TECHNICAL DATA

Insultec Test Reports



Test Reports

No.	Name of Testing authority or company	Country
1AU	<u>"Performance of Insultec"</u> University of NSW (Prof. H.J. Goldsmid)	Australia
2AU	<u>"Evaluation of Insultec"</u> Unisearch, Sydney, Australia (Prof. J.K. Haken)	Australia
3AU	<u>"Electricity Saving"</u> AE Smith Wesair, Western Australia (F Toussaint B Eng)	Australia
4AU	"Value of Insultec" MPN Timar Martin, Brisbane Australia	Australia
5AU	"Measurements of Heat Gain" Vipac Engineers and Scientis Melbourne, Australia (S. Fernando D.Sc. & N. Broner D.Sc.)	
6AU	<u>"The 'K' Factor"</u> Unisearch, Sydney Australia (Prof. D.H. Morton)	Australia
7AU	<u>"Emissivity Measurements"</u> University of Western Australia (R. Cammarano B.E., Hons)	Australia
8AU	<u>"Evaluation of insultec"</u> Comalco Research & Technology Victoria, (Noel L. Martyn, MIE Aust CPEng.	Australia
9AU	<u>"Evaluation of Insultec"</u> Broome Regional TAFE W.A. (John Hutchinson B.A. Dip Ed.)	Australia
10AU	1520 - "Carbon Dioxide Diffusion Resistance (with R33X prints 1528 - "Water Vapour Transmission (with R33X primer)" 1593 - "Reduction in Chloride Ion Penetration" 1594 - "Reduction of Water Absorbtion" 1706 - "Chloride Ion Diffusion Resistance" 2815 - "Colur Change" 2816 - "Crack Bridging Test" 2972 - "Water Vapour Transmission" 2973 - "Carbon Dioxide Diffusion Resistance" Taywood Engineering Ltd., NATA accredited laboratory Bentley W.A. (SangWong B.Sc & A.M. Peek B.Sc.	<u>mer)"</u> Australia

11AU	"Certificate of Fire Rating Test" (Fire Resistance – CSIRO, NATA accreditation)	Australia
12AU	<u>"Test for Fuel Storage Tanks"</u> Mobile Oil Refining Test (J. Papageorgiou, Snr Project Engineer)	Australia
13AU	"Investigation prior to coating schools with Insultec" Department of Public Works, New South Wales (Peter Loveridge, Electrical Engineer)	Australia
14AU	"Comparative measurements of Emissivity & Absorptance" (Prof. Richard Aynsley), School of Tropical Arcitecture James Cook University	Australia
1EU	<u>"Properties of Insultec"</u> Bureau Veritas France (A Fernandez D. S.c.)	France
2EU	"Optical and Thermal Characterisation of Insultec" CSTB Fort De France. Cedex France (Francois Olive B.Eng & Robert Cope D.Sc) French Partial Translation	France
3EU	<u>"Accelerated Weathering Test"</u> EABASSOC & Associated Engineers. Altrincham, Cheshire	England
1AS	"Report on Insultec Performance" Indian Institute of Technology, Bombay	India
2AS	"Savings on Air-conditioning Costs" Solar Agni (C.I. Gunta D.Sc.) Pondicherry	India
3AS	<u>"Energy Savings"</u> Shital Cold Storage & Ice Plant, Proprietor Engineer	India
4AS	"Comparison of various coatings" Durbanville Nico Janse van Rensburge	South Africa
5AS	<u>"Test on railway petrol tankers and Engines"</u> Spoornet – National Railway South Africa	South Africa
6AS	<u>"Evaluation of the Standard of Insultec Membrane"</u> The Materials & Chemicals Enterprise, Hanoi (Le Quang Tuan)	Vietnam

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THE UNIVERSITY OF NEW SOUTH WALES

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SUMMARY OF TESTS ON INSULTED MEMBRANE CARRIED OUT AT THE UNIVERSITY OF NEW WALES

Introduction

Prior to these tests it was claimed that, if the outside walls and roof of a building were coated with a novel membrane "Insultec", then the interior of that building remained much cooler than a similar uncoated building or one coated with ordinary paint. Our purpose was to carry out tests under controlled conditions to ascertain the validity of the claims.

Nature of the tests

A number of galvanised steel boxes of about 300mm cube size were constructed. Inside each box was placed an electronic thermometer, the output of which could be continually monitored. The boxes could be left bare or coated with various paints or membranes. The boxes were mounted on the roof of one of the University buildings in Kensington, New South Wales. The internal temperatures were recorded day and night for several days. The particular tests reported here compared two boxes coated with Insulted with a bare box over the period 30 June, 1988 to 10 July 1988. The results refer to the times between 1100 hours and 1500 hours on all the days within that period when it was substantially sunny. It should be noted that, even though it was winter, the uncoated box reached some 33 °C on some occasions.

Results

It was found that the boxes coated with Insulted remained of the order of 10 °C cooler than the uncoated box when the sun was shining. The actual results are shown in the accompanying graph in which the temperature of the Insulted coated boxes is plotted against that of the uncoated box at the various times. Attention is drawn to the lines of best fit [for the two Insulted coated boxes]. These show that the cooling benefit of the Insulted coating is always substantial but becomes even more so under warmer conditions. In other words we might expect a greater difference between the temperatures in the Insulted-coated and uncoated boxes during the summer. We have also obtained evidence that the temperature difference is greater for full size buildings than it is for the test boxes.

Conclusions

It is concluded that the claims made for Insulted are fully justified. It is clear that this membrane acts as a heat rejecting medium and one can expect that, if the roof of a building is coated with Insultech, then the interior of that building will be 10 °C or more cooler then that of a similar building with a plain galvanised roof during the warmest part of the day.

His ground

H. J. Goldsmid Emeritus Professor of Physics. 22 February 1990

PERSONAL PROFILE

The testing program was performed under the supervision of Professor H. J. Goldsmid, Professor of Experimental Physics and Head of the Department of Applied Physics at the University of New South Wales. The following is a brief profile of Professor Goldsmid.

Qualifications B. Sc. Honours in Physics, Queen Mary College,

University of London. PhD. University of London. D.Sc. University of London.

Fellow of the Australian Institute of Physics

Career 1951-1984 Staff of the Research Laboratories of the

General Electric Cod., Wembley, England.
[Up to Principal Research Scientist]

1964-1969 Reader in Solid State Physics,

University of New South Wales.

1969-1988 Professor of Physics

University of New South Wales.

1988-present Emeritus Professor Physics University of New South Wales.

1989-present Chairman, National Standards Commission.

Research Record Author of about 150 publications, mainly in

the field of thermoelectrics and thermal

properties of materials, including thermal

conductivity. These include 6 textbooks.

Consultancies Consultant to the following organizations:

The General Electric Co. Ltd.

De La Rue Ltd., AERE Harwell

IBM [UK] Ltd.

Marlow Industries, Dallas, USA. Italian Atomic Energy Commission.

Emeritus Professor H.J. Goldsmid Consultant Physicist

> 'Rockcorry 2' Woodford NSW 2778 Australia

REPORT: Performance of Insultec Membranes as Heat-Rejecting

Coatings.

TO: Insulating Paint Pty. Ltd., PO Box 873, Dubbo,

NSW 2830, Australia.

DATE: 3rd May 1993.

Introduction

The range of products carrying the name "Insultec" consists of paint-like coatings that have been developed primarily to prevent the entry of heat from the environment into buildings. The products have been developed by Mr. Raymond Brooks, an experienced and innovative paint technologist.

It is well known that heat can pass from one place to another by three mechanisms, (1) radiation, (2) conduction and (3) convection. Insultec, when applied to the roof and walls of a building or other enclosure, reduces the temperature inside that enclosure by the following means:

- (1) Due to the specially selected pigments in the membrane, the surface becomes a good reflector of solar radiation (visible and near infrared) and a good radiator of terrestrial radiation (far infrared). This enables the building to radiate heat effectively while at the same time minimising the influx of heat from the sun.
- (2) The selective radiative and reflective properties of Insulted explain no more than a fraction of its beneficial properties. Accordingly, I presume that, in spite of being relatively thin, an Insulted coating offers significant resistance to heat conduction. I understand that the constituents of Insulted were selected in the first place so that the membrane would offer subtantial thermal resistance.

(3) It is difficult to see any way in which Insultec could modify thermal convection through the surrounding air. Nevertheless, in the light of the outstanding behaviour of Insultec as a heat rejecting medium, I cannot dismiss the possibility that enhanced thermal convection may be playing some part.

Nature of the Tests

The initial tests on this type of product were carried out by Mr. Brooks and his assistants using small portable buildings. A comparison was made between buildings coated with the new membrane that had been developed by Mr. Brooks and other buildings that were either uncoated or coated with other finishes. The effect of internal thermally insulating batts on the same buildings was also investigated. I acted as an advisor in the setting up of the experiments to ensure that a fair comparison was being made. I advised, for example, on the location of the buildings with respect to one another and on the temperature monitoring.

Subsequently, I designed similar tests that were performed in association with colleagues in the School of Physics at the University of New South Wales. These tests used smaller enclosures with inbuilt heat capacity, the interior temperatures being monitored and recorded continuously. These experiments were aimed particularly at the testing of modified products that Mr. Brooks was developing over the years. Nevertheless, the real test of the membranes is their behaviour when applied to full size permanent buildings and Mr. Brooks has ensured that such field tests are performed as a matter of course, particularly when any modification is introduced.

Results of the Tests

As a result of the tests carried out both by Mr. Brooks and myself, I have become convinced of the remarkable properties of Insultec. This is in spite of the fact that I was most sceptical about the claims when I was first approached by Mr. Brooks.

The performance varies somewhat according to the external conditions. Thus, on a cold, wet and cloudy day there is little difference between the temperature of an uncoated enclosure and one that is coated with Insultee. However, under full sunlight with a clear sky and with a low humidity a building coated with Insultee would typically be well over 10°C cooler than one which is not so coated. In my own experience, even when conditions were not so ideal (i.e. in central Sydney where the atmosphere is far from clean and the humidity is usually high) it is still possible to observe a typical temperature difference of 10°C between Insultee-coated and uncoated enclosures. In other words, the experiments with which I have been directly associated have confirmed all the claims made by Mr. Brooks about the thermal performance of his products.

A full statistical analysis of the results was not performed but it will be appreciated that such an analysis is not needed when an effect is very much greater than any estimated variance. Here, for example, when a lowering of temperature by, say, $x^{O}C$ was observed, then a repeat experiment under the same conditions would yield a lowering of temperature of $(x^{\pm} 1)^{O}C$.

Comparison with Other Products

I understand that Insulating Paint Pty. Ltd. are often asked to quote the "R" factor (i.e. the thermal resistance rating) for Insulted so that this substance can be compared with other products such as insulating batts made of fibre-glass or other fibrous materials. The use of an "R" value is unrealistic for Insulted since it does not rely solely on a reduction of thermal conduction for its operation. Suppose, for example, that an enclosure with no Internal source of heat, were maintained in sunlit surroundings for an extended period of time. Even if the walls and roof were insulated with resistive batts, the interior of the enclosure would eventually reach the temperature of the external surface, which would be substantially higher than the air temperature. On the other hand, no matter how long one waited, an Insulted-coated enclosure would remain at a

much lower temperature since the external surface would stay cool, possibly even cooler than the surrounding air because of the selective radiating properties of the membrane. In other words, conventional heat insulating materials tend to delay the ingress of heat whereas Insulted also provides continuous rejection of heat.

Of course, it is possible to apply reflective coatings other than Insultee to buildings but, even if they are selective radiators in the same way as Insultee, ordinary paints are greatly inferior to Insultee in their overall heat rejection.

Modified Insulted Products

The name "Insultec" refers not to a single product but to a range of products. Some differ from each other solely in their durability, their ease of application or their suitability for different substrates but others differ in their colour. I would expect the original white Insultee to give the best performance but I believe that tinted Insultee would still be effective and I understand that the company would not introduce modified Insultee until adequate tests, of the kind that I have described, had been performed.

Summary

I can confirm that the performance of Insultec membranes as heat rejecting coatings is substantially in accordance with the behaviour claimed by Mr. Raymond Brooks and Insulating Paint Pty. Ltd. The effect of applying Insultec to a typical building situated in full sunlight is to lower the interior temperature by some 10°C or even more than this under favourable conditions, during the hottest part of the day.

H.J. Goldsmid

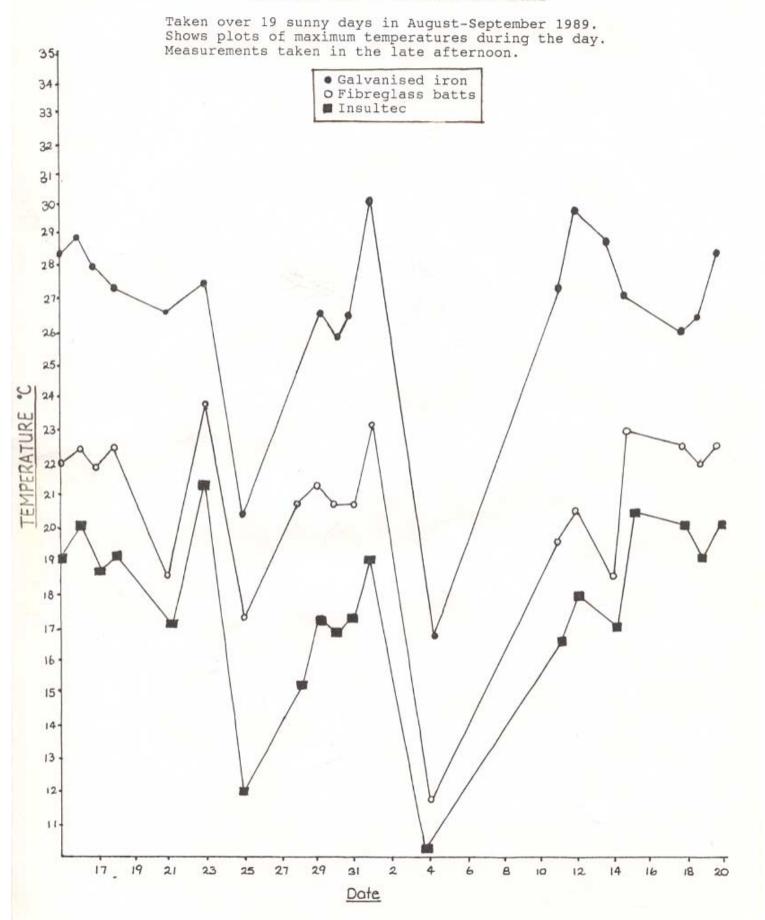
Credentials of the Author of this Report

Dr. H.J. Goldsmid is Emeritus Professor of Experimental Physics at the University of New South Wales. He hold the degrees of Doctor of Philosophy and Doctor of Science at the University of London and is a Fellow of the Australian Institute of Physics. He has experience as a Principal Research Scientist with The General Electric Co. Ltd. and as Reader in Solid State Physics at the University of Bath. At present he is Chairman of the Australian National Standards Commission. He has acted as consultant to many overseas organizations including AERE, Harwell, De La Rue Ltd., IBM (UK) Ltd., Marlow Industries and the Italian Atomic Energy Commission.

As the author of over 150 publications, including 6 textbooks, Dr. Goldsmid is recognised as an authority on the physics of materials, particularly in the fields of thermoelectricity and heat conductivity. In 1987 he was elected to Fellowship of the International Thermal Conductivity Conferences, an honour that is bestowed on only one or two specialists each year.

UNIVERSITY OF NEW SOUTH WALES

INSULTEC TEST - INTERNAL AIR SPACE



Report prepared on behalf of Unisearch limited

by

Associate Professor J. K. Haken Head of the Department of Polymer Science University of New South Wales

REPORT ON EVALUATION OF INSULTEC INSULATING MEMBRANE

March 1993

Thermal Conductivity

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Thermal conductivity (k) is the calculation of the rate at which heat flows through a material by conduction. The property is defined as the rate at which heat flows through the material by conduction per unit of cross sectional area taken normal to the direction of the heat flow and the unit temperature gradient measured in the direction of heat flow.

For low conductance materials such as the Insultec membrane the method specified in Plastics Institute of Australia Code of Practice for PVC Wall Cladding, Appendix E is appropriate and was used. The principle of the method is to measure the rate of heat penetration into an enclosure by determining the rate at which solid carbon dioxide contained in the enclosure is volatalised by the heat. The method provides a measurement of thermal resistance 'R' of the specimen, from which thermal conductance 'C' may be derived directly and by knowledge of specimen thickness the thermal conductivity 'K' can be derived. Accuracy of the method is estimated to be plus or minus 15%. Nevertheless the 'K' factor is significantly below those of solid vinyl, acrylic or olefine polymers, which are in the order of 0.15 to 0.30 W m⁻¹K⁻¹.

The conductivity is, however, higher than that of low density insulants such as cork, polystyrene foam and the like, which range from 0.03 down to 0.015 W m K. Values of various common insulating materials are shown below.

Cork	0.0381
Polystyrene foam	0.036
Glass fibre	0.033 - 0.044
Rigid Polyether Urethane foam	
Trichlorfluoromethane Blown	0.016 - 0.026
Carbon Dioxide Blown	0.036

The relationship of thermal resistance (R), the thermal conductance (C) and the thermal conductivity (K) is shown below

$$R = \frac{1}{C}$$

$$m^{2} K w^{-1} = m^{-2} K^{-1} W$$

$$C = K x m$$

$$m^{-2} K^{-1} W = m^{-1} K^{-1} W$$

Thermal resistance of sample, 'R' = 0.12 m² K W⁻¹
Thermal conductance of sample, 'C' = 8.6 W m⁻² K⁻¹
Thermal conductivity 'K' (based on a thickness of 250 microns for the specimen submitted), 'K' = W m⁻¹ K⁻¹

The density of the specimen provided is 1290 kg m indicating a filled material.

Exposure Testing (Townsville, Queensland, Australia. Tropic of Capricorn).

A particular advantage of the Insultec membrane is its suitability for exterior exposure. Testing was conducted at the Allunga Exposure Laboratory for six months at an inclination of 20oC facing North, the samples were evaluated in accordance with the procedures of Australian Standard 1580, Method 481.1.3. and at the conclusion of the testing the samples were in excellent condition and indicative of the product possessing a long life in normal service situations.

The exposure of many synthetic foam insulating materials such as polystyrene polyurethane is unsatisfactory due to raped yellowing, hardening and deterioration. Some polyurethane foam insulating materials have been coated after application with a compatible coating material to seal and protect the foam from the elements. The success of such systems has been limited.

Insulating materials such as fibreglass or slag wool batts are not suitable for exterior exposure due to removal of part of the layer by mechanical action and to their porous nature and water penetration.

Summary

Performance testing of the Insultec membrane on small steel buildings has shown that a considerable reduction in the interior temperature is achieved. In Sydney over a three month period a reduction of 9.6 oC was achieved while in Townsville similar testing showed an average reduction of 11.5oC, while on some occasions reductions of 15-20 oC were achieved. No attempts were made to fill gaps in the buildings and such actions could be expected to further increase the reductions.

Thermal conductivity measurements showed that the insulating filling material present in the membrane reduced the thermal conductivity from 0.15 - 0.30 W m⁻¹K⁻¹ to a value of 0.50 W m⁻¹K⁻¹.

A particular advantage of the Insultec membrane product is its formation as a continuous membrane and its suitability to withstand exterior exposure. Most available insulating material batts and foams are not continuous or suitable for exterior use.

If we can be of further assistance in this matter please contact the writer.

J.K. Haken Associate Professor & Head of Department of Polymer Science University of New South Wales



CORR234

The Manager Karratha Coatings P.O. Box 1084 KARRATHA WA 6714

ATTENTION: Mr Terry Ross

THE A.E. SMITH ORDER OF COMPANIES MATERIALS INSTRUCTION INSTRUCTION IN CONTRACTOR IN C

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Temperature Testing 19/9/90 - 26/9/90 Residence - 386 Turner Way - Karratha -Residence - 44 Padbury Way - Karratha -

KW READINGS 21-26/9/90-KW READINGS 21-26/9/90130 UNITS 51 UNITS 79 UNITS Dillorence

As requested temperature recording instruments were placed in the above dwellings to record the temperature variations that occurred within the ceiling spaces over a period of a week.

In each case a recorder was placed in the ceiling near the manhole access panel basically in the same location at each house. Following a calibration check of the instruments, the access panels were then replaced.

Appended are the recorded results, along with a performance graph indicating a comparison of the temperature variations recorded in each space, with bars indicating the corresponding maximum and minimum ambient temperatures.

In addition the units of electrical power consumed by each air-conditioning system over the same period was recorded and is also displayed on the graph.

The tests results over the test period show considerably lower ceiling space temperatures and airconditioner power consumption for the Padbury residence under similar ambient conditions for both residences.

Should you require any further information, please make contact.

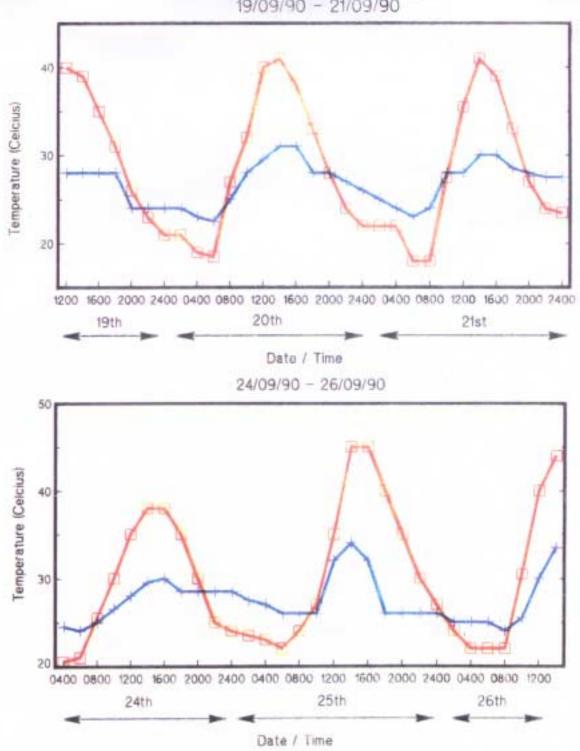
Yours sincerely n.E. SHITH/WESINIK

EIGNE TOUSTMINT

TEMPERATURE READINGS

AT KARRATHA RESIDENCES WA. BY A.E.SMITH - WESTAIR

19/09/90 - 21/09/90



MPN TIMAR MARTIN REFRIGERATION AND AIR CONDITIONING ENGINEERS

REPORT ON THE INSULATION VALUE OF INSULTEC

FOR AGGREGATE APPLICATORS OF AUSTRALIA P/L

1.0 INTRODUCTION

This technical appraisal has been prepared at the request of Mervin Okeefe, for Aggregate Applicators of Australia Pty Ltd., to determine the reduction in temperature across a roof, gained by the application of Insultec to the exposed surface of the roof.

2.0 CASE STUDIES

We have taken the following case studies as examples of typical situations where Insultec may be applied. It has been assumed that the electricity used is charged at the Tariff 41 rate and that the reflectance of Insultec, remains constant over a period of ten years.

2. 1 New Uninsulated Roof

For a new uninsulated metal deck roof the application of Insultec would give a reduction in air conditioning operating costs, of approximately \$3,38 per square metre per year. At an application cost of \$8.50 per square metre for a new roof, this would give a payback period in the order of 2.5 years.

2.2 Existing Uninsulated Roof

The savings gained in air conditioning operating costs by the application of Insultec to this type of roof, would be the same as for a new uninsulated roof \$3.38 per square metre, per year. Assuming the cost of cleaning the roof was a \$1.00 per square metre, the pay back period would be in the order of 2.8 years.

2.3 New Insulated Roof

For a new building with an insulated (fibre-glass or similar insulation) metal deck roof, the application of Insultec would give a reduction in air conditioning costs of approximately 0.85cents per square metre per year. At an application cost of \$8.50 per square metre for a new roof, this would give a payback period in the order of 8 years. However the additional protection to the metal, with Insultec against corrosion, pollution, contraction and expansion etc., would enhance the life of the roof and reduce the payback period by several years, although how would be saved, would depend on several factors such as location, maintenance etc.

2.4 Existing Insulated Roof

The savings in air conditioning operating costs gained by the application of Insultec to this type of roof would be the same as for a new insulated roof (See 2.3 above).

2.5 Insultec Versus Other Insulation

Substantial field tests have been carried out by various experts in the field of Thermal Insulation, one such report showed that Insultec had a maximum daily temperature of 4 degrees Celcius lower than fibreglass batts rated at R2.5. The same report stated "It is concluded that a coating of Insultec on the roof of a building confers considerable benefit in maintaining the interior at a relatively low temperature...... Although the use of fibreglass enables the temperature to be kept more nearly constant between day and night, it does not seem to be effective in keeping the maximum daytime temperature at a low value.

The experimental findings of the report indicate substantial benefits in daytime temperature trials by the use of Insultec against fibreglass batts rated R2.5. We are unable to confirm the results of this report as certain factors have not been adequately explained to us. We therefore believe the figures produced in our technical appraisal are conservative.

3.0 EXPERIMENTAL DATA

Dr Julien Goldsmid has conducted experiments on Insultec to determine the imperical values of Absorptance and Reflectance of Insultec. Dr Goldsmid found in his experiments that Insultec had an emissivity of 95% at Infra-Red wavelengths. Dr Goldsmid considers that this high emissivity at Infra-Red wavelengths was part of the reason for the better than expected performance of Insultec

4.0 CALCULATIONS

4.1 General

Heat flow through a roof can be found by using well established heat transfer formulae

4.2 Transmission Co-efficient

We will assume that the roof is constructed of corrugated metal, 50 mm fibreglass insulation, an air gap and plasterboard false ceiling for the following calculations:

Air film	0.044
Insultec	0.000
Corrugated Iron	0.000
Fibreglass Insulation	1.576
Air Gap	0.217
Plasterboard	0.071
Air Film	0.162
TOTAL	2.07

U = R = 2.07 = 0.483

But we will use U = 0.5 W/m2 oC

Dr Goldsmid states in his report that: "The temperature inside a closed building is determined by the properties of its cladding. One such property is the thermal resistance per unit area, which is proportional to the thickness of the cladding material and inversely proportional to its thermal conductivity.

It can therefore be assumed that the corrugated iron and the Insultec membrane (when applied) have no thermal resistance to the heat flow since they are both very thin. However, the lack of thermal resistance of Insultec is countered by the high degree of reflection.

We again refer to Dr Goldsmid, wherein his practical experiments indicate a lower internal temperature for Insultec compared with fibreglass batts.

4.3 Carrier Method for Heat Load Estimating

The carrier Design Manual provides a table of equivalent temperature differences for a roof with an absorptance of 0.9 and based on 35°C Dry Bulb outdoor design temperature 25°C DB room temperature, 10°C daily range, January and 40° South latitude.

Brisbane is located on 27.5' South latitude and we are interested in year long data so we therefore corrected the information provided by Carrier.

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4.3.1 Adjusted Equivalent Temperature Differences
The following table of figures is the corrected year long data for the Brisbane area.

TABLE OF EQUIVALENT TEMPERATURE DIFFERENCES

TIME	JAN		MAR				
6 a.m.	-0.51		-0.80			-0.60	
7 a.m.	-0.71	-0,67	-0.68	-0.83	-0.61	-0.61	-0.70
8 a.m.	-0.41	-0.33	-0.28	-0.20	-0.16	-0.11	-0.40
9 a.m.	-0.88	-0.72	-0.76	-0.81	-0.87	-0.89	-0.68
10a.m.	2.1	2.1	2.1	2.1	2.1	2.1	2.1
11a.m.	4.0	4.0	3.9	3.9	3.8	3.8	4.0
12 Noon	6.9	6.8	6.7	6.6	6.5	6.4	6.9
1 p.m.	9.4	9.2	9.1	8.9	8.7	8.6	9.3
2 p.m.	11.7	11.5	11.3	11.0	10.7	10.5	11.8
3 p.m.	12.9	12,5	12.2	11.7	11.3	11.1	12.9
4 p.m.	13.8	13.1	12.7	11.9	11.4	11.1	13.8
5 p.m.	13.4	12.1	11.1	10.4	9.7	9.6	13.0
6 p.m.	11.7	9.8	8.9	8.9	8.9	8.9	11.0

5.0 COMPARISONS

For the purposes of comparing different roof treatments we will consider one square metre of roof.

TREATMENT	Q (W/=2)	% REDUCTION
Bare roof	12.8	0
White paint	9.2	28.1
Insultec	6.9	46.1

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It can be seen therefore, that a white paint treatment, is 33% less effective than Insultec.

In the comparison between Insultec and Fibreglass insulation, the two products operate on separate principals, reflection is the major character of Insultec, thereby preventing heat from travelling through a metal roof into the relative area. Fibreglass insulation allows heat to penetrate through the metal roof but absorbs the heat before passing into the protected area. Again we report that we have been unable to theoretically prove the better efficiency of Insultec, but the field tests that have been carried out by Dr Goldsmid indicate up to 6oC lower temperatures inside a metal shed than the protection of Fibreglass batts.

Insultec Coatings

Measurement of Solar Heat Gain Properties



Rep. No.38630/M65

Prepared by Vipac Engineers & Scientists Ltd March, 94



DOCUMENT CONTROL FORM

INSULTEC COATINGS MEASUREMENT OF SOLAR HEAT GAIN PROPERTIES				
FILE: SF630	REPORT CODE: M65			
PREPARED FOR:	PREPARED BY:			
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1	0	Vipac Melbourne
2-4	0	Brandy Pines

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1.0 INTRODUCTION

Vipac Engineers and Scientists Ltd. was commissioned by Brandy Pines Pty. Ltd. to measure the solar heat gain properties of Insultee Coatings to compare with those properties for commercially available roofing materials. The absorbance of several samples of Insultee Coatings and commercially available metal roofing materials were measured using a UV/IR Spectrophotometer. These measurements were then used to calculate the Solar Heat Gain (SHG), Solar Heat Gain Factor (SHGF), Shading Coefficient (SC), Overall Heat Transfer Coefficient (U-Value) and Maximum Surface Temperature, according to the methods described in ASHRAE handbook 1993, Chapter 27.

The types of samples used for the test are;

Colorbond - Heritage Red

Colorbond - Off White

Colorbond - Mist Green

Galvanised Steel

Insultec - Sample 1 - -0.01 mm thick coating

Insultec - Sample 2 - =0.05 mm thick coating

Insultec - Sample 3 - -0.1 mm thick coating

Insultec - Sample 4 - =0.5 mm thick coating

Since only a flat sample was used for each test as per ASTM E903-82 the measured absorptance is diffused absorptance for normal incidence of the solar beam. The effect of Greca or Roma Profile is not included in this procedure.

2.0 METHODOLOGY

One test piece of dimension 13 mm x 50 mm was cut from each type of sheeting. The test piece was then placed in a GBC 916 UV-Visible Spectrophotometer and a PE -IR infra red spectrophotometer. The absolute diffused absorbance of each sample was measured for wavelengths 190 nm to 2500 nm (Figure 1) using Integrating Sphere attachment. The solar absorptance for the total solar spectrum was evaluated using the Air Mass 1 Spectrum (Figure 2).

The solar absorptance of the samples were calculated using the following formula in the wavelength range 190nm - 2500 nm.

% Absorptance

 $\frac{\sum a(\lambda) \times S(\lambda)}{\sum S(\lambda)}$

x 100

where, $S(\lambda)$ is the Air Mass 1 solar spectrum and $a(\lambda)$ is the absolute absorptance of the sample.



The above measurements were used with the typical properties of Galvanised Steel to evaluate the Solar Heat Gain (SHG), Solar Heat Gain Factor (SHGF), Shading Coefficient (SC), Overall Heat Transfer Coefficient (U-Value), and Maximum Surface Temperature using the methodology described in ASHRAE Fundamentals Handbook Chapter 27.

3.0 RESULTS

The measured absorbance spectra were identical for the four Insultec Coated samples with different thicknesses. This implies that the solar heat transfer properties of the coatings do not depend on the coating thickness when the thickness is greater than ~0.01mm. In the results shown in Figure 1 only one curve is used to represent all Insultec samples.

The following standard conditions were assumed for the calculation of Solar Heat Gain Properties:

Solar Beam Intensity	782	W/m2
Outside Temperature	32	°C
Inside Temperature	24	°C
Outside Wind Velocity	3.3	m/s
Inside Wind Velocity	0	m/s
Thermal Conductivity	50.5	W/m2/K
Emissivity of Air	0.93	

The results obtained are shown in Table 1.

Table 1: Solar Heat Transfer Properties of the Samples Tested

Sample	Solar Absorbance %	Overall Heat Transfer Coefficient (U) [W/m2/K]	Maximum Surface Temperature [C]	Solar Heat Gain (W/m2)	Solar Heat Gain Factor (SHGF	Shading Coefficient (SC)
Heritage Red	80.2	5.64	49.9	152.0	0.19	0.22
Off White	24.7	5.42	36.8	52.4	0.07	0.08
Mist Green	54.2	5.55	44.2	108.3	0.14	0.16
Galv. Steel	29.3	5.44	38.0	61.6	0.08	0.09
Insultee	15.1	5.38	34.2	32.7	0.04	0.05



The errors associated with the measurement and calculation of the above results are less than $\pm 3\%$.

Based on the above results Insultec Coatings have the best solar insulation properties. In terms of Solar Heat Gain, Insultec Coated sample is 38% better than the Off White-Colorbond sample and 47% better than the Galvanised Steel sample. The maximum surface temperature of the Insultec sample is only 2.2°C higher than the ambient temperature whereas the corresponding temperature difference for Colorbond-Heritage Red sample is 17.9 °C. The Colorbond-Heritage Red sample showed the worst solar insulation properties.

Based on the above test results and analysis it can be concluded that the Insultec Coatings provide a significant benefit in solar insulation when compared to the commonly used commercial metallic roofing materials.

Report Prepared for Brandy Pines Pty. Ltd. by VIPAC ENGINEERS & SCIENTISTS Ltd.

Table 1: Solar Heat Transfer Properties of the Samples Tested

Sample	Solar Absorbance %	Overall Heat Transfer Coefficient (U) [W/m2/K]	Maximum Surface Temperature [C]	Solar Heat Gain (W/m2)	Solar Heat Gain Factor (SHGF	Shading Coefficient (SC)
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Off White	24.7	5.42	36.8	52.4	0.07	0.08
Mist Green	54.2	5.55	44.2	108.3	0.14	0.16
Galv. Steel	29.3	5.44	38.0	61.6	0.08	0.09
Insultec	15.1	5.38	34.2	32.7	0.04	0.05

Full report available on request

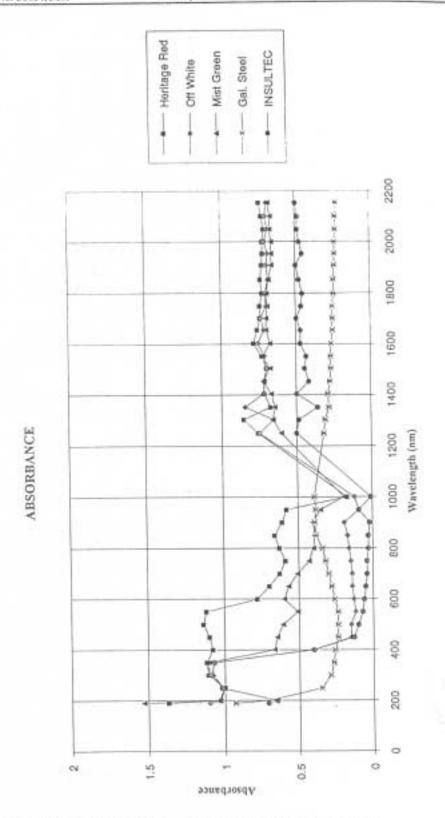


Figure 1: Absolute Diffused Absorption of the Samples Tested



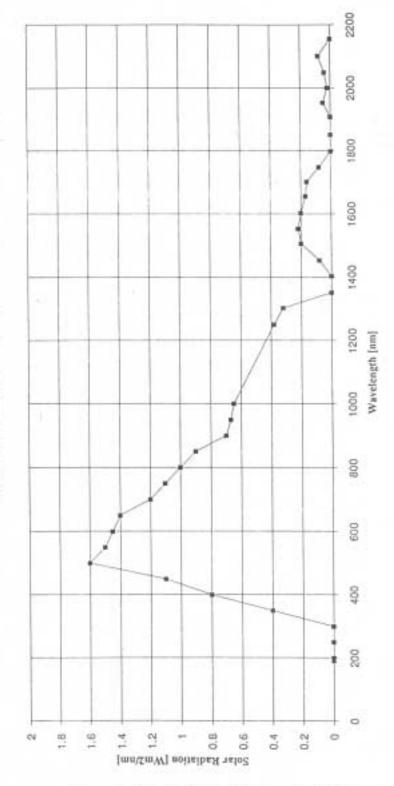


Figure 2: Solar Radiation Spectrum for Air Mass 1

UNISEARCH LIMITED

THE UNIVERSITY OF NEW SOUTH WALES PO Box 1 Kemington NSW Australia 2033 Telephone: 662 3701

Unisearch House 221-227 Anzac Parade Kernington, NSW 2033

Client: Brooks Paints Pty Ltd Purvis Lane, Dubbo, NSW 2830 8th June 1990

'K' Factor of Insultec liquid membrane

The client provided a sample of Insultec Liquid Membrane in the form of a panel approximately 285 mm square and a dry film thickness of approximately 1 mm thickness. It was requested that the 'K' factor of this membrane be determined. For such low conductance materials the method specified in Plastics Institute of Australia Code of Practice for PVC Wall Cladding, Appendix E is appropriate and was used. The principle of the method is to measure the rate of heat penetration into an enclosure by determining the rate at which solid CO2 contained in the enclosure is volatolised by the heat. The method provides a measurement of thermal resistance 'R' of the specimen, from which thermal conductance 'C' may be derived directly and, by knowledge of specimen thickness the thermal conductivity 'K' can be derived. Accuracy of the method is estimated to be plus or minus 15%:

Results

Thermal resistance of sample, $'R' = 0.12 \text{ m}^2 \text{ K W}^{-1}$ Thermal conductance of sample, $'C' = 8.6 \text{ W m}^{-2} \text{ K}^{-1}$ Thermal conductivity 'K' (based on a thickness of 1.0 mms for the specimen submitted). $K = 0.090 \text{ W m}^{-1} \text{ K}^{-1}$

Comment

The density of the specimen provided is 1290 kg m⁻⁵, indicating a modest level of expansion of the foamed material. Nevertheless the 'K' factor is significantly below those of solid vinyl, acrylic or olefine polymers, which are of the order of 0.15 to 0.30 W m⁻⁵ K⁻¹.

The conductivity is however higher than that of low density insulants such as cork, polystyrene and the like, which range from 0.03 down to 0.015 W m K-1.

D.H. Morton

Associate Professor

Department of Applied Physics University of New South Wales

P 01 Copy to Correspondence



The University of Western Australia

Department of Mechanical Engineering Nedhards, Perin, Western Australia (889) Facsande (100) 580-1024, Telex AA92942 Telephone (100) 580-2945

SOLAR MATERIALS TESTING LABORATORY

5 June 1992

Insultee Unit 3, 502 Marmion St Booragoon W.A. 6145

Attention: Mr Dion Smith

Dear Mr Smith

Re: Emissivity and Optical Properties Measurements, Ret. 18/92

Emissivity measurements have been carried out on "Insulating Paint", in accordance with Australian Standard 1903 - 1976 (with 1979 amendments). The result was an emissivity of 0.89. The optical properties results are enclosed.

We will gladly conduct any further testing you may require.

Yours sincerely

Raffaele Cammarano (B.E., Hons)

Emil.



COMALCO RESEARCH CENTRE 15 EDGARS ROAD THOMASTOWN, VICTORIA 3074, AUSTRALIA.

17 January, 1995

TO WHOM IT MAY CONCERN

Thermal efficiency improvements made to buildings at Comalco Research Centre, Thomastown last year included coating the gable roof of two buildings with Insultec.

The two buildings are very similar, with identical materials of construction and gable roof-space above the two story construction. The roof comprises ribbed metal decking with reflective foil backed fibreglass insulation 50mm thick.

The application program was such that for part of one day, one roof was coated with Insultec, the other was not and although the sky was continuously overcast that day and ambient temperatures only in the mid 20's, the temperature contrast between the two roof-spaces was significant.

A temperature traverse of the two roof spaces showed a difference of 10°C at head height above the level two ceiling walkway and 15°C on the foil backing under the roof insulation layer.

Subsequent maintenance visits onto the roof of the various buildings, has evidenced an astonishing temperature difference between the outside surface of the coated and uncoated roof decks and other metal components, particularly on hot, bright sunny days.

Noel L. Martyn MIEAust CPEng

1. K. Maryon



BROOME REGIONAL TAFE CENTRE

Mr Terry Ross
'Insulted'
118 Marine Terrace
Sorrento WA 6020

INSULTEC - BROOME TAFE CENTRE

I would like to comment on the success of the painting on the roof of the workshop at the above centre.

As you may well know, the temperatures in the Klimberley region do get extremely hot. The students here were very uncomfortable especially in the welding area of our workshop. The roof is only corrugated iron with no insulation and this did not help with the coolness.

On a visit to Katherine in 1992, I met with the Adelaide agent for Insultic who explained the principles of the product. He convinced me that this was the cure for the workshop roof. So much so, that I purchased every drop he had with him. On my return to Broome I found that I did not have enough to cover the whole roof, I discovered a local agent who contracted to do the job for me.

Prior to commencing the painting he took the temperatures from various areas around the workshop and the average at door each day (6 days) was 530 C.

After the painting was completed, temperatures were again taken for the 5 days and it was found that the temperature did not exceed 440C a reduction of 90C.

Along with the students' and lecturers, I would readily recommend the use of INSULTEC for any metal building which has no other insulation.

John Hutchison

Tafe Regional Co-ordinator

West Kimberley

June 17, 1993

TAYWOOD IN ENGINEERING IN LIMITED

CONSULTANTS IN MATERIALS TECHNOLOGY

Technology Park State 2, 14 Brodie Hall Drive Bentley WA 6102

Post Office Box 221, Victoria Park WA 6100 Tel: (09) 470 1511 Fax: (09) 470 1279 A.R.B.N. 009 474 079

CLIENT:

Brooks Liquid Insulation

YOUR REF:

Insultec 1 System

OUR REF:

J/N 606

Certificate of Test No. 1520

SAMPLE:

Insultec 1 System

Date Received:

20 May 1996

From:

Brooks Liquid Insulation

Description

1 x 4L container Insultec 1

& Condition:

2 x 1L container R33X cement primer

TEST DESCRIPTION: CARBON DIOXIDE DIFFUSION RESISTANCE

Sample Preparation

Coating system consisted of one coat (nominal 0.125 litre/m²) R33X Primer and one coat (nominal 0.5 litre/m²) of Insultec 1. Application was by brush to unglazed ceramic tiles by Taywood Engineering Limited (Perth). Recoat interval was 2 hours.

Test pieces conditioned at 23±2°, 65±5%RH to constant weight prior to test.

Test Method

The sample was sealed in a circular steel rig such that both faces were exposed. Carbon dioxide (15% in oxygen) at a known pressure and flow rate was passed over the coated face of the sample, and helium gas was passed over the opposite face at the same pressure and flow rate. The helium gas stream was monitored by gas chromatography to analyse for carbon dioxide and oxygen.

Equilibrium conditions were achieved after approximately 24 hours and the steady state flow of carbon dioxide and oxygen calculated from the percentages of carbon dioxide and oxygen in the helium stream and the flow rate of gas. The diffusion coefficients were calculated using Ficks First Law of Diffusion.



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Certificate No. 1520

Page 2 of 2

TEST RESULTS

TEL Sample No.	P10939 and P10940
Client Identification	R33X Primer and Insultec 1
Nominal Dry Film Thickness, microns	300
O2 Diffusion Coefficient, cm2sec-1	8.2 x 10 ⁻⁷
CO ₂ Diffusion Coefficient, cm ² sec ⁻¹	6.2 x 10 ⁻⁷
Diffusion Resistance Coefficient (μ)	239700
Equivalent Air Layer Thickness (R), m	72
Equivalent Thickness of Concrete (Sc), cm	48

Note:

Results shown are the mean values from four determinations, test pieces P11080 and P11081.

3.

R and Sc are calculated for nominal dry film thickness of composite. D_{CO2} for uncoated tile is $1 \times 10^{-3} \text{cm}^2 \text{s}^{-1}$. Klopfer criterion for an effective anti-carbonation coating is R>50m. Calculation of Sc assumes typical $\mu=150$ for 30 N/mm² concrete. 4.

5.

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CONSULTANTS IN MATERIALS TECHNOLOGY

Technology Park Saite 2, 14 Brodie Hall Drive Bendey WA 6102

Past Office Box 221, Victoria Park, WA 6100 Tel: (09) 470 1511 Fax: (09) 470 1279 A.R.E.N. 009 474 079

CLIENT:

Brooks Liquid Insulation

YOUR REF:

Insultec 1 System

OUR REF:

J/N 606

Certificate of Test No. 1528

SAMPLE:

Insultee 1

Date Received:

20 May 1996

From:

Brooks Liquid Insulation

Description

1 x 4 L container Insultec 1

& Condition:

2 x 1 L container R33 x Cement Primer

TEST DESCRIPTION: WATER VAPOUR TRANSMISSION

Sample Preparation

Coating system consisted of one coat (nominal 0.125 litre/m²) R33X Primer and one coat (nominal 0.5 Litre/m²) of Insultee 1. Application was by brush to unglazed ceramic riles by Taywood Engineering Limited (Perth). Recoat interval was 2 hours.

Test pieces conditioned at 23±2°C, 65±5%RH to constant weight prior to test.

Test Method

The method of test was in accordance with ASTM Standard E96-94 "Water Vapour Transmission of Materials" Section 12 (Procedure for water method). The sample was scaled in a test dish using a previously characterised water vapour impermeable silicone scalant. The coated face was exposed to dry atmosphere (0% RH) and the other tile race was exposed to water vapour (100% RH). The test dish was weighed daily for a period of 10 working days. Equilibrium conditions were achieved after approximately 1 day and the water vapour transmission rate calculated (g/m²/24 hr). The diffusion coefficient for water vapour (D₁₁₂₀) was calculated using Fick's First Law of Diffusion.



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Certificate No. 1528

Page 2 of 2

TEST RESULTS

P10939 & P10940 TEL Sample No. R33X Primer & Insultec 1 Client Identification 300 Nominal Dry Film Thickness, microns Vapour Transmission Rate, g/m2/24 hour 40.7 Vapour Diffusion Coefficient, cm2 sec-1 7.4 x 10⁻⁵ 3440 Diffusion Resistance Coefficient (µ) 1.0 Equivalent Air Layer Thickness (Sd), m

Note:

Sd calculated for nominal dry film thickness of composite. 1.

Klopfer criterion for an effective anti-carbonation coating is Sd < 4m.

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Pass Office Box 221, Viztoria Park WA 6100 Tel: (09) 470 1511 Fas: (09) 470 1279 A.R.B.N. 009 474 (179

CLIENT:

Brooks Liquid Insulation

YOUR REF:

Insultee 1 System

OUR REF:

J/N 606

Certificate of Test No. 1593

SAMPLE:

Insultec 1

Date Received:

20 May 1996

From:

Brooks Liquid Insulation

Description & Condition:

1 x 4L container Insultec 1 2 x 1L container R33X Primer

TEST DESCRIPTION: REDUCTION IN CHLORIDE ION PENETRATION

Sample Preparation

Coating system consisted of one coat (nominal 0.125 litre/m²) R33X Primer and one coat (nominal 0.5 litre/m²) of Insultec 1. Application was by brush to a 200 x 100 mm diameter N30 grade concrete cylinder by Taywood Engineering Limited (Perth). Recoat interval was 2 hours.

Test piece conditioned at 23±2°C and 60±10% RH for 7 days prior to test.

Test Method

Samples dried at 40°C in ventilated oven. Samples then subjected to alternate cycles of 24 hours immersion in 5% sodium chloride solution; 24 hours at 40°C ventilated chamber for 28 days.

Coating removed from coated cylinders, then whole cylinders crushed and pulversied to pass $150 \mu m$ sieve prior to determination of chloride content.

Chloride content carried out in accordance with BS 1881; Part 124:1988 "Methods for Analysis of Hardened Concrete" Section 10.2 except titration by potentiometric method.

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Certificate No. 1593

Page 2 of 2

TEST RESULTS

TEL Lab No.	Sample	Chloride Content %w/w	Mean Chloride Content %w/w	Reduction in Chloride Penetration %
P10962 P10963	Control Control	0.189 0.194	0.192	
P10964 P10965	Insultec 1 System Insultec 1 System	0.018 0.022	0.020	90

1 2 19 1 . 8-8-96
Tested by Date

Approved by

Date

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CLIENT:

Brooks Liquid Insulation

YOUR REF:

Insultec 1 System

OUR REF:

J/N 606

Certificate of Test No. 1594

SAMPLE:

Insultec 1

Date Received:

20 May 1996

From:

Brooks Liquid Insulation

Description & Condition: 1 x 4L container Insultec 1 2 x 1L container R33X Primer

TEST DESCRIPTION: REDUCTION IN WATER ABSORPTION

Sample Preparation

Coating system consisted of one coat (nominal 0.125 litre/m²) R33X Primer and one coat (nominal 0.5 litre/m²) of Insultec 1. Application was by brush to a 200 x 100 mm diameter N30 grade concrete cylinders by Taywood Engineering Limited (Perth). Recoat interval was 2 hours.

Test pieces conditioned 41 days at 23±2°C and 60±15% RH.

Test Method

Reduction in Water Absorption carried out in accordance with ASTM C642-90, "Standard Test Method for Specific Gravity, Absorption and Voids in Hardened Concrete", Section 5.2 except initial drying at $23\pm2^{\circ}$ C and $65\pm15\%$ RH.

CONSULTANTS IN MATERIALS TECHNOLOGY

Certificate No. 1594

Page 2 of 2

TEST RESULTS

TEL Lab No.	Sample	Water Absorption %w/w	Mean Water Absorption %w/w	Reduction in Water Absorption %
P10958 P10959	Control Control	1.62 1.71	1.67	
P10960 P10961	Insultee 1 System Insultee 1 System	0.22 0.19	0.20	88

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Date

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Technology Park Saint 2, 14 Brodie Hall Drive Bentley WA 6102

Pent Office Box 221, Victoria Park WA 6100 Tel: (09) 470 1511 Fax: (09) 470 1279 A. R.B.N. 009 474 079

CLIENT:

Solux Liquid Insulation Pty Ltd

YOUR REF:

Insultec 1 System

OUR REF:

J/N 606/02

Certificate of Test No. 1706

SAMPLE:

Insultec 1

Date Received:

20 May 1996

From:

Brooks Liquid Insulation

Description & Condition: 2 x 1 L container R33X Primer 1 x 4 L container Insultec 1

TEST DESCRIPTION: CHLORIDE ION DIFFUSION RESISTANCE

Sample Preparation

Coating system consisted of one coat (nominal 0.125 litre/m²) R33X Primer and one coat (nominal 0.5 litre/m²) of Insultec 1. Application was by brush to unglazed ceramic tiles by Taywood Engineering Limited (Perth). Recoat interval was 2 hours.

Test piece conditioned at 23±2°C, 58±2% RH to constant weight prior to test.

Test Method

Chloride ion diffusion resistance in accordance with Section 5.3 of "Chemical Testing Procedures Manual, TEL Perth Laboratory" Document No. 014H/90/4683.

Diffusion coefficient estimated at non-steady-state condition using Ficks Second Law of Diffusion.

CONSULTANTS IN MATERIALS TECHNOLOGY

Certificate No. 1706

Page 2 of 2

TEST RESULTS

TEL LAB SAMPLE No:	P10939 (Primer) P10940 (Topcoat)
Client Identification:	R33X Primer Insultec 1
Test Piece:	P11754
Driving cell NaCl concentration, M	5.0
Volume of driving and measuring cells, mL	550
Thickness of composite, mm	6.5
Measured dry film thickness of system, microns	250
Cross-sectional area of test specimen, cm2	54.7
Temperature during test, °C	23±2
Duration of test, days	27
Chloride Ion Diffusion Coefficient, m ² /sec	2 x 10 ⁻¹³

Many 1- 5.11.96 Tested by Date

Approved by

Date

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CONSULTANTS IN MATERIALS TECHNOLOGY

Technology Park Suite 2, 14 Brodie Hall Drive Bentley Western Australia 6102

Past Office Box 1071, Bentley Delivery Centre Western Australia 6983
Tel: (08) 9470 1511 Fax: (08) 9470 1279
Email: selper@taywood.auert.com
A.R.B.N. 009 474 079

CLIENT:

Solux Liquid Insulation Pty Ltd

YOUR REF:

Insultec 1

OUR REF:

J/N 2219-2

Certificate of Test No. 2815

Sample:

Insultee I

Date Received:

19 March 1999

From:

Solux Liquid Insulation Pty Ltd

Description

& Condition:

1 x 1L container Insultec 1

TEST DESCRIPTION:

COLOUR CHANGE

Sample Preparation

Coating system consisted of two coats Insultec 1 (nominal 0.5 L/m²). Application was by 10mm pile regular nap roller to unglazed ceramic tiles by Taywood Engineering Limited (Perth). Recoat interval was 4 hours. Test pieces conditioned at 23±2°C and 50 to 70% RH for 14 days prior to accelerated weathering.

Test Method

Test pieces exposed to accelerated weathering in accordance with ASTM D4587-91, "Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV - Condensation Light and Water Exposure Apparatus", Condition D. The weathering cycle being 8 hours UV-B light at 60°C followed by 4 hours condensation at 45°C for 2000 hours.

Test pieces then assessed visually for condition in accordance with AS1580.481.1.12 1998 "Coatings - Exposed to Weathering - Degree of Colour Change".





CONSULTANTS IN MATERIALS TECHNOLOGY

Certificate No. 2815

Page 2 of 2

TEST RESULTS

Lab Sample No.

P18325

Client ID:

Insultec 1

Test Piece No.	Gray Scale Reading	Rating
P18352	4 to 5	0 to 1, no colour change to very slight colour change
P18353	4 to 5	0 to 1, no colour change to very slight colour change

Note: A very slight pink tint is observed.

Nongo

7.99

Date

Approved by

/2/99 Date

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CONSULTANTS IN MATERIALS TECHNOLOGY



Technology Park Saite 2, 14 Brodie Hall Drive Bentley Western Australia 6102

Post Office Box 1021, Bentley Delivery Centre Western Australia 6983

Tel: (08) 9470 1511 Fax: (08) 9470 1279 Email: selper@saywond.aust.com A.R.B.N. 009 474 079

CLIENT:

Solux Liquid Insulation Pty Ltd

YOUR REF:

Insultee 1

OUR REF:

J/N: 2219-04

Certificate of Test No. 2816

Sample:

Insultee 1

Date Received:

19 March 1999

From:

Solux Liquid Insulation Pty Ltd

Description

1 x 1L container Insultec 1

& Condition:

TEST DESCRIPTION:

CRACK BRIDGING TEST

Sample Preparation

Coating system consisted of two coats Insultee 1 (nominal 0.5L/m²). Application was by doctor blade to a substrate prepared as specified in ASTM C836-89a by Taywood Engineering Limited (Perth). Test pieces were conditioned at 23±2°C and 50±5% relative humidity for 14 days and followed by 7 days in circulating-air oven at 70±2°C prior to testing.

Test Method

The test was conducted in accordance with ASTM C836-89a "Standard Specification for High Solids Content, Cold Liquid - Applied Elastomeric Waterproofing Membrane for Use With Separate Wearing Course" Section 5.7 and ASTM C957-93 (Reapproved 1998) "Standard Specification for High Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane with Integral Wearing Surface" Section 5.5. Test pieces tested at ambient temperatures and a displacement width of 1.6mm.

The test was performed using a Universal Testing Machine with a crosshead rate of 0.05mm/minute.





CONSULTANTS IN MATERIALS TECHNOLOGY

Certificate No. 2816

Page 2 of 3

TEST RESULTS

Lab Sample No:

P18325

Client ID:

Insultec 1

Test Piece No.	Observation After 10 cycles
P18572A	No defects observed
P18572B	No defects observed
P18572C	No defects observed

Note: ETRS Pty Ltd Report No. WT99-569.001 forms an integral part of this document.

ETRS Pty Ltd Tested by

16 July 1999

Date

Approved by

Date

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Report:

WT99-569.001

Client:

Taywood Engineering Ltd

Attention:

Mr S. Wong

Order No:

Subject:

Crack Bridge Testing of Three Membrane Samples.

Date:

16 July 1999



ETRS Pty Ltd A.C.N. 006 353 046 8 Egmont Road Henderson WA 6166 PO Box 187 Hamilton Hill

WA 6963 Australia Fax (08) 9437 6022 Phone (08) 9437 6155

Introduction:

A request was made to conduct crack bridging tests on three (3) prepared samples. The test samples were identified as ;

> P18572/A P18572/B P18572/C

Procedure: 2.

Crack Bridge Testing Testing was performed in general accordance with ASTM C836, Sections 5.7.4 and 5.7.5; "High-Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane For Use with Separate Wearing Course." and as modified by ASTM C957, Section 5.5; "High-Solids Content, Cold Liquid Applied Elastomeric Waterproofing Membrane With Integral Wearing Surface"

Testing was conducted on a 2500 N capacity, A Grade, Universal Testing Machine at ambient conditions. Each membrane sample was subjected to 10 cycles, consisting of extending the masonry blocks 1.6mm and then relaxing back to zero displacement. Each cycle was conducted at a crosshead separation rate of 0.05mm / min. Following ten test cycles, the bridging membrane on each test sample was examined for cracking, loss of adhesion or other failure modes

3. Results:

3.1 Crack Bridging Test.

Sample Number	Observation After Test Completion	Compliance (Referencing ASTM C957)
P18572/A	No defects detected	Complies
P18572/B	No defects detected	Complies
P18572/C	No defects detected	Complies

Mechanical Testing Manager

ETR5(WA)mireport/wt99-569.001

Please note that following the completion of testing ETRS Pty Ltd will retain test samples for a period of 14 Days, unless prior written briangements have been made with ETRS. Note that this report is based on the products supplied to ETRS Pty Ltd and it remains the responsibility of the client to ensure the samples presented are representative of the whole product batch. Reproduction of this report, other than in its entirety, must by approved by ETRS.

TAYWOOD MENGINEERING LIMITED

CONSULTANTS IN MATERIALS TECHNOLOGY

Tüchnology Park Suite Z. 14 Brodie Hall Drive Bentley Western Australia 6102

Post Office Box 1021, Bentley Delivery Centre Western Australia 6983

Tel: (08) 9470 1511 Fax: (08) 9470 1279 Email: telper@tunwood.aust.com A.R.B.N. 009 474 079

CLIENT:

Solux Liquid Insulation Pty Ltd

YOUR REF:

Insultec 1

OUR REF:

J/N 2219-02

Certificate of Test No. 2972

Sample:

Insultec 1

Date Received:

19 March 1999

From:

Solux Liquid Insulation Pty Ltd

Description

& Condition:

1 x 1L container Insultec 1

TEST DESCRIPTION:

WATER VAPOUR TRANSMISSION

Sample Preparation

Coating system consisted of two coats Insultee 1 (nominal 0.5 L/m²). Application was by 10mm pile regular nap roller to unglazed ceramic tiles by Taywood Engineering Limited (Perth). Recoat interval was 4 hours. Test pieces exposed to accelerated weathering in accordance with BS3900 Part F3:1971 'Resistance to Artificial Weathering (enclosed carbon arc)' for 2000 hours. Test pieces reconditioned at 23 ± 2°C and 65± 5%RH to constant weight prior to test

Test Method

The method of test was in accordance with ASTM Standard E96-94 "Water Vapour Transmission of Materials" Section 12 (Procedure for water method). The test dish was weighed daily for a period of 11 working days. Equilibrium conditions were achieved after approximately 72 hours and the water vapour transmission rate calculated (g/m²/24 hour). The diffusion coefficient for water vapour (D_{N20}) was calculated using Fick's First Law of Diffusion.

This method complies with the requirement of AS/NZS 4548-1999 Part 5 Appendix C "Guidelines on Water Vapour Transmission Testing".



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CONSULTANTS IN MATERIALS TECHNOLOGY

20000

Certificate No. 2972

Page 2 of 2

TEST RESULTS

Lab Sample No	P18325
Client Identification	Insultec 1
Nominal Dry Film Thickness, microns	500
Vapour Transmission Rate of Composite, g/m²/24 hour	34.8
Vapour Diffusion Coefficient of Film, cm ² /sec	1.2 x 10 ⁻⁴
Diffusion Resistance Coefficient (µ)	2050
Equivalent Air Layer Thickness (Sa), m	1.0
Estimated Vapour Transmission Rate for:	
Unsupported Film, g/m ² /24 hour	48.7
Permeance of Film, g/Pa sm ²	2.0×10^{-7}

Note:

- 1 Result shown is mean value from test pieces P18345 and P18346.
- 2 S_a calculated from nominal dry film thickness.
- 3 Klopfer criterion for an effective anti-corbonation coating is S_d<4m.</p>
- 4 Vapour Transmission Rate of unsupported film estimated from film diffusion coefficient. Permeance value calculated from this value.

Nogn.

22.12.99

Date

Approved by

Date

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CONSULTANTS IN MATERIALS TECHNOLOGY

Technology Park Suite 2, 14 Brodie Hall Drive Bentley Western Australia 6102

Post Office Box 1021, Bontley Delivery Centre Western Australia 6983 Tel: (08) 9470 1511 Fax: (08) 9470 1279 Email: telper@tuywoodeng.com.uu A.R.B.N. 009 474 079

CLIENT:

Solux Liquid Insulation Pty Ltd

YOUR REF:

Insultec 1

OUR REF:

J/N 2219-02

Certificate of Test No. 2973

Sample:

Insultee 1

Date Received:

19 March 1999

From:

Solux Liquid Insulation Pty Ltd

Description

& Condition:

1 x 1L container Insultee 1

TEST DESCRIPTION:

CARBON DIOXIDE DIFFUSION RESISTANCE

Sample Preparation

Coating system consisted of two coats Insultec 1 (nominal 0.5 L/m²). Application was by 10mm pile regular nap roller to unglazed ceramic tiles by Taywood Engineering Limited (Perth). Recoat interval was 4 hours. Test pieces exposed to accelerated weathering in accordance with BS3900 Part F3:1971 "Resistance to Artificial Weathering (enclosed carbon arc)" for 2000 hours. Test pieces reconditioned at 23±2°C and 65±5%RH to constant weight prior to test.

Test Method

The sample was sealed in a circular steel rig such that both faces were exposed. Carbon dioxide (15% in oxygen) at a known pressure and flow rate was passed over the coated face of the sample, and helium gas was passed over the opposite face at the same pressure and flow rate. The helium gas stream was monitored by gas chromatography to analyse for carbon dioxide and oxygen.

Equilibrium conditions were achieved after approximately 24 hours and the steady state flow of carbon dioxide and oxygen calculated from the percentages of carbon dioxide and oxygen in the helium stream and the flow rate of gas. The diffusion coefficients were calculated using Ficks First Law of Diffusion.

This method complies with the requirements of AS/NZS 4548.5-1999 Appendix D "Guidelines on Carbon Dioxide Diffusion Testing".



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CONSULTANTS IN MATERIALS TECHNOLOGY

Certificate No. 2973

Page 2 of 2

TEST RESULTS

TEL Sample No:	P18325
Client Identification:	Insultec 1
Nominal Dry Film Thickness, microns	500
O2 Diffusion Coefficient, cm2sec-1	7.3x10 ⁻⁷
CO2 Diffusion Coefficient, cm2sec-1	3.4x10 ⁻⁷
Diffusion Resistance Coefficient (µ)	488600
Equivalent Air Layer Thickness (R), m	244
Equivalent Thickness of Concrete (S,), cm	61

Note:

- Results shown are the mean values from 2 determinations, test pieces P18345 & P18346
- 2. R and Sc are calculated for nominal dry film thickness.
- D_{cor} for uncoated tile is 1.3 x 10⁻² cm²s⁻¹
- Klopfer criterion for an effective anti-carbonation coating is R>50m
- Calculation of S_e assumes typical μ = 400 for concrete

Nagh Tested by

24.12.99

Approved by

Date

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Certificate of Test

CZ52NS2830

REPORT NO.: FNS0094

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TESTS ON A SPRAY APPLIED PAINT IN ACCORDANCE WITH

BS 476: PART 7-1987

TRADE NAME:

INSULTEC

SPONSOR:

SOLUX LIQUID INSULATION PTY LTD

30 Walker Street WINDSOR NSW AUSTRALIA

DESCRIPTION OF SAMPLE:

The sponsor described the sample as an high build re-radiating elastomeric membrane. It is a water-based co-polymer compound containing pigments and fillers. Two coats of the sample were applied over calcium silicate boards.

Nominal paint thickness:

250 µm

Colour:

white

TEST METHOD:

The specimens were tested in accordance with British Standard 476, Fire tests on building materials and structures, Part 7. Method for classification of the surface spread of flame of products - 1987. For the test, each specimen measured 885 mm long and was clamped to the water-cooled frame.

OBSERVATIONS:

The sample underwent blackening and blistering during the test.

RESULTS:

Specimen	Spread of Flame at 1.5 min(mm)	Final spread of flame at 10 min (mm)
1	• / 10	
2	•	
3		
4		
5	•	
6		

These samples did not ignite.

CLASSIFICATION:

Class 1

The test results relate only to the behaviour of the test specimens of the product under the particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

DATE OF TEST:

3 August 1999

Issued on the 4th day of August 1999 without alterations or additions.

6. White Glenn Whittaker

Testing Officer

Manager, Fire Testing and Assessments

This laboratory is accredited by the National Association of Testing Authorities, Australia. The tests reported herein have been performed in accordance with its terms of accreditation.



aproving the Built Environment

Building, Construction and Engineering

14 Julius Avenue, Riverside Corporate Park, Delhi Road, North Ryde NSW 2113 AUSTRALIA Telephone: 61 2 9490 5444 Facsimile: 61 2 9490 5555

Mobil Refining Australia Pty Ltd

Altona Refinery Cur Millers & Kororoit Rda Altona, Victoria 3018

Telephone: (03) 92865666 Facsimile: (03) 92865588

7th March 1994

Insuitec Australia Pty Ltd.

Attn: Mr Jim Della-Bona

Re: Insultec Pairt Trials

As discussed a Refinery Engineer has organised a test of your product on a small surface area leading to a control room air conditioning inlet duct. The surface received the prescribed coating thickness as per your technical advise.

Some of the results to date, indicated a significant surface temperate reduction. During a 32oC day the surface temperature of an untreated area was 51oC whilst the Insulted treated area had a 33oC reading.

Temperature monitoring is continuing with the view of painting the entire ducting to minimise the air conditioning heat load.

The Refinery will be contacting your organisation to recommend a suitable coating for the outside of a storage tank.

J. PAPAGEORGIOU Snr Project Engineer



REFLECTIVE ROOF TREATMENT OF A DEMOUNTABLE BUILDING

MONITORING REPORT

FOR

DEPARTMENT OF EDUCATION AND TRAINING

CLAIRGATE PRIMARY SCHOOL

NSW Department of Public Works and Services Environmental & Energy Services McKell Building 2-24 Rawson Place Sydney NSW 2000

Telephone: 02 9372 8255

Facsimile: 02 9372 8299

Email: peter.loveridge@dpws.nsw.gov.au

PREFACE

Program

This monitoring report has been prepared for the Department of Education and Training (DET).

Compliance with Standards

The Department of Public Works and Services' Quality Assurance (QA) System has been applied throughout the preparation of this report. This QA System has been independently certified by the National Association of Testing Authorities. Australia as meeting the requirements of AS3901/ISO 9001.

Disclosure Of Interests

Department of Public Works and Services receives no financial benefits from and has no ties with utilities, equipment suppliers or contractors in the conclusions or recommendations reached in this monitoring report. Apart from possible future commissions to project manage the implementation of recommendations. Department of Public Works and Services has no vested interests in the recommendations of this report.

Disclosure of Information

This report may contain commercial in confidence, sensitive or privileged information. It is intended for use by the Department of Education and Training. Any use, disclosure, copying or distribution of this report or information contained in it is prohibited without express permission of the Department of Education and Training.

Job Number 325E464

Publication June 1999

File Number SS148726

Computer file address Housy_ENERGROPENERGY/EDUCATN/SCHOOLS/CLAIRGAT/AUDITREP.DOC

Prepared by Environmental and Energy Services - Peter Loveridge

Acknowledgments

Ian Sutton - Principal Clairgate Primary School

Mrs Murray - Teacher

Steve Hitchcock - GA, Shirley Phipps - Cleaner

Garry Stevenson - DET Properties Directorate

Gerrard Twomey - The Heat Management Company

Project Controller Peter Loveridge

Tel: (02) 9372 8203, Fax: (02) 9372 8299, Email: peter.loveridge@dpws.gov.au Please contact the Project Controller for further assistance or for additional copies of the report.

NSW Department of Public Works and Services

Environmental & Energy Services

McKell Building

2-24 Rawson Place

Sydney NSW 2000

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1. EXECUTIVE SUMMARY

1.1 Aim of Energy Study

The Department of Education and Training (DET) are investigating opportunities to reduce energy consumption and greenhouse gas emissions, heating costs and cooling costs in demountable school buildings, through improved design standards and materials used in their construction.

DET were approached by the Heat Management Company to trial a heat reflective membrane coating for roofs. The coating was claimed to reflect infrared and ultra violet solar rays and reduce the temperature within the class room space.

This monitoring study was performed to evaluate the:

- effect of a heat reflective membrane coating, applied externally to the roof of a demountable class room building,
- · external ambient and internal class room temperatures and
- energy consumption and running costs of similar air conditioning systems in two demountable class rooms, one standard and the other with the roof treatment applied.

1.2 Building/Facility Summary

The primary school is located at Colorado Drive, St Clair, in Sydney's outer Western suburbs. The two demountable class rooms which were used for the temperature and energy monitoring were located within a series of 6 demountable buildings. The monitored classrooms are adjacent to each other with both subject to the same weather conditions. Each demountable building has two, -7kW split, air conditioning systems.

1.3 Monitored demountable buildings

Room	Serial No	Treatment	
Room 19	OS 602 14157	Insultee 1 Heat re-radiating elastomeric membrane	
Room 20	OS 602 14155	Standard demountable - no treatment	

1.4 Summary of Estimated Costs

The temperature and energy monitoring has identified the following differences between the two buildings due to the application of the Insultec 1 Heat reradiating elastomeric membrane, during the monitoring period of January 28 to April 16, 1999:

Period - January 28 to April 16 1999.	Data selected is for 34 days when both
demountable class room air conditioni	ng systems were operating on the same day.

Room	Energy Consumption kWh	Energy Consumption MJ	Calculated Running cost	kgs of Greenhouse gasses	
Room 19	464	1,691	\$47.61	443.9	
Room 20 822		3,129	\$84.24	785.5	
Savings 358		1,438	\$36,63	1,229.4	

Table 1.1 Cost Summary

The cost of operating the air conditioners in room 20 for the 34 days was \$36.63 higher than room 19, a 77% increase in operating costs, for the limited monitoring period.

The control system for the air conditioners limits their operation to a two hour period and must be manually reset for continued operation. This limits unnecessary and excessive operation of the air conditioners. The individual teacher's preferences and comfort will also affect the operation of the air conditioning system.

1.5 Conclusion

From the monitoring data obtained and calculations based on this data, the demountable building with the roof treatment, room 19, had superior performance for room temperature and air conditioning running costs compared to the other monitored demountable building.

The demountable with the membrane also received favourable comments from the teacher regarding the comfort conditions and reduced desire to use the air conditioning system, compared to past personal experience in other demountable buildings during summer.

The simple payback period for the installation of the material, at \$880, and the air conditioning savings, based on 10.26 cents per kWh, estimated for a full summers operation is 17.2 years. This appears excessive but may be considered by DET.

The reduced air conditioning run time and the reduced associated noise is an additional factor for consideration when evaluating the treatment within a teaching environment.

As the paint product claims to retain heat in the room, savings may also be achieved during winter through reduced heat loss, but this was not evaluated as part of this study.

2. Introduction

2.1 Aim

The monitoring of two demountable school buildings at Clairgate Primary School was undertaken for the Department of Education and Training (DET). The aim was:

- to monitor and evaluate the performance of the heat reflective membrane coating, applied externally to the roof of a demountable class room building.
- monitor the external ambient and internal class room temperatures and
- monitor and calculate the energy consumption and running costs of the air conditioning systems for two similar demountable class rooms, one with the roof treatment applied and the other, a standard demountable.

2.2 Facility

The primary school is located at Colorado Drive, St Clair, in Sydney's West. The two demountable class room buildings used for the monitoring were located in a row of six demountable buildings. The entrance to each of the demountable buildings face North. The demountable buildings monitored were numbered 19 and 20. The site was chosen because the demountables utilise the current DET Standard, demountable air conditioning system. There are two split system air conditioners installed in each class room, controlled by a common timer. The school's location was convenient for the company providing the roof treatment and for DPWS to monitor the installation. The site also provided a number of similar air conditioned demountables to choose from.

2.3 Roof coating

The Department of Education was approached by the Heat Management Company to trial a heat reflective membrane coating for roofs. The coating was claimed to reflect infrared and ultra violet solar rays and reduce the temperature within a class room space and therefore reduce the running cost of air conditioning the room. DET provided two demountable class rooms for the trial of the product and later arranged for DPWS to carry out monitoring during the first school term of 1999.

3. FACILITY DETAILS

This section provides a description of the site, buildings, materials and services and the types and energy use.

3.1 Facility Description & Operation

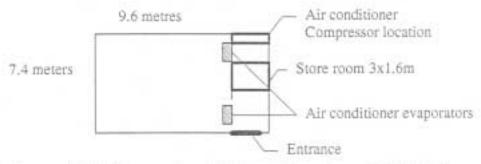
The facility is a primary school operated by the Department of Education and Training. The normal teaching hours are 9 AM to 3 PM Monday to Friday. Recess is at 11 am for 30 minutes and lunch is 1.20 pm-2 pm. Each of the class rooms accommodate about 28 pupils. The normal school year consists of about 41 weeks over four terms. There were two weeks of school holidays during the monitoring period, from April 2 to 16, 1999.

3.2 Building Form & Finishes Description

The demountable class rooms used for the temperature and energy monitoring were located adjacent to each other in a line of 6 demountable buildings. The two demountable buildings are refurbished standard design demountables with 75 mm of Rockwool insulation installed in the roof space.

The roofs of the buildings are similar to 'Cliplock steel' roofing material.

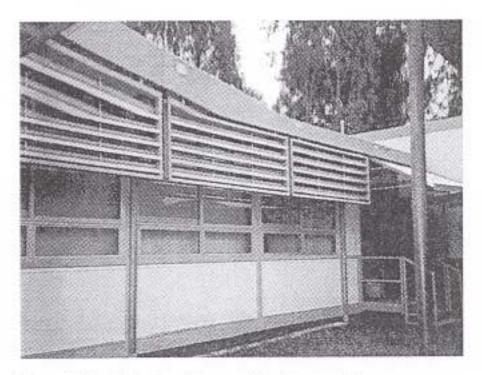
The class rooms are about 71 m² in area, including an internal 3.7m² teacher's store room, as shown in the plan view below.



The demountable buildings monitored had the serial numbers, OS602 14157 and OS602 14155.

3.2.1 Windows

Each of the class rooms have large openable windows on the North and South sides of each class room. The North side opens onto a covered walk way and the playground. The South side is on the boundary of the school with shading provide by a row of established trees. The windows have external and internal shading devices fitted to both the North and South facing windows. The external shading devices are shown in the following picture. The window glass is not tinted.



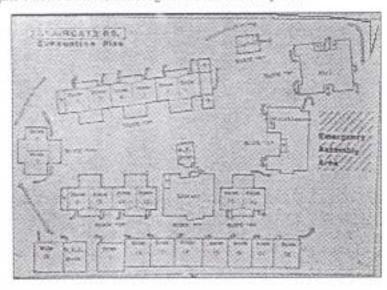
External, Northerly view of demountable class room 19.

3.2.2 Floor and Walls

The floors are timber with carpet coverings. There is timber panelling on the walls. The buildings are about 300-400 mm above the ground level.

3.2.3 Layout

Clairgate Public school, building and class room layout.



Class rooms 19 & 20.

A number of the other demountables have been removed since the previous layout drawing was made.

3.3 Roof Treatment

The Heat Management Company were responsible for the application of INSULTEC 1 elastomeric membrane to the roof of demountable class room 19 at Clairgate Public School in late 1998.

The application method required the roof having a rust kill primer coat and then two coats of Insultec applied using an airless spray gun. The finished coating is reported to be about 200 microns in thickness. The time required for application was two days. The value of the application is normally \$11-15 per square metre and depends upon the condition of the roof, the amount of cleaning required and preparation of the surface.

A roof in good condition requiring only water blasting for preparation would be about \$11 per square metre. A copy of the Product Data Sheet and Material Safety Data Sheet are included in Section 8 Appendix.

The cost to DET for coating the demountable roof would be approximately \$880. Based of \$11 per m² and 80 m². The class rooms are 71 m² but the roof area is approximately 80 m² including the eaves.

The coating is claimed to function by re-radiating infra-red and ultra violet solar radiation. This reduces the heating up the roof material and subsequent heat transfer into the building's interior.

The paint is off white in colour and has a matt finish to reduce glare. Past experience with white painted or unpainted steel roofs has been substantial glare problems in ajoining multi story buildings. The current DET standard roof finish is a beige colour.

3.4 Air conditioner Installation

Each demountable has two independently controlled, split system air systems.

The air conditioners are:

Fujitsu Air conditioner, model ABT24RAF-W, with the following rating.

- cooling 6760 watts output, 2650 watts input, 12.6 amps
- heating 7320 watts output, 2520 watts input, 12.1 amps

Each unit can be turned on independently and has its own adjustable thermostat. The thermostats, when the monitoring was installed were set at about 16-18C° for all four of the units. The fan speed controls were all set to auto. Each of these settings can be manually altered by the teacher and are located out of the reach of the students.



The above picture is of the two Fujitsu air conditioner compressor/condenser units installed in a sound insulated cabinet within each demountable class room. There is only external access to the units.

3.5 Control Systems

Each class room is fitted with a small exhaust fan which provides fresh air to the class room when the air conditioners are operating. The exhaust fan has a two hour electronic timer which limits its operation. The air conditioners are controlled so that they may only run when the exhaust fan is running. At the end of the two hour time limit, the exhaust fan stops, this results in the air conditioners stopping. To start the air conditioning again the exhaust fan timer must be re-activated and only then can each air conditioning unit be turned on. This method of timer control prevents the air conditioners operating excessively in unoccupied rooms or for long periods. There is no automatic starting of the air conditioners.

3.6 Monitoring

The electrical and temperature monitoring was carried out on the two demountables between the 28 January and 19 April, 1999. Monitoring was not carried out on the demountables prior to the treatment of the roof. The monitoring of the energy consumption was achieved by installing a VTP System 3 Energy Analyser in the electricity supply to the air conditioners at the distribution board in each of the store rooms, located in demountables 19 & 20. The Energy Analysers monitored energy consumption for the duration of the test period.

The various electrical quantities, such as watts, kWh, power factor, voltage and current were recorded and averaged over each 1/2 hour period. Approximately 3,200 measurements were recorded.

The temperature monitoring was performed by using four ACR Systems, Trend Loggers. A logger was installed in each class room in a ventilated plastic utility box located about 1,500 mm above floor height and was used to monitor internal room temperatures. The logger monitored, averaged and recorded the room temperature every 1/2 hour.

Two temperature loggers were installed outside the demountable buildings, under the eaves, to measure ambient conditions.

4. ENERGY TARIFFS

4.1 Electricity Tariff

Electricity is supplied to the site by Integral Energy. The tariff applicable is the General Supply Rate Tariff, effective from 1 July 1998.

The tariff is:

15.845 cents per kWh for the first 198 kWh, bi- monthly and 10.197 cents per kWh for the balance.

Based on the schools March 1999 electricity account, the average cost of electricity was 10.26 cents per kWh. This average cost has been used when calculating the running costs and savings.

5. TEST RESULTS

5.1 Energy Consumption Analysis

There were approximately 11 weeks of monitoring data, including weekends and the two weeks of April school holidays. The following table shows the number of days of operation, energy and cost of the air conditioning systems during the monitoring period.

Room	Insultee roof treatment	No. of days operation	No. of kWh consumed	Cost of air conditioning operation
Room 19	Yes	35	470	548
Room 20	No	38	869	589

Table 5.1 Days of operation

The difference in cost of running the air conditioning systems was \$39 for the 9 weeks the air conditioners were used during the monitoring period. The air conditioners did not operate during the school holidays. The difference in the number of days of operation may be due to the teachers preferences and perceptions.

Table 5.2 Energy consumption per month in kWh and average ambient temperatures.

7 days starting	28/1/99 kWh	4/2/99 kWh	11/2/99 kWh	18/2/99 kWh	25/2/99 kWh	4/3/99 kWh	11/3/99 kWh	18/3/99 kWh	25/3/99 kWh	Total
Room 20 (Standard)	98.7	47.7	170.3	99.1	45.4	131,3	104.9	95.2	76.5	869.1
Savings in kWh	49.9	4,7	55.4	59.9	24.3	75.9	26.7	69,4	33.1	399.2
Average 9-4 pm Temperature degrees "C	26.6	27.2	30.6	27.6	25.8	29.3	28.9	26.5	27.9	n/a

Note: The table excludes the April school belinkys starting 234/99 fair two weeks as there was no air conditioning energy consumed.

From the above table it can be seen that the highest energy consumption occurred when the average, daytime ambient temperature peaked at 30.6 °C in the 7 days starting 11/2/99.

The results show that the air conditioning system in room 19 used the least energy.

These figures may be affected by the thermostat settings of each air conditioning unit, they are not fixed but were set to the same level at the commencement of the test.

The lower the thermostat setting, the more energy will be required to obtain the desired temperature.

The number of weeks the air conditioning systems would be expected to be used, based on the mean daily average temperature exceeding 25°C would be 12-16 weeks per year. This period starts early November and continues to the end of March. This period is based on historical data for the Liverpool area obtained from the Bureau of Meteorology.

The air conditioning running costs, calculated over a full summer period of an average 14 weeks, has been calculated to result in an electricity saving of \$51.28.

The simple payback period for the roof heat treatment membrane based only on summer cooling load and the minimum installation cost per m², is 17.2 years.

The air conditioning systems may also be used during winter as they are reverse cycle units, capable of heating. There has been no monitoring performed to establish the performance of the system during a winter period.

The membrane could reduce the winter solar gain requiring a greater air conditioning heating input. There would need to be further monitoring to quantify the effects during winter.

5.2 Electrical load profile

5.2.1 Room 19 - Insultec treated

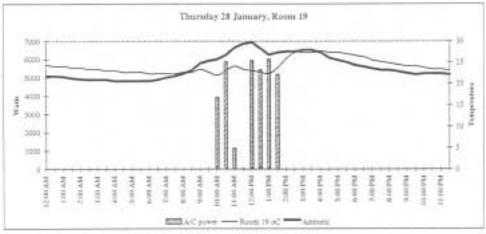


Diagram 6.3 Typical daily profile.

The above diagram for room 19, shows a typical day's room temperature and air conditioning load.

6. RECOMMENDATIONS

From the data obtained during the monitoring period the demountable class room with the Insultec roof treatment reduced the energy consumption required by the air condition systems to provide comfort conditions.

The trial results are subject to the operation of the system by the responsible class room teachers which may be affected by:

- manual starting of the air conditioning systems, this places the starting responsibility on to the preferences of the individual teacher,
- personal preference to use or not use air conditioning, even though conditions may require its operation,
- thermostat settings, which were within the control of the individual class room teacher, may have been altered,
- the opening or closing of windows and doors while the air conditioning systems were in operation. Increased infiltration of warm outside air will affect the operation by increasing the cooling load.

The treated class room received favourable comments from the occupying teacher as to the improved comfort conditions, which also may have reduced the requirement to use the air conditioning system.

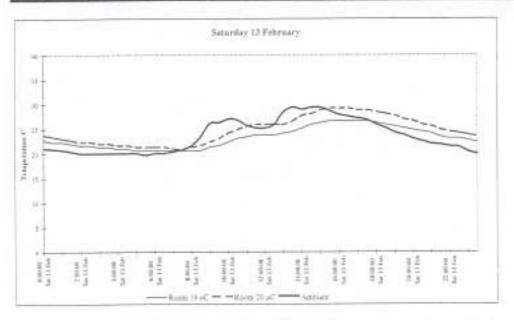
The simple payback period for the installation of the material, based on the air conditioning savings estimated for a full summers operation is 17.2 years.

Savings may also be achieved during winter through reduced heat loss, but this was not evaluated as part of this study.

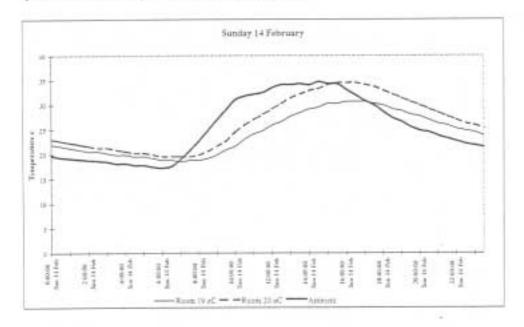
With a payback period of 17.2 years the coating are not be recommended in the Sydney area due the long payback period. The treatment would be more viable in locations where the ambient temperatures are higher and the summer period longer. Under these conditions greater air conditioning use and increased savings, would improve the payback to a reasonable period.

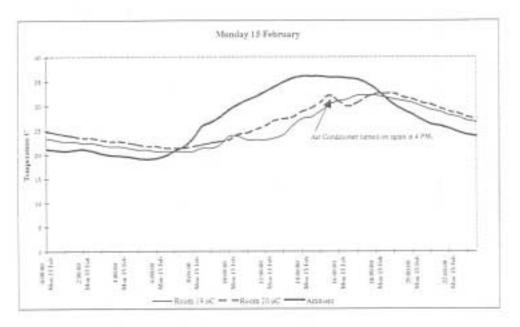
The reduced air conditioning run time and the reduced associated noise is an additional factor for consideration when evaluating the treatment within a teaching environment.

7. LOAD PROFILES



From the above graph is can be seen that the internal temperature of room 19 is lower than room 20. The external ambient temperature was about 30 °C. In the following graph, as the external ambient is higher, at about 35°C, the difference between the two class rooms has increased. The air conditioning system was not in operation over the weekend,



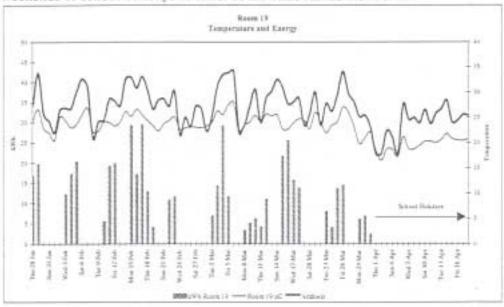


The above graph shows the two class room temperatures on a typical school day. The temperature in room 19 is constantly lower than room 20, except for about 10 am as the air conditioner in room 19 had not been turned on.

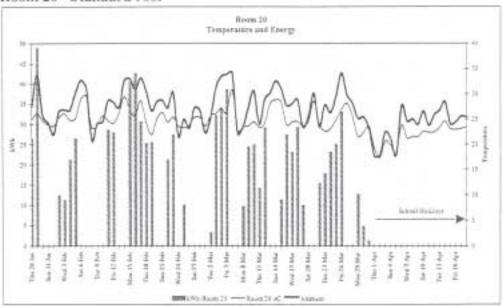
For the following two graphs, the daily external ambient and internal room temperatures are averaged between 9 am and 4 pm each day. Therefore the graphs represent the temperature conditions when air conditioning systems were operating. The averages exclude the overnight conditions.

Room 19 - Insultec treated

The graph below shows each day the air conditioner was in operation and the external ambient and internal room temperatures and daily total kWh consumption. There was no operation of the air conditioning system during weekends or school holidays in either of the class rooms monitored.



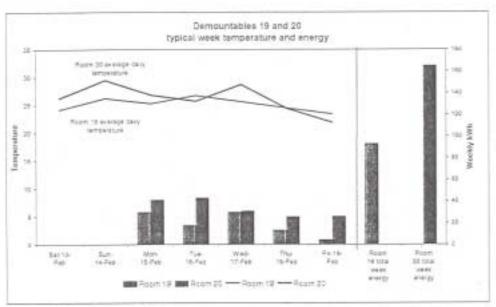
Room 20 - Standard roof



The above graph shows the increased daily energy consumption and the number of days the air conditioner was in operation, compared to room 19. The graph also shows the internal room and external ambient temperatures.

Both of the above graphs are to the same temperature and kWh scales.

The graph below shows the daily energy consumption and average room temperature between 9 am and 4 pm for the week starting 13 February and the total weekly energy consumption for each demountable.



Room 19 has the Insulted treatment.

8. APPENDIX

Attachments.

- 1. Material Safety Data Sheet
- 2. Product Data Sheet

SOLUX LIQUID INSULATION PTY. LTD.

ACN 059 170 357

30 WALKER STREET WINDSOR NSW 2756 AUSTRALIA Windsor, Head Office & Factory Phone: 61 45 775 336 Fax: 61 45 775 269 Dubbo, Office Phone: 61 68 843 557 Fax: 61 68 843 558

MATERIAL SAFETY DATA SHEET

INSULTEC 1

High build heat re-radiating Elastomeric Membrane

Description:

Heat resistant and water proofing membrane

Manufacturer:

Solux Liquid Insulation Pty Ltd.

30 Walker Sreet Windsor N.S.W. 2756

Australia

Hazardous

Non -hazardous Acrylic co-polymer 50 %, Filler and pigments

Ingredients:

35-40%, Additive 5 %.

Flash point:

N/A

Unusual Fire and

Explosive hazards: Non flammable. Will not support combustion but in the likely

event that water is removed the resulting polymer will burn if involved in a fire. Decomposes on heating, emitting traces of

monomers.

Health Hazard Information:

Toxicity Data:

Non toxic.

Emergency and First Aid Procedure:

Eyes :

Mild irritation, wash away with plenty of water.

Skin :

No effect, wash away with soap and water.

Inhalation

No effect, remove person to fresh air.

Ingestion

Mild irritation, give water to drink and seek medical assistance.

Spill or Leak

Procedures :

Slippery when spilt. Avoid accidents, clean up immediately, use absorbent material such as sand. Collect and seal in drums for disposal. Wash area down with detergent and excess water.

Page 2

Waste Disposal Method:

Refer to State Waste Management Authority. Normally suitable

for disposal at an approved land waste site

Special protection information:

Ventilation requirements: Adequate natural ventilation.
Respiratory protection: None normally required.

Eye protection: Chemical goggles or face shield.

Protective clothing / other: Impervious gloves.

Handling and storage: Use good occupational work practice. Store in a cool

place out of direct sunlight and heat.

Other precautions: Use good industrial hygiene, and the usual

precautionary measures for handling chemicals.

Fire fighting and extinguishing procedures:

Non flammable, use water spray or foam. Wear self contained breathing apparatus. Use water spray to

cool fire exposed container.

For further information refer to product data sheet

DISCLAIMER:

This information is based on data believed by the company to be accurate at the time of writing, but is subject to change without notice. It is given in good faith, for the assistance of users and is of general nature. No legal warranty expressed or implied is made as to its accuracy, completeness or otherwise. Every person dealing with the materials referred to herein does so at their own risk absolutely and must make independent determinations of suitability and completeness from all sources to ensure their proper use. We have no control over the conditions under which these products are stored, handled or used, and therefore our recommendations must not be regarded as amounting to legal warranty or as involving any legal liability on Solux Liquid Insulation Pty Ltd.

SOLUX LIQUID INSULATION PTY. LTD.

ACN 059 170 357

30 WALKER STREET WINDSOR NSW 2756 AUSTRALIA Windsor, Head Office & Factory Phone: 61 45 775 336 Fax: 61 45 775 269 Dubbo, Office Phone: 61 68 843 557 Fax: 61 68 843 558

INSULTEC 1

PRODUCT DATA SHEET

HIGH BUILD HEAT RE-RADIATING ELASTOMERIC MEMBRANE

- * Outstanding heat re-radiating elastomeric membrane
- * Suitable for most building substrates
- * Low cost / Energy efficient

DESCRIPTION: Insulted 1 heat re-radiating membrane is highly durable and flexible, allowing it to move with the substrate. Insulted 1 fills and bridges hairline cracks. Insulted 1 can be applied to a wide variety of materials such as concrete, brick, asphalt, timber, clean or primed fibro and properly primed metals. It is supplied in an off white colour with a matt finish to alleviate glare. The Insulted 1 membrane treatment adds longer life to the substrates over which it is used. Its heat insulating ability is remarkable with reports, during excessive temperature periods, of interior temperatures being lowered by 15°C and more.

COMPOSITION: Insulted 1 is a water based co-polymer compound containing inert pigments and special fillers.

PROPERTIES:

Coverage :

I little per I meter square of flat area assuming no losses, if waterproofing

is apply I square meter per litre.

Drying time :

\$\overline{q}\$ 25°C Touch I hour: Recost, 4 hours

Component :

One component system.

Shelf life :

I year in sealed container at 25oC

Film thickness:

Wet-500 micron per coat. Dry - 250 microns per coat

Solids by vol%:

50% +/- 1 %

No. of coats :

One or Two, dependant upon application requirements

Finish

Matt

Thinners

Do not thin Insulted 1, use as is.

Cleaning :

Insulted 1 is easily cleaned with water when wet. When dry use

white spirit.

Storage

Protect from heat and frost. Ideal storage conditions are in the shade at

artibient temperatures of between TooC and 25oC

APPLICATION DATA: Stir thoroughly before use. Insulted I may be applied by brush, roller or airless spray gun. Equipment may be cleaned with water and dry paint can be removed with solvents.

PRECAUTIONS: Provide adequate ventilation during use. Spray painters should comply with health regulations. Do not use on glazed surfaces unless previously treated. Do not apply if rain is expected or the relative humidity is above 85% or within 3°C of the Dew point. Insulted 1 is not suitable for areas where permanent ponding may occur.

SURFACE PREPARATION: Prepare surfaces as for normal painting.

Crack in masonry: Insultee 1 can be successfully applied over cracks and small gaps by using a polyester tape pressed into a coat of wet Insultee 1 and then over coated with another coat of Insultee 1.

Fibro, Masonry: Wire brush or scrape away surface dirt or fungus. Repair surface. Mould, fungus. mildew, algae growth should be treated with a 10% solution of Acticide fungicide. On particularly bad surfaces, it may be necessary to repeat the treatment. Do not water blast asbestos surfaces.

Slate, Tiles: Remove surface dirt by wire brushing or water blasting. Carry out repairs to tiles prior to application.

Unpainted metal surfaces: Remove any rust and abrade to bright metal. Apply a zinc phosphate primer MPC.P.2. Apply a full coat of solvent based metal primer and allow to dry. If the metal is badly corroded, two coats of primer may be needed. Lead or soft alloys can be prepared by using a wire brush to roughen the surface before priming. This treatment is followed by the usual one or two coats of Insultee 1. Non ferrous metal can be primed with water base metal primer.

New Metal less than 2 years old: Acid etch, rinse thoroughly and follow the steps for unpainted surfaces as above.

Non bleeding asphalt. Bitumen and pitch coated surfaces: Apply a bitumen primer such as B1500X Bitumen primer and allow to dry thoroughly for 24 hours before coating with Insulted 1.

Painted surfaces: Gloss surfaces should be well sanded to break up the gloss. Any other painted surface should be sound and well bonded to the substrate. Apply finalities I to the prepared surface.

Timber: New unpainted timber should be primed with a wood primer. For previously painted timber, remove flaking and loose paint. Spot prime where necessary. (see-painted surfaces)

RESISTANCE:

Chemicals: Standard 10% solution of acids and alkalis, including nitric acid and caustic soda failed to cause breakdown of the Insultec 1 membrane. Impervious to salt spray and shows good resistance to water permeability

Mould and fungus. Insulted I exhibits extremely high resistance to mould and fungus.

TESTING: Insulted 1 samples were subjected to testing by the Experimental Physics Department of the University of New South Wates and by the Department of Main Roads. South Australia. These tests showed interior temperature reductions of up to 15°C on a 40°C day. Test results are available on request to Brooks Insulating Paints. The membrane which is the vehicle for the special heat rejecting fillers has been in constant use for the past 15 years in Australia.

DISCLAIMER: The data contained herein is based upon information which the company believed to be reliable at the time of preparation of this data sheet. No responsibility can be accepted, or any express or implied warranty given where performance of the product is affected by surface preparation, method of application or any other circumstance beyond the control of Solux Liquid Insulation Pty Ltd.

JAMES COOK UNIVERSITY OF NORTH QUEENSLAND

The Australian Institute of Tropical Architecture

School of Public Health & Tropical Medicine TOWNSVILLE QLD 4811, AUSTRALIA E-Mail: Richard.Aynaley@jcu.edu.au

TELEPHONE: +61 77 81 4147 FAX: +61 77 81 5766

FACSIMILE TRANSMISSION TO: Gerard Twomby - Insultec Pty Ltd

FAX:

07 3806 0944

DATE:

25 August 1997

SENDER:

Professor Richard (Dick) Aynsley, Director

SUBJECT:

Insultec Paint on Metal Roofing

Number of pages including this cover sheet: 1

Dear Gerard,

We have taken a few preliminary comparative measurements of underside of corrugated custom orb metal roofing temperatures with and without your Insulted insulating paint.

Upper surface finish Zinc/Alumin	Lower Surface Finish Zinc/Alumin	Roofing Temperature °C 77°C
	Caulfield Green Paint	73°C
White Gloss Paint	Zinc/Alumin.	58°C
	Zinc /Alumin.	53°C

These are only preliminary spot measurements but we would be delighted to perform a fully documented test program should one be required.

Regards,

Professor Richard Aynsley



CENTRE EUROPEEN DES TECHNIQUES DE LA CONSTRUCTION DIVISION ESSAIS ET MESURES TESTS & MEASURES DIVISION

TEST REPORT Nº DME 7 92 539

TEST CLAIMANT

MACHINERY SALES NOUMEA (M.S.N.)

BP 3989 - OUEMO - MAGENTA NOUMEA - NEW CALEDONIA SOUTH WEST PACIFIC

Date of claim: 23 november 1992

Reference:

Fax Jim DELLA-BONNA

TEST CARRIED OUT ON: INSULTEC PAINT

SAMPLES:

Received: On the november 10, 1992

Registered Nº 699

TYPE OF TESTS:

Tests on roof covering for water-proofing.

DATE OF TESTS:

From january 6th to march 26th, 1993.

DH/OT

Bureau VERITAS, established in 1828, is the largest Building Controler in Europe.

The following Test Report is issued from its Tests and Measures Division.

At this point, it must be kept in mind that all buildings subject to a loan from any private or government banking institution must be covered by a ten year construction warranty; that against any faulty workmanship, faulty materials or materials which do not stand up to a very strict quality control and again inaccurate engineeing calculations.

As soon as a total estimate has been carried out on and the tender adjudicated, the company must register the total cost of the building and an insurance policy for a ten year cover must be paid. Bureau VERITAS then controls the structure from the foundations to the paint finishes and until the final handing over to the owner.

Not a single item in the construction must be unknown to Bureau VERITAS. Builders are required to show that all merchandise used is ratified by the European Standards Body.

DME 7 92 539

SAMPLES USED

INSULTEC METAL PRIMER

1 - PREPARATION OF TEST SURFACES

1-1 SURFACES

- Cement mortar finely finished following standard Nº P 84-402.
- Fibro coment prepared in conformity with standard NF T 30-800.
- Fibro cement prepared as for NF T 30-800 but rendered alkaline by a process of standard NF T 30-803.
- Galvanised steel, new and cleaned with scouring solvant, then washed with a solution of concentrated soda to obtain a pH of 13.
- Sheet of vinyl to obtain a single coat of paint.

1-2 APPLICATION OF THE MATERIAL

1 - 2.1 Primary undercoat

* Surfaces : cement mortar, fibrocement, sheet vinyl.

Brush on of a coat of INSULTEC diluted with 50 % water.

Mass of product applied per sqm = 11 sqft

Mortar	Fibrocement	Vinyl
560 gm.	340 gm.	315 gm.
1 lb 4ozs	12 ozs	11 ozs

Drying time: 24 hours at 23°C +/- 2°C and 50 % +/- 5 % relative humidity. 24 hours at 73°F +/- 4°F.

1 - 2.2 INSULTEC paint

On all the above test surfaces.

First coat of INSULTEC paint applied by brush.

Mass of paint applied per sqm = 625 gm,

or 11 sqft - 1 lb 6oz.

Drying time: 24 hours at 23°C 1/- 2°C and 50 % 1/- 5 % relative humidity.

thers at 73°F +/- 4° F.

Brush application of a second coat of INSULTEC paint.

Mass of paint applied per sqm = 625 gm.
or 11 soft = 1 lb 6oz

1 - 3 CONSERVATION PRIOR TO TESTS

After treatment, the test bars are kept away from dust for a month at 23°C +/- 2°C temperature and in a relative humidity of 50 % +/- 5 %.

2 - WATER PENETRATIONFOLLOWING CONVENTIONAL CODES: NF T 30-801

Test explanation

3 tubes of a diameter of 40 mm (about 1 1/2") are sealed on the INSULTEC paint which has been previously applied on a non-alkaline fibrocement and a 4th tube is sealed on a piece of plate glass.

These have at their end a reduction of 8 mm (about 5 / 16th) in diam, and a line is traced at 10 cm (about 4") from the base.

The water level is checked and corrected every 24 hours during 8 days with the help of a drop glass.

The loss of water mass then corrected is weighed and gives the water absorption content of the surfaced in gm / dm2 per day.

Results:

Water absorption	TEST 1	TEST 2	TEST 3	AVERAGE
g/dm²/day	0.5	0.5	0.4	0.5
0.035 g / 1 3/4 sqin	0.0175 oz	0.0175 oz	0.014 oz	0.0175 oz

3 - WATER VAPOUR PENETRATION TEST: NF T 30-018

Test explanation

3 samples of INSULTEC paint having a diameter of 50 mm (1 15/16 th") are sealed inside aluminium cells having a sump of (35.7 +/- 0.1) mm (about 1 3/8").

With the help of a pipette, 20 ml of saturated solution of ammonium chloride are introduced into the sump.

The aluminium cells are then placed into a dryer for calcium chloride at 23°C +/- 2°C and 50 % +/- 5 % relative humidity.

Every 24 hours, the loss of weight is registered.

The water vapour penetration through the material becomes with a 5 % error, constant. It is expressed in g / m² / 24 hours.

Results

Water vapour penetration	TEST 1	TEST 2	TEST 3	AVERAGE
g / dm² / day	11	12	9	11
Per 11 sqft / 24 hours	3/8th oz	7/16th oz	1/4th oz	3/8th oz

4 - TEST FOR ENDURANCE UNDER NORMAL CLIMATIC CONDITIONS:

Test carried out under the method of 75 automatic cycles in 12 hours.

* Cement mortar surface

At the conclusion of the cycles the product showed no apparent dust, no sign of coming away from the surface, no crackling, no change of colour and no trace of bubbles.

5 - ADHERENCE TEST: NF 30-062

On cement mortar base.

Patches of 50 mm diameter (about 2").

The stress and the tearing point are shown in the table below:

Test Number	Applied stress in MPa	Average	Type of rupture looked for
	5 - 1 Before clima	tic cycles test average	
1 2	1.5 1.8		5.4
3	1.7		27
4	1.8	1.6	Rupture of
5	1.7		adhesion (coming
6	1.5		unstuck at the base)
7	1.4		
8	1.6		

5 - 2 After climatic cycles' test average

1	1.4		Tests I to 6
2	1,3		Unsticking at the
3	1.3		base.
4	1.4	1.5	5430.
5	1.8		Tests 7 and 8
6	1.2		Unsticking at the
7	1.7		base and later
8	2.1		coming off with
			the material.

6 - STANDARD TEST OF PERFORMANCE TO HUMIDITY AND HEAT: NF T 30-802

Surface used : Fibro cement

Alkaline fibro-cement

After 3 weeks exposure at 40°C (104°F) +/- 2°C and 95 % relative humidity, the tested material showed no dust, no loss of adhesion, no crackling, no change of colour nor bubbling.

7 - ADHERENCE TEST: NF T 30-062

Surface used: Fibro cement

Alkaline fibro-cement

Patches of 50 mm diameter (2")

Test Number

Applied stress in MPa

Average

Type of rupture looked for

7 - 1 Before exposing to humidity and heat

7 - 1.1 Test samples : Fibro cement

1 2 3 4 5	0.6 0.7 0.6 0.6 0.7 0.5	0,6	Bonding break of the base
7	0.6		

7 - 1.2 Test samples : Alkaline fibro-cement

1 2 3	0.7 0.7 0.6		Bonding break of the base
4	0.7 0.8	0.7	
6	0.6		100
7	0.5		

7 - 2 After climatic cycle's test

7 - 2.1 Test samples : Fibro-cement

1 2 3 4 5 6 7 8	1.8 1.6 1.7 1.7 1.8 1.6 1.5	1.7	Bonding break of the base and partly unsticking of the base.
--------------------------------------	---	-----	---

7 - 2.2 Test samples : Alkaline fibro cement

1 2 3	0.7 0.8 0.7		Bonding break from the base.
5	0.7	0.8	
6	0.8		
7	0.8		63
8	0.8		

8 - STANDARD TEST OF PERFORMANCE TO SALINATED FOG

Test sample : Galvanised sheet steel (new).

Preparation according to standard NF x 41-002

After 500 hours of exposure to salinated fog, the material showed no effect of dusting, unsticking, crackling, change of colour, bubbling nor traces of rusting of the surface on which the material is applied.

9 - ADHERENCE TEST: NF T 30-062

The stress and the type of separation are indicated in the table below:

Test Number	Applied stress in MPa		Type of rupture looked for
		Average	
	9 - 1 <u>Before 500 h</u>	ours exposure to sa	linated fog
1 2 3	0,9 1.0 1.1		Unsticking of the applied material and its base.
3 4 5 6 7	1.1 0.8 1.0 1.1	1.0	
	9 - 2 After 500 hor	urs exposure to sali	nated fog
1 2 3 4 5 6 7	1.1 .0.9 0.8 0.8 1.0 0.9	1.0	Unsticking of the aplied material and its base.
8	1.1		

10 - RESISTANCE TEST FOR BREAK FOLLOWING FALL OF A MASS: NF T 30-039

Procedure of the test

Base of the test : Galvanised steel sheet (new).

A weight of a 1 000 gms (2 lbs 2ozs) with polished and rounded ends having a diameter of 23 mm +/- 1 mm (7/8") is dropped through a guide tube from varying heights and without initial velocity.

The crackling or unsticking of the material is observed at the point of impact from a given height.

Results:

Thickness of the material in mm - minimum: 0.4 / maximum: 0.6 (4/25" and 6/25").

- M = 2 lbs 20zs

- h = 0.5 m - 20"

- Number of impacts : 5 - no crackling, no unsticking

11 - ABRASION RESISTANCE TEST

This test is carried out according to standard NF - T 30-015 (december 1991) on 3 tests samples made of galvanised steel sheeting covered with INSULTEC paint.

Number of abrasions: 100

Results

Test number	TEST 1	TEST 2	TEST 3	AVERAGE
Loss of weight in mg	21	22	22	22
Doss of weight in ing	7/1 000th oz	8/ 1 000th oz	8/1 000th oz	8/1 000th oz

12 - COMPARISON TEST

The measures carried out are those taken on samples previously used for testing.

Product identification	METAL PRIMER	INSULTEC
Volumetric mass at 23° C (g/cm3) (73.5° F oz./ cu in	0.947 1/2 oz / cu in	1 240 2/3 oz / cu in
Extracted dry at 105° C (220° F)	24.8 %	56 %
Quantity of ashes at 450° C (840° F)	11.7 %	19.2 %
Quantity of ashes at 900° C	11.6 %	19.4 %

Viscosity at 23° C (73.5° F)

Brookfield apparatus	Type	T2	T6
Speed in revolutions / min	nute	Viscosity	1.7
5.0 10. 20.	0	0.2 0.2 0.2	46 26 15
50.	0	0,2	7
pH indicator at 73.5° F /	23° C		7.5

Gennevillers the 7th april 1993

Technicien chargé des essais

Dominique HEITZLER

Resodasable el Activité

Grenoble the 14th May 1996 N/REF GM/96-279/FO/SN

REPORT OF TESTS No. CM/96-30
OPTICAL AND THERMAL CHACTERISATION OF A PAINT (INSULTEC)

ONLY THE COMPLETE REPRODUCTION AND PHOTOCOPY OF THIS REPORT OF TESTS IS AUTHORISED

This report of tests vouches for the characteristics of the sample supplied for the tests but does not prejudge the characteristics of similar products. Therefore it does not constitute a certificate of description in the sense of the law of 10th January 1978.

The beneficiary of the report of tests will have to make its true range very clear if it is being used for commercial ends. The sanctions article 24 makes provisions for can be taken against the offending beneficiary.

At the request of: S.D.C., BP 1018 97247 FORT DE FRANCE CEDEX

This report of tests includes 5 pages numbered 1/5 to 5/5

CSTB

LE FUTUR EN CONSTRUCTION

S.D.C. BP 1018 9/24/FORT DE FRANCE CEDEX Tel: 62 29 69 - Fex: 62 29 79

OBJECT

On a painted steel sheet, it is a matter of:

- Measuring the factor of reflection of Solar energy
- Measuring the factor of reflection of Ultra-Violet Rays
- Comparing the temperature of 2 samples (one with paint and the other without paint), under exposure and controlled atmosphere.

SAMPLES

The samples are made up of galvanised steel sheet covered again with a paint called "INSULTEC". The 3 samples have been supplied by S. Le Coq, dela Societe, S.D.C.

TESTING METHOD

The factors of transmission and of reflection are measured by using the method of the Spectrophotometre. The calculation of optical factors is stemmed from the Standard plan pr EN 410 of the European Committee of Standardisation "Glass in the construction - determination of the luminous transmission, of the direct Solar transmission of Ultra-Violet Rays and of the factors derived from the windows".

The temperature is measured according to the method described in Paragraph 2.

Done at Saint Martin d' Heres, 14th May 1996

Francois OLIVE Ingenieur, Responsable des Essais Robert COPE Chef du Service Materioux

S.D.C. BP 1018 97247 FORT DE FRANCE CEDEX Tel: 02 29 69 - Fax 62 29 79

METHOD USING THE SPECTROPHOTOMETRE

The measurement is achieved with a Spetrophotometre PERKIN ELMER type Lambda 19 equipped with light sources permitting to cover the spectral range from 0.230 to 2.5 um and equipped with an incorporated sphere permitting to stop in the spectral domain, all of the radiance transmitted (direct and diffused).

1.2 Measurement and calculation of the factors of reflection

Figure 1 shows how the sample is placed in relation to the sphere and the incident radiance. You obtain therefore, with means of a monochrometer, the spectrum P $\min\left(\chi\right)$ that is to say the normal/hemispheric reflection according to the wave length.

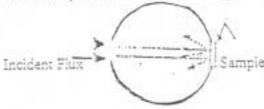


Figure 1: Measured normal hemispheric reflection

In order to calculate the factor of reflection of Ultra Violet Rays $\rho^{ab}_{\ \ cv}$, you use the formula:

U is the relative distribution of the Ultra Violet part of the Solar Spectrum, Alis the distance of wavelength.

The field of balance is $\lambda_i = CMLi$ am

The field of balance is

No = 277,5 aus

In order to calculate the factor of reflection of Solar energy ρ^{Th}_{e} , you use the formula:

$$\rho_{k}^{\text{en}} = \frac{\sum_{kl}^{kl} \rho_{(k)}^{\text{en}} S_{(k)} \triangle \lambda}{\sum_{kl}^{kl} S_{(k)} \triangle \lambda}$$

S(2) is the efficiency of the Solar spectrum. A \(\) is the distance of wavelength. The field of balance is $\lambda_1 = 300$ nm

22= 2500 nm

Measurement of the temperature under exposure and controlled atmosphere

2.1 The source of radiance

The radiance is stemmed from an opening of 500 mm diameter carried out on a sphere of integration of 3 m diameter in which is placed a halogen lamp of 2 kw with a tungsten filament. A screen prevents all radiance from the lamp directly reaching the opening.

The opening defines thus a source of about 1000 W/m 2 whose radiance is homogeneous and perfectly diffused (coming from all directions). The luminous flux is controlled with the help of 2 Pyranometres.

2.2 Measurement of temperature

The temperature on the back of the samples (side not exposed to the radiance) is measured with the help of thermo probes with platinum resistance type P+ 100 - DIN 43760. The temperatures are measured simultaneously on both samples. The samples are placed vertically to 50 mm of the source defined in paragraph 2.1. The measurements are carried out in a room air conditioned to 23oC. No forced convection is applied.

2.3 Preparation of samples

Two samples of 120 x 120 mm are cut up from the same painted steel sheet. The samples are fixed in a wooden support. The painted side of the first sample is exposed to the radiance, through an aperture of 100 mm diameter, the second is cleaned in order to suppress all traces of paint, then exposed through an aperture of 100 mm diameter.

RESULTS

3.1 Factors of reflection

The values of the factors of reflection of the Ultra Violet Ray and of the Solar energy are given in the table below. The accuracy given by the Spectrophotometre on the factors is 1%.

	P nh uv	P nh e
Sample with Insulted Paint	9.4%	33.2%

3.2 Thermal Tests

The values of the temperatures as well as of the energy of the incident radiance are given in the table below. The accuracy on the measurement of temperature is plus or minus 1.5%, the accuracy on the measurement of flux is plus or minus 2%.

	Without radiance		With radiance	
	Temp oC.	Flux W/M2	Temp oC.	Flux W/M2
Sample with Insulted Paint	22.9	7	41.5	1270
Sample without Paint	23.0	7	56.8	1270

Gronoble, le 14 mai 1996 N/REP. GM/96-279/FO/SN

RAPPORT D'ESSAIS Nº CM/96-30 CARACTERISATION OPTIQUE ET THERMIQUE D'UNE PEINTURE

REPRODUCTION INTEGRALE ET PHOTOCOPIE DE CE RAPPORT D'ESSAIS EST SEULE AUTORISEE

Ce rapport d'essals atteste des caractéristiques de l'échantillon soumis aux essais mais ne préjuge pas des caractéristiques de produits similaires. Il ne constitue donc pas un certificat de qualification au sens de la loi du 10 janvier 1978. Le bénéficiaire du rapport d'essais devra, s'il en fait état à des

fins commerciales, faire apparaître clairement sa portée réelle. Les sanctions prévues à l'article 24 de la loi peuvent être prises à l'enventre du bénéficiaire contrav most.

A la demando de : S.D.C.

97247 FORT DE FRANCE CEDEX

Ce ropport d'essais comprend \$ pages numérosées de 1/5 à 5/5

S.H.C. 15/18. capital \$0,000 F - 180 M U 321 110 1018 97847 FORFUR PRANCE CROSS rol, 62.29.89 - Fax 62.20.79



Rapport d'essais n°GM/26-30 page 2/5

OBJET

Il s'agit, sur une tôle peinte :

687253111

- de mesurer le facteur de réflexion de l'énergie solaire
- de mesurer le facteur de réflexion de l'ultraviolet.
- de comparer la température de deux échantillons (un avec peinture l'autre sans peinture) sous exposition et ambiance contrôlées.

ECHANTILLONS

Les échantillons sont compasés d'une tôle galvanisée recouverte de la peinture d'appellation « INSULTEC ». Les 3 échantillons ont été fournis par S. LE COQ de la Société S.D.C.

METHODE D'ESSAIS

Les facteurs de transmission et de réflexion sont mesurés en utilisant la méthode du spectrophotomètre. Le calcul des facteurs optiques est issu du projet de nonne prEN 410 du Comité Européen de Normalisation « Verre dans la construction » Détermination de la transmission lumineuse, de la transmission solaire directe, de la transmission totale de l'énergie solaire, de la transmission de l'ultraviolet et des facteurs dérivés des vitrages ».

La température est mesurée solon la méthode décrite au paragraphe 2.

Fait à Saint Martin d'Hères, le 14 mai 1996

François OLIVE Ingénieur, Responsable des Essais

Robert COPR Chef du Service Mutérioux

P. 0.

The CHEVALION

S.D.C. SARL capital \$0.000 F - HC 94 6 321 BP 1016 972-7 FORD DE FRANCE CODEX TOLGS.20.00 - Fox 62 20,70

Rapport d'essais nºGM/96-30 page 3/5

I - Méthode dite du spectrophotomètre

La mesure est réalisée avec un spectrophotomètre PERKIN ELMER type Lambda 19 équipé de sources lumineuses permettant de couvrir la gamme spectrale de 0.280 à 2.5 µm et d'une aphère intégrante permettant d'appréhender dans le domaine spectral. la totalité du rayonnement transmis (Direct + Diffus).

1.2 . Mesure et calcul des facteurs de Réflexion

La figure 1 montre comment l'échantillon est placé par rapport à la sphère et au rayonnement incident. On obtient ainsi, au moyen d'un monochromateur, le spectre p nh (x), c'est à dire la réflexion normale/hémisphérique en fonction de la longueur d'onde.

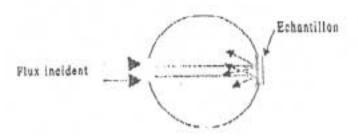


figure 1: Mesure de la réflexion normale hémisphérique

Pour enteuler le facteur de réflexion de l'ultraviolet pnh

$$\rho_{uv}^{nh} = \frac{\sum_{\lambda}^{\lambda} 2 \rho_{\lambda}^{nh} \ U_{\lambda} \Delta \ \lambda}{\sum_{\lambda}^{\lambda} 2 \ U_{\lambda} \Delta \ \lambda}$$

Ux est la distribution relative de la partie ultraviolet du spectre solaire

Δλ est l'intervalle de longueur d'onde.

Le domaine de pondération est :

$$\lambda_1 = 282.5 \text{ nm}$$

$$\lambda_2 = 377.5 \text{ nm}$$

Pour calculer du facteur de réflexion de l'énergie solaire partie et attion:

$$\rho_{\varepsilon}^{\text{th}} = \frac{\sum_{\lambda I}^{\lambda 2} \rho_{(\lambda)}^{\text{th}} S_{(\lambda)} \Delta \lambda}{\sum_{\lambda I}^{\lambda 2} S_{(\lambda)} \Delta \lambda}$$

S(λ) est l'efficacité du spectre soluire

Δλ est l'intervalle de longueur d'onde.

Le domaine de pondération est :

λ1 = 300 nm

 $\lambda_2 = 2500 \text{ nm}.$

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2 - Mesure de la température sous exposition et ambiance contrôlées

2.1 - La source de rayonnement

687253111

Le rayonnement est issu d'une ouverture de 500 mm de diamètre effectuée sur une sphère d'intégration de 3 m de diamètre dans laquelle est placé une lampe halogène de 2 kW à filament de tungstène. Un écran empêche tout rayonnement de la lampe d'atteindre directement l'ouverture.

L'ouverture définit ainsi une source d'environ 1000 W/m² dont le rayonnement est homogène et parfaitement diffus (provenant de toutes les directions). Le flux lumineux est contrôlé à l'aide de deux pyranomètres.

2.2 - Mesure de température

La température en face arrière des échantillons (face non exposée aux rayonnements) est mesurée à l'aide de thermosondes à résistance platine type Pt 100 · DIN 43760. Les températures sont mesurées simultanément sur les deux échantillons. Les échantillons sont placés verticalement à 50 mm de la source définie au paragraphe 2.1. Les mesures sont effectuées dans un local climatisé à 23°C. Aucune convection forcée n'est appliquée.

2.3 - préparation des échantillons

Deux échantillons de 120x120 mm sont découpés à partir d'une même tôle peinte. Les échantillons sont fixés sur un support en bois. Le premier échantillon est exposé, face peinte vers le rayonnement, à travers un diaphragme de 100 mm de diamètre, le second est décapé, afin de supprimer toute trace de peinture, puis exposé à travers un diaphragme de 100 mm de diamètre.

3 - Résultats

3.1 - Facteurs de Réflexion

Les valeurs des facteurs de réflexion de l'ultraviolet et de l'énergie solaire sont données dans le tableau ci dessous. La précision donnée par le spectrophotomètre sur les facteurs est de 1%.

	ρ^{nh}_{uv}	P ^{nh}
Echantillon avec pointure	9.4%	83,2 %

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3.2 - Essais thermiques

Les valeurs des températures ainsi que de l'énergie du rayonnement incident sont données dans le tableau el dessous. La précision sur la mesure de température est de ± 1.5%, la précision sur la mesure de flux est de ± 2%

	Sans rayonnement		Avec rayonnement	
	"l'empérature °C	Plux W/m ²	Température °C	Plux W/m1
Echantillon avec pelnure « INSULTEC »	22,9	7	41.5	1270
Echantillon sans	23,0	7	56.8	1270

SAME CONTRACTOR OF THE SAME OF 181 1013 AND ASSESSED OF SEWING COUNTY 64, 62.23.01 - Ex. 61.29.79



E = A = B Associates (Bayley-Edge Limited): 3 Craven Court, Craven Road, Altrincham, Cheshire, WA14 5DY England.
Tel: (0)161 - 926 9077 Fax: (0)161 - 927 7718 e-mail: all@eabassoc.co.uk http://www.eabassoc.co.uk

QUV Accelerated Weathering Test - August 1999

Aims

To test the durability of Solux radiation control coating Insultec 1.

Plates Tested

Plate 1:	Insultee on fibre cement board at coverage rate 2.5 m2/ltr.	Primer CWS.
Plate 2:	Insultec on fibre cement board at coverage rate 2.5 m ² /ltr.	Primer CWS.
Plate 3:	Insultec on fibre cement board at coverage rate 2.5 m2/ltr.	Primer CWS.

Method

Test Conditions:

4 hours UV at 64 °C.

4 hours humidity at 45 °C.

Total Test Time:

Plate 1 removed at 2,010 QUV hours. Plate 2 removed at 1,048 QUV hours. Plate 3 removed at 743 QUV hours.

Procedure

The plates were placed in the QUV machine at 32,752 hours and examined at 68, 743, 1,048 and 2,010 QUV hours. Plate 3 was removed after 743 QUV hours. Plate 2 was removed after 1,048 QUV hours, and plate 1 was removed after 2,010 QUV hours.

Results

Inspection at 68 QUV hours.

Plate 1: No apparent change

Plate 2: No apparent change.

Plate 3: No apparent change.

Inspection at 743 QUV hours

Plate 1: A very slight colour change observed when plate held up to light. The coating had begun to lose its sheen and had become slightly matt in appearance.

Plate 2: A very slight colour change observed when plate held up to light. The coating had begun to lose its sheen and had become slightly matt in appearance.

Plate 3: A very slight colour change observed when plate held up to light. The coating had begun to lose its sheen and had become slightly matt in appearance. Removed from machine.

Plate 3 removed @ 33,495 hours (743 QUV hours).

Inspection at 1,048 QUV hours (equivalent to -5 years natural weathering):

Plate 1: Slight increase in the affect noted above.

Plate 2: Slight increase in the affect noted above. Removed from machine.

Plate 2 removed @ 33,800 hours (1,048 QUV hours).

Inspection at 2,010 QUV hours (equivalent to ~ 10 years natural weathering):

Plate 1: Increase in the affect noted above. The coating had become whiter in colour and matt in appearance. Removed from machine.

Plate 1 removed @ 34,762 hours (2,010 QUV hours).

Conclusion

Insultec showed slight discolouration and lost its sheen.

Insultec performed very well and did not show any signs of failure in terms of durability.



मारतीय प्रौद्यांगिकी संस्थान पवई, बम्बई-४०००६, भारत

Indian Institute of Technology Powal, Bombay 400 076, India

Ref. :

Date:

Dr. J. K. Nayak Dept. of Mech. Engq.

December 14, 1995.

To Mr. K.R. Bhatt Director, Chitra Insulted Pvt. Ltd. "ASHISH" 2nd Floor, C.G.Road, Swastik 4 Rd. Jn., Navrangpura, Ahmedabad 380 009

Dear Mr. Bhatt,

Please find enclosed herewith our report concerning the consultancy work of insulted paint. I may mention that the work got unduly delayed because of certain unavoidable reasons: I am extremely sorry for that.

The paint has got reasonably high emissivity and relatively low absorptivity for solar radiation; hence it would be suitable for cooling applications.

Thanking you and with regards,

Yours sincerely,

(J.K. Nayak)

Encl: Report

Phone: (022) 578 2545, 578 6530 Gram: Technology, Bombay-76 Telex: 011-72313 IITB IN

Fax : 091-22-578 3480

Report on the Characterization of insultec Coated Surface

by

Energy Systems Engineering IIT BOMBAY

December 1995

CHARACTERIZATION OF INSULTEC COATED SURFACE

Introduction

Chitra Insulttee Pvt. Ltd., Ahmedabad is marketing a new paint called "Insultee" in India. In order to characterize surfaces coated with insultee, the company contacted us and investigations were conducted in our laboratories.

Scope of work

The scope of work consists of the following tests:

- 1. Emissivity test (The total emissivity of samples at room temperature).
- 2. Absorptivity test (Absorptivity of surfaces for solar radiation).
- Infrared spectral reflectivity between 2.5 μm to about 25 μm.
- Measurement of temperatures attained by the surfaces (Painted and unpainted) when exposed to sun.

Tests:

The company supplied us samples of G.I. sheets with and without insultec paint. The relevant tests were carried out in various laboratories of HT Bombay.

Emissivity Test:

The instrument used for emissivity measurement is Emissometer model AE of Devices and Services Co, USA. The materials to be tested are flat samples as per the requirement of the instrument. The detector portion of the sensor is heated so that the sample does not have to be heated. After allowing a warm-up period of about 30 minutes, the sensor is calibrated with samples of known emittance. Then the detector is used for actual measurements. The detector's voltage output is linear with emittance. The emissivity values referred to the room temperature conditions of the samples.

Absorptivity Test:

Albedometer CM14 of Kipp and Zonen, Netherlands is used for measuring reflectivity of surface. It has two pyranometers, one measures the incident radiation while the other records the reflected radiation. The ratio gives the reflectivity of the surface.

For opaque surfaces such as the insultec coated G.I. sheets, the absorptivity is calculated by subtracting reflectivity from unity.

IR Spectral Reflectivity Measurements:

Globar Infrared source is used for IR spectral reflectivity measurements. The IR beam from the source is made to incident on the sample. The reflected radiation in various wavelength regions is measured. The spread of the spectral distribution of IR beam used in the experiment is from 2.5 μm to 25 μm .

Heat Gain:

In order to find out the reduction in heat gain due to the paint, the temperatures attained by the painted and unpainted surfaces are recorded. Two G.I. plates of 30 cm × 30 cm are taken; one is painted with insultec. The surfaces are kept horizontal and are exposed to solar radiation; Copper-Constantan thermocouples are fixed, one each to the center of the unexposed side of the plates. The unexposed sides are insulated by glass-wool insulation. The steady temperatures attained by the sheets are recorded; the corresponding solar radiation incident on a horizontal surface and shade ambient temperatures are also measured.

Results

1. For the measurement of the emissivity, two samples supplied by the company are tested; two samples are prepared by us using the paint given to us by the company. The emissivity of an unpainted surface (supplied to us by the company) is also measured. The values are presented in Table 1. The ambient temperature to which these measurements correspond is also mentioned in the table.

Table 1: EMISSIVITY VALUES

Sample	Emissivity	Ambient temperature ("C)
Painted		
1 -	0.89	29.5
2 -	0.90	29.5
3	0.88	29.5
4	0.89	29.5
unpainted	0.11	

^{*} Samples 1 and 2 are supplied by the company.

It is seen that the average emissivity is 0.89 and it is much higher than that of an unpainted G.I. sheet.

- 2. The total absorptivity of the painted surface for solar raidation is 0.24 corresponding to an angle of incidence of 55°. The ratio of emissivity (ε) to absorptivity (α) is about 3.7. On the other hand, the absorptivity of an unpainted surface is found to be 0.74 for the same angle of incidence. Consequently, the ratio of emissivity to absorptivity is about 0.15. Clearly the paint is selective in nature.
- 3. The IR spectral reflectivity of painted surface is shown in Fig. 1 and 2 for two painted surfaces. The same result for an un-painted surface is shown in Fig. 3. It is seen that the IR reflectivity of the painted surface between wavelength regions of about 2.65 μm to 14.5 μm is more or less constant and it is much less than the corresponding values of unpainted surface; it suddenly shoots up beyond 14.5 μm.

 The temperatures attained by the painted and unpainted surfaces are shown in table 2. The corresponding solar radiation incident on the surfaces and the ambient temperatures are mentioned.

Table 2: MAXIMUM TEMPERATURES ATTAINED

Sr. No.	Solar Radiation	Ambient	Temperatures	attained (°C)
	on horizontal surface	temperature (°C)	Unpainted	Painted
1	571 C VÝMC)	30.5	54.4	32.8
2	684	32.5	57.5	33.8
3	400	29.5	49.3	31.0

The temperature of the painted surface is significantly lower than that of unpainted surface. Clearly, heat gain would be much less in the former case.

Conclusion:

Based on the results obtained in the tests it is found that the aboseptivity of insulted paint is low (about 0.24) and emissivity at about 30 °C is 0.89. The ratio of emissivity to absorptivity is about 3.7 and it is selective in nature. The temperature attained by a painted surface is much less than the unpainted one. It is only marginally higher than the ambient temperature. Clearly, heat gain through a painted surface would be much less.

It can be concluded that the paint can provide a significant benefit in reducing heat gain and would find application for cooling purposes..

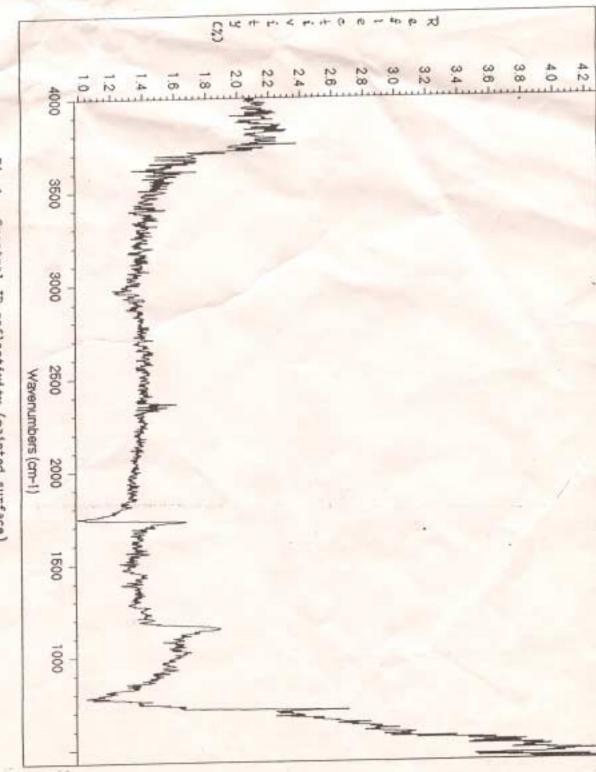
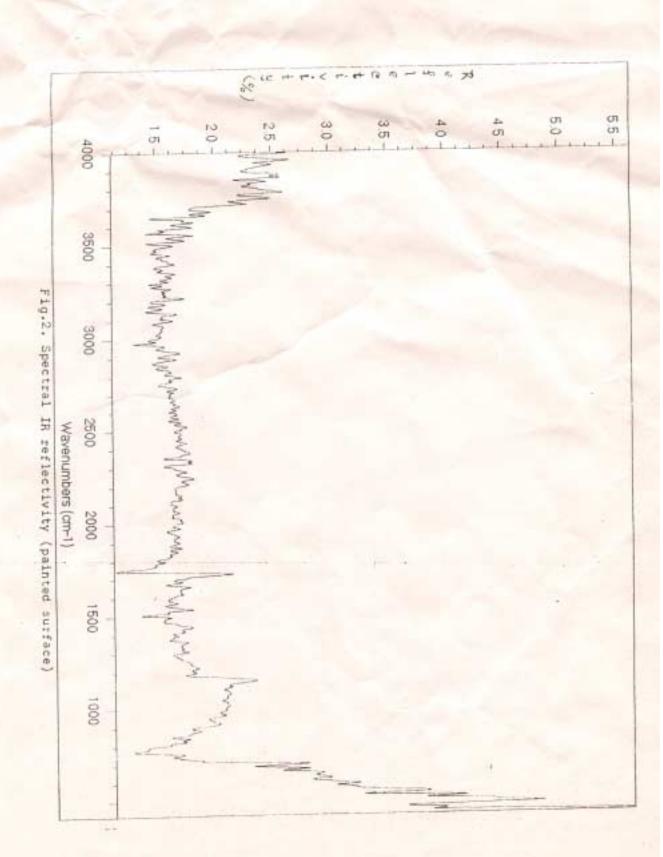


Fig.1. Spectral IR reflectivity (painted surface)



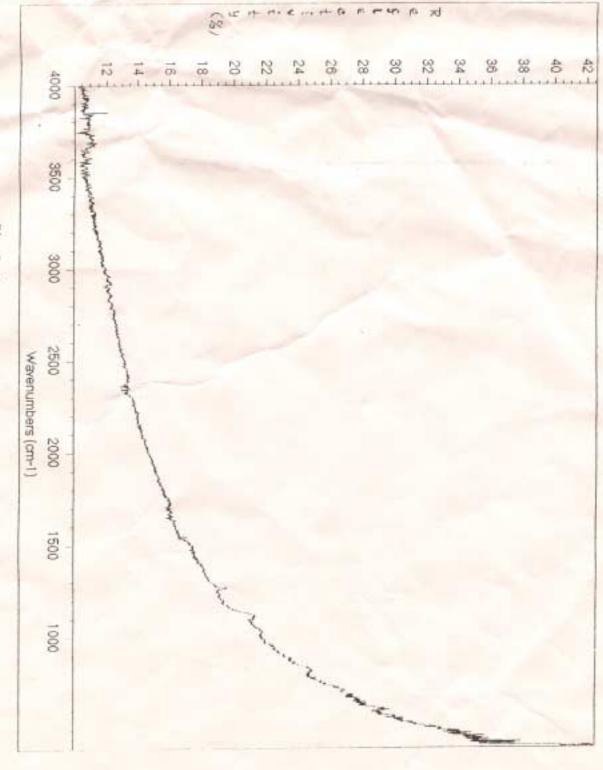


Fig. 3. Spectral IR reflectivity (unpainted surface)



Solar Agni International

COMMUNITY AND ENERGY SYSTEMS

(A Unit of Mother's Centenary Memorial Trust)

	Ref		Date	
	Insultec/	Test/01/95	26th July 1995	
RESEARCH				
DESIGN		TEST REPORT		
CONSULTANCY				
TESTING	SAMPLE	- INSULTED x 300 mmmth	ick on GI sheet	
TRAINING		applied by brush in microns each as per	3 coats of 100 application	
FABRICATION		Instructions by the manufacturer.	proprietary	
NSTALLATION		manutacturer.		
	COMPANY	- M/S Chitra Insultec	Put (I td)	
FOR		"ASHISH", 2nd Floor, S Navrangpura, AHMEDABA	wastik Junction.	
SOLAR	RESULT	- It is a mildly selec	tive white	
WIND		surface with double	quality emitter.	
BIOGAS		The value (€ / d) i		
BIOMASS		7.00 mm 1		
&:		€(low temperature he	at radiation)	
WASTE		& (solar radiation f	= 4.6	
SYSTEMS		~	T-100	
IN.	EFFECT	 This will reduce c appreciably (partic roofing) for all k surfaces. 	eiling temperature cularly of sheet inds of sun exposed	
COMMUNITY				
DESIGN		 * In non-conditioned reduce the air tem 	rcoms, it will	
&	For SOLAR AGNI INTE	Little Salprom ceiling to flo	oor considerably	
PLANNING	ZOMMUNITY AND ENER	ar systemed also reduce th		
		Director 26/7/93	contd2	



Solar Agni International

COMMUNITY AND ENERGY SYSTEMS

(A Unit of Mother's Centenary Memorial Trust)

Ref.....

Date

Insultec/Test/01/95

26th July 1995

RESEARCH

DESIGN

CONSULTANCY

TESTING

TRAINING

FABRICATION

INSTALLATION

FOR

SOLAR

WIND

BIOGAS

BIOMASS

&

WASTE

SYSTEMS

LN

COMMUNITY

DESIGN

数

PLANNING

TEST REPORT Continued

breast level. The exact magnitude will depend upon location, surface, orientation, type of material and details of enclosure.

 * In conditioned rooms, it will cut down solar part of sensible heat gain by almost seventy percent as compared to non coated surfaces.

to STEER AND DEED A PROPER STEEL

(Dr. C.I., Guata) 26/1/95

CERTIFIED TRUE COPY OF ORIGINAL FAX COPY

JAI JALARAM Subject to ANAICO Introduction

SHITAL COLD STORAGE & ICE PLANT

National Highway No 8, Boriavi - 387310, Ta Anand Phone 02692-24524

Date: 05/6/96

Certificate of observation To whomsoever this may concern

During our visit at COMFEX - 96 Ahmedabad, in January 1996, we came to know about Insultec Coatings of M/S. INSULTEC PVT. LTD., Ahmedabad. We had Insultec applied on our cold storage plant by Insultec marketing division on 21/03/1996.

From the very first day of its application we felt a drastic difference in the surface temperature on the roof. We found that we could walk bare footed on the Insultec coated surface, which had previously been impossible.

We compared electric energy consumption on unit basis with last year's reading and found as follows:

Month	1995 (units)	1996 (units)	Units saved
	Without Insultec	With Insultec	
March	74,960	74,808	152
April	75,864	59,516	16,348
May	61,596	49,516	12,080

Above observation fully justified application of Insultec as claimed by the manufacturer. Also we have observed that after Insultec coating was applied we will not need any other water-proofing treatment which we normally have to have done, periodically.

In short we are totally satisfied with the performance of the Insultec coating for both its Heat Insulation property and its water-proofing ability.

We have saved costly electricity normally used on refrigeration. We strongly recommend the use of Insultec on all similar applications.

With regards and good luck.

From Shital Cold Storage & Ice Plant

Proprietor

TO M/S CHITRA INSULTEC PVT. LTD. 2ND FLOOR, "ASHISH' C.8 ROAD NAVRANGPURA, AHMEDABAD, 380009



Shital Cold Storage & Jee Plant

Nerional Highway No. 8 BORIAVI-Shi. GU. Ta Anand, Inc. Barra, Commercian Gram: SHITAL Phone Gyngy-2-524-7881714-555

REF NO :

DATE .05/06/96.

Certificate of observation to whomseever this may concern.

During our isit at COMFEX -96 Ahmedabad, on Jan 96., We came to know about INSULTEC Coatings of M/S. INSULTEC PVT. LTD. Ahmedabad. We got INSULTEC applied on our cold storage by their marketing Div. M/S. Weathertuff sales and Marketing on 21/03/96.

From the very first day of it's emplication we felt drastic difference in surface temp, on the roof. We could walk bare footed, on such confece, which otherwise is impossible.

We con the entric energy consumption on unit basis, with isto

CHONTEN	1995 (units)	1996 (unita)	
MERCH HPALL NEY	Without Insulted	With Insulted 74808 (Full load) 59516 (Mormal run) 49516 (Normal run)	Units Saved 152 16,348 12,080

Above observation fully justified application of INBULTED on Claimed by the manufacturer. Also we have observed that after INSULTED coatings we will not need any other water proofing periodically.

In short, we are totally satisfied with INSULTEC Coatings for its both protective performance as claimed, being solar heat Insulation and waterproofing. Thereby, we have saved costly electricity used on refrigeration. We strongly recommend use of INSULTEC on all similar applications.

With regards and good luck.

Shital cold stortes & Ice plant

From.

proprietor

M/S. CHITRA INSULTED PVT.LTD., 2ND.FLOOR, "ASHISH", C.S.ROAD, NAVRANSPURA, AFMEDABAD 350009.

Nico Janse van Rensburg

Raadgowende Ingenieurs/Consulting Engineers BK/CC (Reg. No. CK 96/26389/23)

1996-12-20

Insulation Coatings (Pty.) Ltd. P O Box 229 WITKOPPEN 2068

For the Attention of Mr A de Comarmond

COMPARISON OF DIFFERENT ROOF COVERINGS

The effect of different roof coverings on the internal temperature of a typical industrial building located in a warm climate area (i.e. Phalaborwa) was investigated. A proven computer programme was used to simulate the heat flow and to predict the thermal conditions inside the building and to calculate the expected surface temperature of the roof. The temperature profiles of the following alternatives were calculated and are shown on the attached graph.

- A galvanised roof (as the reference);
- A galvanised roof with clean white paint;
- A gr.lvanised roof with white paint partly covered with dust and soot;
- A heat radiating paint similar to INSULTECHEATGARD.

From the graph it can be seen that the best thermal insulation, and therefore the lowest internal temperatures, are obtained with the use of a beat radiating paint. An ordinary clean and uncontaminated white paint is also effective but the maximum internal temperature is in the order of 4°C higher than the temperature obtained from painting the roof with a heat radiating paint. When the paint surface becomes dirty, the thermal insulating properties are reduced considerably and this results in the average maximum temperature being almost 11,5°C higher than that of the heat radiating paint.

It is also evident that it is not only the maximum temperature that is being reduced by the heat radiating paint, but the average internal daily temperature is also the lowest of the alternatives.

The expected surface temperatures on the underside of the roof for the various alternatives are approximately the following:

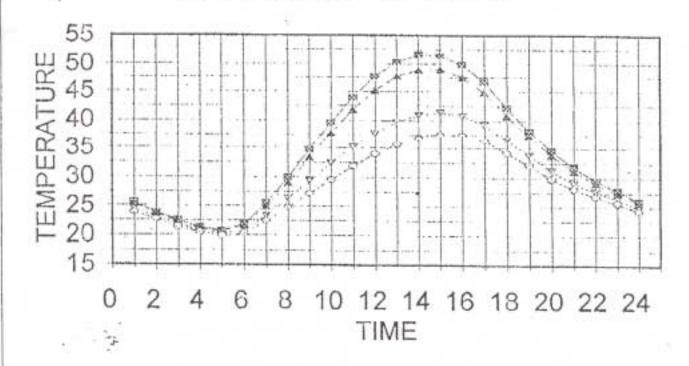
ю.,	Galvanised roof	53°C
*	White paint - clean	42°C
w	White paint - soiled	50°C
25	Heat radiating paint	3700

The benefits of the lower roof surface temperature resulting from the application of the heat radiating paint, i.e. lesser contraction and expansion of roof sheeting, can be seen from the above figures.

N MANSE VAN RENSBURG Pr. Eng.

TEMPERATURE PROFILE

DIFFERENT ROOF COVERINGS



Galv. Roof
 → White clean
 ▲ White soiled
 ← Radiating

SPOORNET - FAX/FAKS

Telephone: (012) 6719-362 Fax number: (012)6719-351

Ref : S.RM(WE) 15/8/10/6/1/2 Date : 23rd September 1996 To fax number : 011-4652381

Addressed to : Transvaal Metal Spraying Services

Att: Mr Alain De Comormond

From:

V.I.T. Owner (Surface Protection)

Spoornet (Rolling Stock) CENTURION

INSULTEC. HEAT RETARDING COATING FOR PETROL TANK WAGONS

We report back on you Insultee radiant heat barrier coating applied to the petrol tank wagons in January 1996.

The tank wagons convey petrol from the coastal depots at Port Elizabeth and East London, to Upington in the Northern Cape Province, travelling a distance of approximately 1,000 kilometres.

The excessively high ambient temperatures attained while in transit and during the waiting time at Upington, before off loading, results in the petrol attaining a temperature in excess of 45 oC. These high temperatures result in evaporation and petrol loss.

REBULTION

The application of the Insultec system to the petrol tank wagons gave a considerable in the temperature of the petrol (Average 10 oC). The test conducted were very satisfactory and twenty tank wagons will be coated with this system.

During a recent inspection of the tank wagons, it was noticed that the top coat has a tendency to retain dirt. To overcome this problem, we will by applying Insultec clear glaze coat as a final coat. It was interesting to note however, that although the coating was covered with dirt and dust, the tank body remained cool in direct sunlight.

We will carry out a series of tests again during January 1997 and you will be kept informed.

Kind regards

B.E. Berner

V.I.T. OWNER (Surface Protection)

Hoofbestuurder (Rollende Materiaal)

Posbuz 30824 BRAAMFONTEIN

2017

SPOORNET

N Divisie Transnet Beprerk Registraslenommer 90/00900/06 General Manager(Rolling Stock)

PO Box 30824 BRAAMFONTEIN

2017

SPOORNET

A division of Transnet Limited Registration number 90 00900 06

CLASS 36 DRIVERS CAB: TESTS TO DETERMINE THE EFFECT OF A ROOF PAINTED WITH WHITE INSULTEC PAINT

Object:

A comparison test between a locomotive painted with Insultec and one without. The roof of locomotive 36-107 was painted by Mr. van Heerden and Mr. Berner during October 1995 with white Insultec paint. The control locomotive, 36-116, recently returned from a Transwerk workshop where it was painted in the Spoomet (orange and grey) colour scheme.

Method:

The two class 36 locomotives were placed nose facing each other and comparison temperature tests were recorded on a Rustuk data logger with 8 temperature probes. These probes were placed at different locations in the driver's cab (see diagram 1). The placements of probes in the two cabs were exactly the same. The tests were performed on the 22nd and 23rd of January 1996 at Sentra Rand Diesel Depot.

Results:

The two days were fairly hot with scattered cloud cover. The following was measured: the ambient temperature outside, the ambient inside the cab, the temperature of the ceiling and the temperature of the roof on the outside. The temperature probes on the roof were shielded against direct sunlight, so that the true temperature of the metal roof could be recorded.

A difference in temperature between the driver's cab of the test locomotives was recorded. The cab of locomotive 36-107, with the roof painted with Insultec, was with an average 1,25 °C cooler over the two days than 36-116. See figure 1 and 2. On the 22 Jan the Ave. difference was 1.2 °C and on the 23 Jan the Ave difference was 1.3 °C.

A large temperature difference was noted when comparing the roof temperature of the test locomotive with that of the control locomotive. The roof painted with Insulted was on average 13.02 °C cooler than the standard roof. In direct sunlight the difference increased to 20 °C -25 °C. The ceilings of the two locomotives also showed a difference, the Insulted locomotive's ceiling was 3,95°C cooler than that of the control locomotive. See figures 3 and 4. The large variation of the roof temperature against time as recorded on 23 January is due to loose clouds which frequently moved in front of the sun.

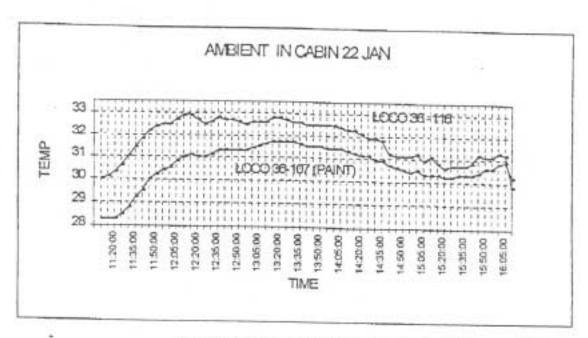


fig 1 Ambient temperature in cabins during 22 January 1996

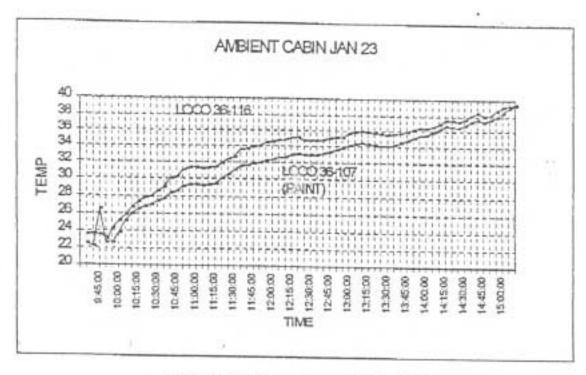


fig 2 Ambient temperatures of cabins during 23 January 1996

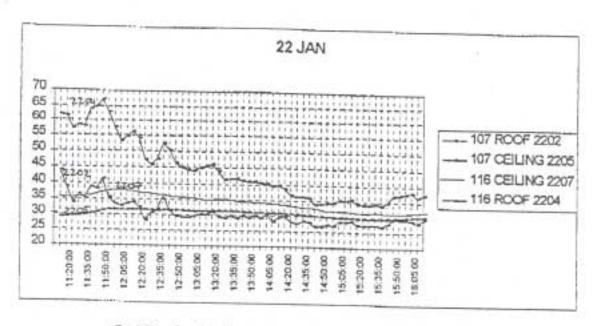


fig.3 Roof and ceiling temperatures for both loco's for the 22 January

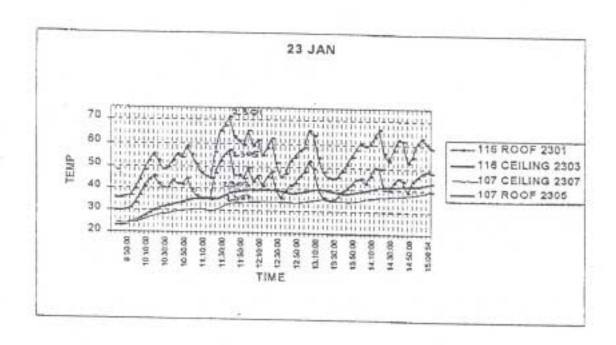


fig. 4 Roof and ceiling temperatures for both loco's for the 23 January

White Insultec paint was used on the test locomotive. At the time of application, the durability of the white paint within the diesel environment was of concern. After having been inservice for 4 months the roof was inspected and found to be remarkably white in colour and no peeling or other form of deterioration could be detected.

Conclusion:

The use of Insulted is a cost effective way of reducing temperatures within the driver's cab of the class 36-000 diesel electric locomotives. The achieved reduction in temperatures is however not significant enough and it is therefor recommended that this should be combined with other solutions, such as sunscreens.

DIAGRAM 1

NO 1 END
CLASS 30-000 CAB

450

450

AND ROOF MEASURED
IN THE AREA

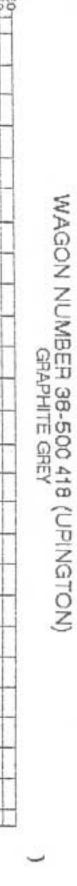
VOILANCE
BOX

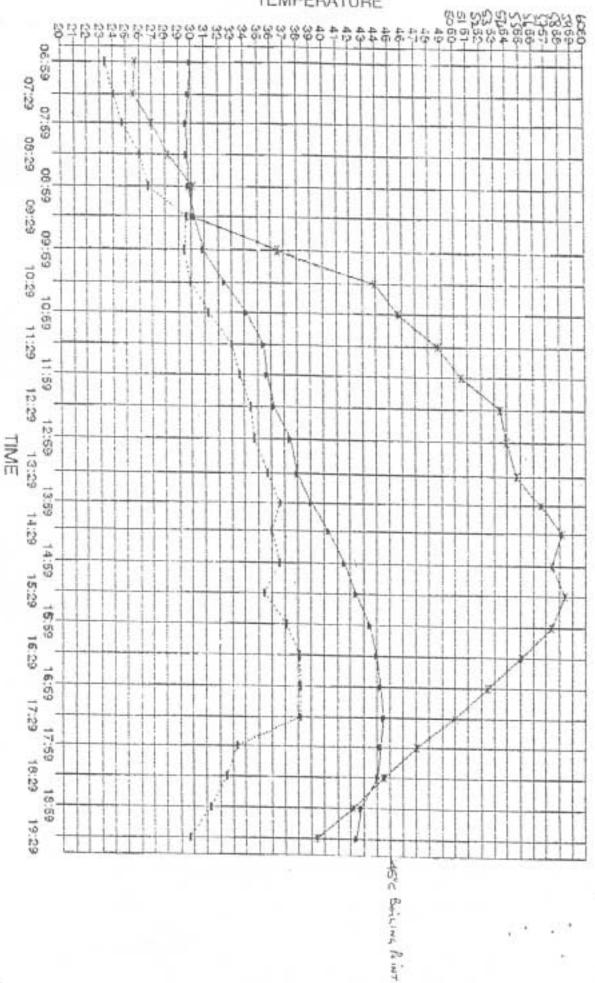
145

VOILANCE
BOX

LERS WITH FROME
CEILING
(CAB)

* NORMAL AMBIENT MERGURED OUTSIDE LOCOMOTIVE





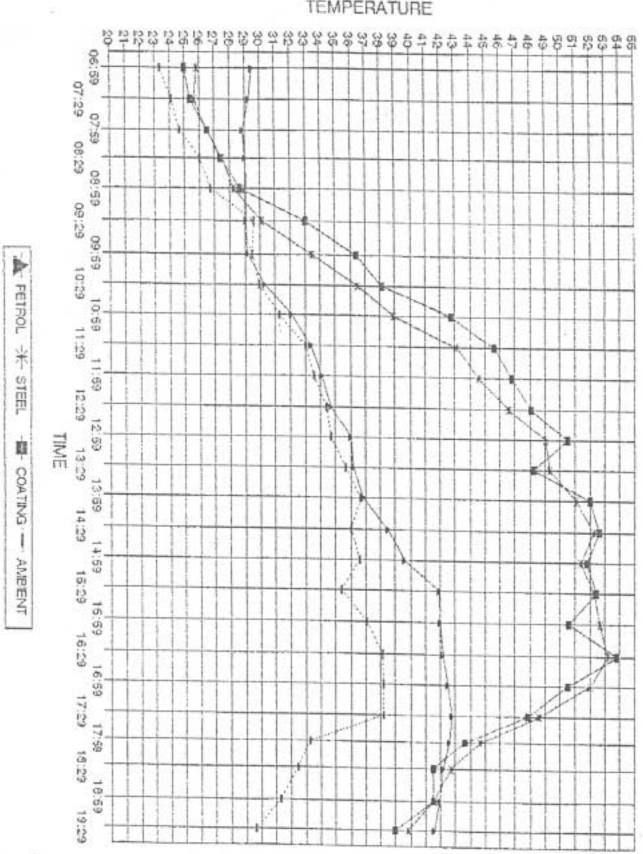
PETPOL * STEEL

AA的情以T

WAGON 38-500 418 (G/GREY)

TIME	PETROL	STEEL	AMBIENT
06:59	0.00	25.7	23.4
07:29	29.8	25.6	24.1
07:59	29.6	26.9	24.7
08:29	29.7 *	28.2	26.0
08:59	29.8	30.1	26.7
09:29	30.2	30.0	29.6
09:59	30.9 *	36.5 *	29.5
10:29	32.5 *	43.9	29.9
10:59	34.1 *	45.7 *	31.3
11:29	35.5	48.7	33.0
11:59	35.7	50.5	93.6
12:29	36.2	53.5	34.4
12:59	37.5	54.0 *	34.7
13:29	38.0 *	54.7	35.7
13:59	39.1 *	56.6	36.7
14:29	40.3 *	58.2	36.0
14:59	41.5 *	57.4	36.6
15:29	42.4 *	T58.4	35.4
15:59	43.5 *	57.4	37.1
16:29	(44.0)	55.1	38.1
16:59	44.3	52.5	38.2
17:29	44.5 *	50.0	38.2
17:59	44.9 */	47.1	99.8
18 29	44 1/	44.5 •	32.5
18.59	42.8	42.2 *	
19.29	42.4	39.4	29.7
			4.00

TEMPERATURE



V'AGON NUMBER 38-505 54' (UPINGTON)

WAGON 38-505 541 (UPINGTON)(ALUM.)

TIME	PETROL	STEEL		COATING	AMBIENT
06:59	29.5	25.8		25.0	23.4
07:29	29.3	25.7		25.4	24.1
07:59	28.9	26.5	*	26.5 *	24.7
08:29	29.0 *	27.5	*	27.4 *	26.0
08:59	29.1 *	28.3		28.7	
09:29	29.1	30.1		33.0	26.7
09:59	29.2	33.5		36.4	29.6
10:29	30.3 •	36.5		38.1	29.5
10:59	32.1 •	38.9		42.8	29.9
11:29	33.4 *	43.1		45.6	31.3
11:59	34 1	44.6			93.0
12:29	34.7	46.6		46.8	33.6
12:59	36.0	49.1		48.1	34.4
13:29	36.2 *			50.5	34.7
13:59	36.9 *	49.3		48.2	35.7
14:29	38.5 *	51.1		52.0	36.7
14.59	396 *	52.3 51.4		52.6	36.0
15:29	41.9	52.3		51.8	36.6
15:59	42.0 *	52.7		52.4	35.4
16:29	42.2			50.6	37.1
15:59	42.5	59.2		53.8	38.1
17:29	42.8	52.0		50.5/	38.2
17:59	42.6	48.6		47.8	38.2
18:29	1	44.7		43.6	33.3
	42.2/	42.7		41.5	32.5
18.59	41.9 *	41.5 *		41.5	31.3
19:29	41.6	39.8		39.0	29.7

06:59

9 07:59

08:29

09:29

10:29

11:23

12:23

13:29

14:29

15:29

16:29

17:29

18:29

19:29

TIME

02.59

09:59

10:59

11:59

12:59

13:69

14:59

16:69

16.69

17:59

18 59

7.

TEMPERATURE

中华华华华华华华华华华华华

6 4 4 4 4 6

WAGON NUMBER 38-501 317 (UPINGTON)

A FETRO, * STEEL - COATING - AMBIENT

WAGON 38-501 317 (UPINGTON) (INSULTEC)

TIME	PETROL		STEEL		COATING		AMBIENT
06:59	27.8		24,7		24.2		23.4
07:29	27.7		24.9		24.6		24.1
07:59	27.6 *		25.1		26.5	*	24.7
08:29	27.5 .		27.4		27.5	*	26.0
08:59	27.4		28.8		28.7		26.7
09:29	27.5 *	Ċ.	31.1		31.9		29.6
09:59	27.7		33.1		33.0		29.5
10:29	26.2		35.5	*	35.4	*	29.9
10:59	28.6	t	37.4		37.2		31.3
11:29	29.2		38.6		38.7		33.0
11:59	29.6		39.6		40.0		33.6
12:29	30.0	*	41.0		(42.0	1	34.4
12:59	30.4		41.5		42.0	1	34.7
13.29	31.8		41.8		43.3		35.7
13:59	32.3		42.1		43.4		36.7
14:29	32.9		42.7		44.3		36.0
14:59	33.4	*	42.6		44.8	1	36.6
15:29	34.0		42.5		43.5	1	35.4
15:59	34 4	٠	40.8		41.6	-	37.1
16:29	04.8		39.4		38.2		38.1
16:59	35.3	/	39.6	*	36.6		38.2
17:29	35.7	1	39.8	*	36.8	٠	38.2
17:59	35.5	ŧ	36.0	*	36.6	*	33.3
18:29	35.3	-	34.2		34.4	*	32.5
18:59	35.0		34.3		32.5	*	31.3
19:29	34.7		31.4		30.9		29.7

Socialist Republic Of Vietnam MINISTRY OF NATIONAL DEFENSE THE CHEMICAL AND MATERIAL ENTERPRISE

Nghia do - Caugiay - Ha Nnoi City S.R. Vietnam Tel: (844)8346478 - Fax: (844)7561701

To: Albesti Insultec Paints Pty Ltd.

1 Dempster Crescent
Regents Park, N.S.W. 2143,
Australia
Tel:(61-2)97439932 - Fax (61-2)96444497

TO WHOM IT MAY CONCERN

The decision was made at the beginning of March 1993 by the Vietnamese Ministry of Defense to trial a new product named Sun-Master/Insultec P.I.

It was claimed by Albesti Insultec Paints Pty Ltd., (Sole and Exclusive agents for the South East Asian area and manufactured by Solux Liquid Insulation Pty Ltd., of Australia and the Dongnai Paint Factory of Vietnam at Bien Hoa Industrial Zone 1, Dong nai Province.

We have since found that the use of Sun-Master/Insultec has helped to save many thousands of litres of petroleum stored in holding tanks, all year round, with special emphasis in summer.

The Ministry of the National Defense has monitored (6) large petroleum storage tanks over the past 3 years and found that the product Sun-Master/Insultec has indeed reduced the losses of stored petroleum by evaporation by as much as 7% per week as claimed by the manufacturer. (Normally the losses have averaged about 10% per week, now the losses are about 3% per week).

On the basis of these trials we have no hesitation in stating that the product has met the standards claimed by the manufacturers.

The Ministry of Defense will continue using Sun-Master/Insultec P.I. on all such storage facilities over the coming years.

Ha Noi, Vietnam, 30th November 1997

Sealed with the Seal of the Ministry of Defense

Lt. Colonel: Le Quang Tuan (Eng) Manager

This letter has been re-typed and corrected for clarity by Raymond Brooks, Managing Director, Solux Liquid Insulation Pty Ltd., and Certified a true copy.

THE MATERIALS & CHEMICALS ENTERPRISE.

Nghia Do Str., Tu Liem Dist. Ha Noi City

Tel.: 84 8 346478 Fax.: 84 8 354436

To: Albesti Insutec Paints Pty Ltd

Fax.: (61-2) 644 4497

Attn: Mr. Charlie T. Tran

EVALUATION OF THE STANDARD OF INSUTEC PAINT

The Materials & Chemicals Enterprise have been using Insutec Paint of Brooks Insulation Liquid, supplied by Asian General Exclusive Agent Albesti Insutec Paints Pty Ltd, from 1993. It has been applied to paintworks of the General Warehouse of the Ministry of Defense and civil paint works and showed very good finishes. The temprature of the space has been reduced 10 to 15 Degree Celeius in comparision with other works which have not used Insutec paint.

Inthis connect, we'd like to express our special thanks to the manufacturer of Insutec paint through Albesti Insutec Paint Pty Ltd. We're as well willing to introduce Insutec Paint to other entities that need to use chemicals for insulation and explain them the good performance of Insutec Paint.

Por intermation concerning our works, Pls contact directly with us.

Le Quang Tunn

CÔNG TY ĐIỆN TỬ, TIN HỌC, HÓA CHẤT XÍ NGHIỆP VẬT LIỆU HÓA CHẤT

Nghĩa đỏ, Từ liêm, Hà nội Tel. 8 346478 Fax.: 84 8 354436

Kính gửi: Ông Ch

Ông Charlic T. Tran

Công ty Albesti Insutec Paints Pty Ltd.

Thưa ông,

V/v: Đánh giá Chất lượng Sơn Insutec.

Xí nghiệp Vật liệu hóa chất, Bộ Quốc phòng, đã và đang sử dụng sơn Insutec của Công ty Brooks Insulation Liquid qua Tổng Đại lý Độc quyền Á châu Albesti Insutec Paints Pty Ltd từ 1993 qua các công trình Tổng kho của Bộ Quốc phòng và dân sự với kết quả tốt đẹp và đã giảm được nhiệt độ 10 đến 15°c so với các công trình không sử dụng Insutec.

Chúng tôi hài lòng và chân thành cảm tạ Nhà sản xuất sơn Insutec qua Công ty Albesti Insutec Paints Pty Ltd cũng như sẵn sàng giới thiệu sơn Insutec với các Cơ quan có nhu cầu sử dụng hóa chất chống nhiệt và thuyết phục họ nên sử dụng Insutec.

Về mọi thông tin liên quan đến các công trình của chúng tôi, xin liên hệ trực tiếp với cơ quan chúng tôi.

Lê Quang Tuấn

T/L GIAM DOC Giám đốc Xĩ nghiệp BỘ QUỐC PHÒNG XI NGHIỆP VẬT LIỆU HÓA CHẤT CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM Độc lập - Tự do - Hạnh phúc

Số: 82/VLHC

BIÊN BẦN NGHIỆM THU BÀN GIAO CÔNG TRÌNH

Theo hợp đồng số 82/VLHC đã ký ngày 7/5/1996 giữa Công ty xăng đầu Hà Nam Ninh và Xí nghiệp Vật liệu Hóa chất - Bộ Quốc Phòng đã ký hợp đồng triển khai công nghệ chống nóng bằng màng phủ chống nóng tại kho dự trữ xăng đầu quốc gia Hà Nam Ninh.

Sau khi sơn phủ bồn, hai bên thống nhất cử đại diện để nghiệm thu bàn giao công trình và đưa vào sử dụng.

I. THÀNH PHẦN NGHIỆM THU.

1. Đại ciện bên A:

- Ong: Nguyễn Hông Kha - Bà: Nguyễn Quỹnh biển - Ông: Giản Công Luấn - Ông: Hàng Gián Chức vụ: Phó giám đốc

Chức vụ: Guing glung ty thuết Chức vụ: Cán to đại Thuết Chức vụ: Brandaung

Chức vu:

2. Đại diện bên B:

- Ông: Lê Quang Tuấn

- Ông: Đặng Vũ Tường
 - Bà: Nguyễn Thanh Hiện

Chức vụ: Giám đốc . ·

Chức vụ: Cán bộ kỹ thuật

Chức vu: Kế toán trưởng

II. ĐÁNH CIÁ VỀ KỸ THUẬT SƠN VÀ CHẤT LƯỢNG SƠN.

Bên B triển khai công nghệ theo đúng hợp đồng đã ký gồm các công đoạn

sau:

- Tây rửa hết lớp sơn nhũ, sơn chống gì cũ bằng hóa chất đặc biệt.
- Dùng giẻ lau và nước rừa sạch toàn bộ bề mặt.

- Sơn 02 lớp sơn chống gi màu vàng nhạt.

- Son 03 lớp sơn phản nhiệt màu trắng ngà. INSULTEC"

Kết quả do nhiệt đô trước và sau khi sơn phủ:

Ngày Giè		Nhiệt độ	Nhiệt độ trước	khi son	Nhiệt độ sau khi sơn		
tháng	do	không khí	Tâm bồn xáng	Van thở	Tâm bồn xăng	Van thở	
22/5 22/5 25/5 25/5	12 150 14 6 50 12 hje 14 h	707207	+9'6 41'4 61'1 55'1	374 366 41°3 40°7	36° 37°2 42°2 40°1	32°7 32°6 33°4 33°6	

III. DIỆN TÍCH THỰC TẾ ĐÃ THI CÔNG.

A. Son phan nhiệt: 'INSULTEC'

1. Diện tích nóc bồn:	69m*
	281m ²
Diện tích xung quanh:	1,5m ²
 Diện tích gờ tăng cường: 	
 Các phụ kiện khác: 	3m²

 $Tong = 354,5m^2$

Diện tích cho 02 bồn:

 $354.5\text{m}^2 \times 2 = 709\text{m}^2$

B. Son nhū:

Thình tiên:

 Diện tích lan can: Diện tích cầu thang: Các phần phụ trợ: 		10m ² 23m ² 3m ²
	Tinge	36m²

Tong =

Diện tích cho 02 bon:

 $36m^2 \times 2 = 72m^2$ $709\text{m}^2 \times 67.000, \text{d/m}^2 = 47.503.000, \text{d}$

72m2 x 11.m */m2 = 4512. 100 x

Tổng cộng = 49.015.008

IV.YEU CẦU VỀ KỸ THUẬT SỬ DỰNG CÔNG TE NH.

Tránh mọi trường hợp va đập mạnh trên màng sơn. Bên B bàn giao công trình cho bên A kể từ ngày ký biên bản này. Thời gian bảo hành 3 năm.

Biên bản này được lập thành 06 bản, mỗi bên giữ 03 bản.

Hà nội, ngày 14 tháng 6 năm 1996.

KŸ THUẬT A ĐẠI DIỆN BÊN A

KŸ THUẬT B

DAI DIÈN BÊN B

Đặng Vũ Tường

Thiếu tá Lê Quang Tuần

cud mine can LYEN LONG AHL

INSULATING TECHNOLOGY PTY. LTD.

ABN 93 092 861 008

Manufacturers of INSULTEC™ and SOLUX™ Products

30 WALKER STREET WINDSOR NSW 2756 AUSTRALIA
Telephone: 61 2 4577 5336 Fax: 61 2 4577 5269 Email: insultec@ozdocs.net.au

INSULTEC PRODUCT RANGE

Insultec 1

Heat Re-radiating Membrane

High build heat re-radiating elastomeric membrane

Insultec 4

Heat Re-radiating Paint

Heat re-radiating paint for the "Do it Yourself market".

R1000X

Waterproofing Membrane

Waterproofing and Encapsulating membrane

R33X

Cement Primer

Pliolite based primer for cement, concrete, bricks,

unglazed tiles and fibro cement

R400X

Fibro Sealer

Fibro ashestos sealer and conditioner

B1500X

Acrylic Primer

Water based primer for concrete, brick, fibro and bitumen surfaces

MPC P2

Metal Primer

Zinc phosphate metal primer

Glaze Coat

Clear finishing coat to give glass finish to Insultec