Heater / Thyristor Notes

version 1

All references to client and their process removed for the purposes of this publication

Eurotherm PC3000 system replacements

**********, Beijing

Our Ref	:	D_HeaterNotes / SNH,AT / V1
Version	:	1
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Contents

Version Control

Version	Date	Description
1	11/11/16	Original release

1. Introduction

1.1 Discussion Document

The details of this document will be added to the Discussion Document D*****, if another release is called for.

1.2 Purpose of this Document

Whilst reviewing the different thyristor options and prices, it became clear that it was necessary to look beyond simply offering a straight replacement to;

- provide the best price
- lower the heat generated within the control panel

It is understood that the original idea was to look into upgrading the aging thyristors currently installed in the control panels with modern devices that would be easier to maintain and connect via Ethernet to the control systems and data logging systems. There would be clear benefits to the simplified installation and inbuilt diagnostics that the Ethernet devices offer.

Several different manufacturers thyristors were reviewed, but this document does not intend to cover those details. That will be covered at a later date.
This document will show our understanding of the current heater circuit and alternate costs involved. All the thyristor manufacturers had similar pricing strategies and for the purposes of simple comparisons in this document, only the Eurotherm Schneider thyristors are shown.

The prices shown are UK list price. Attractive discounts will be available once the purchasing schedule is known.

2. Heater Types

There are many Kanthal heater types, most of which could be used at **********.

Examples include;

Kanthal A-1	FeCrAl	1400°C
Kanthal Super ER	$Mo(Si,Al)_2$	1580°C
Kanthal Super 1700	$MoSi_2$	1700°C
Kanthal Super RA	$MoSi_2$	1700°C
Kanthal Super 1800	$MoSi_2$	1800°C
Kanthal Super HT	$MoSi_2$	1830°C
Kanthal Super 1900	$MoSi_2$	1850°C

********** heaters are run at a low AC voltage (15-30; ???) and high current.

The heater voltage *must* be a fixed value and not the variable implied in the data recently provided. The value will, ultimately, need to be determined.

3. Heater Circuit

3.1 Known Details

Known facts are

Mains Voltage	220Vac
Low Voltage Supply	15-30Vac ????
Max Load Current	125A

There is a large transformer in each control panel that must be used to step down the ac supply.

What is uncertain is the low voltage supply, described as 15-30Vac. It is not understood quite what this means.
A FIXED value is expected (e.g. 20Vac). If this is the case, the voltage will need to be determined.

If it truly is a sliding or changing value, a description of how this occurs and why will be required. The thyristor support personnel at Eurotherm, Siemens and AE Technology could not understand why the low voltage would be variable.

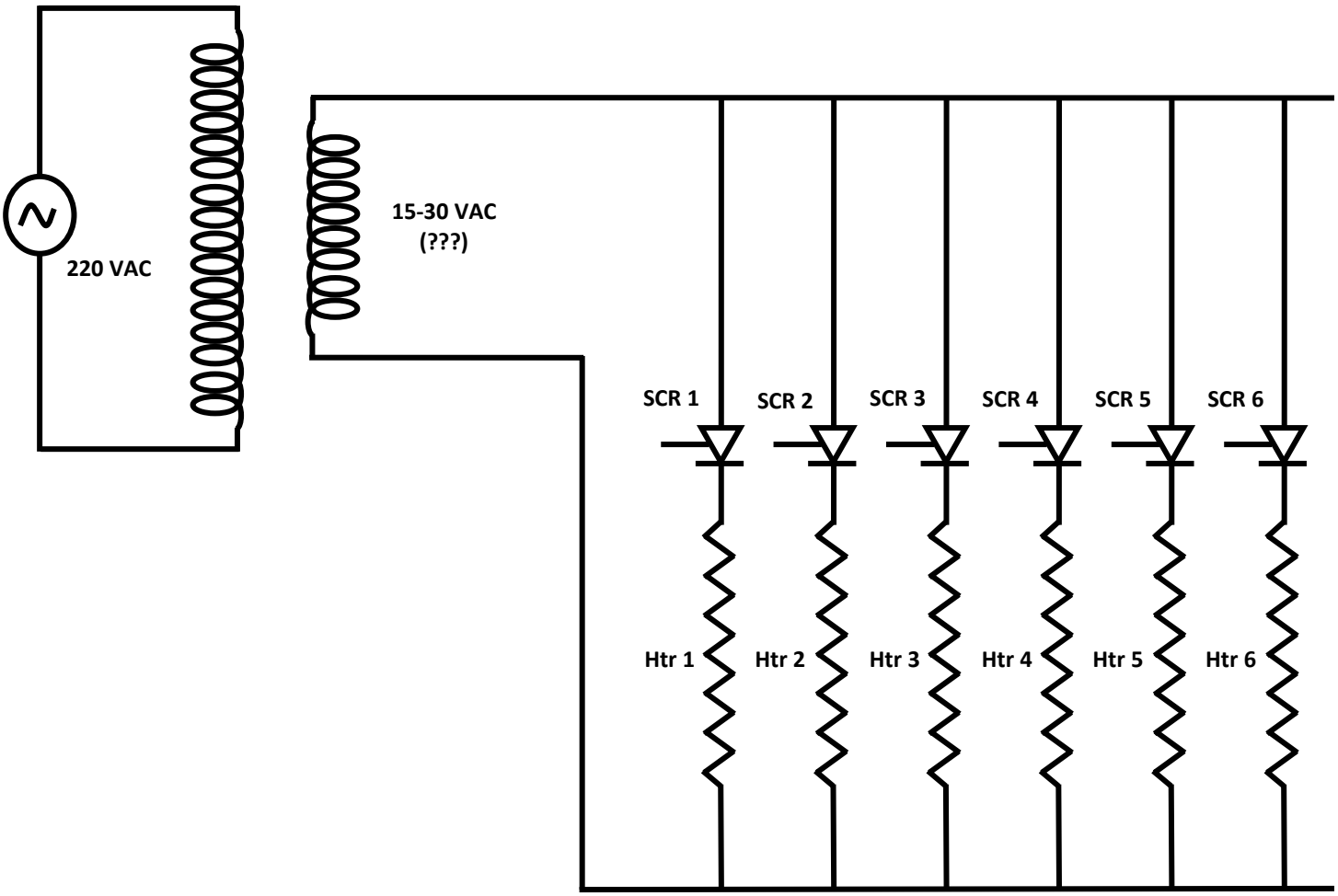
3.2 Calculated Power

Maximum power depending on what the actual low voltage is;

If the voltage is;	and max current is;	then power is;
15Vac	125A	1875 W
20Vac	125A	2500 W
30Vac	125A	3750 W

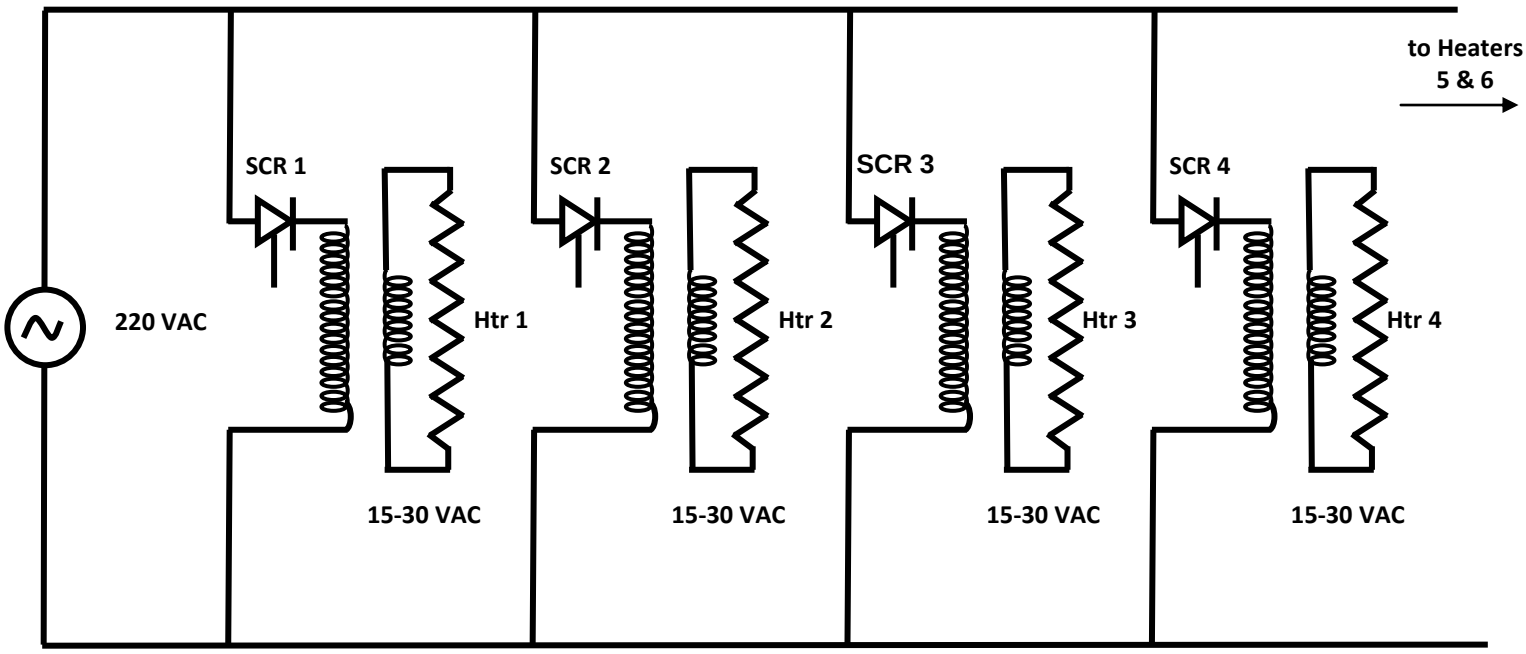
This power is what is required to energise the heaters.

3.3 Assumed Circuit



EPACK Thyristor	Unit Price	6 Thyristors
125A	£ 724.00	£ 4344.00

3.4 Alternate Circuit



Using the previous power calculations (section 3.2), we can calculate the thyristor rating with the new transformer layout

If the power is;	and mains voltage is;	then Max current is;	therefore SCR Rating is;
1875 W	220 V	8.5 A	16 A
2500 W	220 V	11.4 A	16 A
3750 W	220 V	17.0 A	32 A

The new circuit would therefore require significantly smaller thyristors, which will be cheaper.

EPACK Thyristor	Unit Price	6 Thyristors
16A	£ 352.00	£ 2112.00
32A	£ 439.00	£ 2637.00

3.5 Heat Dissipation

The thyristors give off a certain amount of heat, depending on the load current. The larger the load current, the larger the heat sink mounted on the side of the thyristor unit.

As a general rule of thumb for this type of device, there are approx. 1.7W of energy (heat) per Amp of load current.

Therefore,

if Max current is;	then energy dissipated could be up to;	total dissipation per enclosure;		
		6 heater	7 heater	9 heater
125 A	212.5 W per thyristor	**1275.0 W**	**1487.5 W**	**1912.5 W**
8.5 A	14.5 W per thyristor	87.0 W	101.2 W	130.5 W
11.4 A	19.4 W per thyristor	116.4 W	135.8 W	174.6 W
17.0 A	28.9 W per thyristor	173.4 W	202.3 W	260.1 W

3.6 Conclusions

If we can determine the actual low voltage value then either 16A or 32A thyristors could be used instead of the 125A thyristors, thus **reducing the overall cost** by a significant amount.

In addition, there would be a significant **reduction in the heat** given off by the thyristors and this should help reduce the temperature within the control enclosures. A reduction in enclosure temperature should lengthen the lifespan of the devices inside.

Note; This does require fundamental rewiring of the existing enclosure and the installation of smaller transformers, but should provide overall cost and heat savings.