be monitored	9
7. Main Building, Panel -6A	Circuit breakers	1	To be monitored	10
8. Main Building, Panel -2B	Circuit breakers	2	Repair at scheduled shut down	11
	Circuit breakers	1	To be monitored	11



Thermography Inspection at:
ABC Company

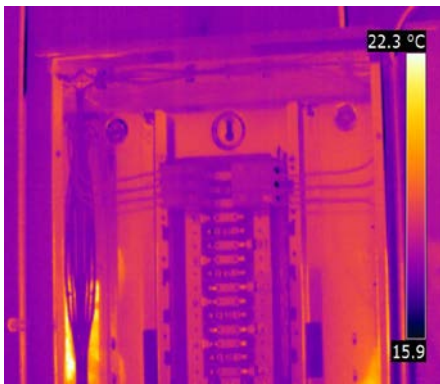
Date:

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Location	Electrical Room
Equipment	House Panel ,120/208V, 225A
Type	Incoming lugs:120/208V
Nom/Rated Load	225A
Actual Load	Phase: A=0.3A; B=0; C=0.6A, Load is under 3%,
Fault	Fault Rating: Loads =under 3%, Not possible to analyze. Room Temp. C =19.7; Reflected Temp.=18.2 Rel. Humidity= 53% Emissivity= 0.95; Distance=2m See IR picture.

Thermogram



**RESERVED FOR THERMOGRAM
AFTER COMPONENT REPAIR**

Analysis and Recommended Action:

All phases' loads are too small, under 3% of the nominal/rated load. **Not possible to analyze.**

Recommendation: Book another survey when an acceptable (at least 50% of the normal rate) load is available.

Inspected By: (Rick Turdubay)

Signature:

Date:

Repaired By:
Comment:



Thermography Inspection at:
ABC Company

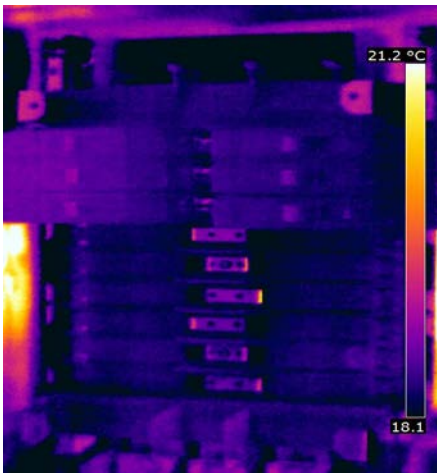
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Location	Electrical Room
Equipment	House Panel ,347/600V, 125A
Type	Incoming lugs, 347/600V
Nom/Rated Load	125A
Actual Load A	Phase: A=0; B=0; C=0
Fault	Loads =0; Not possible to analyze. Room Temp. C =19.7; Reflected Temp.=18.2 Rel. Humidity= 53% Emissivity= 0.95; Distance=2m See IR picture.

Thermogram



**RESERVED FOR THERMOGRAM
AFTER COMPONENT REPAIR**

Analysis and Recommended Action:

All phases' loads are equal 0 (zero). **Not possible to analyze.**

Recommendation: Book another survey when an acceptable (at least 50% of the normal rate) load is available.

Inspected By: (Rick Turdubay)

Signature:

Date:

Repaired By:

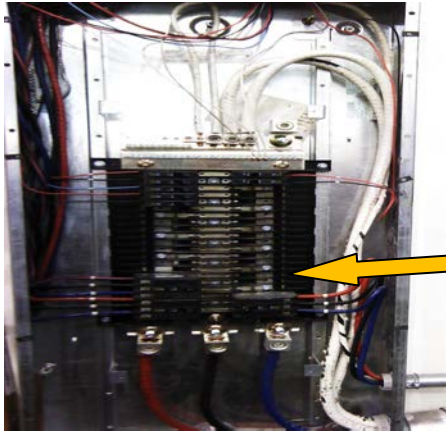
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Thermography Inspection at:
ABC Company

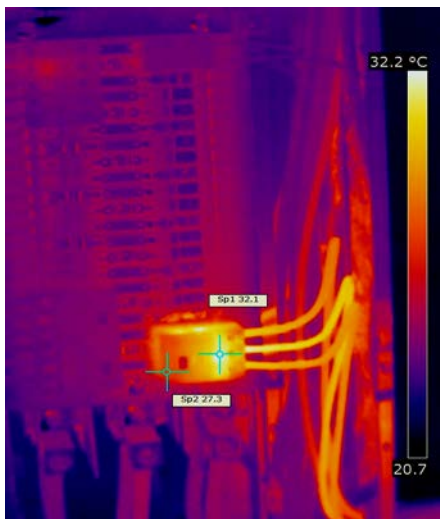
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Location	Main Building
Equipment	Panel 4A, 120/208V, 400A
Type	Incoming lugs:120/208V
Nom/Rated Load	400 A
Actual Load :A	A=42; B=61;C=42
Type	Circuit Breakers:
Nom/Rated Load	CB # 38-40-42 3Phase;100A
Actual Load: A	A= 44A; Load %= 44 B =46A; Load %= 46 C= 40A; Load %= 40 Room Temp. C =23.5; Reflected Temp.=23.1 Rel. Humidity= 48.7% Emissivity= 0.95; Distance=2m
Fault	Fault Rating: 1: Low grade Spot1.Temp =32.1, Spot2=27.5; Tem. rise ΔT 4.6 °C, See IR picture.

Thermogram



Fault Suggestion: The $\Delta T < 5$ °C. However, the corrected maximum allowable temperature for the circuit breaker # 38-40-42 at the existing actual phase loads and room t °C is 29-30°C. The operating t°C=32.1
See calculation formula on the last page of the report.

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AFTER COMPONENT REPAIR**

Analysis and Recommended Action:

3Phase CB # 38-40-42; Nominal rate: 100A. Actuals: A= 44A; Load %= 44; B =46A; Load %= 46; C= 40A; Load %= 40
Spot1.Phase B, Temp =32.1, Spot2=27.5; Tem. Rise ΔT = 4.6 °C. **Fault Rating: 1: Low grade.** See the suggestion above.
Recommendation: The CB to be monitored.

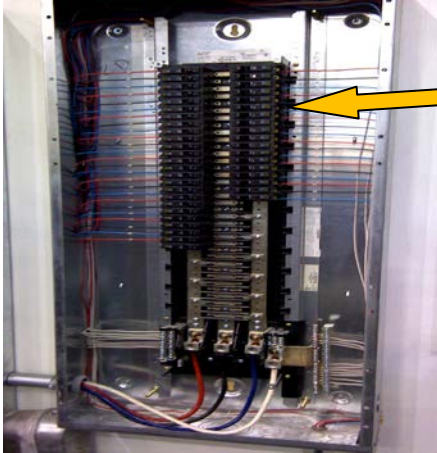
Inspected By: (Rick Turdubay)	Signature:	Date:
Repaired By:		
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Thermography Inspection at:
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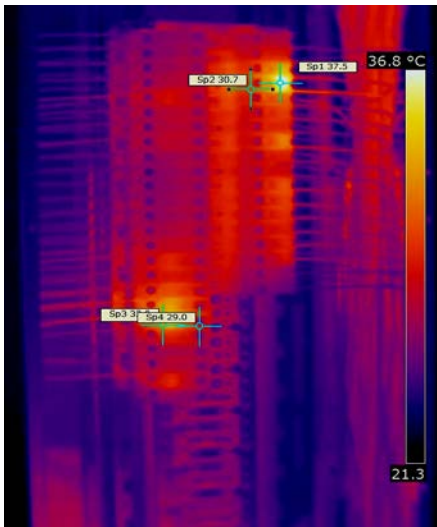
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Photo and Identification:



Location	Main Building
Equipment	Panel 4B , 120/208V, Rated:225A Incoming lugs loads: A=35A, Load %=15 B=45A, Load %=20 C=41A, Load %=18
Type	Circuit breakers
Nom/Rated Load	15 A
Actual Load	Max. load on the CB # 8 Load =10 A; Load %= 66 CB# 39 ; Load= 9A; Load %= 60 Tem. Rise $\Delta T = 4^{\circ}C$ Room Temp. C =23.5; Reflected Temp.=23.1 Rel. Humidity= 48.7% Emissivity= 0.95; Distance=2m
Fault on the CB# 8	Fault Rating: 1: Low grade Spot1.Temp =37.5, Spot2=30.7; Tem. rise $\Delta T = 6.8^{\circ}C$ See IR picture.

Thermogram



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Analysis and Recommended Action:

CB # 8: Spot1.Temp =37.5, Spot2=30.7; **Tem. Rise $\Delta T = 6.8^{\circ}C$. Fault Rating: 1: Low grade.**
Recommendation: the CB # 8 to be monitored.

Inspected By: (Rick Turdubay)

Signature:

Date:

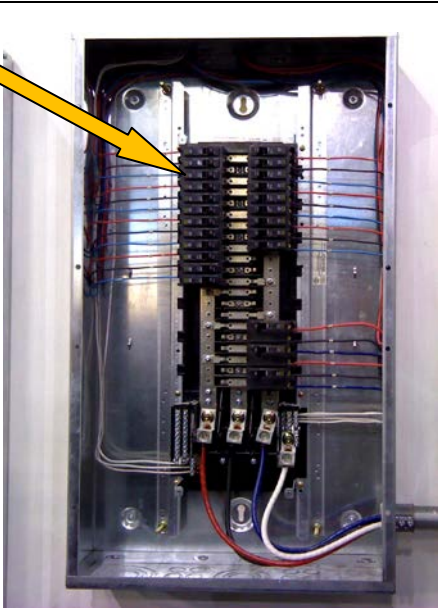
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Thermography Inspection at:
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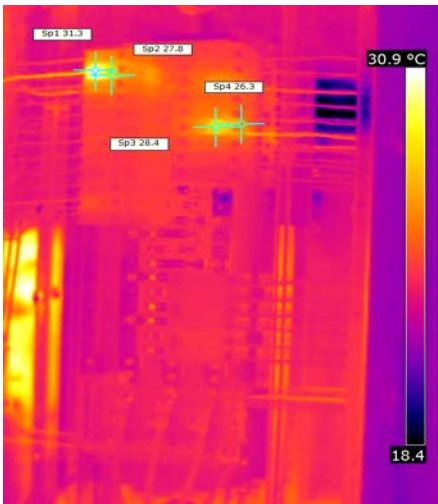
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Location	Main Building
Equipment	Panel 2C, 120/208V, 225A
Type/Nom. Load	Main lugs-225 A
Actual Load:	A=1A; B=21A; C=23A Load unbalanced
Type	Circuit breakers
Nom/Rated Load	15 A
Actual Load	CB #3, Load=1A; Load %=6 CB #6, Load=4A; Load %= 26 Room Temp. C =23.5; Reflected Temp.=23.1 Rel. Humidity= 48.7% Emissivity= 0.95; Distance=2m
Fault	Fault Rating: 1: Low grade. CB #3; Spot1 t°C =31.3, Spot2=27.8; Tem. rise ΔT = 3.5 °C, CB #6; Spot3 t°C =28.6, Spot4=26.3°C; ΔT = 2.3 °C,

Thermogram



Fault Suggestion: CB# 3, the $\Delta T < 5$ °C. However, the corrected maximum allowable temperature for the circuit breaker # 3 at the existing actual load =1A and room t °C is 23-24°C. The operating t°C=31.3
See calculation formula on the last page of the report.

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AFTER COMPONENT REPAIR**

Analysis and Recommended Action:

Fault Rating: 1: Low grade. See the fault suggestion above.
Incoming lugs phases loads somewhat **unbalanced** at A=1A; B=21A; C=23A
Recommendation: the CB # 3 to be monitored.

Inspected By: (Rick Turdubay) | **Signature:** | **Date:**

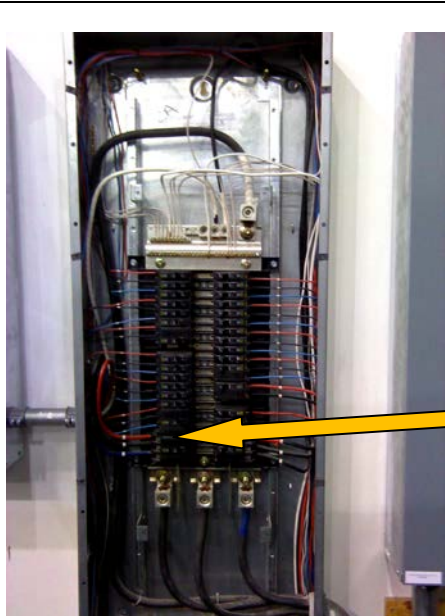
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Thermography Inspection at:
ABC Company

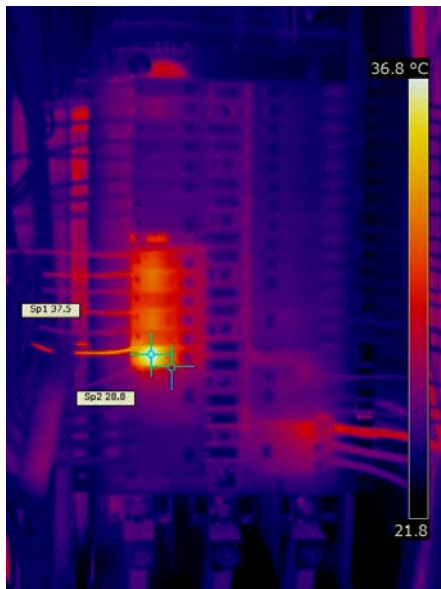
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Photo and Identification:



Location	Main Building
Equipment	Panel 2A, 120/208V, Rated :400A Actual load: A=80A;B=50A;C=60A
Type	Circuit breakers
Nom/Rated Load	20 A
Actual Load	Circuit Breaker #29 Load = 15 A; Load %= 75 Spot1 t°C =37.5, Spot2=28.8; Tem. rise ΔT= 8.7 °C, Circuit Breakers # 21 and 25 Load jumping between 4÷17A; Room Temp. C =23.5; Reflected Temp.=23.1 Rel. Humidity= 48.7% Emissivity= 0.95; Distance=2m
Fault on the CB#29	Fault Rating:1 Low grade See IR picture.

Thermogram



**RESERVED FOR THERMOGRAM
AFTER COMPONENT REPAIR**

Analysis and Recommended Action:

Circuit Breaker #29; Load = 15 A; Load %= 75. Spot1 t°C =37.5, Spot2=28.8; **Tem. rise ΔT= 8.7 °C,**
Fault Rating: 1: Low grade
Recommendation: the CB # 29 to be monitored.

Inspected By: (Rick Turdubay)

Signature:

Date:

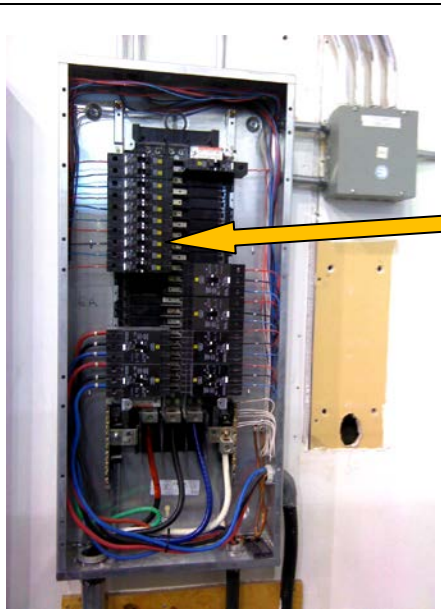
Repaired By:
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Thermography Inspection at:
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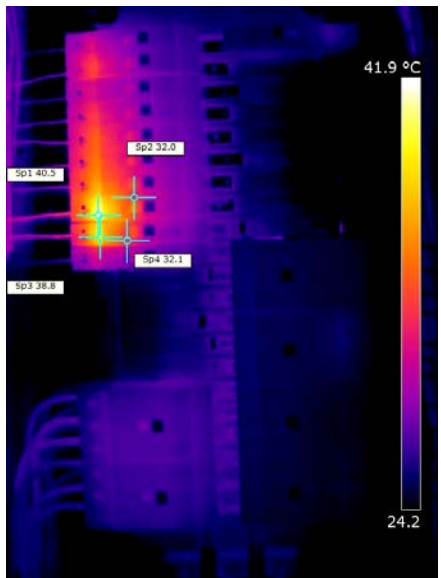
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Location	Main Building
Equipment	Panel 6A, 347/600V, Rated :250A Actuals=66A;B=73A;C=70A
Type	Circuit breakers
Nom/Rated Load	15 A
Actual Load	Circuit Breaker #15 Load = 11A; Load %= 73 Spot1 t°C =40.5, Spot2=32.0; Tem. rise ΔT= 8.5 °C Circuit Breaker #17 Load = 11A; Load %= 73 Spot1 t°C =38.8, Spot2=32.1; Tem. rise ΔT= 6.7 °C
Fault on: CB# 15 and CB#17	Fault Rating: 1 Low grade Room Temp. C =23.5; Reflected Temp.=23.1 Rel. Humidity= 48.7% Emissivity= 0.95; Distance=2m See IR picture.

Thermogram



RESERVED FOR THERMOGRAM
AFTER COMPONENT REPAIR

Analysis and Recommended Action:

Circuit Breaker #15, Tem. rise $\Delta T = 8.5 \text{ }^\circ\text{C}$; Circuit Breaker #17 Tem. rise $\Delta T = 6.7 \text{ }^\circ\text{C}$. **Fault Rating: 1 Low grade.**
Recommendation: the CB # 15 and CB# 17 to be monitored.

Inspected By: (Rick Turdubay)	Signature:	Date:
Repaired By:		
Comment:		



Thermography Inspection at:
ABC Company

Date:

Photo and Identification:

	Location	Main Building
	Equipment	Panel 2B, 120/208V, Rated :225A Actual load: A=48A;B=20A;C=17A Neutral=20A. Load unbalanced
	Type	Circuit breakers
	Nom/Rated Load	20 A
	Actual Load	CB#37, Load=17A, Load %=85; Spot1 t°C =46.6, Spot2=35.6; Tem. rise ΔT= 11 °C Circuit Breaker #39 Load = 10A; Load %= 50 Spot1 t°C =40.8, Spot2=35.0; Tem. rise ΔT= 5.8 °C
	Fault on the CB#37 Fault on the CB#39	Fault Rating: 2: Medium grade Fault Rating: 1 Low grade Room Temp. C =23.5; Reflected Temp.=23.1 Rel. Humidity= 48.7% Emissivity= 0.95; Distance=2m See IR picture.

<p>Thermogram</p>	<p>Fault Suggestion:</p> <ul style="list-style-type: none"> a) Incoming lugs phases loads somewhat unbalanced at A=48A; B=20A; C=17A; Neutral= 20A. b) CB # 37, Load %=85 overloaded. Tem. rise ΔT= 11 °C. Fault Rate: 2; Medium grade. c) CB # 39, Load = 10A; Load %= 50 Tem. rise ΔT= 5.8 °C. Fault Rate: 1; Low grade. <p style="text-align: center;">RESERVED FOR THERMOGRAM AFTER COMPONENT REPAIR</p>
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Analysis and Recommended Action:

Recommendation:
 CB# 37, Fault Rate: 2; Medium Grade. Repair at scheduled shut down.
 CB# 39 Fault Rate: 1; Low grade –to be monitored

Inspected By: (Rick Turdubay) Signature: Date:

Repaired By:
Comment:

Standard for Infrared Inspection of Electrical Systems & Rotating Equipment (2008)



11.6 Unless noted otherwise, these absolute temperature criteria are based on equipment operating at the stated ambient temperature and at 100% of their rated load. The following formula below can be applied to these absolute temperature criteria to give a corrected maximum allowable temperature

(Tmaxcorr) for the reduced operating load and actual ambient temperature of the exception:

$$\mathbf{Tmaxcorr} = \{(Ameas \div Arated)^2 \times (Trated\ rise)\} + Tambmeas$$

Tmaxcorr = corrected maximum allowable temperature.

Ameas = measured load, in amperes

Arated = rated load, in amperes

Trated rise = rated temperature rise (from standard), in this case =30.

Tambmeas = measured ambient temperature

Example: See the report Page # 6. (Spot1.Temp =32.1, Spot2=27.5; Tem. rise 4.6 °C)

The 3Phase CB # 38-40-42 of the Panel 4A is found to be operating at a temperature of 32.1°C.

The measured ambient temperature (Tambmeas) = 23.5°C. The circuit breaker (CB) is rated at 100 amps (Arated) but its actual average load is measured at only 43.33 amps.

1. What is the Tmaxcorr for the CB?

2. Is the temperature of the CB an exception?

$$\mathbf{Tmaxcorr} = \{(Ameas \div Arated)^2 \times (Trated\ rise)\} + Tambmeas$$

$$Tmaxcorr = \{(43.33 \div 100)^2 \times (30)\} + 23.5 = \{(0.43)^2 \times (30)\} + 23.5 = \{(0.18) \times (30)\} + 23.5 = 29.5$$

$$Tmaxcorr = \mathbf{29.5^\circ C}$$

The actual operating temperature of the CB (32.1°C) is greater than the Tmaxcorr of 29.5°C.

This is an exception!



Thermography Inspection at:
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Date:

Key Words:

Electrical Equipment, Infrared Survey. Certified, B.S. Engineering, Equipment, Panels, Infrared, Type, Circuit breakers, Scanning, Thermal Imaging, Survey, Testing, Nominal Rated, Actual, Related ,Humidity, Temperature, Emissivity, IR picture, Rise, Fault Suggestion, Load, Amperes, Unbalanced, Phase, Rotating, Flir Camera. Overheating connectors, conductors, components.