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# Test Report

UKAS TESTING
0002

**Series of U-value measurements of a PIR insulated roof section to evaluate the thermal performance of Gapotape.**



FOR

Gapogroup Ltd
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For the attention of Edward Ward

IDENTIFICATION

NPL quotation number 2014020306 dated 19th March 2014. NPL specimen number R162 was assigned to the roof section incorporating the Gapogroup Ltd, Gaptape GT10/100 product.

BASIS OF TEST

The NPL Rotatable Wall Guarded Hot Box whose calibration is traceable to National Standards and using the measurement procedures defined in the standard BS EN ISO 8990.

UNCERTAINTY

The overall measurement uncertainty is estimated to be within ± 5.5 % based on a standard uncertainty multiplied by a coverage factor $k = 2$ providing a level of confidence of approximately 95 %.

**Reference:** PP31/2014020306/1



**Date of issue:** 18 November 2014 **Signed:** (Authorised Signatory)

**Checked by:** **Name:** Ray Williams for Managing Director

## 1 DESCRIPTION OF THE SPECIMEN

**Table 1: Test element details**

| **NPL Identity Number**<br>**Service Number** | **R162**<br>**PP31/2014020306/1** |
|---|---|
| Basic roof structure | A cross section drawing of the basic roof structure is shown in Figure 1 and a front elevation drawing in Figure 2. The 150 mm deep x 50 mm thick rafters were on 400 mm centres. Half width rafters are used at the sides to produce the correct ratio of rafter to roof areas. Tyvek Supro roof tile underlay was fixed beneath the Rozadais natural roofing slates. The insulation was 100 mm thick Kingspan Thermapitch PIR rigid foam board. |
| Gapotape GT10/100 product | This product comprises a latex foam sheet covered with a FSD7140 Aluminium / Tri-way scrim / adhesive tape. It is designed to firmly fixed around the perimeter of the rigid PIR boards to ensure a good air seal between the Gapotape and the rafters. The method of installation is shown in Figure 3. |
| R162A | This test element comprised the basic roof structure with the plasterboard. The rigid PIR board was installed between the rafters in a manner approved by BBA. The Gapotape product was NOT installed around the primeter of the PIR insulation. |
| R162B | This test element comprised the basic roof structure but with the plasterboard removed. The rigid PIR board was installed between the rafters in a manner approved by BBA. The Gapotape product was NOT installed around the primeter of the PIR insulation. |
| R162C | This test element comprised the basic roof structure with the plasterboard as shown in Figure 1. The rigid PIR board was installed between the rafters in a manner approved by BBA but with the Gapotape product fixed to the edges of the perimeter of the PIR boards. |
| R162D | This test element comprised the basic roof structure but with the plasterboard removed. The rigid PIR board was installed between the rafters in a manner approved by BBA but with the Gapotape product fixed to the edges of the perimeter of the PIR boards. |
| Dimensions of test element | 1.488 m high x 1.211 m wide by approximately 210 mm thick |



**Checked by:** CTB

## 2 THE APPARATUS

Thermal transmittance measurements are made in the NPL Rotatable wall Guarded Hot Box, described in NPL Report CBTLM 25. Where relevant, the equipment and measurement procedures are in accordance with the requirements of BS EN ISO 8990. The main features of the equipment are

- The interior dimensions of the hot box are 2.4 m x 2.4 m.
- All surfaces "seen" by the test element are matt black.
- There are twenty five air temperature sensors, 75 mm from the holder panel face, positioned at the centres of squares of equal areas in front of the test element in both the hot and cold boxes.
- The net heat flow direction is horizontal

## 3 MEASUREMENT PROCEDURES

The measurement procedure used was essentially an air-to-air method. Thermocouples were also mounted on the hot and cold surfaces of the specimen to facilitate calculation of the environmental temperatures, as specified in BS EN ISO 8990

The test element was mounted in an expanded polystyrene surround panel. The heat flow through this surround panel was calculated from its thermal conductivity and the surface temperature difference across it. The thermal conductivity of the EPS material was measured in the NPL guarded hot plate

The measurements were carried out with the test element installed vertically - that is with horizontal heat flow.

The 1.48 m x 1.2 m x approximately 0.21 m thick, roof structure was mounted in a 300 mm thick expanded polystyrene (EPS) surround panel. In order to ensure air from the cold chamber could circulate through the roof cavity just underneath the roofing membrane and over the surface of the insulation, the test element was mounted proud of the cold face of the surround panel, leaving a 10 mm slot all along the bottom and top edges through which air could pass.

This evaluation comprised four separate measurements as specified in Table 1.

Thermal transmittance values quoted are the mean of five sets of readings taken at two-hourly intervals. Equilibrium is assumed when the maximum difference between the five thermal transmittance values is less than approximately 1.0%.

## 4 RESULTS

The four sets of measurements were taken on the following days:

| | |
|---|---|
| R162A | 28-Sep-14 |
| R162B | 02-Oct-14 |
| R162C | 10-Oct-14 |
| R162D | 14-Oct-14 |

The measured thermal transmittance values for R162A, R162B, R162C & R162D are given in Table 2 and a summary of the main experimental parameters for each test given in Tables 3, 4, 5 and 6.

**Table 2: Standardised Thermal Transmittance (U)**

| NPL Number<br>Customer Identity | Specimen description | Environmental Temperature Mean<br>°C | As measured Thermal Transmittance<br>W/(m²·K) |
|---|---|---|---|
| R162A | Roof + Plasterboard & No Gapotape | 11.88 | 0.65 |
| R162B[1] | Roof & NO Plasterboard & No Gapotape | 12.06 | 1.51 |
| R162C | Roof + Plasterboard + Gapotape | 11.98 | 0.31 |
| R162D[1] | Roof & NO Plasterboard + Gapotape | 11.97 | 0.31 |

Note [1] The low emissivity surface of the insulation product is exposed as the main component of the warm exterior surface for these test elements. This will have the effect of lowering the U-value (by producing a slightly higher surface resistance value).

**Table 3: Measurement data for test element R162A**

| **R162A** | | |
|---|---|---|
| Insulated roof section - with plasterboard but no Gapotape | | |
| **Panel dimensions** | | |
| Height | 1.488 | m |
| Width | 1.211 | m |
| Thickness | 0.210 | m |
| **Measured values** | | |
| Mean warm air temperature | 22.13 | °C |
| Mean warm baffle temperature | 21.66 | °C |
| Mean cold air temperature | 1.89 | °C |
| Mean cold baffle temperature | 1.94 | °C |
| Power to hot box | 32.923 | W |
| Air flow rate in the cold box | 4.45 | m/s |
| Air flow rate in the hot box | 0.10 | m/s |
| **Calculated values** | | |
| Heat flux density through test element | 12.891 | $W/m^2$ |
| Warm side environmental temperature | 21.86 | °C |
| Cold side environmental temperature | 1.89 | °C |
| Environmental temperature difference | 19.98 | °C |
| Environmental temperature mean | 11.88 | °C |
| **Measured thermal transmittance (U)** | **0.645** | **$W/(m^2 \cdot K)$** |
| Total surface resistance | 0.116 | $(m^2 \cdot K)/W$ |



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**Table 4: Measurement data for test element R162B**

| **R162B** Insulated roof section - No plasterboard and no Gapotape | | |
|---|---|---|
| **Panel dimensions** | | |
| Height | 1.488 | m |
| Width | 1.211 | m |
| Thickness | 0.210 | m |
| **Measured values** | | |
| Mean warm air temperature | 22.27 | °C |
| Mean warm baffle temperature | 21.77 | °C |
| Mean cold air temperature | 1.88 | °C |
| Mean cold baffle temperature | 1.93 | °C |
| Power to hot box | 66.208 | W |
| Air flow rate in the cold box | 4.35 | m/s |
| Air flow rate in the hot box | 0.08 | m/s |
| **Calculated values** | | |
| Heat flux density through test element | 30.788 | $W/m^2$ |
| Warm side environmental temperature | 22.24 | °C |
| Cold side environmental temperature | 1.88 | °C |
| Environmental temperature difference | 20.37 | °C |
| Environmental temperature mean | 12.06 | °C |
| **Measured thermal transmittance (U)** | **1.512** | **$W/(m^2 \cdot K)$** |
| Total surface resistance | 0.045 | $(m^2 \cdot K)/W$ |



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**Table 5: Measurement data for test element R162C**

| **R162C** Insulated roof section - Plasterboard and Gapotape | | |
|---|---|---|
| **Panel dimensions** | | |
| Height | 1.488 | m |
| Width | 1.211 | m |
| Thickness | 0.210 | m |
| **Measured values** | | |
| Mean warm air temperature | 22.12 | °C |
| Mean warm baffle temperature | 21.84 | °C |
| Mean cold air temperature | 1.88 | °C |
| Mean cold baffle temperature | 1.95 | °C |
| Power to hot box | 20.990 | W |
| Air flow rate in the cold box | 4.24 | m/s |
| Air flow rate in the hot box | 0.10 | m/s |
| **Calculated values** | | |
| Heat flux density through test element | 6.193 | $W/m^2$ |
| Warm side environmental temperature | 22.08 | °C |
| Cold side environmental temperature | 1.88 | °C |
| Environmental temperature difference | 20.20 | °C |
| Environmental temperature mean | 11.98 | °C |
| **Measured thermal transmittance (U)** | **0.307** | **$W/(m^2 \cdot K)$** |
| Total surface resistance | 0.119 | $(m^2 \cdot K)/W$ |



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**Table 6 Measurement data for test element R162D**

| **R162D** | | |
|---|---|---|
| Insulated roof section -No plasterboard but with Gapotape | | |
| **Panel dimensions** | | |
| Height | 1.488 | m |
| Width | 1.211 | m |
| Thickness | 0.210 | m |
| **Measured values** | | |
| Mean warm air temperature | 22.13 | °C |
| Mean warm baffle temperature | 21.92 | °C |
| Mean cold air temperature | 1.86 | °C |
| Mean cold baffle temperature | 1.93 | °C |
| Power to hot box | 21.169 | W |
| Air flow rate in the cold box | 4.26 | m/s |
| Air flow rate in the hot box | 0.08 | m/s |
| **Calculated values** | | |
| Heat flux density through test element | 6.253 | $W/m^2$ |
| Warm side environmental temperature | 22.08 | °C |
| Cold side environmental temperature | 1.86 | °C |
| Environmental temperature difference | 20.22 | °C |
| Environmental temperature mean | 11.97 | °C |
| **Measured thermal transmittance (U)** | **0.309** | **$W/(m^2 \cdot K)$** |
| Total surface resistance | 0.225 | $(m^2 \cdot K)/W$ |



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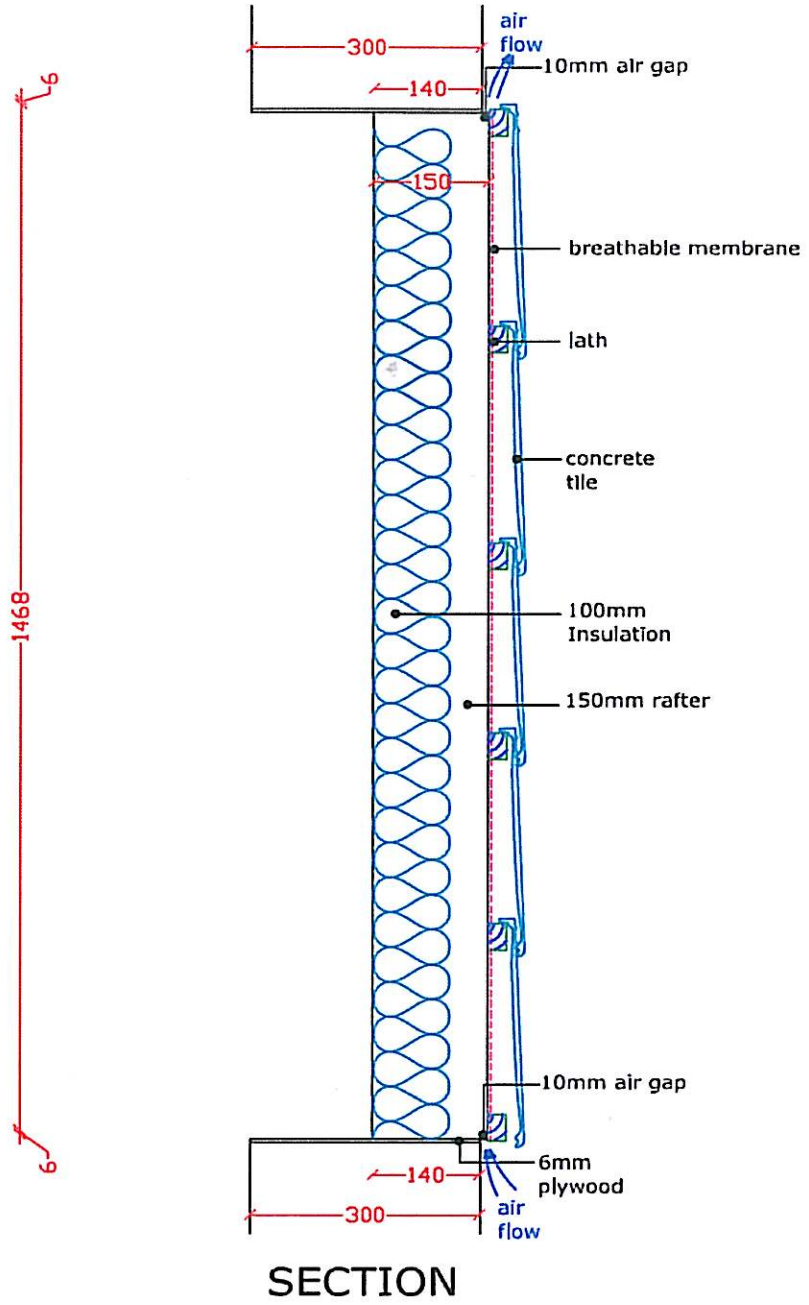
Figure 1 Cross section drawing of the basic roof structure






**Checked by:** GTB

Figure 2 Front elevation of basic roof structure

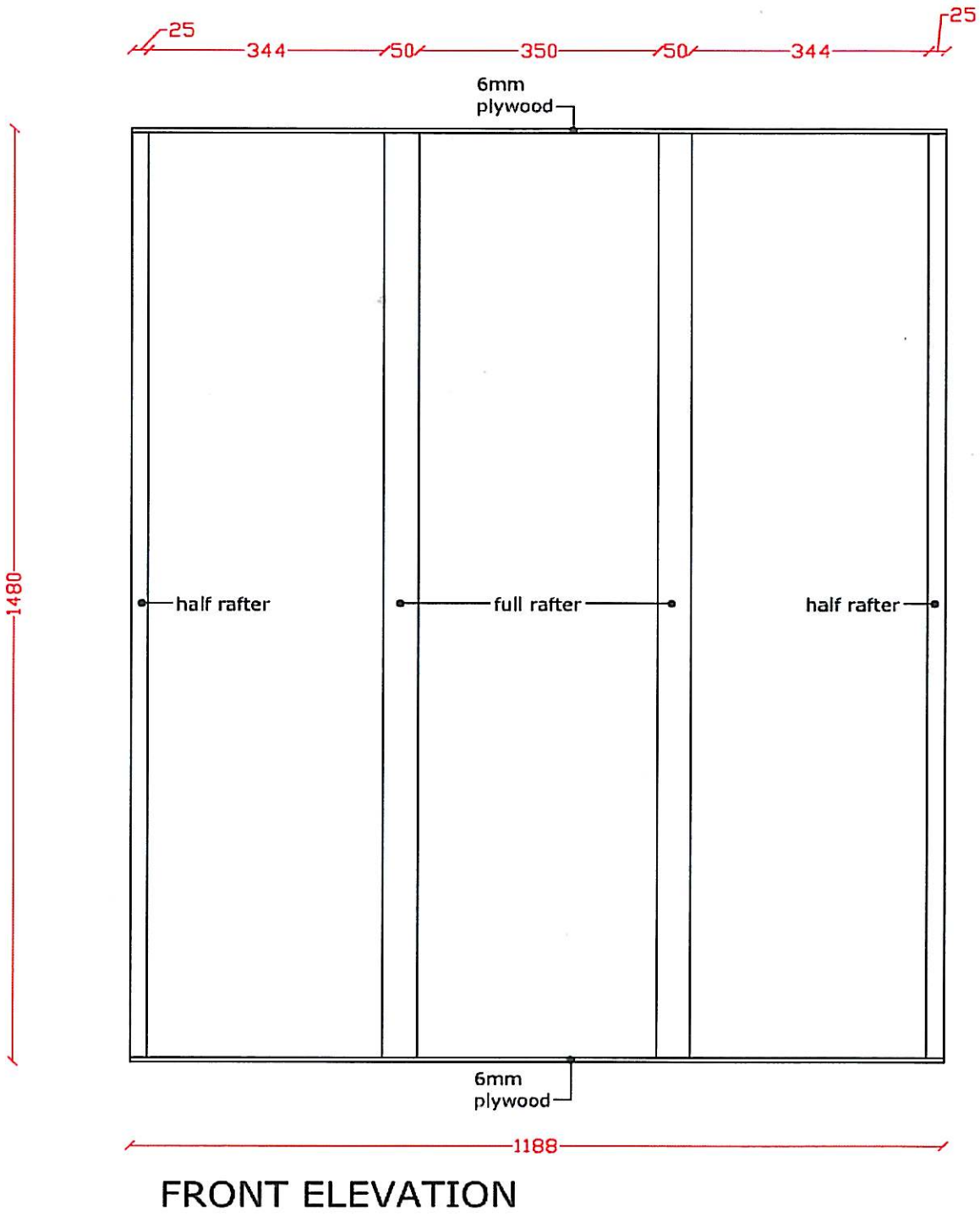





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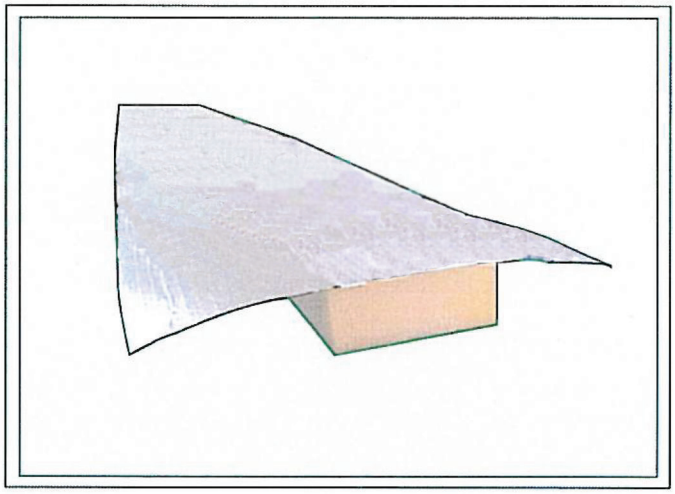
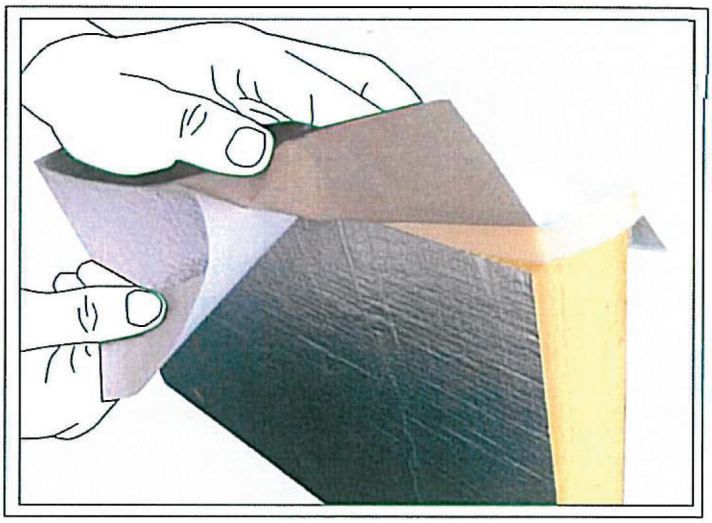
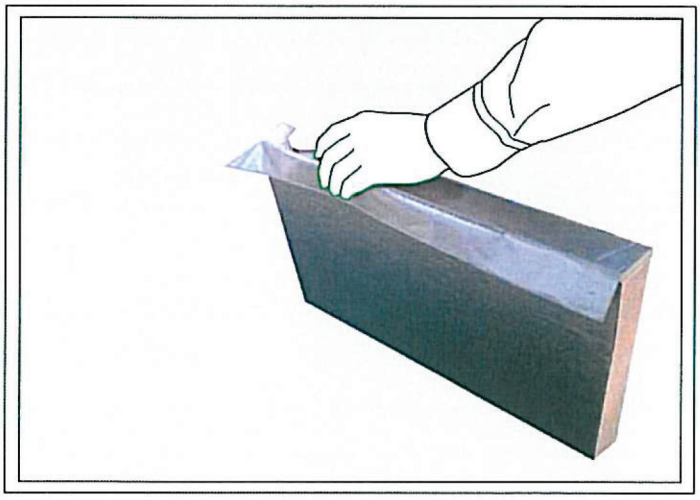
Figure 3 Method of application of the Gapotape product









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