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# TEST REPORT

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## Underfloor Comparative Heating Test between LaminaHeat and Resistive Wire Mat

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### 1) SCOPE

To compare the thermal performance of LaminaHeat ComfortFilm and Resistive Wire heating mat.

### 2) TEST SET UP

#### 2.1) Test Jig

- Wooden floor structure with ceramic tile surface covering bonded with tile adhesive
- A. One half heated with Resistive Wire heater mat which is commercially available at DIY outlets for underfloor heating
- B. The other half heated with **LaminaHeat** full surface heating technology.
- Temperature sensors thermocouple 'Type K' were positioned on the floor surface to measure temperature.
- *PICO* temperature data logger recorded the data and was connected to a laptop computer for data analysis.
- Heat control from Heatmiser® floor thermostats completed with **LaminaHeat** low profile thermistor sensors.

#### 2.2) Installation of the heaters in the floor

Both, the resistive wire mat and the **ComfortFilm** heater were taped in position on the wooden floor. Tile adhesive was applied to the heaters so that they were covered with adhesive such that the ceramic tiles could be bonded in place.

- The ceramic tiles were then positioned on the adhesive; the adhesive was allowed to cure for 24 hours.
- For the **ComfortFilm** heater, power cables were attached to the film with T4 connectors and then connected to the 48 Volt transformer output.
- For the resistive heater mat, the heater cable was connected to the 230 Volt main power supply.

#### 2.3) Heater details

A. ZONE 1. Product Reference: **LaminaHeat ComfortFilm** PP-PETV-P-4060-720-C1000

- Heaters size: 670 x 1000mm
- Heater Resistance: 14  $\Omega$
- Voltage: 48 VAC
- Power density: 245 W/m<sup>2</sup>

B. ZONE 2. Resistive wire material reference: MMH-135-1

- Heated Area: 500 x1000mm
- Heater Resistance: 220  $\Omega$
- Voltage: 230 VAC
- Power Density = 480 W/m<sup>2</sup>

## 2.1) Heater Control

- The surface temperature of the floor was controlled by the Heatmiser® thermostat with **LaminaHeat** thermistor sensors taped on the floor surface to monitor temperature
- The floor temperature was set for one test condition at 30 °C
- Two floor control sensors were used, one for each heater system zone.

## 2.2) Temperature measurement

- Two thermocouples were used to measure temperature of the floor surface, one in each zone. Thermocouples type K were used and these were identified as follows

- Kanal 1: Thermocouple 1,

Located on tile floor surface in Zone 1-  
**LaminaHeat**

- Kanal 2: Thermocouple 2,

Located on tile floor surface in Zone 2-  
Resistive Wire mat

## 3) TEST PROCEDURE

3.1. A pre-heating test was carried out on the floor without any covering objects to check the heated floor system was working correctly. A thermal image was taken (see FIG 2).

3.2 The time temperature curves were recorded via the PICO data logger and displayed in real time on the laptop computer via USB connection (find them reported below).

3.3 The Thermostats for each heating zone were then turned on and power was applied. The thermostats were set at 30 °C and the floor surface temperatures were recorded.

3.4 The heating was kept on for 24 hrs and all temperature measurements remained stable below.

## 4) TEST RESULTS

FIG. 3 shows the temperature profile for the measured points on the floor surface.

**4.1** The power density input from the **ComfortFilm** was chosen to approximately match the temperature profile of the resistive wire mat.

**4.2** The heat output used to achieved the floor temperature of 28.5 °C was 245 W/m<sup>2</sup> for the **LaminaHeat ComfortFilm** full surface heating.

The floor temperature remained constant at 28.5 °C for the full 24 hours duration of the test.

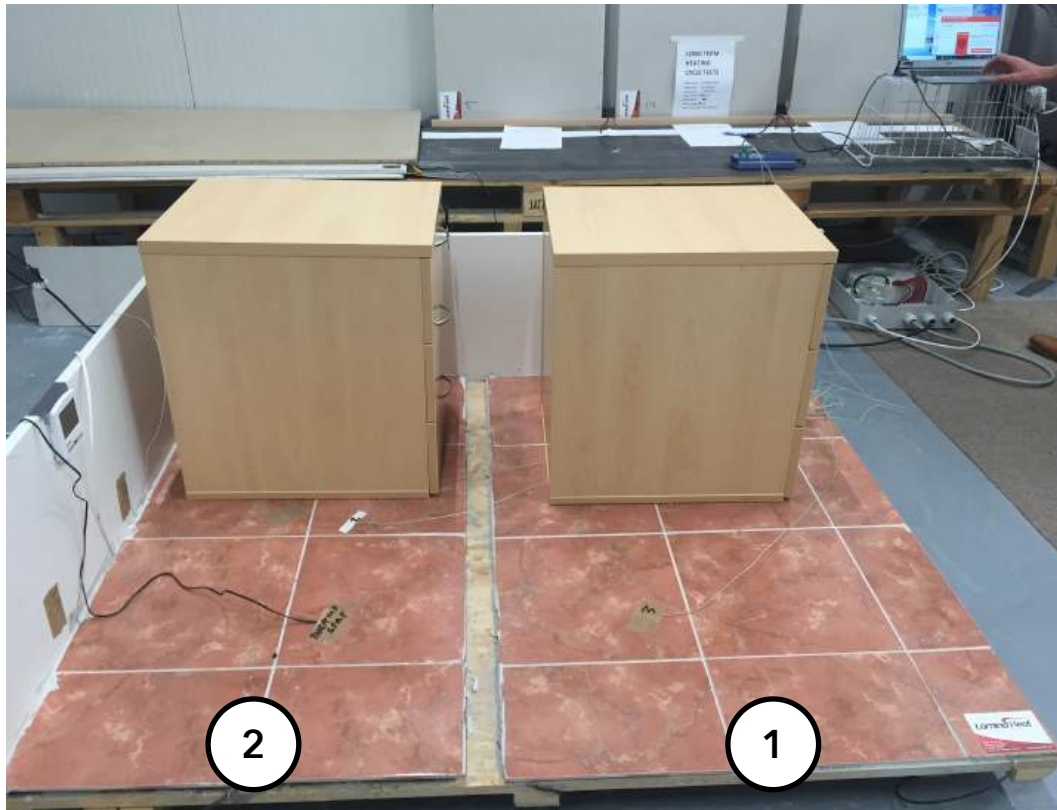
**4.3** In comparison the resistive wire mat was 500 W/m<sup>2</sup> to achieve the same average of 28.5 °C. The surface temperature was not constant but fluctuated between 27 and 30 °C for the full duration of the test.

**4.4** Comparing both heating systems confirms the LaminaHeat system is much more efficient; the thermostat was controlling typically **17 minutes ON / 17 minutes OFF** for the Resistive Wire heater mat ie. 50% utilisation of power (see FIG. 5). For the LaminaHeat system it was typically **1 min ON / 3 minutes OFF** ie. 25% utilisation of power (see FIG. 4)

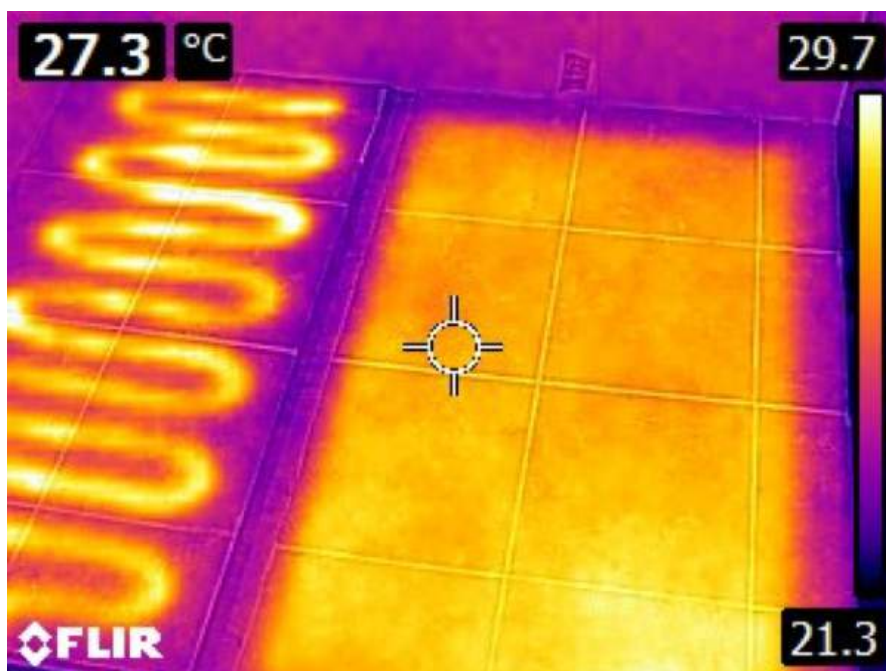
This confirms the superior efficiency of the **LaminaHeat** full surface heating. The small heating surface of the electric cable heater requires more power to conduct heat, and, subsequently radiate heat from the surface area of the floor.

**4.5** The thermal image of the floor in FIG. 2 shows that the **LaminaHeat** system gives a uniform heating over the floor; the Resistive Wire mat only heats where the wires are positioned, and results in hot and cold areas.

## PHOTO APPENDIX



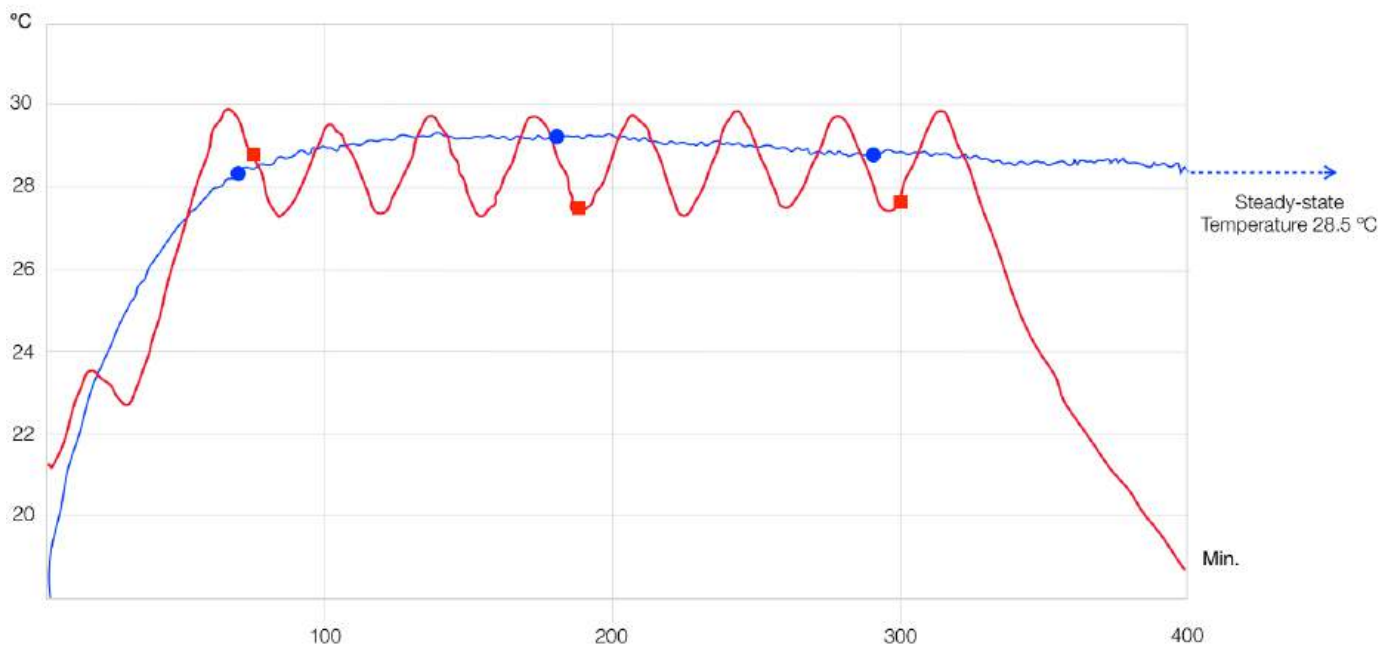
**FIG. 1** Test floor heating systems layout with ceramic tile covering. On the left side Zone 2 Resistive wire mat, on the right side Zone 1 LaminaHeat ComfortFilm.



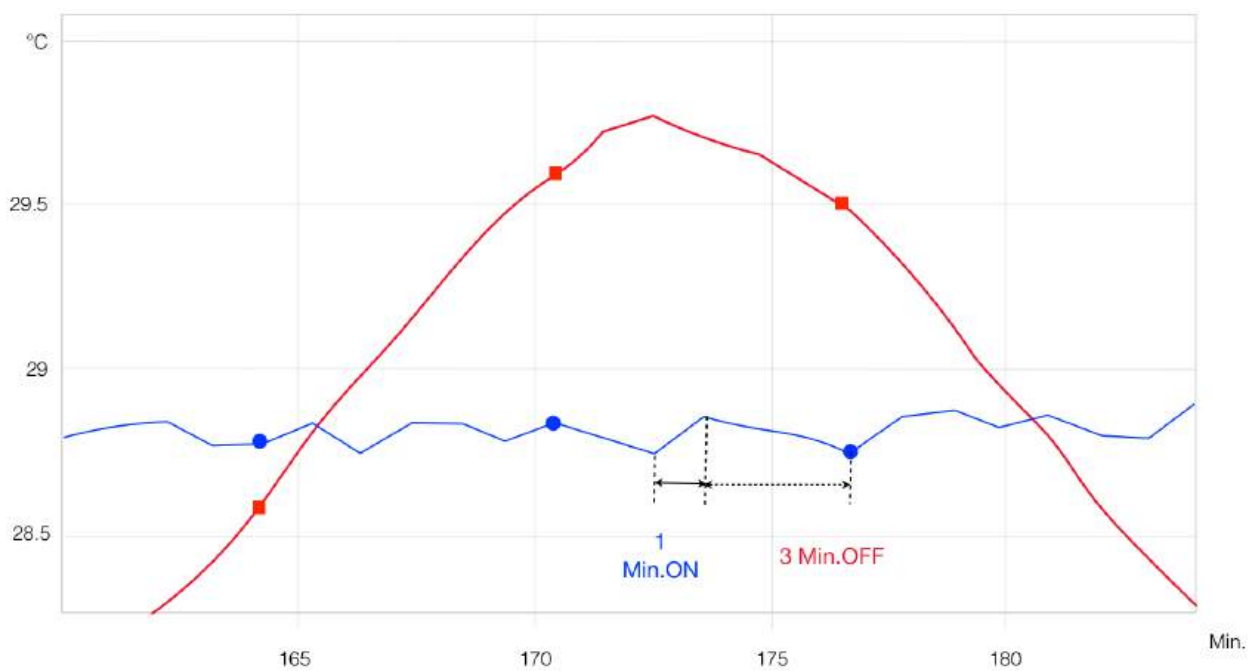
**FIG. 2** Thermal image of comparative heating system on the floor.

## TIME/TEMPERATURE CURVES

- KANAL1: Thermocouple 1, located on tile floor surface in Zone 1-**LaminaHeat ComfortFilm**
- KANAL 2: Thermocouple 2, located on tile floor surface in Zone 2-Resistive Wire mat



**FIG. 3** Time/Temperature curves (temperature profile for the measured points on the floor surface)



**FIG. 4** Power usage during heating LaminaHeat system

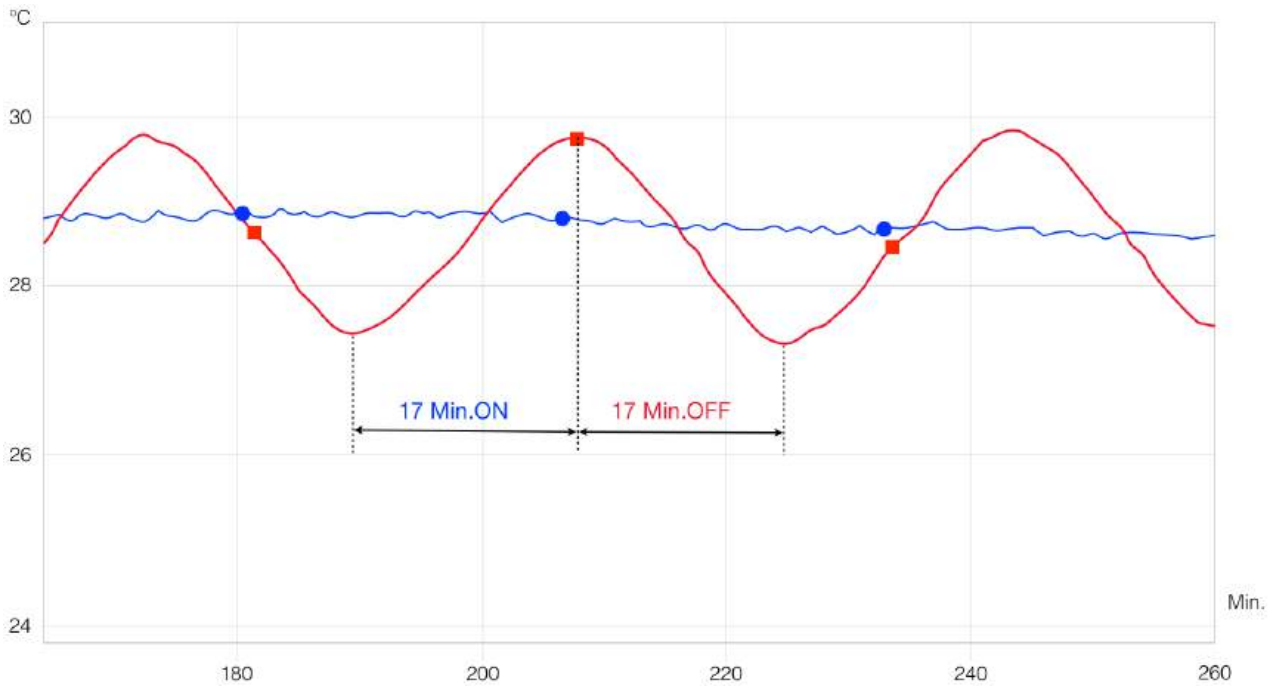


FIG. 5 Power usage during heating Resistive Wire mat