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ENGINEERING

TECHNICAL INVESTIGATION REPORT (INTERIM)

Temperature Excursion on [REDACTED] Facility [REDACTED]

	Technical Investigation Report Number:	[REDACTED] REP/FDA/100
AE Date: 15/10/09	AE/Defect Form Ref No.: 09514339	Investigation Start Date: 21/10/09
1. Incident/Defect Summary		
<p>The following observation was recorded in Assurance Event Report No: 9514339. A temperature excursion on [REDACTED] furnace was experienced. The furnace power was turned down and the FEC was contacted immediately. The lab was restricted and all relevant parties were made aware.</p> <p><u>Additional information</u> The furnace function is to apply [REDACTED] conditioning. The furnace was set for a temperature of [REDACTED]. The policeman thermocouple is set to trip the furnace if the temperature exceeds [REDACTED]. The instrumentation for the furnace recorded temperatures in the order of [REDACTED]. Both the process and policeman control functions failed to shut the furnace down. Twenty grams [REDACTED] in aluminium was in the furnace at the time of this incident. This would melt at approximately [REDACTED] at present it is not known what has happened to the material within the furnace. The process operation has been made safe and terminated with the box placed out of service via electrical isolation and management controls.</p>		
2. Technical Investigation Findings		
<p><u>Scope of investigation</u> The scope of this technical investigation is to identify the probable cause of the temperature excursion on furnace C (of 3 furnaces in this [REDACTED] only. This stage of the investigation does not include recovery of the material, entry to the [REDACTED] or de-isolation of electrical power.</p> <p><u>Description of furnace temperature control (Refer to Annex A)</u> The furnace heater is connected to a single phase of a three phase supply via a control relay (Re13), a MCB rated at 6amps, and a 25 amp contactor that is enabled through a set of marshalled 'alarm' interlocks. The contactor make/break decision logic does not include furnace over-temperature protection. Provided that Relay 1 contacts 1 & 3 and Relay 4 contacts 8 & 12 are closed, the coil of Relay 13 is controlled from the output of a Eurotherm 818 Controller. This is connected to a thermocouple to provide temperature control to the</p>		

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furnace. The Eurotherm Controller 106C, acting as the Policeman, will on over temperature de-energise Relay 4, opening contacts 8 & 12. Relay 1 is enabled from the process [REDACTED] controller closing contacts 1 & 3.

Relay 13 which controls the heater appears to be single point of failure. If contacts 5 & 9 fail to open on de-energisation of the coil heat to the furnace would be continuous.

Investigation findings

MCB 6 found to be tripped (Bay [REDACTED] staff confirmed they had not manually tripped MCB 6). Relay 13 labelled as Relay 11 (Relay 11 originally carried out the same function in the A furnace which is stripped down and not in use)

On inspection of Relay 13 its transparent cover was found to be blackened and carbonised around the area of the contacts (Refer to Annex B). Although contacts 5 & 9 on Relay 13 were found as being open when the relay was tested, it's possible the contacts may have temporarily welded shut.

At this point the evidence collection of the technical investigation halted.

Configuration check

The record drawings for this [REDACTED] were found to have accurately reflected the plant status.

AMS Check

There is no maintenance scheduled for the process equipment or its protection systems in this [REDACTED]

Further actions required

[REDACTED] Furnace requires unloading then Relay 13 will be replaced.

Once material has been removed, the furnace will then under go further testing to establish if Relay 13 was the cause of the temperature excursion.

Note: This process/[REDACTED] is now the subject of a PRS Category 1 shortfall. This identifies technical/engineering corrective actions leading to a return to service. This plan includes provision of [REDACTED] interlocking, an integrity review of the over-temperature protection system and addition of the overprotection system (current and future) onto the facility EMIT Plan. This does not negate the need for this investigation to be completed.

3. Conclusions

At the time of this interim report Relay 13 appears to be a single point of failure in the over temperature protection circuit. To validate this statement requires further testing once the furnace has been unloaded.

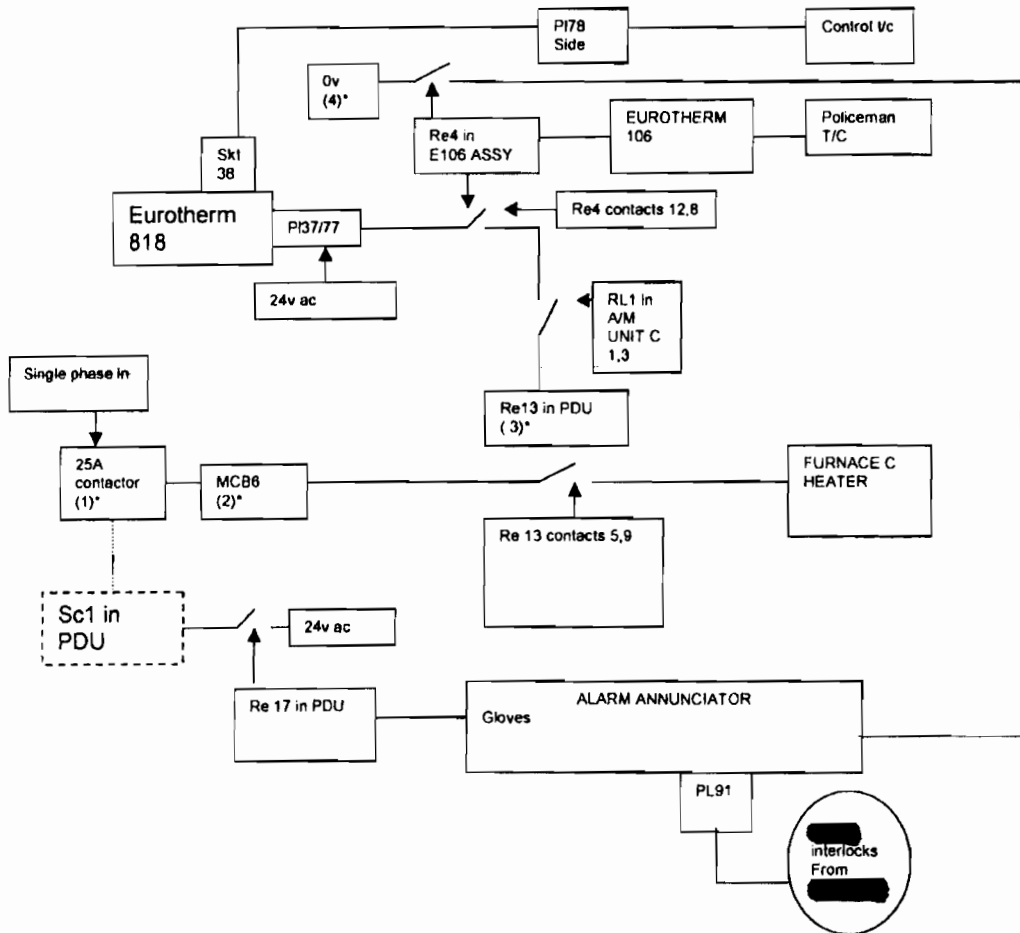
If required, the design and construction of the temperature control circuits would allow for the policeman control to be moved to the contactor rather than Relay 13 giving an improvement in redundancy.

To make this change would require a facility modification and review against the PRS

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Category 1 shortfall to determine if it is suitable and sufficient to allow a return to service.	
4. Causes	
Investigation not complete	
5. Human Factors	
This has not been included in the remit of this report.	
6. Deficiencies and Agreed Actions (Including responsibility and timescales)	
Investigation not complete	
7. Documents seen, references etc	
AE 9514339 Plant Manuals ref [REDACTED]/1/1230310 HR/1/981537 HR/1/981587 HR/1/981571 PRS Shortfall Action Plan [REDACTED]/PRS/C1/AP/11	
Investigator: [REDACTED]	Signature..... Date.....
Reviewer: [REDACTED]	Signature..... Date.....
Approver: [REDACTED]	Signature..... Date.....

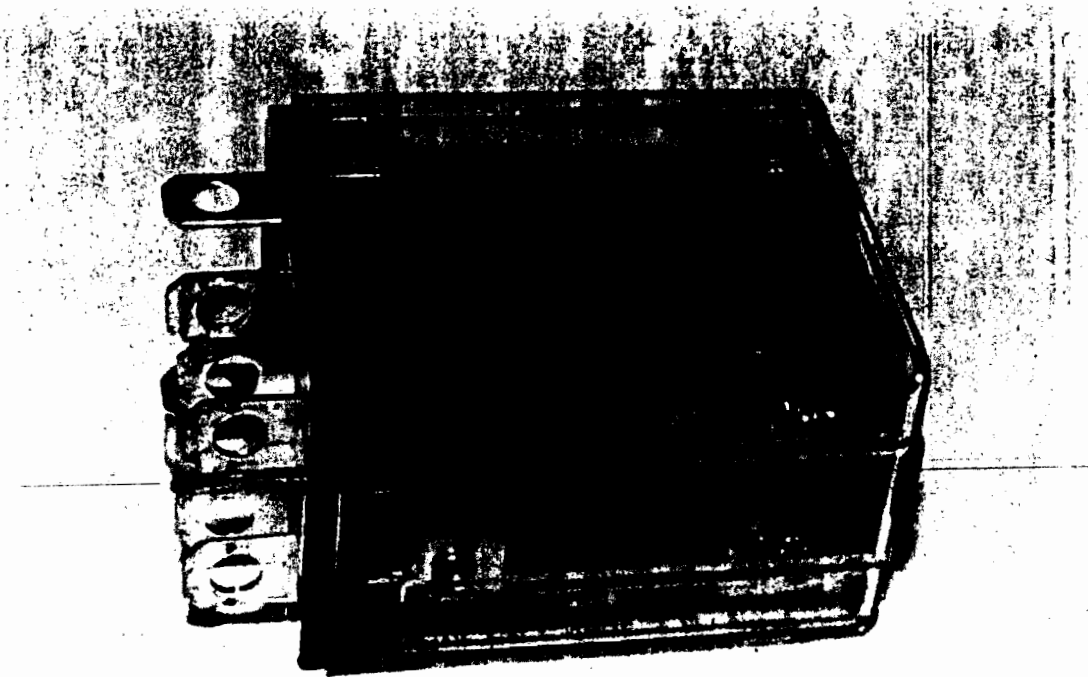
Annex A - Block Diagram of Furnace Controls



- (1)*. Power from Blue phase of 3 phase supply is fed through 25A contactor to MCB6 if certain conditions from alarm annunciator are met. ([redacted] etc)
- (2)* .If mcb6 contact is made (no overload) then power is fed to the furnace via RL13 (PDU) contacts 5,9 .
- (3)*.Control signal from Eurotherm 818 to RL13 is enabled via RL1 in auto/manual unit (signal from [redacted] controller when guard [redacted] is correct) and RL4 in EUR 106 unit (which will be made if temperature is below the threshold level set by the Eurotherm 106 controller)
- (4)*.The input from Re4 in Eurotherm 106 unit to alarm annunciator will only cause an alarm to be generated i.e. it does not act as an interlock.

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Annex B - Photograph of relay 13



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