



<b>Technical Report:</b>	TES/R/10-30
<b>Company:</b>	Wuhu Jiahong New Material Company
<b>Tester:</b>	Joe Preston (Technical Services Engineer)

**1. INTRODUCTION**

The purpose of this preliminary report is to identify and evaluate trace heating cable sets received by Heat Trace Limited. The trace heating cables have been (as far as we know) manufactured by Wuhu Jiahong New Material Company based in China; the four types of trace heater received were labeled by them with Heat Trace’s product references FSM, FSLe, FSR and FSP as illustrated in figure 1. Many of Heat Trace’s customers have been approached by this Chinese company, who have provided them with samples and quotations for the supply of ‘Heat Trace’ cables.



*Fig. 1*

A number of preliminary tests have been carried out in order to identify the effectiveness and safety of the products as well as their relationship to the Heat Trace Limited heaters marketed as Freezstop Micro, Freezstop Lite, Freezstop Regular and Freezstop Plus.

The majority of the tests carried out are derived from the latest trace heating industry standards as well as current scientific analytical techniques.

This is a preliminary in-house report. A further independent report will follow.

**2. PHYSICAL ASSESSMENT**

The trace heaters come in a number of colours relative to the product type; the FSM heater consists of a green primary insulation, the FSR a blue primary insulation. Please refer to the pictures and information below:

2.1 - 'FSM'



	Wuhu Jiahong	HTL
Braid	7 x 0.13mm coated copper	6 x 0.203mm coated copper
Bus wires	7 x 0.33mm coated copper	7 x 0.32mm coated copper
Overall width	8.56mm	10.50mm
Overall height	6.03mm	5.90mm

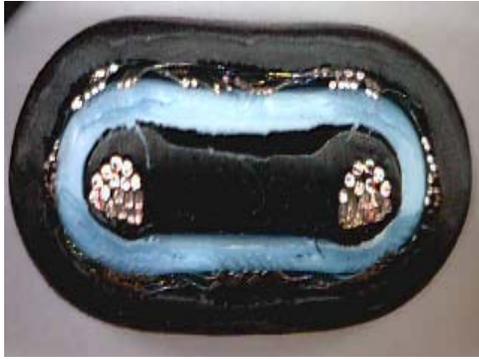
2.2 - 'FSLe'



	Wuhu Jiahong	HTL
Braid	7 x 0.13mm coated copper	6 x 0.203mm coated copper
Bus wires	19 x 0.29mm coated copper	7 x 0.45mm coated copper
Overall width	10.85mm	10.50mm
Overall height	6.28mm	5.90mm

2.3 - 'FSR'

	Wuhu Jiahong	HTL
Braid	7 x 0.13mm coated copper	6 x 0.203mm coated copper
Bus wires	19 x 0.29mm coated copper	7 x 0.45mm coated copper
Overall width	12.50mm	12.95mm
Overall height	6.28mm	5.95mm



2.4 – ‘FSP’



	Wuhu Jiahong	HTL
Braid	7 x 0.13mm coated copper	7 x 0.203mm coated copper
Bus wires	7 x 0.65mm coated copper	7 x 0.574mm coated copper
Overall width	14.69mm	14.10mm
Overall height	5.95mm	5.30mm

All four products consist of the same braid material and dimensions; the braid strands are of a smaller gauge to that of Heat Trace’ Freezstop range.

The main issue surrounding the smaller gauge braid wire is that the braid strands are weak and break when the outer sheath is removed; this can cause problems not only when the sheath is subjected to an impact but also when the braid is required for earthing.

With reference to the above photographs; it can be observed that the insulation extrusion process does not use any form of vacuum to encapsulate the core with the molten insulation material. It is evident in the air voids between the web of the core and the primary insulation; this air void debilitates the heaters output efficiency due to the additional insulative layer (air).

### 3. POWER OUTPUT VERIFICATION

The power output verification of the Wuhu Jiahong manufactured products has been carried out in accordance with IEC 60079-30-1:2007 clause 5.1.10 option (b).

‘FSM’ heater	= 19.41 W/m
‘FSLe’ heater	= 24.34 W/m
‘FSR’ heater	= 26.59 W/m
‘FSP’ heater	= 52.90 W/m

It must be noted that the ‘FSP’ product had a considerable start-up current and therefore the test was carried out again to determine any changes in its characteristics.

The 'FSP' resistance after being energized once had increased by 17% from its original value.

#### 4. THERMAL CYCLING

The four trace heating samples were placed in a temperature controlled chamber and thermally cycled whilst energized at 230Vac. This preliminary test was performed **over just 32 cycles**. Official Heat Trace product manufactured and tested in Cheshire, United Kingdom, has successfully undergone the thermal ageing test in accordance with IEEE 515:2004 clause 4.1.6.2 **for 1500 cycles**. The product is deemed in accordance with the standard if the heating device maintains its power output of plus 20% or minus 25% of its original output. The preliminary Heat Trace test reflects only 3% of the IEEE 515 requirement, but resulted in the following power output reductions:-

'FSM' heater	= 43% power reduction
'FSLe' heater	= 34% power reduction
'FSR' heater	= 15% power reduction
'FSP' heater	= 20% power reduction*

\* It should be noted that the 'FSP' product according to <http://www.ahjiahong.com/en> website is rated up to temperatures of 110°C. The thermal cycling test was carried out to a maximum temperature of 85°C for 32 cycles; it can be assumed that when tested at 110°C limiting temperature, the power output reduction is likely to be substantially more.

#### 5. DSC THERMAL ANALYSIS

Comparative thermal analysis traces were carried out on both Wuhu Jiahong samples and Heat Trace samples.

Descriptions:

Peak Melt Temperature = the point where all sample material is molten. (Completely melted)

Onset Temperature = the point where the crystalline structure begins to break down. (Polymer begins to melt)

FSM Product

	WJ Product
Peak Melt (°C)	108.1
Onset (°C)	91.3

	HTL Product
Peak Melt (°C)	126.2
Onset (°C)	113.1

FSLe Product

	WJ Product
Peak Melt (°C)	106.6
Onset (°C)	85.6

	HTL Product
Peak Melt (°C)	124.1
Onset (°C)	112.6

FSR Product

	WJ Product
Peak Melt (°C)	110.6
Onset (°C)	92

	HTL Product
Peak Melt (°C)	127.1
Onset (°C)	115.8

FSP Product

	WJ Product
Peak Melt (°C)	124.1
Onset (°C)	108.3

	HTL Product
Peak Melt (°C)	159.8
Onset (°C)	142.1

As mentioned in paragraph four; according to the website <http://www.ahjiahong.com/en>; the Wuhu Jiahong products illustrated as FSR and FSP are stated to have maximum exposure temperatures of 85°C and 110°C respectively.

According to the DSC traces this is not possible; the reason for this is that the molecular structure alters the closer the material's temperature is to its melt temperature; as a result of this the resistance of the thermal matrix increases.

The results illustrate that the onset temperatures of the materials used within the heaters are either within close proximity of the maximum rated exposure temperature (for the FSR) or are less than the maximum rated exposure temperature (for the FSP).

It can be concluded that the materials used in the manufacture of the Wuhu Jiahong products are that of a substantially lower temperature grade than the materials used by Heat Trace Limited.

## 6. IR SPECTROSCOPY

IR Spectroscopy is a widely used analytical technique used to compare material types; although it may not always be effective to determine a material type it is very useful in determining like or unlike materials.

The IR traces further indicate that the materials used for the manufacture of the Wuhu Jiahong products are not the same as the materials used in the Heat Trace Freezstop range and therefore do not share the same thermal and electrical properties.

The IR traces further indicate the unsuitability of the materials used by Wuhu Jiahong as well as dispute the claims of temperature withstand declared by the company.

## 7. CONCLUSION

This preliminary report is conclusive in demonstrating that the samples of self-regulating heating cables provided by Wuhu Jiahong, whilst being intended to be Heat Trace product 'clones' bear little resemblance to the genuine Heat Trace products, either in materials or performance.

The heating matrices, in each of the four types provided have a significantly lower temperature withstand than the genuine product, and are unsuitable for the claimed temperatures of 85 and 110 deg. C respectively.

Just a few thermal cycles have resulted in a substantial loss of power, and demonstrate that the products will have limited life.

More seriously, it will be appreciated that, anyone operating these 'cloned' products at the limiting temperatures of the genuine Heat Trace products will have the heating matrix at its onset melt temperature which may pose a safety risk.

Signed:



(Joe Preston – Technical Services Engineer)

Date: 03/06/2010

For and on behalf of Heat Trace Ltd

