

# THERMOGRAPHIC SURVEY OF PLANT AND EQUIPMENT

Prepared for



## SAMPLE REPORT

September 2020



ON LINE VIBRATION MONITORING Ltd.  
THE KEY TO MACHINE CONDITION

10<sup>th</sup> September 2020

## 1.0 THERMOGRAPHY

All bodies at temperatures above absolute zero radiate heat from their surfaces in proportion to the temperature of the body. Such radiant heat invisible to the naked eye can be detected using a suitable camera to produce thermal images. These images are converted to a radiometric image or video format and show the variation and distribution of temperature of the object viewed. The resulting thermal pictures show heat distribution as coloured contours. These isothermal bands represent higher temperatures as paler colours, i.e. whites, yellow etc. and cooler temperatures at the opposite end of the spectrum, i.e. blue, violets etc.

The practical uses of this technique are as a diagnostic measure for the inspection of electrical and mechanical equipment and processes to give early warning of fault conditions characterised by overheating or variations of temperature.

In the normal course of events, plant is surveyed whilst operating at normal load and either still thermographic images taken or a thermographic video recording made for post survey analysis and the production of still pictures to enable follow up remedial action to be taken at the earliest convenient time by the client.

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## 2.0 INTRODUCTION

2.1 A Thermographic Survey of the **Bakery, Services and Ancillary Equipment** was carried out on the **10<sup>th</sup> September 2020** on behalf of **On Line Vibration Monitoring Ltd, Cumbria**. This is a report on the conditions prevailing when the items in the schedule were inspected.

2.2 Where it is safe and practical, covers are removed in a controlled manner to facilitate inspection. Where covers cannot be moved for safety (e.g. HV) or operational reasons, external scans can be made.

2.3 A high resolution infra red camera in conjunction with a digital camera was used to inspect equipment and relevant anomalies or defects were recorded either on video or as still images. From the analysis of the video or still images, a report is produced to illustrate areas for further investigation by the Client.

2.4 The colouration of the pictures depicts isothermal patterns showing heat distribution. Warmer areas show as white, yellows etc., cooler areas show as violets and blues etc.

2.5 To assist in identification of components normal digital pictures of the areas viewed are also attached.

2.6 Where items were inspected and no abnormalities prevailed, no images are taken and no comment is made.

### 3.0 SCOPE

3.1 The following items shown in the accompanying schedule were selected by the Clients representatives for survey and covers were opened where safe and practicable to facilitate inspection.

3.2 Titles and description of equipment and locations have been taken as those in common usage in the Plant for identification purposes.

3.3 The defects seen can be at various levels of severity and since many factors will influence the life of components any opinions given on conditions and life expectancy are given in good faith and cannot be considered absolute.

3.4 Follow up work including remedial work and investigations into causation etc. or any other factors outside the control of On Line Vibration Monitoring Ltd. are not the responsibility of On Line Vibration Monitoring Ltd. and are not covered by this Contract

3.5 The Survey and Report are not undertaken with any intention to ascertain that the buildings, plant, equipment and installations would comply with any Regulation or Code of Practice as may be required by any Authority under whose jurisdiction they may be operated.

3.6 Where On Line Vibration Monitoring Ltd. have been unable to inspect equipment or plant which is covered, unexposed, inaccessible or without load, we are therefore unable to report that any such system components are free from defect.

## SCHEDULE OF ITEMS INSPECTED

- Mixer No.1 Control Panel – 4 Sections
- Mixer No.2 Control Panel – 4 Sections
- Hi-Tip Control Panel – 1 Section
- Tin System Control Panel – 2 Sections
- Flour System Control Panel – 2 Sections (keys required from engineering)
- Conical Moulder JB Panel – ¼ Section
- Autoplant Control Panel – 3 Sections
- Moulder 1 Control Panel – ¼ Section
- Moulder 2 Control Panel – ¼ Section
- Prover/Loop/Oven Loader Control Panel – 2 Sections
- Old Prover Air Conditioning Control Panel – 1 Section
- New Prover Air Conditioning Control Panel – 2 Sections
- Burner Control Panels, 4 off – ½ Sections
- Oven Unload Control Panel – ½ Section
- Depanner Control Panel – 2 x ½ sections
- Oven end conveyors Control Panel - 3 Sections
- Cooler Air Conditioning Control Panel – 4 Sections
- Cooler Control Panel – 2 Sections
- Hot Bread Control Panel - 3 Sections
- Cold Bread Conveyors Control Panel - 3 Sections
- Basket loader panels - 4 off
- Tin Cleaner Panel
- Robot Panels 2 off
- Tin Cooler Panel
- Full Basket Conveyor Panel – 2 Sections
- Empty Basket Conveyor Panel – 3 sections

### AIR COMPRESSOR ROOM

- Air Compressor No.1 Control Panel
- Air Compressor No.2 Control Panel and Inverter
- Extract Fan Panel

### EXTERNAL PLANT

- Brine Control Panel
- Yeast Plant Control Panel
- Yeast Chiller Control Panel -2 off
- Chilled Water Control Panel - ½ Section
- Chiller 1 Control Panel
- Chiller 2 Control Panel

### EXTERNAL L.V. SWITCH ROOM

- MEM Main ACB and Busbar connections
- PFC Capacitor panel
- Main Switch Fuse No.1
- Main Switch Fuse No.2
- Main Switch Fuse No.3
- Main Switch Fuse No.4
- Main Transformer

### WORKSHOP

- Dis. Board ref: 1A,
- Ventilation Control Panel

### INTERNAL L.V. SWITCH ROOM

- Incomer, Main Switchfuse, Busbar connections and 13 switchfuses
- 'I Line' MCCB Board ref: 2A
- Merlin Gerin MCCB Board ref: 4A
- Switch room MCB Dis Boards 1A/10 & DB-1-2-1-3
- Unmarked Merlin Gerin MCB Dis. Board

### BAKERY

- Packaging Dis. Board 4A/3    Packaging Dis. Board 2A/9
- Production Dis. Board 1A/6    Production Dis. Board 2A/5
- Production Dis. Board 1A/7
- Packing Dis. Boards 2A/4 & 2A/5/9

### Production Distribution Area by Prover

- Main Switch, Busbars, 12 switch fuses, PFC Equipment
- Production Dis. Board 3A/2, Production Dis. Board 3A/13
- MCCB Section Board 1A/2 (by depanner)
- Production Dis. Board 4A/4

### DESPATCH AREA

- Dis. Board 1A/5
- Dis. Board 1A/8
- Dis. Board 1A/14
- Stacker system Control Panel
- Denester Control Panel
- Basketwash Control Panel

## 4.0 SUMMARY

The Survey was carried out during normal operations of the site whilst most equipment was functioning. The work was completed without any disruption to the usual activities of the site.

The foregoing Schedule describes in general terms the equipment inspected, however, it does not attempt to detail the vast number of individual components scanned.

*During the Survey 7 **thermal anomalies** were detected for further investigation by the Client. The accompanying pictures illustrate these items.*

*In addition to these thermal defects, 3 other observations were noted. Details of these can be found in the Appendix at the rear of this report.*

Wherever heating effects are noted the Client should investigate why these occur and whether the temperatures are within acceptable limits.

When carrying out repairs it is preferable that cables etc. should be cut back to bright metal and where possible terminations and components should be replaced, as simply tightening the connections may not be successful.

Repairs should only be undertaken by authorised persons, site isolation procedures followed and the 'dead' state verified before work commences.



It is recommended that thermographic surveys are carried out regularly as part of your predictive maintenance programme.

Dated the 10<sup>th</sup> September 2020



**S R Hurst**  
**On Line Vibration Monitoring Ltd**



## 5.0 THERMOGRAMS

In some cases it may be desirable to have a guide to the temperatures of areas or objects in a Thermogram.

Subject to factors such as emissivity, reflectivity, angle of view and environmental conditions, the text of the Thermogram shows as follows:-

**Spot** = Temperature °C registered at the cross hairs at the centre of screen

**Box** = Maximum Temperature °C registered in the box at the centre of screen

*(Note that the cross hairs do not always show the hottest point)*

**Temperature Rise** is the difference in temperature of an object or surface compared with similar objects, surfaces or ambient temperature as appropriate.

### **GUIDELINES:**

Under 15 °C	Temp. Rise	Monitor, repair as scheduling permits
15 °C - 30 °C	" "	Caution - schedule for early action
30 °C - 50 °C	" "	Serious - repair as soon as possible
Above 50 °C	" "	Repair immediately

The above guidelines are advisory only and may need to be modified by the Client's knowledge of particular systems and history of plant.

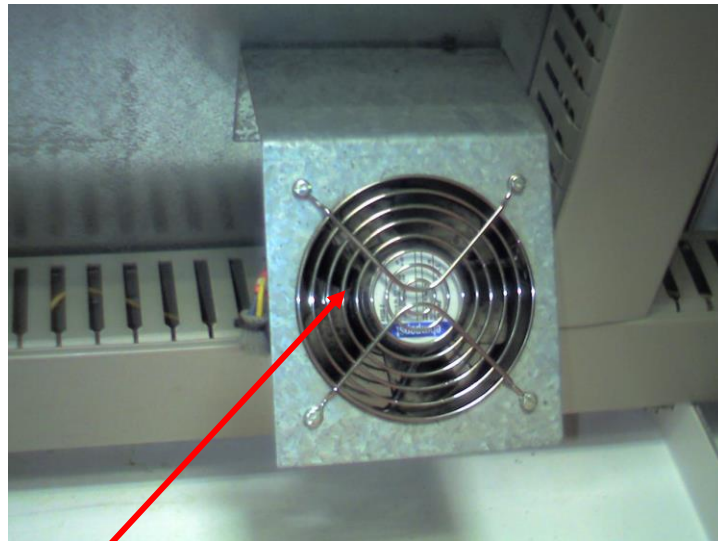
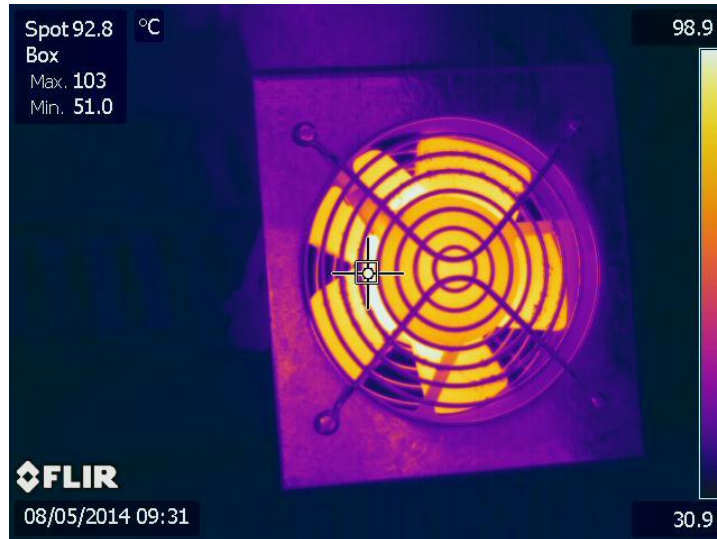
<b>Client</b>	On Line Vibration Monitoring Ltd	<b>Report No.</b>	IR 001
<b>Location</b>	External LV Switch room	<b>Asset No.</b>	
<b>Plant Item</b>	Main Switch Fuse No.1		




<p><b>Fault Description</b>  Bottom connection L3 (marked as red phase). Thermogram taken looking up from under the switch.  Temp. Rise = 30°C    Max. Temp. = 80°C</p>	<p style="text-align: center;"><b>Severity</b></p> <div style="text-align: center;"> </div> <p><i>Critical</i></p> <hr/> <p><i>Inspect / Rectify</i></p> <hr/> <p><i>Inspection Required</i></p>
<p><b>Possible Cause</b>  Defective Connection</p>	
<p><b>Recommended Action</b>  Open fused switch and inspect crimp lug, connection and switch contacts</p>	

Notes:-	Actioned By:	
	Date:	

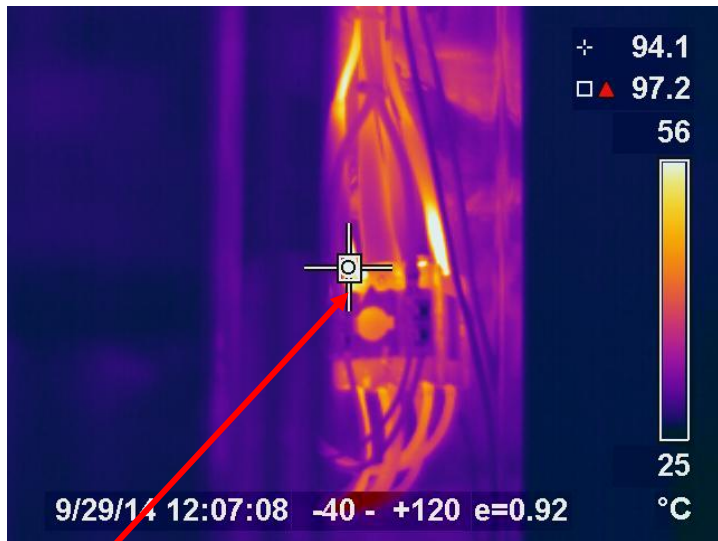
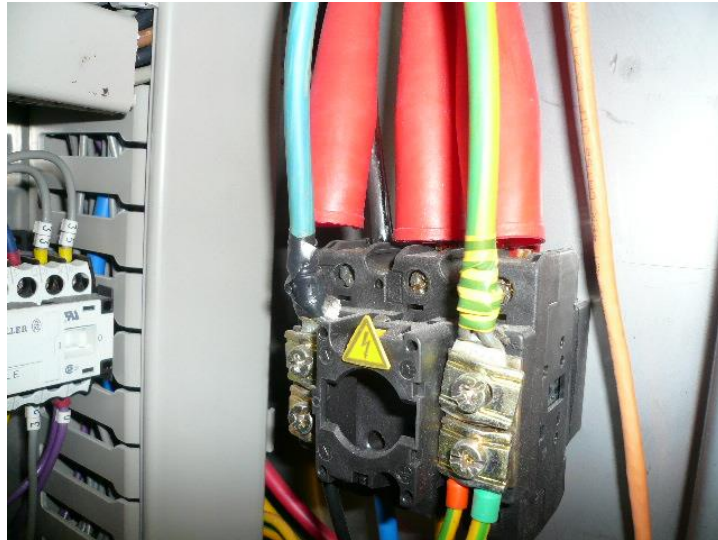
<b>Client</b>	On Line Vibration Monitoring Ltd	<b>Report No.</b>	IR 002
<b>Location</b>	Bread Plant (Oven / Prover Area)	<b>Asset No.</b>	
<b>Plant Item</b>	Oven control panel – Zone 2 section		



<p><b>Fault Description</b>          Stalled panel cooling fan          Temp. Rise = 56°C          Max. Temp. = 103°C</p>	<p style="text-align: center;"><b>Severity</b></p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p><b>Critical</b></p> <hr style="width: 50px;"/> <p><b>Inspect / Rectify</b></p> <hr style="width: 50px;"/> <p><b>Inspection Required</b></p> </div>  </div>
<p><b>Possible Cause</b>          Defective / stalled fan</p>	
<p><b>Recommended Action</b>          Replace the cooling fan</p>	

Notes:-	Actioned By:	
	Date:	

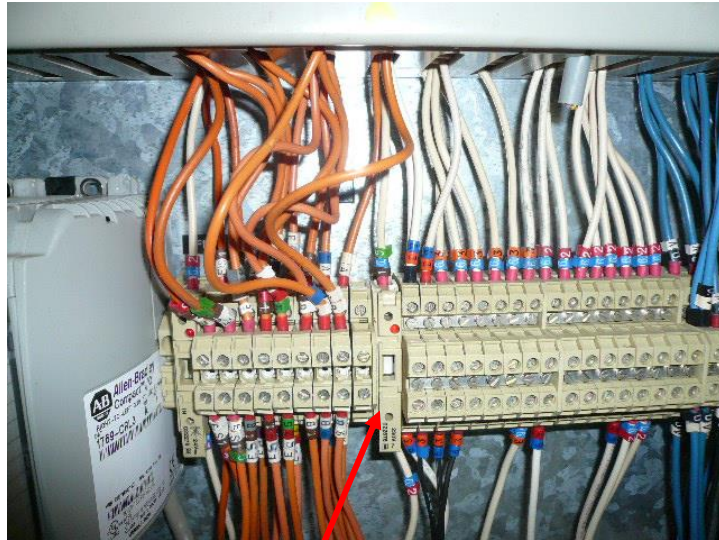
<b>Client</b>	On Line Vibration Monitoring Ltd	<b>Item No.</b>	IR 003
<b>Location</b>	Bread Plant 1	<b>Asset No.</b>	
<b>Plant Item</b>	Tin Cleaner Control Panel (ex tin stores)		



<p><b><u>Fault Description</u></b>          Brown phase top (incoming) connection on panel isolator          Also – grey phase top (incoming) although to a lesser extent          Temp Rise = 47°C</p>	<p style="text-align: center;"><b><u>Severity</u></b></p> <div style="text-align: center;"> </div> <p><b><i>Critical</i></b></p> <hr/> <p><b><i>Inspect / Rectify</i></b></p> <hr/> <p><b><i>Inspection Required</i></b></p>
<p><b><u>Possible Cause</u></b>          Defective / loose connections</p>	
<p><b><u>Recommended Action</u></b>          Cut back cables and remake connections</p>	

Notes:-	Actioned By:	
	Date:	

<b>Client</b>	On Line Vibration Monitoring Ltd	<b>Item No.</b>	IR 004
<b>Location</b>	Despatch	<b>Asset No.</b>	
<b>Plant Item</b>	Basket Storage Control Panel - RH section		

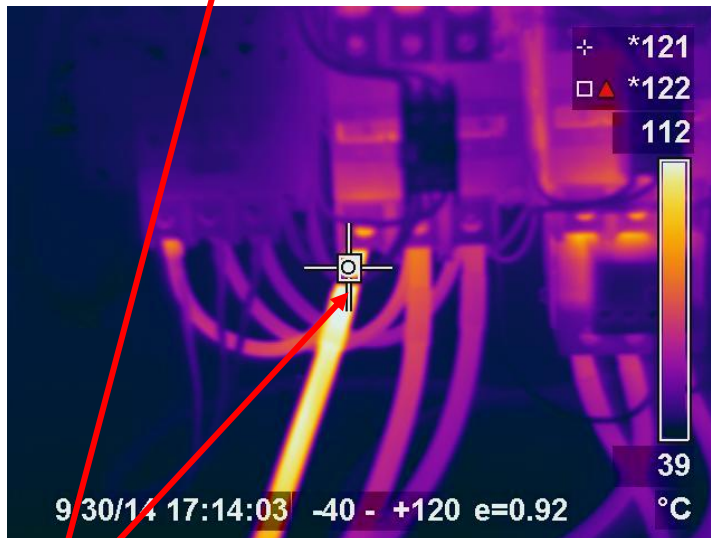


<p><b><u>Fault Description</u></b> Terminal rail fuse (to the right of the PLC) Temp Rise = 47°C, Temp Max = 88°C</p>	<p style="text-align: center;"><b><u>Severity</u></b></p> <div style="text-align: center;"> <p><b>Critical</b></p> <p>_____</p> <p><b>Inspect / Rectify</b></p> <p>_____</p> <p><b>Inspection Required</b></p> </div>
<p><b><u>Possible Cause</u></b> High load – This fuse supplies the Pilz relay and numerous contactor coils</p>	
<p><b><u>Recommended Action</u></b> Consider splitting the circuit or uprating the fuse holder</p>	

Notes:-	Actioned By:	
	Date:	



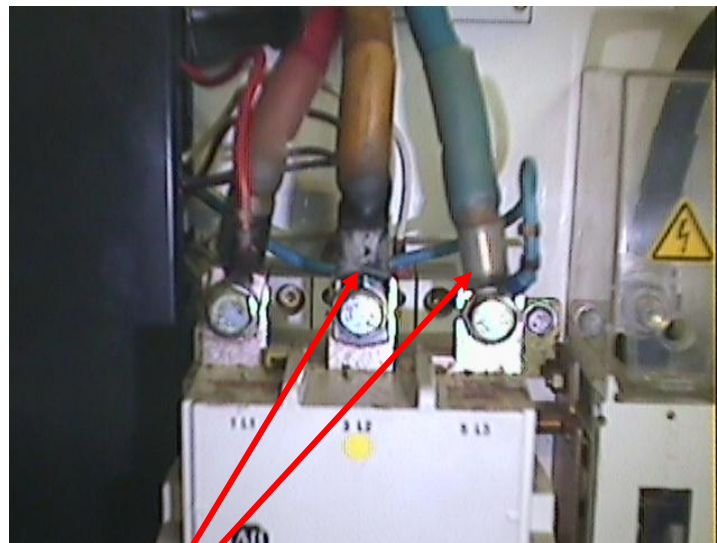
<b>Client</b>	On Line Vibration Monitoring Ltd	<b>Item No.</b>	IR 005
<b>Location</b>	Compressor House	<b>Asset No.</b>	
<b>Plant Item</b>	Compressor No.1 Control Panel		




<p><b>Fault Description</b> Delta contactor bottom L1 connection (Wire No. W2) Temp Rise = 36°C, Max Temp = 122 °C</p>	<p style="text-align: center;"><b>Severity</b></p> <div style="text-align: center;"> <p><i>Critical</i></p> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 20px; background-color: red; margin-right: 5px;"></div> <div style="width: 10px; height: 20px; background-color: orange; margin-right: 5px;"></div> <div style="width: 10px; height: 20px; background-color: yellow; margin-right: 5px;"></div> </div> <p>←</p> <p><i>Inspect / Rectify</i></p> <hr style="width: 50%; margin: 5px auto;"/> <p><i>Inspection Required</i></p> </div>
<p><b>Possible Cause</b> Loose connection</p>	
<p><b>Recommended Action</b> Tighten / remake connection</p>	

Notes:-	Actioned By:	
	Date:	

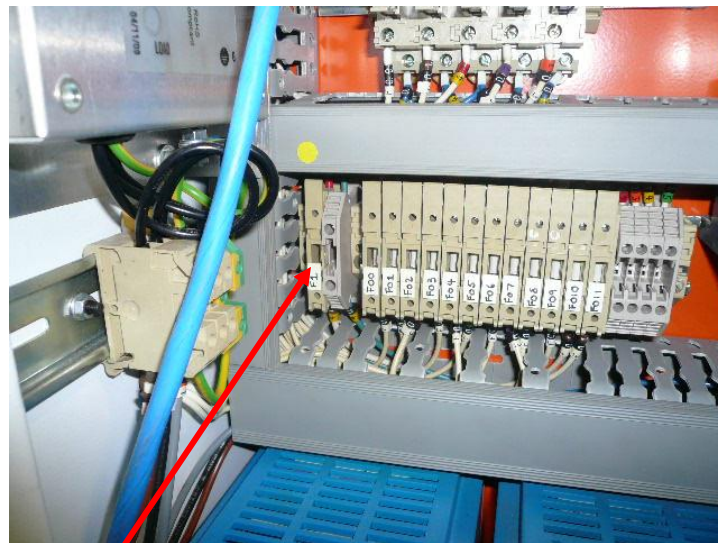
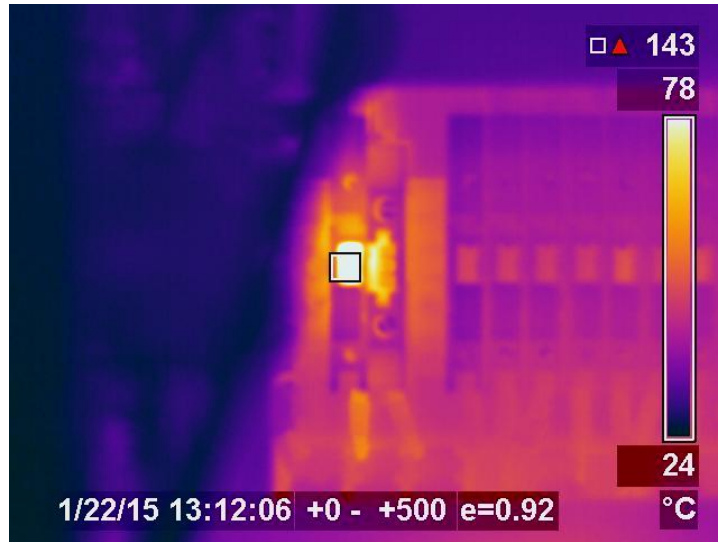
<b>Client</b>	On Line Vibration Monitoring Ltd	<b>Report No.</b>	IR 006
<b>Location</b>	Bread Plant	<b>Asset No.</b>	
<b>Plant Item</b>	Oven control panel		



<p><b>Fault Description</b>  Top L2 and L3 connections on Safety Contactor 'SC'  Temp. Rise = 120°C  Max. Temp. = 162 °C</p>	<p style="text-align: center;"><b>Severity</b></p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p><b>Critical</b></p> <hr style="width: 50%; margin: 5px 0;"/> <p><b>Inspect / Rectify</b></p> <hr style="width: 50%; margin: 5px 0;"/> <p><b>Inspection Required</b></p> </div>  </div>
<p><b>Possible Cause</b>  Defective connections</p>	
<p><b>Recommended Action</b>  The previous repair has not resolved the problem so consider replacing the 50mm<sup>2</sup> tails and the safety contactor.</p>	

Notes:-	Actioned By:	
	Date:	

<b>Client</b>	On Line Vibration Monitoring Ltd	<b>Report No.</b>	IR 007
<b>Location</b>	Bread Plant	<b>Asset No.</b>	
<b>Plant Item</b>	Wrapper D Control Panel		



<p><b><u>Fault Description</u></b>  DIN rail fused terminal 'F1'  Temp. Rise = 95°C  Max. Temp. = 143 °C</p>	<p style="text-align: center;"><b><u>Severity</u></b></p> <div style="text-align: center;"> <p><b>Critical</b></p> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 20px; background-color: red; margin-right: 5px;"></div> <div style="font-size: 2em;">←</div> </div> <p><b>Inspect / Rectify</b></p> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 20px; background-color: orange; margin-right: 5px;"></div> </div> <p><b>Inspection Required</b></p> <div style="display: flex; align-items: center;"> <div style="width: 10px; height: 20px; background-color: yellow; margin-right: 5px;"></div> </div> </div>
<p><b><u>Possible Cause</u></b>  Defective fuse carrier contacts</p>	
<p><b><u>Recommended Action</u></b>  Replace the fused terminal</p>	

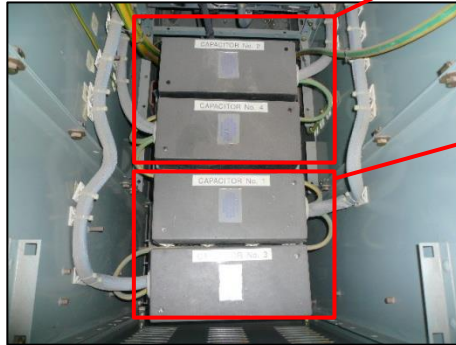
Notes:-	Actioned By:	
	Date:	



## APPENDIX

### ➤ LV Switchroom – Power Factor Correction

The power factor display was noted to be running at 0.87  $\cos\Phi$ . There are four banks of capacitor with six capacitors in each bank. All capacitor banks are energised but only four capacitors are shown to be loaded (see images).



### ➤ Compressor Room

The Compair compressor is flashing a high temperature warning alarm



The Atlas Copco compressor is leaking oil onto the floor



➤ **Bread Plant Cooler Control Panel**

There are a number of panel cooling fans not running on this panel suite.

Enclosure 2 – Top fan stalled

Enclosure 3 – Both fans not running

Enclosure 4 – Top fan not running

