



# Tŷ-Mawr

sustainable building materials for healthier homes  
deunyddiau adeiladu cynaliadwy ar gyfer cartrefi iachach

**therma  
fleece**<sup>®</sup>  
Nature's finest insulation

## Borax Treatment...

The wool used in Thermafleece contains sodium borate commonly known as borax. Borax is used in many industrial and consumer applications at safe levels and is applied to our wool as a fire retardant. The concentration of borax in our wool means that the wool and in turn the insulation is not susceptible to clothes moth attack and does not need the addition of a biocide.

Whilst borates are essential micronutrients that help growth, they are effective preservatives that can prevent growth. Research into boron chemistry suggests that both these effects are likely to result from the role that borates play in regulating metabolism. At a micro-nutrient level, borates are essential for the regulation of normal cell growth. However, if the concentration is increased, regulation will turn to inhibition and stop cells from growing. Stopping cell growth rather than killing the cell makes borax a biostat. This explains how and why materials containing borax compounds are not susceptible to many pests.

Source: Borax Inc.

### **Efficacy of Borax Treatment**

Natural borax compounds have been shown to work against and control fungi, algae, bacteria, and many insects including cockroaches, beetles, ants, wasps, fleas, termites, flies, and moths. Borax is currently used to provide material protection in many applications including structural and non-structural construction uses, insulation, and fillers or strengtheners of other materials such as plastics and concrete.

Source: Borax Inc.

Laboratory assays have been conducted on our wool by Central Scientific Laboratories in the UK using common clothes moths (*Tineola bisselliella*) according to standard BS4797/ISO3998. The tests show that under standard and extended exposure period, the wool used in Thermafleece is not susceptible to attack by clothes moths.

### **Borax Treatment of Thermafleece Wool Insulation**

Borax solution is impregnated into the wool fibres by immersing all the wool. This ensures each wool fibre contains borax. Borax is water soluble and does not chemically bind to natural fibres including wool. Once the wool has been immersed in Borax solution, it is dried to a moisture content of approximately 12% and is not exposed to any further prolonged wetting or water-based treatment.

### **Permanence of Borax Treatment**

Loss of borax can only take place to a serious degree when wool remains wet throughout its cross section for long periods while at the same time having an external sink for boron migration. When the use of borax preservatives is limited to use in internal situations where the treated material is protected from prolonged wetting or moisture build-up, the borax preservative will remain effective for the life of the treated material.

The permanence of borax has been well documented in internal construction situations, particularly in wood. It has been used as a standard preservative treatment in construction for more than 50 years and has been incorporated into many standards throughout the world.

It should be emphasised that boron can only diffuse or leach from treated materials that are wet throughout for long periods of time. In some situations, water condensation may appear on the insulation surface, but this poses no risk in terms of boron loss because it is transient and will be quickly evaporate. If the moisture build up is a non-transient phenomenon then fibrous insulation and natural fibres in particular are not recommended.



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## Borax Treatment...

Water can be present on natural fibres in two forms, free moisture and bound moisture which is fixed to the fibre via weak bonds. In this state, water is not available to dissolve soluble compounds such as borax.

Processes that rely on the presence of free moisture, including boron diffusion, cannot occur if the only moisture present in the wool is bound moisture. Moreover, boron cannot be lost by evaporation from treated materials under normal conditions. In the absence of free water, there is no mechanism available for borax to be lost from the insulation and it will remain within the treated material indefinitely.

Water entering wool fibres will be physically or chemically bound to the fibre cells up to the point when binding sites on the fibres become saturated and are longer capable of binding water. Any water entering the wool after this point will be present as free water but all moisture entering the wool up to this point will be bound within the wool. In the case of wool, this point is reached when the wool contains approximately 30% moisture.

The moisture content of wool insulation in service will be governed by the relative humidity of the surrounding air. Wool absorbs moisture from the surrounding atmosphere and reaches an equilibrium moisture content dependant on the relative humidity of the surrounding air. Even at extremely high relative humidity, the equilibrium moisture content of the wool fibres will be less than the wool fibre saturation point. Boron diffusion cannot occur unless the moisture content of the wool is above the fibre saturation point.

### **Conclusion**

The risk of borax loss from treated wool is negligible under normal conditions where the wool insulation is protected from prolonged or cyclical wetting.