WREN INDUSTRIES and
The History and Science of Foil Insulation in Australia

Tim Renouf **June 2012**

A Little History

Wren Industries is a family owned business, based in Melbourne, Victoria. It commenced trading in 1991 and is operated by Tim Renouf. Wren manufactures two aluminium foil radiant heat barrier insulation products – ***CONCERTINA FOIL BATTS*** and ***RENSHADE***. The Renouf family have been involved in the manufacture, marketing and sales of foil insulations since the early 1950's.

The story begins with Ted Renouf when he started his career as a salesman for Sisalkraft Australia(part USA owned), in a branch office in North Melbourne in the early 1950's. Sisalkraft sold bitumen laminated paper to the packaging and building industry and as a sarking material under sheet and tiled roofs. In 1953 a roll of reflective foil laminate arrived from the USA as a potential new product. Ted's interest was ignited and he approached the CSIRO at the Division of Building Research in Highett, Melbourne where Dr. Roy Muncey confirmed that aluminium foil had in fact remarkable insulating properties previously not seen in Australia. At that time there was only one form of insulation on the market, a fibrous bulk insulation called Rockwool, a product made from blown melted rock. Dr Muncey confirmed that one layer of aluminium foil, in a ceiling with a 100mm downward facing airspace, had the equivalent thermal resistance (R-value) *heat flow down* to approximately 100mm (4 inches) rockwool fibre insulation. But the same foil airspace *heat flow up* was equal to approximately one third to one half of the down value, i.e. horizontal foil had much greater thermal resistance in summer than winter. However, in walls, vertical foil achieved maximum resistance with minimum 20mm adjoining airspaces and gave the same R-value sideways - *heat flow in or out,* summer and winter – and this was equivalent to approximately 50mm of rockwool.

Armed with this knowledge, Ted went out and sold that very first roll of aluminium foil in September 1953 to the St.John's Catholic Church, Maroondah Hwy, Mitcham, a suburb of Melbourne, for use under a curved 'Nissan hut' roof to give relief from summer radiant heat. The brand name Sisalation was born at that time - a new insulation product comprising reinforcing mesh (Sisal fibre) used in the lamination of bitumen adhesive with paper and foil.

By 1961 reflective foil laminate was rapidly gaining acceptance in the Australian market as both a cost efficient and effective insulation and sarking material. Seeing an opportunity to expand, in July 1961 Ted Renouf and an associate, Bill Broadhurst, took the plunge and struck out on their own starting a new company manufacturing foil insulation – Renhurst Industries P/L. Renhurst grew rapidly and the product name ***RENFOIL*** was soon being specified by architects across Australia for use in industrial, commercial and residential buildings in roofs, ceilings, walls and floors. New products were added to the range – ***RENTHENE*** (waterproof underlay for concrete), ***FIBRE-WOOL*** (the first cellulose bulk insulation in Australia to compete against the new bulk insulation that had entered into the insulation

market – fibre-glass), ***RIPPLEFOIL*** and ***RIPPLESOUND -*** a new range of aluminium roof lining products.

In1969 Renhurst was sold to Reed Consolidated (a large UK based paper company) and after the expiration of his three year contract Ted left the industry. Reed subsequently sold the company to James Hardie – an emerging building based company who ran the business until 1986 whereupon it was sold to the market leading bulk fibre-glass insulation company ACI Fibre-Glass. (ACI had acquired the foil laminating plant of St Regis a few years earlier and saw the acquisition of Renhurst as a strategic move to eliminate a competitor and secure market share). ACI closed the laminating plant and sold what assets were remaining to a new company Renhurst Ceilings P/L which continues to this day manufacturing the product range ***RIPPLESOUND, RIPPLEFOIL*** and ***RIPPLETONE*** to markets across Australia and around the world. These products can be found at – www.renhurst.com

In 1982, and after 10 years out of the industry, Ted re-entered the aluminium foil insulation market with a new company – Renouf Industries P/L with his two sons Mike and Tim and together they invented a new style of lightweight reflective foil insulation. This company brought new technology to the industry and was eventually sold to Gang-Nail Australia Ltd (now MiTek Australia Ltd) in 1990.

In 1992 Ted came out of retirement to start yet another company, Wren Industries P/L, sourcing a specially made product from Gang-Nail Australia for a revolutionary new concept – ***CONCERTINA FOIL BATTS*** followed by ***RENSHADE*** in 2000.

A Little Science

Australia has very different climates and energy consumption requirements where winters are much milder and shorter in duration and hot climates exist over the entire continent. The majority of Australia's population live in climates where radiant heat flow into buildings dominates over heat escape or there is a mixed dual climate - hot and cold, i.e. locations experiencing both mild winters and hot summers being most capital cities and along much of the eastern coast. Only a minority of people live in winter dominated climates.

Hot climatic conditions and high external radiation levels exist across all of Australia, where roofs have recorded downward radiating surfaces of 80-100degC, causing roof spaces to be typically 50-70degC. External walls and glazing are also affected. Accordingly, insulation materials need to demonstrate thermal resistance against the effects of inward solar radiant heat gain on buildings as well as winter heat loss.

Types of Insulation

There are basically two different types of thermal insulation – reflective foil and bulk insulation.

Reflective

Aluminium foil insulation, with an adjoining airspace, will provide a permanent and continuous barrier to radiation – a direct result provided by the properties of aluminium - of high reflection (97%) and very low emissivity (3%) or re-radiation. For example, an aluminium coffee pot cannot reflect the heat of the coffee because of conduction, however the outward facing aluminium surface radiates very little heat. Same story with a hot chicken wrapped with aluminium foil. NB: Both shiny and dull aluminium surfaces have the same thermal characteristics.

Foil insulations are expressed only as “Total R-values” between indoor and outdoor air, eg brickwork walls to internal plasterboard, roofs to ceilings, framed floors to ground level. The benefits of foil insulation include thermal resistance, waterproofing-sarking, condensation and vapour control.

Bulk

The first commercially made bulk thermal insulation occurred in Australia in 1933 with rockwool batts (volcanic rock fibre). Loose-fill cellulose insulation (granulated paper) came onto the market in the mid-1960’s. Then in the late 1960’s, fibreglass batt insulation was developed to produce better recovery and loft (*memory)* after compression in packaging, compared to rockwool. Polyester batts and wool combinations entered the market during the 1990’s as low irritant insulation alternatives. There are also a variety of polystyrene boards which are examples of rigid bulk insulation.

The facts are that bulk insulation originated about 60 years ago for use in northern hemisphere climates (USA and Europe) where extensive cold periods cause clearly more energy to be used for internal heating rather than cooling of buildings.
Refer “History of Heat Testing USA” - http://concertinafoilbatts.com/NIST.pdf

Bulk insulations are officially tested for “Material R-value” thermal resistance, typically in Heat Flow Meters, at “Steady State” for *conducted heat* between two temperature plates fixed at 33 and 13degC, where the mean (or average) is 23degC (i.e. 33+13=46/2=23) and when mean temperature increases, resistance falls. All bulk insulations regardless of thickness are tested at a maximum 33deg and labeled as having one “Material R-value” alone, regardless of climatic application.
Clearly a dubious test for high summer temperatures which exist in many regions of Australia.

Application

Understanding what the best insulation for different Australian climates can be very difficult. The public are mostly indoctrinated that *bulk is better*, and *thicker is better still.* It is common to find fibreglass company advertising mentioning only batts and vague detail (or none at all) about their range of foil products. The consumer is not informed about how foil insulations work and are left ignorant or

confused. Why? Because the fibreglass manufacturers have more capital investment in manufacturing fibreglass than foil – and more profit can be generated from fibre-glass than foil.
The selection of the right material or combination of materials will depend on location and climate.

In hot climates, reflective foil laminates are clearly the correct choice as bulk insulations are not radiant heat barriers but rather radiant heat absorbers, which slow down the transfer of heat (relatively low level at 33degC), store it, and then slowly release the heat when cooler periods arrive. And bulk insulation in ceilings causes yet other problems – it traps summer heat within rooms from escaping, as revealed in a 1981 federally funded insulation research project undertaken across Queensland. Refer:
http://www.concertinafoilbatts.com/FOIL_BATT_FACTS_6_Insulation_comparison___AHRC_Report_1981.pdf

High temperature frequently causes refrigerative cooling (and ductwork insulation) to be under severe heat strain, operate longer and consume high levels of electricity, to the point where total power demand exceeds supply and blackouts occur. Refer
http://www.concertinafoilbatts.com/FOIL_BATT_FACTS-1.pdf
http://www.concertinafoilbatts.com/press.htm
When demand is high, peak pricing occurs adding greatly to annual power bills. And greater energy use contributes to ever increasing levels of national greenhouse gas emissions, which Australia is committed to reduce.

The greatest and longest daytime radiant heat loads occur on roofs. Sloping or cathedral roofs with narrow cavities are a particular problem to correctly insulate. When roofing foil insulation is installed it needs a minimum 50mm downward airspace to work at near maximum efficiency and any type of bulk insulation must not fill the cavity and touch the foil, otherwise radiant heat can penetrate the fibres, exceed the 33degC test conditions and cause a substantial drop in summer R-value.
NB: 40% reduction in R-value for bulk insulation directly under hot roofs - 'Insulation Guide 2001'
http://www.concertinafoilbatts.com/FOIL_BATT_FACTS_5_Insulation_Guide___HIA_Greenhouse_Office__2001.pdf

CONCERTINA FOIL BATTS stapled between rafters can replace the bulk or be in combination with it if the roof cavity depth permits. Anti-glare foil wraps on external walls are commonly combined with R1.5-2.0 fibre batts making direct conduction with the inner facing aluminium surface which cannot then function for low emissivity. The foil is rendered useless for thermal resistance against external radiation, and is relegated secondary for its other uses such as waterproofing timber wall frames and the fibre batts themselves - waterproof paper would do the same job. ***CONCERTINA FOIL BATTS*** stapled in wall cavities replace the fibre batts, allow the foil wrap to function and produce higher *overall or total* thermal performance.

It is in the public and national interest, that energy efficient building design should incorporate aluminium foil insulation extensively for ceilings, roofs, walls, floors. Unique and innovative products such as ***CONCERTINA FOIL BATTS*** and ***RENSHADE*** for windows, combined with natural ventilation and ceiling fans, will significantly reduce the need for refrigerative air-conditioning, the most expensive form of cooling and the subsequent drain on our energy requirements.

Industry Association

Wren Industries was also a founding member of the Aluminium Foil Insulation Association Inc (AFIA), formed in 1998 to promote the highest and best use of foil insulation in building design.
AFIA members have no conflicting cross-interest in manufacture of bulk insulations.
Tim Renouf held the position of Secretary of AFIA from 1998-2010.

AFIA is the independent aluminium foil association in Australia represented on:
i) Standards Australia Committee BD/58, which produced AS/NZS 4859.1(2002) Amdt1(2006) – a Standard for the thermal performance of all insulation materials.
ii) Energy Efficiency Reference Group (EERG) of the Australian Building Codes Board (ABCB).
The ABCB with the states under COAG is responsible for the NCC – National Construction Code (formerly the BCA) Building Energy Efficiency Provisions(EEP).

The EEP is based on using tables of Prescriptive Minimum “Total R-values” or House Energy Ratings(HERS) such as FIRST RATE and ACCURATE rating programs. The Insulation Standard AS/NZS 4859.1 is called up in the regulations and it permits insulation materials to be expressed as either “Material R-values”- the basis for bulk insulation, and “Total R-value” for all foil insulations.
Total R-value means the total thermal resistance of the building element, is the entire roof-ceiling, wall or floor structure.

4859 requires all insulation materials to account for all anticipated environmental and in-situ factors, one of which is *radiant energy.* But at the same time 4859 permits bulk insulations to reveal one static “Material R-value” (cross-referencing USA Standard test methods) for bulk labeling purposes in either winter or summer. Applying one R-value for a bulk insulation material to be used anywhere in Australia will frequently cause problems and mislead the public.

Building design will continue with confusion and error until a new comprehensive regime of “Total R-values” are presented for <u>all</u> insulation materials, i.e. a level playing field.
Standards Committee BD58 remains incapable of creating a new “Total R-value” Standard due to the continuous objection from powerful vested commercial interests who do not want a new method of thermal resistance measurement which would include high temperature radiation effects and who wish to promote the sales of bulk insulation over the scientific benefits of aluminium foil.
The principle of uniform “Total R-value” assessment is in the public and national interest.

Wren Industries encourages public requests to Standards Australia for a comprehensive Total R-value Standard (or technical reference document) for all insulation materials.
The current Insulation Standard does not account for high temperature radiation effects.

2010 Senate Inquiry: Home Insulation Program. http://www.concertinafoilbatts.com/senate.pdf
Refer to Recommendations 6-11. Extensive industry-wide changes were recommended.
Tim Renouf – Wren Industries gave oral and written testimonies, along with other persons.
Since the Final Report was released in July 2010, Standards Australia and the ABCB have refused to issue any public statement.

Further information is available through:
Wren www.concertinafoilbatts.com AFIA www.afia.com.au

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