TECHNICAL REPORT

TITLE

HOLLOW V'S TROUGH/FLAT ELEMENTS

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AUTHOR

DR. GERARD McGRANAGHAN

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CERAMICX CENTRE FOR INFRARED INNOVATION

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Introduction

This report explains the differences between standard flat or trough elements and the newer hollow element. It describes the construction of both elements, and discusses the advantages and disadvantages of both.

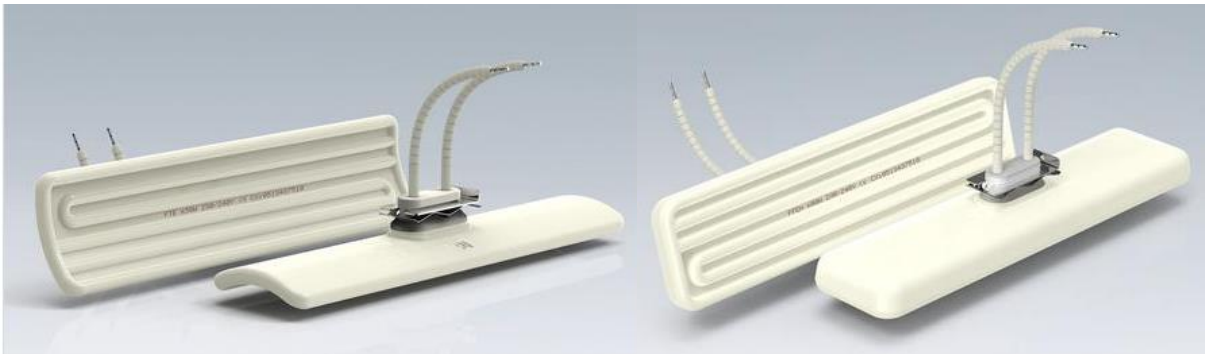

Figure 1: Trough type elements and Hollow type elements

The trough element are cast as a continuous piece of ceramic. The heating coil is placed in a bead to transfer the infrared energy to the front of the element. However a percentage of the infrared energy does conduct through the ceramic to the rear of the element and thus is transferred from the back surface.

The hollow element has an additional layer of insulation material sandwiched between the heating coil and the rear wall of the element. Thanks to this insulation, the path for the heat to reach the rear is more difficult and thus a greater proportion of the coil heat is now radiated from the front of the element.

How much better are hollows compared to standard elements?

In tests carried out by Ceramicx on the "Herschel" robotised test unit, the hollow elements outperform their traditional solid body trough and flat types elements by almost 6% [1]. Figure 2 shows that a 600W hollow has a higher forward projection of infrared than a 650W trough element. These tests are carried out on identical test set ups, with aluminised steel

[1] In reality this percentage could be much higher as this figure is not a true efficiency due to the test only measureing a defined area. Nevertheless it is a very accurate comparator.

reflectors, regulated power supply and a top quality Medtherm Corporation heat flux gauge guided by an ABB robot.

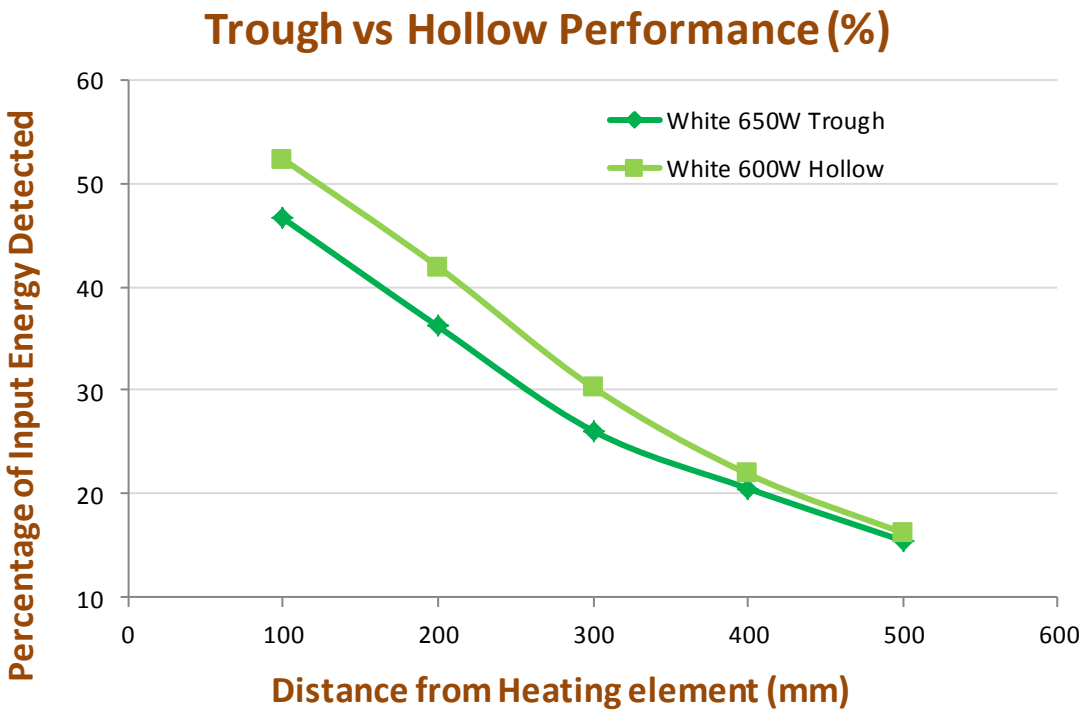

Figure 2: Infrared energy as a percentage of input power for Ceramicx FTE 650W vs. FFEH 600W

In terms of power output, the Herschel detected 314W watts form the 600W hollow compared to 302W from the 650W trough, a very credible demonstration of the higher energy efficiency and projection of the hollow element. This is clearly seen in Figure 3 below where more infrared energy is emitted with less input power.

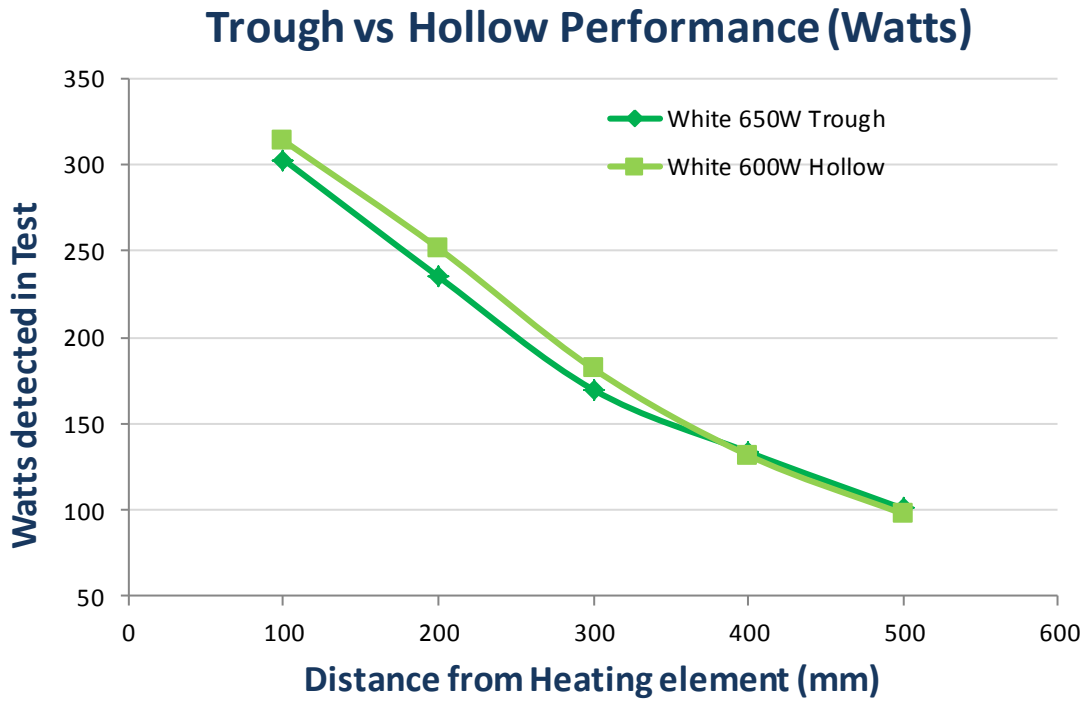

Figure 3: Infrared power detected by Herschel test for 600W hollow and 650W trough elements.

Variations

The previous tests were performed on white glazed ceramic elements. When a black glaze is used instead of a white glaze on the hollow, the amount of infrared emission increases further as seen in Figure 4. Likewise, not all hollows from different manufacturers are equal. The hollow element is tricky to make and a great deal of know how goes into its successful manufacture. As a comparison, we conducted a test on a US competitor manufactured hollow and the performance was significantly lower than Ceramicx examples. This is also seen in the pink line in Figure 4 where the performance of the competitor hollow is significantly lower than the Ceramicx hollow.

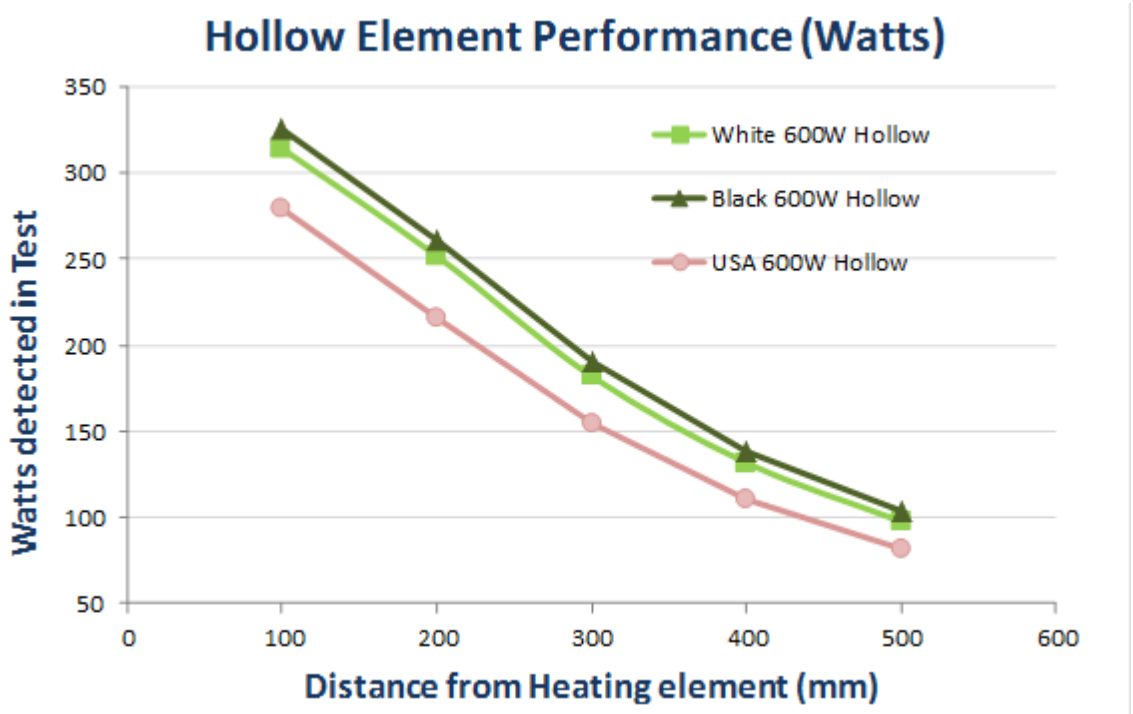

Figure 4: Infrared power measurements for black, white, and US manufactured hollows.

Conclusion

In a comparison of the trough element to a hollow element, the hollow displays superior performance despite using 50W less energy. This is due to the extra insulation which reduces the amount of heat lost from the rear of the element. Assuming a totally radiative requirement at a lifetime of up to 20,000 hours, and an energy rate of $0.10 per kWhour, switching to the FFEH over the FTE could save up to €$100 per element replaced.

Contact Ceramicx or Weco International for more information.

Ceramicx Ltd.
Gortnagrough, Ballydehob, Co. Cork, Ireland.
Tel: +353 28 37510
Fax: +353 28 37509
www.ceramicx.com

WECO International
901 Tacoma Ct, Clio, MI 48420, USA
Phone: 810-686-7221
Fax: 810-686-7564
www.wecointernational.com