Insulfix Limited

Assist Report:

Adoption of Low Carbon Technologies:

Insulfix Track - Evaluation of a new product aimed at reducing energy losses in properties

Prepared for: Insulfix Limited.

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Built Environment Climate Change Innovations

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UNIVERSITY OF WOLVERHAMPTON

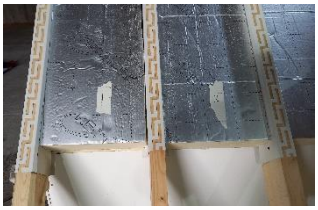
Contents

Management Summary

Insulfix Limited is a West Midlands based SME that has developed a new low carbon product called Insulfix Track. The product is applied to the rafters of a warm roof. The company claims that Insulfix Track makes it easier to install roof insulation boards between the rafters. It also claims that the product improves the energy performance of the roof in comparison to standard friction fitting of insulation boards.

Insulfix Limited first approached the BECCI project with a view to getting an independent evaluation of the Track product. One aspect of the support given to SMEs was to perform some in situ testing of products in a real property. The body of this report provides some details of the testing that was performed on the Insulfix Track product and discusses some of the results obtained. This report should be read in conjunction with the other documents produced by the BECCI project (including Form-A, Form-B and Form-D), which provide additional information.

The high-level summary of this report is that Insulfix Track:



1. Reduces the energy lost through the warm roof area by substantially reducing the gaps between the insulation boards and the rafters. This movement of cold air usually makes the outer layer of insulation much less effective;
2. Reduces the amount of waste insulation board; off-cuts become usable because the Insulfix Track securely holds them in place;
3. Allows for the future possibility of insulating the warm roof using a thinner layer of insulation material;

Overall, Insulfix Track can be fitted to the rafters of the roof easily and very quickly, without requiring any specialist training, strength or effort. The insulation boards are cut and prepared in the same way as before. These boards do need to be put into place using slightly more force than without the Insulfix Track (i.e. using the traditional method). However, most insulation installers will have no difficulty doing this.

The product makes a substantial improvement to the energy efficiency of the warm roof space. The improvement more than covers the cost of the material, will lead to energy saving by the property owner and will also help with the UK carbon reduction target.

Introduction

The BECCI Project benefits **S**mall and **M**edium sized **E**nterprises (SMEs) in the Black Country and Marches LEP areas of the West Midlands, by providing free support in the development of low carbon products and services impacting on the built environment sector.

Insulfix - Company Background

The background to Insulfix is best described by directly taking the works from their website:

> *Difficult problems are often best solved by the people who are most affected by them and such was the case with the story of the creation of Insulfix Track. It was a brilliantly simple solution arrived at after much suffering in many a cramped loft space. Jason, the Founder and inventor of Insulfix Track is a carpenter.*
>
> *Over the years he found that on site there were very few willing volunteers to take up the task of fitting insulation boards. So, this tricky, time consuming and frustrating job ended up with Jason. It was clear that to fix insulation boards properly using the traditional method of friction fitting was, to put it mildly, somewhat tricky.*
>
> *Gaps between the boards and the rafters were a problem. Sure, they could be filled with spray foam but the foam didn't really get into narrow gaps very well and more ended up on the surface of the board than down the gap.*
>
> **Our Story**
>
> *If the boards were deliberately cut smaller and held in place with nails, the foam nozzle would fit in the wider gap and allow the boards to be 'foamed-in'. However, the clients would then complain about the number of cans of foam he was getting through.*
>
> *Using battens to hold boards in place and to stop them being pushed too far towards the roof was another possible solution but accurately fixing the battens on the rafters proved difficult and boards still needed to be accurately cut to minimise any gaps.*
>
> *There was also waste. A lot of it. Each 1200mm x 2400mm board would have a full-length offcut between 100mm and 150mm wide, depending on rafter centres, that would just get thrown in the skip.*

After a particularly frustrating session Jason came up with the idea of a plastic sleeve that could hold the insulation firmly in place. The next day a prototype was made and the idea for Insulfix Track was born.

Scope of the Report

In order for the Insulfix Track to become more credible, it was recommended that Insulfix Ltd completes product testing which BECCI can facilitate (a C26 assist). Using the resources that BECCI has access to, and BECCI's relationship with Veritherm, it was recommended that the following is undertaken:

- Insulfix to create a Testing Rig (a smaller version of a roof) onto which insulation boards could be fitted using the traditional method or using the Insulfix Track product. This structure was transported to an industrial unit where testing could be done in a controlled environment.
- A reputable and independent roof insulation installation company to fit insulation boards to the Testing Rig using the industry standard way, commonly known as the friction fit method.
- Perform an air tightness test of the Test Rig with the insulation fitted. Look for evidence of air leaks, for example, around the insulation boards.
- Perform a Veritherm Rapid Thermal Performance test. Take thermal images and look for heat loss.
- Remove the insulation boards and refit them using the Insulfix Track product.
- Conduct another air tightness test and again look for evidence of air leakage.
- Perform another Veritherm Rapid Thermal Performance test. Take thermal images and look for heat loss again.
- Analyse the results.

The testing elements suggested above should provide valuable evidence of the performance of the product.

The following sections of this report provide details of the tests that were done and the results produced.

The Testing Rig

To reduce the number of variables that could affect the testing, it was decided to create a Testing Rig, i.e. a small section of roof. The structure was created by Jason and was transported to an industrial unit. The structure was insulated all around using two layers of 60 mm insulation board. However, the rafters were not insulated and there was also an opening at the back (for the purposes of performing an air tightness test and also for adding and removing the Veritherm testing equipment). The following images show the Testing Rig.

The picture to the left shows insulation boards fitted between the rafters using the standard friction fit method. On visual inspection they looked to have been installed to a good standard.

The picture below to the left shows the Insulfix Track product fitted over one of the rafters. The pictures to the right shows all eleven rafters with the Track product.

Friction Fitting - The Standard Installation Method

It was considered necessary to ensure that a fair a comparison could be made of the Insulfix Track product against the friction fitting of insulation boards. It was therfore concluded that the installation should be done by a reputable and independent installer who was TrustMark accredited. The company chosen was "South Coast Insulation Services Limited".

The following was done:

1. An insulation installer from the company was invited to come along and see the Testing Rig.
2. The installer then installed the insulation the way that he would normally do.
    a. The insulation was cut using a normal hand saw.
    b. It was placed between the rafters, although it had to occasionally be tapered to fit between the rafters.
    c. Sealing foam was applied to the top and bottom edges of the boards (but not the sides).

Trying the first board

Placing the last board

3. The enviromental conditions for the installation were very favourable in comparision to what is sometimes found, i.e.:
    a. The work was done at a low height so there was no need to use scaffolding (which generally makes the installation more difficult);
    b. There was little risk of falling and so there was less tension during the installation.
    c. There was virtually no wind because the industrial unit was closed on three and a half sides.
    d. There was no rain because the industrial unit's roof was intact.
    e. It was easy to move between the test rig and where the insulation materials were located (there was no need for a long ladder to move the materials to the roof)
4. An air tightness test was performed on the Testing Rig. The results are given in the results chapter of this document. Whilst the Rig was pressurised, it became quite

evident that air was escaping from around some of the insulation boards; it could be felt by placing a hand around those areas.

5. The blower door was removed from the back of the Testing Rig and the opening was sealed and insulated. A Veritherm test was performed on the Testing Rig. During the pre-test checks, thermal images were taken of the insulation boards. It was quite evident that warm air was escaping from around some of the insulation boards. The results are discusssed in the results chapter.

Using the Insulfix Track Product

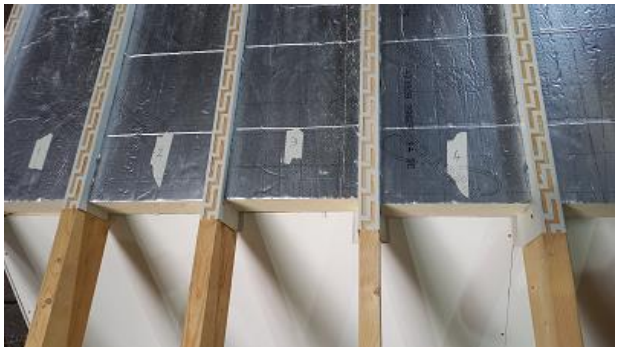
The insulation boards were removed from the Testing Rig as well as any residual foam. Jason then installed the Insulfix Track product to the eleven rafters and refitted the ten insulation boards. The top and bottom edges of the boards were also re-sealed using foam again.

The following was done:

1. The insulation boards were removed from the Testing Rig as well an any residual foam.

Installing the last few pieces of Insulfix Track

2. Jason installed the Insulfix Track product using screws and a power drill to each of the eleven rafters (see adjacent image, showing the left hand track screwed at the bottom)



Track and insulation boards fitted

3. Jason then installed the ten insulation boards in the same locations from where they were removed. Sealing foam was applied to the top and bottom edges of the boards again (but not the sides).

4. An air tightness test was performed on the Testing Rig. The results are given in the results chapter of this document. Even though the Testing Rig was pressurised, there did not appear to be any air leaking from around the boards.
5. The blower door was removed from the back of the Testing Rig and the opening was sealed and insulated. A Veritherm test was performed on the Testing Rig. During the pre-test checks, thermal images were taken of the insulation boards. This time the temperatures across all the boards and rafters apeared to be very even. The results are discusssed in the results chapter.

Analysing the Results

The following are the results of the air tightness tests and the Veritherm Rapid Thermal Performance tests. Thermal images are also included which demonstrate heat losses around the insulation boards in the case of the friction fit method.

	Friction Fit Method	Insulfix Track Method
Air Tightness	25.8 $m^3/m^2/h$	3.56 $m^3/m^2/h$
Veritherm Test HTC, Heat Transfer Coefficient	24.5 W/K	8.0 W/K
Thermal Images	Show Visible Heat Loss	Show Even Temperatures
Drafts around boards	Several Found	None Found

Air Tightness Discussion

The air tightness tests involved forcing air through the blower door and into the Testing Rig. The pressure was slowly increased to 50 pascals (50 newtons per square metre). This can cause air to escape from any cavities or where the material is pervious to air. Building standards today require that new buildings have no more than 10 cubic metres of air passing through each square metre of the envelope of the building per hour. Many developers however, try to achieve a rating of 5 $m^3/m^2/h$ or better

The friction fit method of installing the insulation boards produced an air tightness (air leakage) figure of 25.8 $m^3/m^2/h$. This represents a very leaky building. The 3.56 $m^3/m^2/h$ result by using the Insulfix Track product represents a huge improvement over the standard method. It suggests that the Insulfix Track product can lead to reduced air losses.

However, it should be noted that on a full sized property there may be many other places where there is air leakage. It should also be noted that a second layer of insulation boards is also normally added to the roof. This second layer would most probably reduce the huge different found between the two test results.

Veritherm Rapid Thermal Performance Test Results

The Veritherm Rapid Thermal Performance test applies heat energy to the inside of the Testing Rig using electric fan heaters. Additional fans are used to distribute the heat more evenly throughout the inside area. The heating process lasts for about six hours and during this time the internal temperature becomes about ten or more degrees hotter than the outside temperature. After some time, an equilibrium is reached and the heat energy being supplied into the Rig matches the heat energy escaping from the Rig. This heat energy can flow out of the Testing Rig via either air leakage or through the fabric. After about six hours, the heat input is stopped and the internal temperature starts to fall. Thermometers measure the temperature within the Testing Rig and outside the Testing Rig.

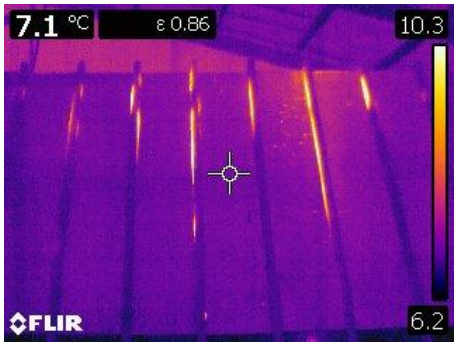
The Veritherm system is able to calculate the energy efficiency of the Rig using the temperature measurements and the energy flow rates into the Testing Rig. The system also takes air leakage into account and so produces a number representing only the fabric performance. The number is known as the “Heat Transfer Co-efficient”. It represents how much energy is required to increase the internal temperature of the building by one degree Kelvin higher than the outside (one degree Kelvin is similar to one Centrigrade).

The results of the Veritherm tests show that the using the friction fit method means that the inside of the Testing Rig becomes one degree warmer than the outside by supplying 24.5 watts of heat energy. However, by using the Insulfix Track product, it only requires 8 watts of heat energy to warm the inside of the Testing Rig by one degree. This suggests that in this instance, the Insulfix Track product produces a 67% improvement in energy losses (a reduction of 16.5 watts per degree Kelvin).

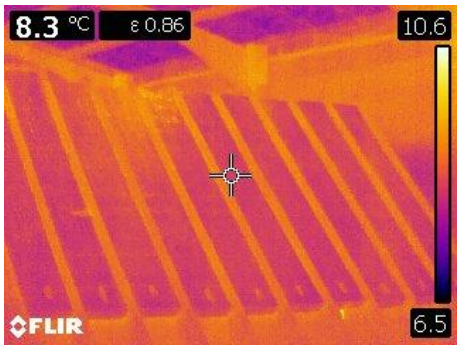
Thermal Images Evidence

Whilst the Veritherm pre-testing setup was being performed, thermal images were taken of the roof to see if there was any evidence of heat losses around the insulation boards.

The following thermal images show that there is heat loss around some of the insulation boards fitted using the friction fit method. The escaping heat appears yellow compared to the colder parts which are purple.



In the case of the Insulfix Track method, there does not appear to be any heat loss around the insulation boards. The yellower colour of the rafters is because they are slightly better at conducting heat than the insulation boards and are therefore slightly warmer. Overall, the images show much better heat energy retention.



A Simplistic Cost Comparison

The following is a very simplistic cost comparison of the energy loss between the friction fit method and the Insulfix Track method of installing insulation using some of the figures in the previous section. Let us assume:

- That the Test Rig was a complete building.
- That it was to be heated by an average of 16 degrees through the day (compared to the outside temperature) and for a period of 16 hours.
- That the cost of gas heating is approximately 4 pence per kWh.
- The Insulfix Track product would save 16.5 (watts) x 16 (degrees) x 16 (hours per day) x 4 pence = 16.9 pence per day.
- Using the £199.11 figure given by Jason for the cost of the Insulfix Track material used in the Testing Rig and including VAT and delivery charges (see the image below), this suggests that the product would pay for itself after about £199.11/£0.169 = 1178 days

  Assuming an average heating requirement of 180 days, this suggests a payback period of 1178/180 = 6.5 years

  (based on the months which have average low temperatures below 5 degrees and therefore need 16 degrees of heating,
  reference https://en.wikipedia.org/wiki/Climate_of_the_United_Kingdom)

  It should be noted that the payback period will clearly vary depending on the cost of space heating in the dwelling and this should always be checked when considering the cost benefit analysis of energy saving measures.
- April 2022 Update – See the next sub-section which details the changes in energy pricing due to the change in the energy price cap.

However, it should be pointed out that this was a very simplistic and specific set of assumptions. In reality, different people may want more or less heating and some warm roofs may have other aspects of insulation added which will reduce heat losses. Likewise, there may be other parts of a property where the most significant losses are taking place.

Insulfix limited

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Your Cart (11)

		Qty	Remove	Price
	Insulfix Track - Half	2		£23.62
	Insulfix Track - Single	9		£160.74

Gift card or Discount code **Apply**

Delivery	£14.75
Subtotal	£165.93
VAT	£33.19

Total
Including Standard (3-5 Days From Dispatch) GBP **£199.11**

Secure payment powered by

CHECKOUT

April 2022 – Energy Pricing Update

The following update to this report has been added due to the significant changes in energy prices introduced by most companies supplying energy to household customers. The reason for this is the change to Ofgems Energy Price Cap for the period 1st April 2022 to the 30th September 2022. The Ofgem website shows that during this period, the price for gas supplied gas to domestic customers is likely to rise to 7 pence per kiloWatt hour.

	Current price cap period (1 October 2021 - 31 March 2022)	Next price cap period (1 April - 30 September 2022)
Electricity	£0.21 per kWh Daily standing charge: £0.25	£0.28 per kWh Daily standing charge: £0.45
Gas	£0.04 per kWh Daily standing charge: £0.26	£0.07 per kWh Daily standing charge: £0.27

https://www.ofgem.gov.uk/information-consumers/energy-advice-households/check-if-energy-price-cap-affects-you

Using the 7 pence figure for gas during the April to September 2022 period, Sept

- The Insulfix Track product would save 16.5 (watts) x 16 (degrees) x 16 (hours per day) x 7 pence = 29.6 pence per day.
- Using the £199.11 figure … this suggests that the product would pay for itself after about £199.11/£0.29.6 = 673 days

  Assuming an average heating requirement of 180 days, this suggests a payback period of 673/180 = 3.7 years

  (based on the months which have average low temperatures below 5 degrees and therefore need 16 degrees of heating,
  reference https://en.wikipedia.org/wiki/Climate_of_the_United_Kingdom)
- It should be noted that the payback period will clearly vary depending on the cost of space heating in the dwelling and this should always be checked when considering the cost benefit analysis of energy saving measures.