HEATSEEKER INFRARED INSPECTION

A Division of Pro Electric Ltd.

Preventive Maintenance Inspection for

Rutland Waterworks - Station 7

8/31/2015

General Information

Survey was conducted using **FLIR SYSTEMS Therma CAM Model PM395.**

This report was created using
Therma CAM Reporter Professional
a software from **FLIR SYSTEMS AB.**

Images and recommendations provided by
Heatseeker Infrared inspection.

HEATSEEKER INFRARED INSPECTION

A Division of Pro Electric Ltd.

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FOR YOUR INFORMATION

I'm often asked for the formula that I use to determine if an item is 'defective' or 'needs attention'.
The short answer is that no such formula exists which is useful for a Thermographer. All electrical components have normal operating or recommended temperatures and typically have 'not to exceed' specifications. These however, are not the same as the temperature of the abnormal hot spot at the point of high resistance.

Normally what a Thermographer does is look for differences among the three phases. If there is a difference, there must be an explanation. Differences in load (imbalances) can cause temperature differences; these may be normal (typical in a Lighting Circuit) or abnormal (such as in a 3-Phase Motor Circuit).

High-resistance Connection Points also often result in abnormal thermal differences. Abnormal thermal differences show up as hot spots associated with a connection. We can only measure a surface temperature! The actual source of the heating is typically internal to one degree or another. When such a connection is disassembled it is common to find the connection inside has melted while the surface was only hot.

In many instances, even a small temperature difference phase to phase can signal a BIG problem. This is especially true for systems which are lightly loaded. Despite the fact that several companies sell programs to adjust load and temperature, the calculation is NOT a simple one. The only thing we really know is that as load increases, so does temperature and it does so at a rate that is more than linear!

EXAMPLE: A 13℃ rise over ambient at 10% load can (and often does) increase to 93℃ with a 50% load.
The best solution is to note ALL differences and determine why they exist. If loads are light, convection is strong, equipment is critical, and measurements are unreliable, ANY temperature difference should be investigated thoroughly.

REPAIR RECOMMENDATIONS

Degrees Celsius Rise Above Reference Temperature:

0-10 degrees Celsius (Classification 1) MINOR
- x Repair at next scheduled shutdown.
- x Low probability of physical damage.

11-35 degrees Celsius (Classification 2) INTERMEDIATE
- x As available.
- x Repair in 2-4 days.
- x Inspect for physical damage.

36-75 degrees Celsius (Classification 3) SERIOUSXXX
- x Repair A.S.A.P. 1-2 days.
- x Component replacement probable.
- x Inspect surrounding components for physical damage.
- x Re-Scan.

>than 75 degrees Celsius (Classification 4) CRITICAL
- x Shutdown component and replace.
- x Re-Scan.

SPECIAL NOTES:

We would like to emphasize that 'tightening' alone often will not be sufficient to solve the problem concerning Connections. Components need to be disassembled, examined for damage and cleaned before assembly.

The above recommendations are meant as a guide only, based on the ASNT (American Society for Nondestructive Testing) specifications. Note that when amperage increases/decreases, the anomaly component temperature will increase/decrease accordingly.

FLIR SYSTEMS

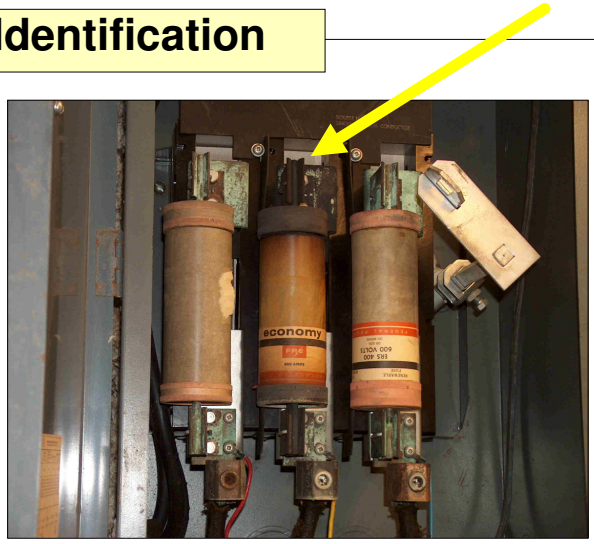
Inspected Equipment:

Main Disconnect

Operator:

Bruce Wiebe

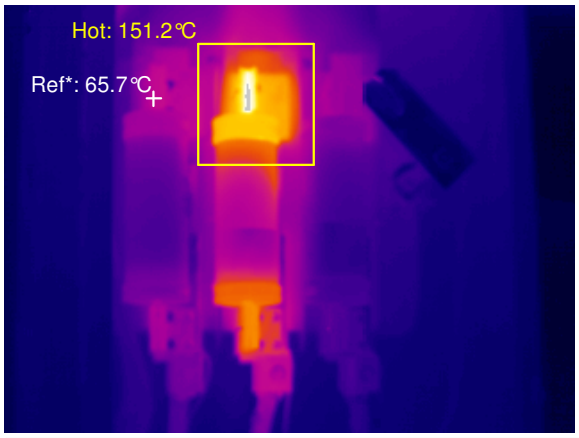
Identification



Location	Pump Stn. 7
Equipment	Main Disconnect
Comment	Phase B
Date	8/31/2015
Time	2:18:55 PM

Rated Current	400 Amps
Actual Current	102, 101, 100 Amps

Fault description



Object parameter	**Value**
Emissivity	0.95
Object distance	1.0 m
Label	**Value**
Ref*	65.7℃
Hot : max	151.2℃

Difference	85.56℃
Severity	Classification 4

Fault	Ph. B fuse clip is heating critically
Recommendation	Replace the switch. Inspect all conductors for damage

Severity	Repair time frame	Temperature above reference
Classification 1	Next scheduled shutdown	0 to 10 degrees C.
Classification 2	As available	11 to 35 degrees C.
Classification 3	A.S.A.P.	36 to 75 degrees C.
Classification 4	CRITICAL	> than 75 degrees C.

Repairs/Corrections_____
Completed by_____
Date_____

FLIR SYSTEMS

Inspected Equipment:

Pump No. 2 Disc.

Operator:

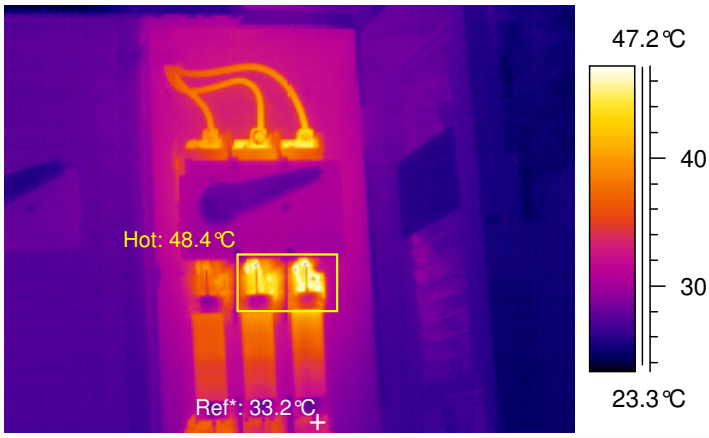
Bruce Wiebe

Identification

Location	Pump Stn. 7
Equipment	Pump No. 2 Disc.
Comment	View # 1 (see next page)
Date	8/31/2015
Time	2:28:14 PM

Rated Current	125 Amps
Actual Current	48, 50, 47 Amps

Fault description



Object parameter	**Value**
Emissivity	0.95
Object distance	1.0 m
Label	**Value**
Ref*	33.2℃
Hot : max	48.4℃

Difference	15.17℃
Severity	Classification 2

Fault	The switch is heating at the Jaw & Hinge
Recommendation	Clean & tighten the mechanism, inspect for damage

Severity	Repair time frame	Temperature above reference
Classification 1	Next scheduled shutdown	0 to 10 degrees C.
Classification 2	As available	11 to 35 degrees C.
Classification 3	A.S.A.P.	36 to 75 degrees C.
Classification 4	CRITICAL	> than 75 degrees C.

Repairs/Corrections_____
Completed by_____
Date_____

FLIR SYSTEMS

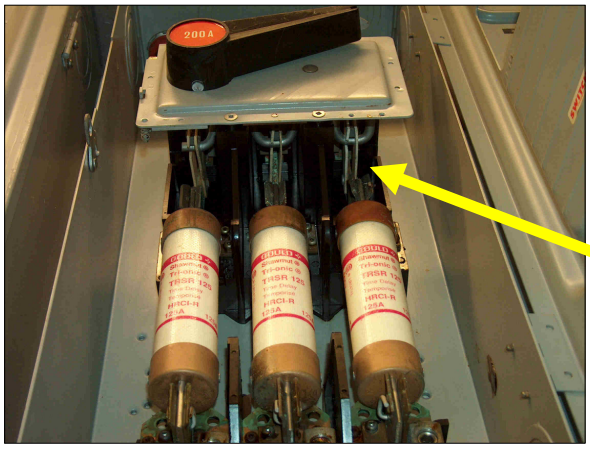
Inspected Equipment:

Pump No. 2 Disc.

Operator:

Bruce Wiebe

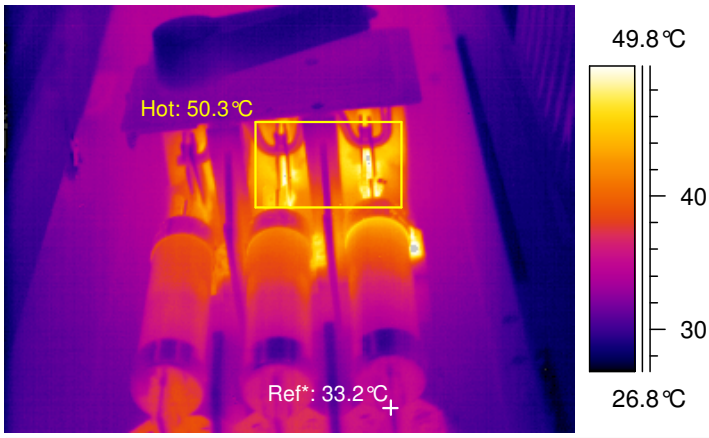
Identification



Location	Pump Stn. 7
Equipment	Pump No. 2 Disc.
Comment	View # 2 (see previous page)
Date	8/31/2015
Time	2:24:07 PM

Rated Current	125 Amps
Actual Current	48, 50, 47 Amps

Fault description



Object parameter	**Value**
Emissivity	0.95
Object distance	1.0 m
Label	**Value**
Ref*	33.2℃
Hot : max	50.3℃

Difference	17.05℃
Severity	Classification 2

Fault	This shows the heating behind the plate
Recommendation	Same as previous page

Severity	Repair time frame	Temperature above reference
Classification 1	Next scheduled shutdown	0 to 10 degrees C.
Classification 2	As available	11 to 35 degrees C.
Classification 3	A.S.A.P.	36 to 75 degrees C.
Classification 4	CRITICAL	> than 75 degrees C.

Repairs/Corrections_____
Completed by_____
Date_____

Executive Summary of Inspection for

Rutland Waterworks - Station 7

8/31/2015

This inspection was initiated because someone noticed that the surface of the main disconnect cabinet was warm to touch. It's a good thing this was noticed !

With the help of Steve Hughes, the electrical cabinets were opened and scanned looking for abnormally heated components. Such components would in due time damage equipment causing premature failure. By comparing the temperatures of similarly loaded phases and components we can determine if a component is begining to show signs of stress prior to complete failure. This allows your staff to order equipment and schedule repair without causing expensive down time.

The Infrared inspection shows that the main switch is severely heating at a Class 4 level and needs to be replaced immediately, as it's failure is imminent. Also the associated conductors need to be examined for damage, and their replacement is possible.

The other anomaly discovered is a Class 2, which involves repair and inspection for damage in the switch. Two images are shown for this switch, first to give an overview and then to show the hidden source of the heating behind the switch cover.

Recommendations are at best only recommendations. Each of the anomalies should be closely investigated by your staff.

List of Anomalies Found

Severity	Page	Equipment	Fault
Classification 4	5	Main Disconnect	Ph. B fuse clip is heating critically
Classification 2	6	Pump No. 2 Disc.	The switch is heating at the Jaw & Hinge
Classification 2	7	Pump No. 2 Disc.	This shows the heating behind the plate

PREPARED BY:

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