

Infrared Thermography Survey

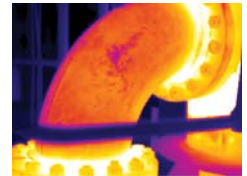
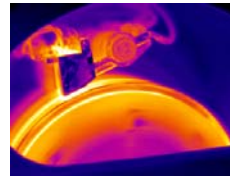
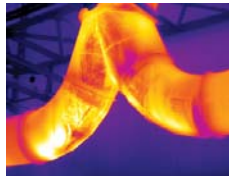
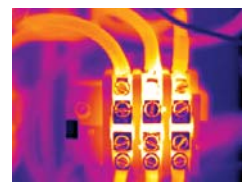
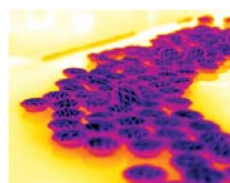
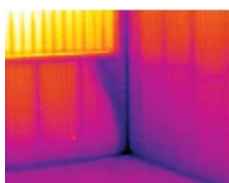
For

DEMO REPORT

COPYRIGHT 2009 Industrial Precision Instruments (IPI) Pty Ltd
The information presented in this report is for demonstration purposes only. The content and images remain the property of Industrial Precision Instruments Pty Ltd and may not be used or reproduced in any way without express authorization

*Prepared by:
Brenton Ward*

Thursday, July 23, 2009



Report Guidelines – General

FOREWARD

This Report of Infrared Inspection provides complete documentation of thermal patterns detected in your in your equipment, structure or system. It uses a subjective evaluation to help you prioritize repairs to provide the greatest return from this inspection and your maintenance.

The Report of Infrared Inspections meets the documentation requirements of the Infraspction Institute **Standard for Infrared Inspection of Electrical Systems and Rotating Equipment**, as well as standards, practices and specifications published by ASTM, NFPA and NETA.

This report has been prepared in accordance with the “Guideline for Infrared Inspections of Electrical and Mechanical Systems” First Edition, Copyright 1993, 1998, 2000 and 2004 Infraspction Institute Inc.

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 colour, colours in the scene are match to the reference bar. Colours appearing closer to the top or right of the reference bar indicate higher temperatures. Colours appearing closer to the bottom or left of the reference bar indicate lower temperatures.

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. No one can predict when a failure will occur. As a result we suggest that you use the Subjective Repair Priority Ratings as a guide but that you investigate and take the appropriate corrective measures as soon as possible.

Inspection Summary

For the equipment inspected, we have recorded a total of 11 thermogram(s) and/or daylight photographs document conditions found during our inspection. These thermograms and/or photographs appear on the Image Pages found at the end of this report.

As a reference, each Image Page contains Evaluation Priority Ratings. Subjective Evaluation Ratings are based upon the Qualified Assistant's opinion of the subject item's importance to the safe and continuous operation of the facility. Objective Evaluation Ratings found on Electro/Mechanical Image Pages are based upon temperature rise criteria as specified by NFPA, NETA and the Infrasppection Institute **Standard for Infrared Inspection of Electrical Systems and Rotating Equipment.**

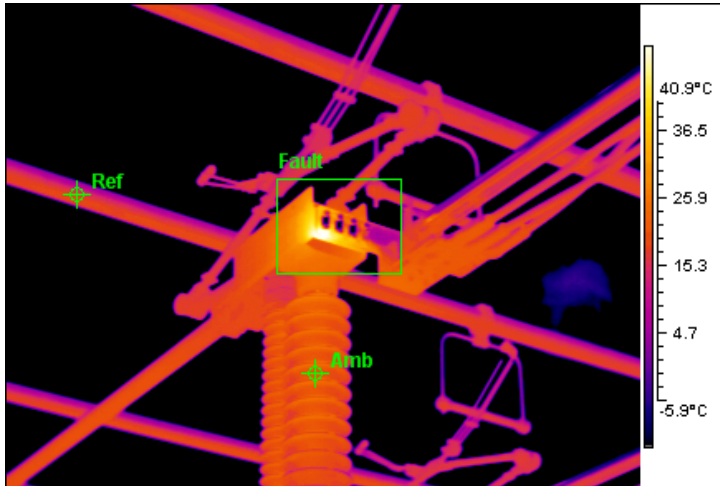
Depending upon the image page format, Subjective and/or Objective Priority Ratings may be found. When both are listed, an Average Repair Priority Rating will also be displayed. This Average Repair Priority Rating is the mean value of the Subjective and Objective Priorities. When appropriate, the Average Repair Priority is rounded up to the next highest whole number.

Potential problems documented in this report are grouped and listed according to the following Average Repair Priority or Subjective Evaluation Ratings

Quantity	Rating	Recommendations
3	low	Possible deficiency and warrants further monitoring.
4	medium	Indicates deficiency; repair as time permits.
2	high	Corrective measures required ASAP.
2	extreme	Corrective measures required immediately

Summary of Images

Picture	Location	Equipment	Priority
1-123	NSW Substation	Switch	Moderate
2- 320	NSW Substation	Capacitor Bank	Low
3- 321	NSW Substation	Switch	Low
4- 008	VIC Substation	XX Internal Main Board, White Phase	High
5- 009	VIC XXX Substation	XX Internal Circuit Breaker White Phase	High
6- 007	VIC XXX Substation	Line 103 on Southern Wall	Extreme
7- 087	VIC XXX -Inside Substation	Line 103	Low
8- 038	Longwarry, Mechanical Services Board	Breaker White Phase	Moderate
9- 044	XXXX Process Line 230	Motor	Moderate
10-232	XXXX	Fuse	Extreme
11- 001	Norske Skog Tasmania Plant	Centrifuge Separation Cones	Moderate



Information:

FileName	IR000123.JPG				
CreateTime	8/12/2008 2:42:28 PM				
Emissivity	0.98	Distance	5.0m		
Max Temp	50.7°C	Min Temp	-30.0°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	21.4°C				
Location:	NSW XXXX Substation				
Equipment:	Switch				
Measured Load (Amps)	NM	Rated Load		% Load	
Ambient	24	Temp	51	Rise Over	27
Obj. Priority	Med	Subj. Priority	Low	Avg. Priority	Med
Environmental:	Partially overcast, 22°C Ambient. Easterly sea breeze.				

Analyses Table:

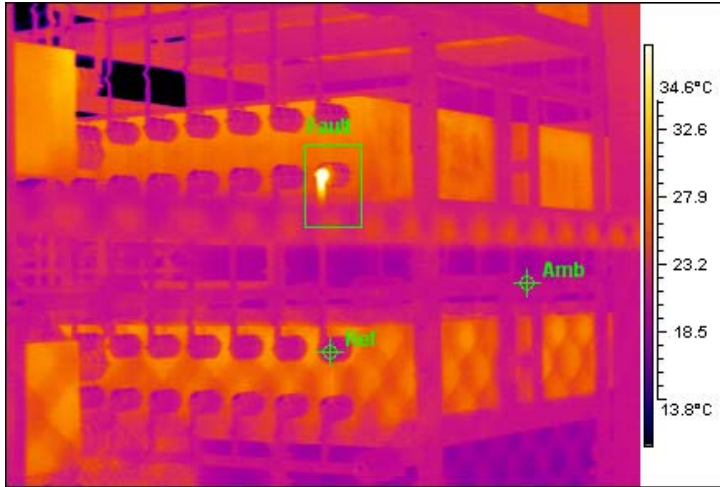
Object Parameter	Value
Fault:AvgTemp	15.9°C
Fault:MaxTemp	50.7°C
Fault:MinTemp	-31.1°C
Ref	20.8°C
Amb	24.1°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
-----	----------	------	---------

Comments:

With load unknown, subjective priority only based on qualitative information. Target is developing a very localized hot spot now exceeding 50°C. Similar components were only slight above ambient. Load is constant given the type of operations (aluminium smelting).



Information:

FileName	IR000320.JPG				
CreateTime	8/13/2008 2:38:23 PM				
Emissivity	0.98	Distance	3.0m		
Max Temp	44.2°C	Min Temp	-8.2°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	24.9°C				
Location:	Substation				
Equipment:	Capacitor Bank				
Measured Load (Amps)	NA	Rated Load	NA	% Load	
Ambient	20	Temp	45	Rise Over	25
Obj. Priority	Mod	Subj. Priority	Low	Avg. Priority	Low
Environmental:	Partially overcast, 22°C Ambient. Easterly sea breeze.				

Analyses Table:

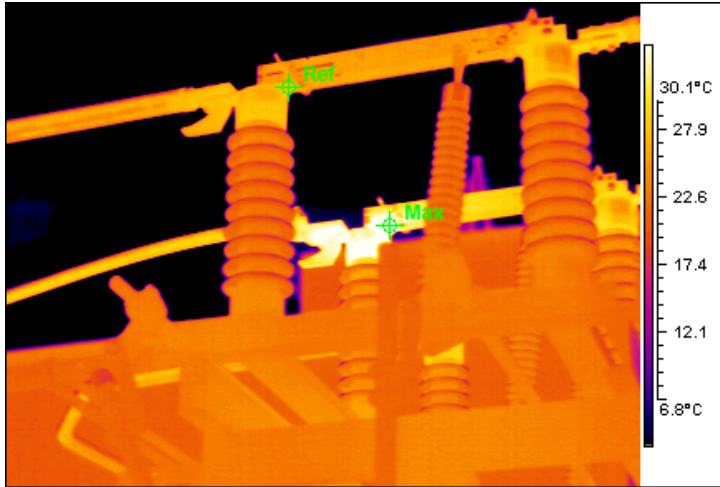
Object Parameter	Value
Fault:AvgTemp	26.3°C
Fault:MaxTemp	45.1°C
Fault:MinTemp	21.9°C
Ref	21.4°C
Amb	20.6°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
------------	-----------------	-------------	----------------

Comments:

10°C Rise above allowable (35°C). Subjective priority based on qualitative analysis only. Load is unknown and was unable to be measured at the time. Similar components should all have been under same load, in which case the hotspot is 24°C above the similar components. This objective priority would be a Moderate. Overall, LOW.



Information:

FileName	IR000321.JPG				
CreateTime	8/13/2008 2:38:23 PM				
Emissivity	0.98	Distance	3.0m		
Max Temp	36.7°C	Min Temp	-32.1°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	23.9°C				
Location:	NSW XXXX Substation				
Equipment:	Switch				
Measured Load (Amps)	NM	Rated Load		% Load	
Ambient	22	Temp	36	Rise Over	14
Environmental:	Partially overcast, 22°C Ambient. Easterly sea breeze.				

Analyses Table:

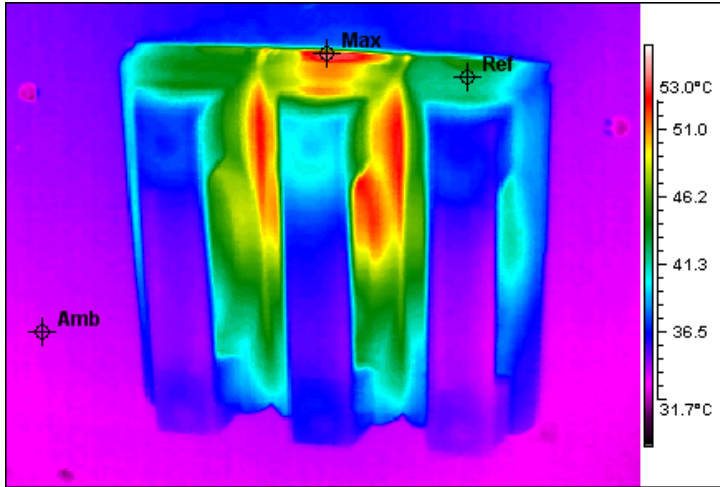
Object Parameter	Value
Max	36.7°C
Ref	28.3°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
------------	-----------------	-------------	----------------

Comments:

Subjective priority based on qualitative analysis only. Measured temp was 14°C over ambient. Load is unknown and was unable to be measured at the time. Absolute temperature rather low, but nevertheless cause for inspection.



Information:

FileName	IR000008.jpg				
CreateTime	3/27/2009 11:35:29 AM				
Emissivity	0.98	Distance	3.0m		
Max Temp	53.0°C	Min Temp	31.0°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	24.6°C				
Location:	VIC XXXX Inside Sub Station. Main Switchboard				
Equipment:	Fuse, White Phase.				
Measured Load (Amps)	60	Rated Load	200	% Load	30%
Ambient	33	Temp	53	Rise Over	20

Analyses Table:

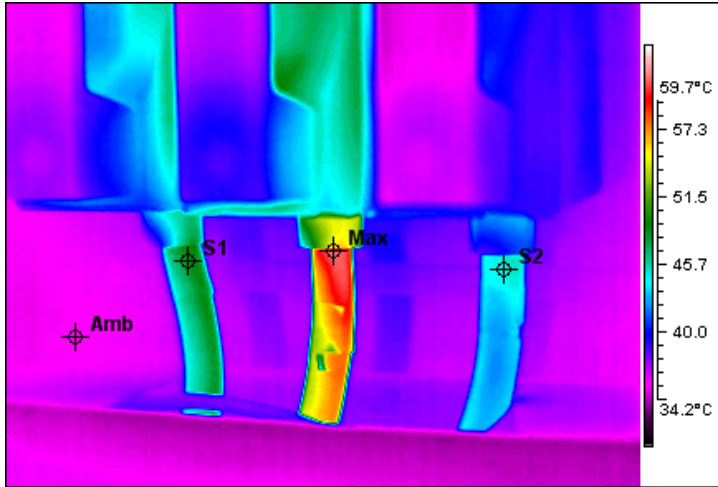
Object Parameter	Value
Max	53.0°C
Amb	32.6°C
Ref	41.4°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
------------	-----------------	-------------	----------------

Comments:

Based on qualitative image only, Fuse is hotter at one end. This localized heat is most likely due to a loose connection at this end. It must be noted that we do not have line of sight to the target, so it is likely that the heat is more significant inside the component. All Fuses were running within similar load, so there is no reason the center phase should be running hotter. Subjectively I would rate this kind of fault as High, especially with the high loads anticipated on this circuit.



Information:

FileName	IR000009.jpg				
CreateTime	3/27/2009 11:36:29 AM				
Emissivity	0.98	Distance	3.0m		
Max Temp	59.7°C	Min Temp	33.5°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	25.8°C				
Location:	VIC XXXX Inside Substation				
Equipment:	Circuit Breaker, White Phase				
Measured Load (Amps)	62	Rated Load	200	% Load	31%
Ambient	35	Temp	60	Rise Over	25
Obj. Priority	High	Subj. Priority	Moderate	Avg. Priority	Mod

Analyses Table:

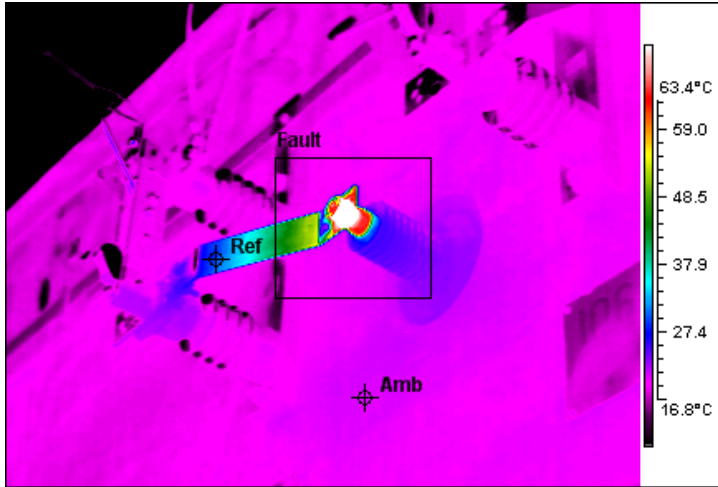
Object Parameter	Value
Max	59.7°C
S1	48.1°C
S2	44.1°C
Amb	34.8°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
-----	----------	------	---------

Comments:

With the load at only 31%, the Load Corrected Maximum is 39°C. Therefore the measured temp exceeds the allowable by 21° pushing us into the High Priority. Subjectively, it would be a Moderate Fault.



Information:

FileName	IR000007.jpg				
CreateTime	3/27/2009 11:27:31 AM				
Emissivity	0.98	Distance	3.0m		
Max Temp	83.5°C	Min Temp	-47.9°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	22.5°C				
Location:	VIC XXXX Main Facility Substation				
Equipment:	Line 103 on Southern Wall				
Measured Load (Amps)	300	Rated Load	1000	% Load	30%
Ambient	21	Temp	84	Rise Over	63
Environmental:	Overcast day, not in direct sunlight. Slight Breeze.				

Analyses Table:

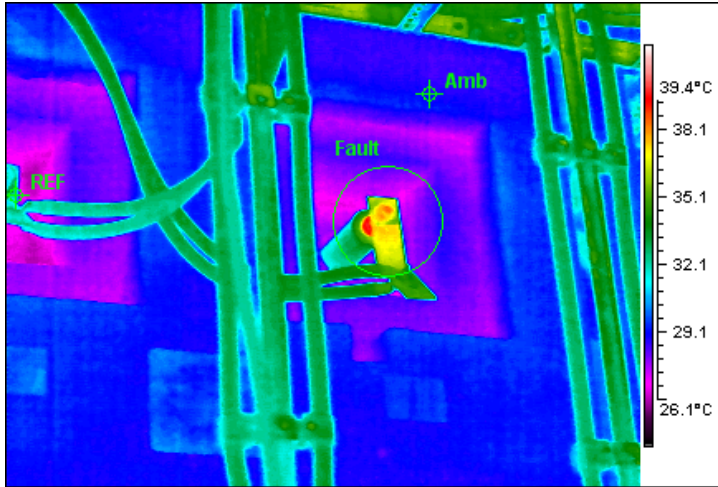
Object Parameter	Value
Fault:AvgTemp	27.6°C
Fault:MaxTemp	83.5°C
Fault:MinTemp	4.0°C
Ref	32.3°C
Amb	20.7°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
-----	----------	------	---------

Comments:

Observed temperatures up to 100°C as load varied. Temperature significantly exceeding allowable limits. Cause for immediate investigation.



Information:

FileName	IR000087.JPG				
CreateTime	3/2/2009 11:45:54 AM				
Emissivity	0.98	Distance	3.0m		
Max Temp	39.4°C	Min Temp	26.1°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	28.3°C				
Location:	VIC XXX -Inside Substation				
Equipment:	Line 103				
Measured Load (Amps)	200	Rated Load	1000	% Load	20%
Ambient	28	Temp	40	Rise Over	12

Analyses Table:

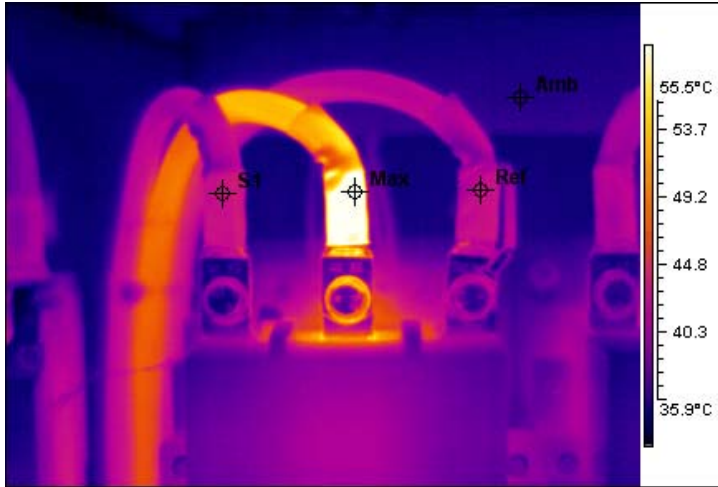
Object Parameter	Value
Fault:AvgTemp	31.7°C
Fault:MaxTemp	39.4°C
Fault:MinTemp	26.1°C
REF	32.4°C
Amb	28.5°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
------------	-----------------	-------------	----------------

Comments:

Despite low temperatures on the inside of the building, the conductor is reaching more than 80°C on the outside. This is just conductive heat we are seeing from another condition present on the line.



Information:

FileName	IR000038.JPG				
CreateTime	2/27/2007 11:42:43 AM				
Emissivity	0.98	Distance	3.0m		
Max Temp	61.0°C	Min Temp	32.4°C		
Lens	35mm / 22°FOV	Filter	None		
Background Temp	28.2°C				
Location:	Longwarry, Mechanical Services Board				
Equipment:	Breaker, White Phase				
Measured Load (Amps)	44	Rated Load	100	% Load	44%
Ambient	35	Temp	61	Rise Over	26
Obj. Priority	Moderate	Subj. Priority	Moderate	Avg. Priority	Moderate
Max Corrected Load	43. Rise over 18.				

Analyses Table:

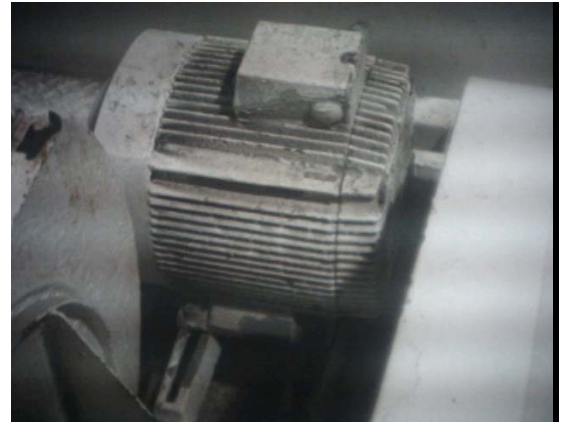
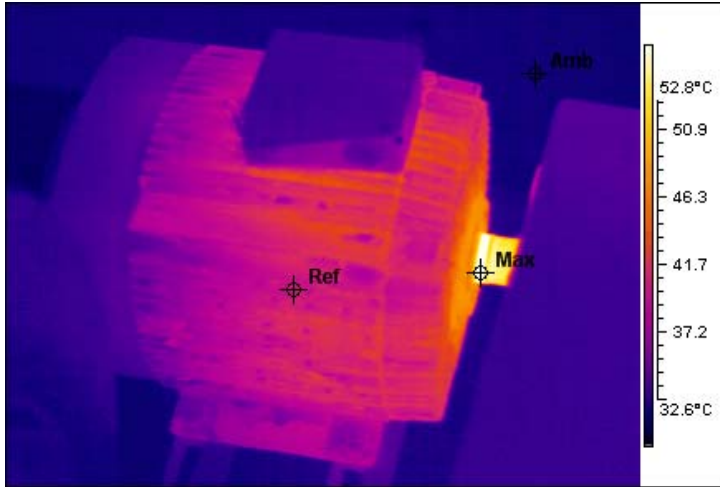
Object Parameter	Value
Max	61.0°C
S1	42.7°C
Ref	42.4°C
Amb	35.3°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
-----	----------	------	---------

Comments:

Significant heating on white phase. Load is similar across phases, so does not account for excess heat. Localized heating typical of loose/deteriorated connection.



Information:

FileName	IR000044.JPG				
CreateTime	2/27/2007 12:01:38 PM				
Emissivity	0.98	Distance	3.0m		
Max Temp	57.6°C	Min Temp	30.3°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	27.5°C				
Location:	XXXX Process Line 230				
Equipment:	Motor				
Measured Load (Amps)	NM	Rated Load		% Load	
Ambient	31	Temp	58	Rise Over	27
Obj. Priority		Subj. Priority	Moderate	Avg. Priority	

Analyses Table:

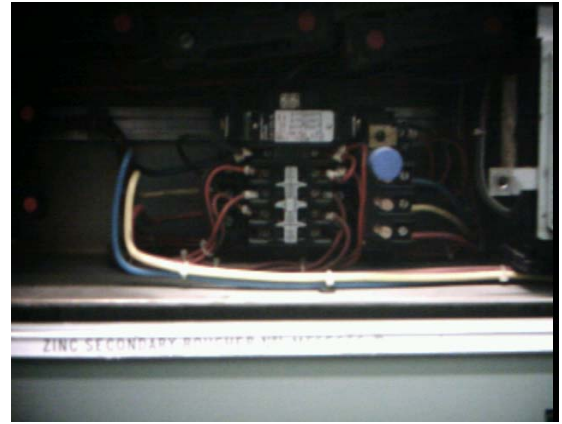
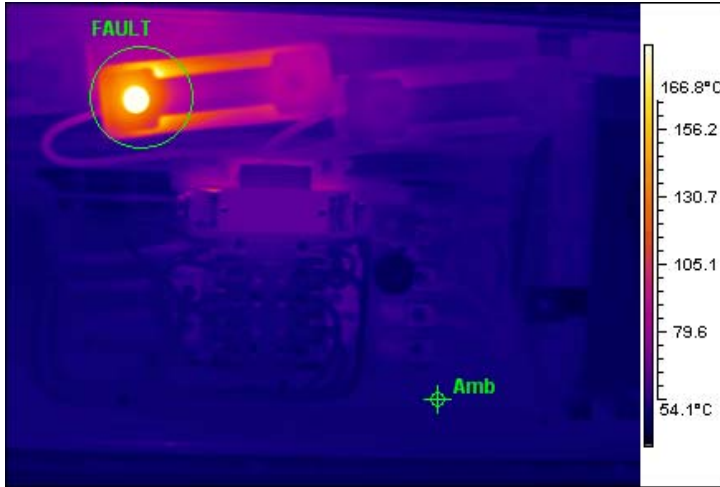
Object Parameter	Value
Max	57.6°C
Ref	40.7°C
Amb	31.0°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
-----	----------	------	---------

Comments:

Inexplicable heat on drive shaft.



Information:

FileName	IR000232.JPG				
CreateTime	2/25/2009 9:53:13 AM				
Emissivity	0.98	Distance	1 m		
Max Temp	223.1°C	Min Temp	33.0°C		
Lens	35mm / 22°FOV		Filter	None	
Background Temp	28.3°C				
Location:	XXXX				
Equipment:	FUSE				
Measured Load (Amps)	NM	Rated Load		% Load	
Ambient	44	Temp	224	Rise Over	180
Obj. Priority	HIGH	Subj. Priority	Extreme	Avg. Priority	Extreme

Analyses Table:

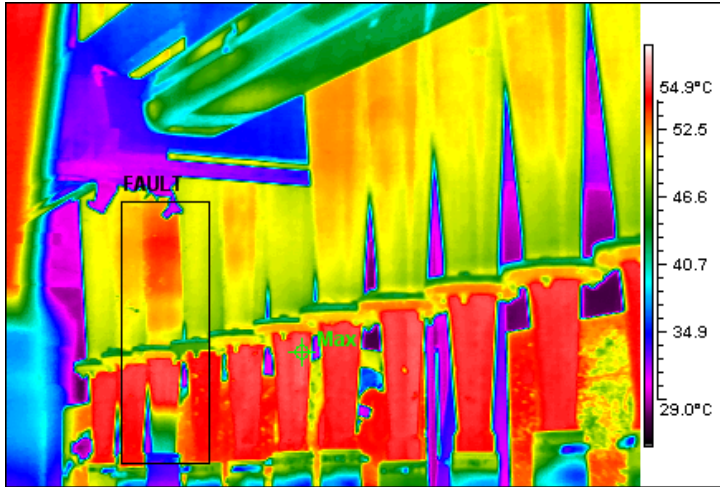
Object Parameter	Value
Amb	44.9°C
FAULT:AvgTemp	125.8°C
FAULT:MaxTemp	223.1°C
FAULT:MinTemp	51.8°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
------------	-----------------	-------------	----------------

Comments:

This extreme temperature should be investigated IMMEDIATELY.
 This was reported immediately to site assistant as an immediate safety issue.



Information:

FileName	IR000001.jpg				
CreateTime	9/4/2008 12:42:38 PM				
Emissivity	0.98	Distance	3.0m		
Max Temp	55.7°C	Min Temp	26.4°C		
Lens	35mm / 22° FOV	Filter	None		
Background Temp	21.5°C				
Location:	Norske Skog Tasmania Plant				
Equipment:	Centrifuge Separation Cones				
Measured Load (Amps)	NA	Rated Load	NA	% Load	NA
Ambient	28	Temp	56	Rise Over	
Obj. Priority	Moderate	Subj. Priority	Mod	Avg. Priority	Mod

Analyses Table:

Object Parameter	Value
Max	55.7°C
FAULT:AvgTemp	51.1°C
FAULT:MaxTemp	55.4°C
FAULT:MinTemp	30.1°C

Priority Rating:

LOW	MODERATE	HIGH	EXTREME
-----	----------	------	---------

Comments:

Third plastic cone counting from the left hand side is wearing very thin in top portion of the cone compared to the others in the train. Cone also blocked in the lower portion. Product has built up and has ceased to flow. Immediate action was taken to stop the flow before it became excessive and a major issue to the feeder plant above. Cone had higher wear rate than others in the train and would be changed on the next shut down