CENTRE FOR **FOOD TECHNOLOGY**

Report

THE COMPARATIVE ASSESSMENT

OF THE INSULATIVE EFFECTIVENESS OF SINGLE-SIDED

10 MILLIMETRE BUBBLE FILM

LAMINATED WITH METALLISED P.E.T. FOIL, P10Sfoil1.

As manufactured and supplied by POLYCELL INTERNATIONAL Pty Ltd

Commissioned by:
Air Freight Council of Queensland Ltd.
Brisbane International Airport.
Queensland, 4007.

Queensland Government
Department of Primary Industries

EXECUTIVE SUMMARY

A trial was conducted to comparatively assess the effectiveness of utilising single-sided 10 millimetre bubble film laminated with metallised P.E.T foil ** (P10Sfoil1) as an insulative cover over standard airline ULDs in maintaining cooler internal temperatures under fairly extreme external conditions. The first unit consisted of the standard airline ULD currently being used by freight forwarders. The second unit was a standard airline ULD with one layer of P10Sfoil1 applied externally with foil side out.

Both ULDs were filled with identical loads of refrigerated mass simulating chilled product. For this trial, the mass consisted of 16 X 25L containers of water pre-chilled to 3-5°c per ULD. No other refrigerant was present in the ULD. Air and surface temperatures were monitored throughout the recording period (up to 26hours) in each of the ULDs. The trial was replicated 4 days later, to eliminate any possible anomalies.

The most significant finding from the trial is illustrated by the internal air temperatures of the ULDs. Appendix 1 shows the ***internal air temperature*** exhibiting an 8°C difference when exposed to an external ambient temperature of 31°C and a tarmac temperature of 45°c.

Another significant outcome, shows the ability of the single-side laminated P.E.T foil to inhibit heat transfer to the ***internal roof surface*** of the ULDs, these results are presented in Appendix 2. During the most extreme times of the day the uninsulated ULD exhibited an ***internal roof surface*** temperature in excess of 45°C, while the insulated ULD obtained only 31°C, a difference of over 13°C.

Appendix 3 presents the ***external roof surface*** temperatures, while the uninsulated ULD experienced in excess of 57°C the insulated ULD displayed only 34°C, a differential around 23°C.

Appendix 4 displays the temperatures monitored on ***either side of the P10Sfoil1*** on the roof of the ULD, during the most extreme times of the day. The temperature encountered on the foil side and the bubble side were 50°C and 34°C respectively, a differential of 16°C.

It is clear from these results that the external application of single-sided laminated P.E.T foil to an airline ULD greatly reduces the internal air and surface temperatures. The overall effect upon temperature sensitive product transported within ULDs could probably be enhanced by utilising some further form of refrigerant eg. dry ice or chill packs, dependant on product requirements.

** *Single-sided 10 millimetre bubble film laminated with metallised P.E.T foil (P10Sfoil1) as manufactured and supplied by POLYCELL INTERNATIONAL Pty Ltd.*

INTRODUCTION

Air freight council of Queensland have commissioned the Centre for Food Technology to conduct a comparative assessment of the insulative effects of single-sided 10 millimetre bubble film laminated with metallised P.E.T foil (P10Sfoil1) when used to insulate a standard airline unit load device (ULD).

Currently these ULDs are owned and operated by airline companies to forward all types of freight. They are basically an uninsulated aluminium box with a folding side. This creates a problem when perishable and or heat sensitive freight is to be stored in these containers prior to and during flight. The ULDs are exposed to hot Australian conditions while on the back of a truck on the way to the airport or sitting on the tarmac waiting to be loaded. Due to the good thermal conductivity of aluminium the ULD becomes a hot box when exposed to these extreme conditions.

This comparative assessment did not aim to replicate or simulate a fully loaded ULD in transit. It did aim to compare the differences between insulated and none insulated ULDs and to find the differences in air temperatures within the two units containing similar bulk refrigerated masses in each.

A series of thermocouples were used (15 for each container) to monitor both air and water temperature in each of the two boxes over a period of 26 hours. A comparison of these temperatures is used to highlight the relative differences between the two ULDs

METHODOLOGY

The Unit load Devices (ULDs) were transported from a warehouse at Brisbane airport and delivered to the Centre for Food Technology (CFT) at Hamilton. The two units were situated on an exposed bitumen area of the CFT car park.

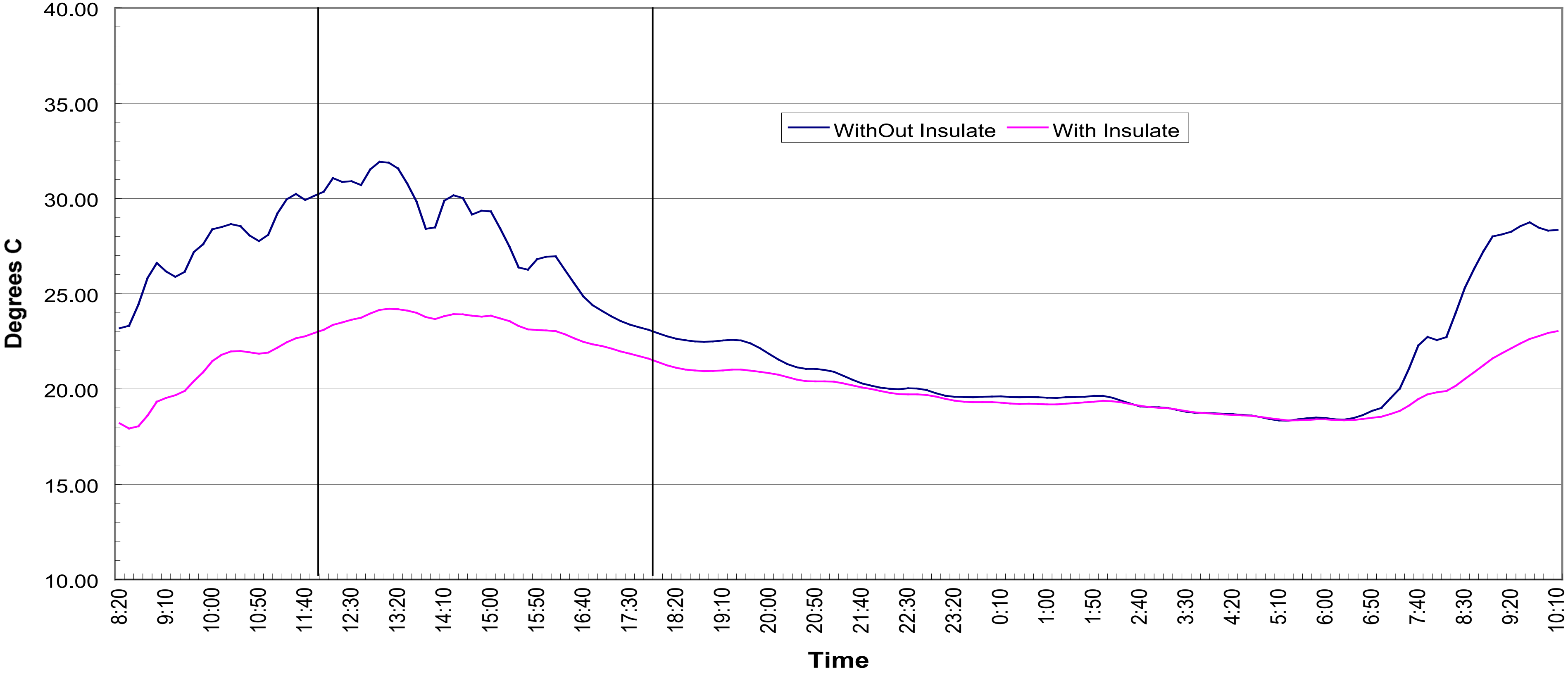
The weather conditions of late April were forecasted to be between 18°c and 28°c. The actual temperature conditions experienced for the two trials were 18°C to 31°C. Tarmac reached a maximum temperature of 45°C.

One ULD had a single layer of single-sided 10 millimetre bubble film laminated with metallised P.E.T foil (P10Sfoil1) applied externally with foil side out.

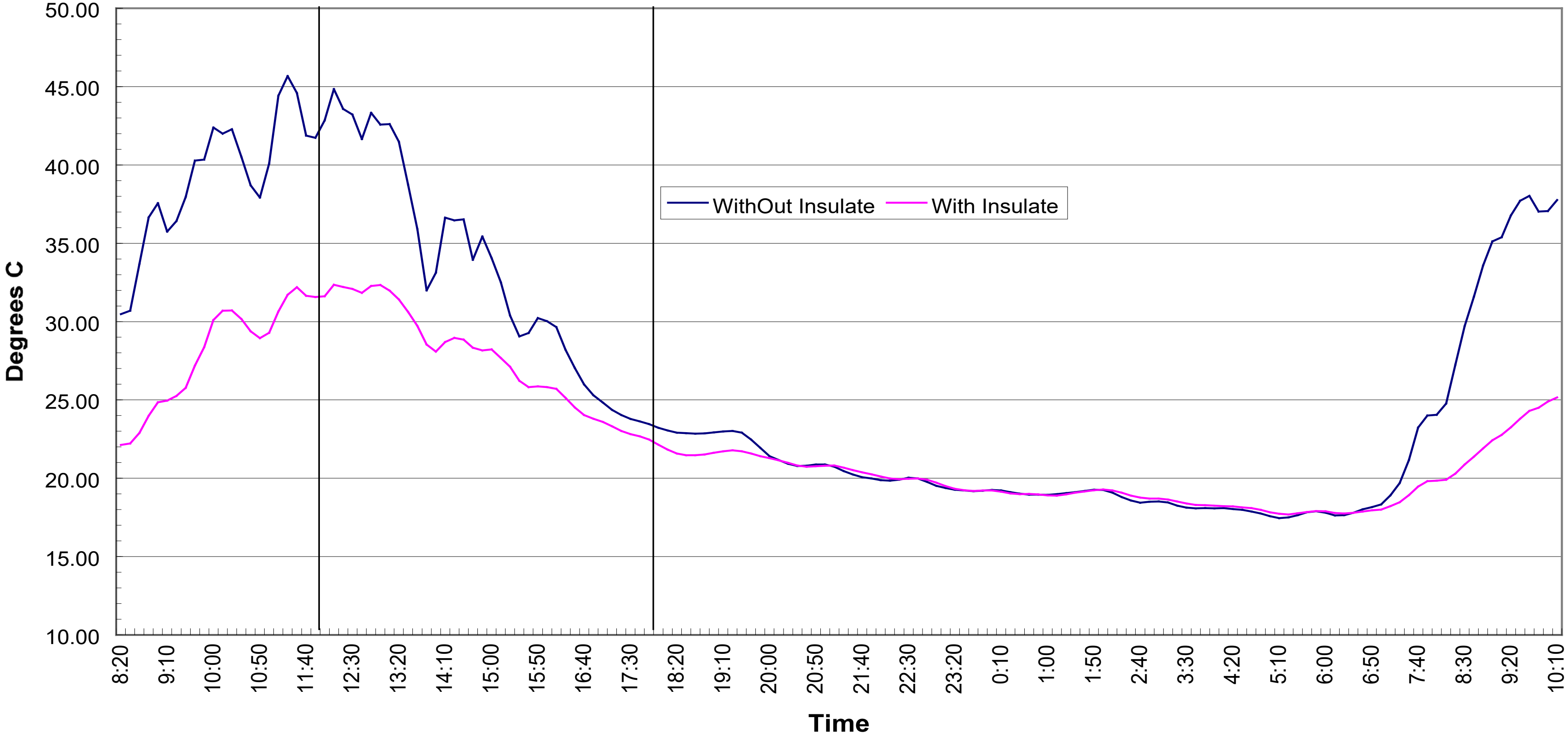
Both ULDs were loaded at 8am on the trial day with an identical mass of simulated product. The mass consisted of 16 x 25L plastic vessels in each container, pre-chilled to a starting temperature of 3 - 5°C.

Temperature logging was conducted by a Datataker DT500 fitted with 30 'T' type thermocouples (15 in each unit). Logging was scheduled at 10-minute intervals for all channels, and both trials were logged for 26 hours.
Data from the temperature loggers was transferred into an Excel file and then generated into a series of graphs to more easily interpret the data. Simplification of the data was also achieved by averaging out the 4 air and water temperature probes in each of the units. The resultant graphs are shown in appendix 1 - 5.

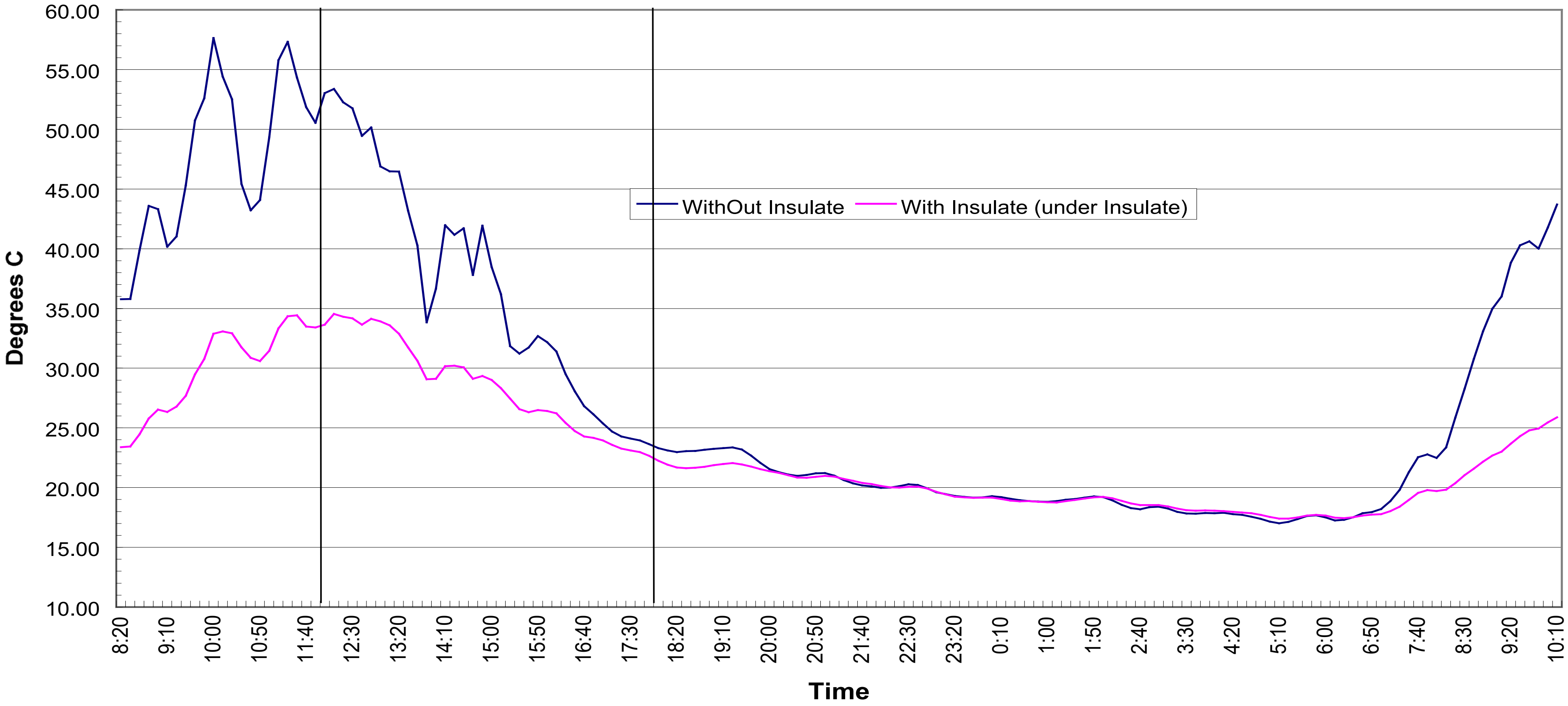
APPENDIX 1 – INTERNAL AIR TEMPERATURES



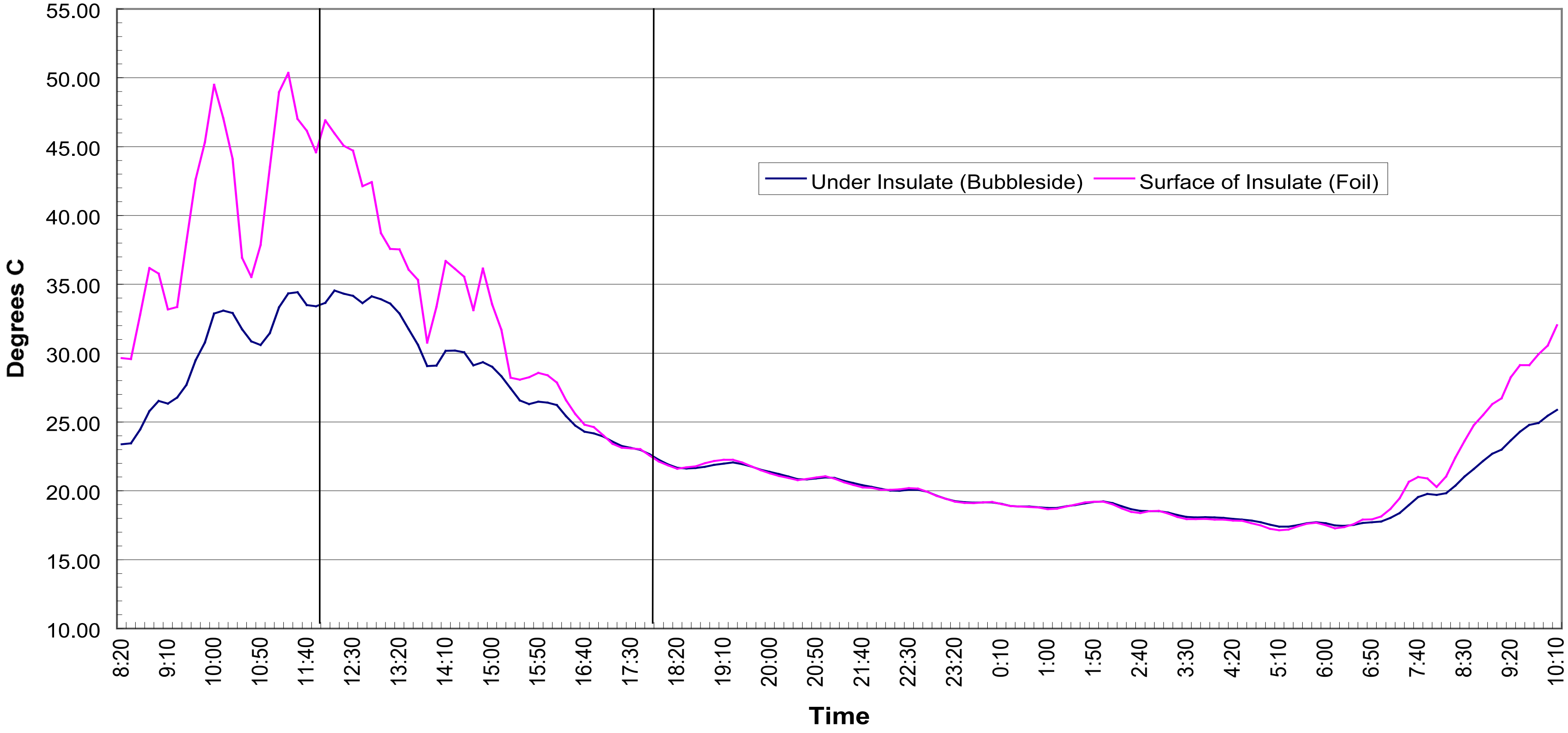
APPENDIX 2 – INTERNAL ROOF SURFACE TEMPERATURES



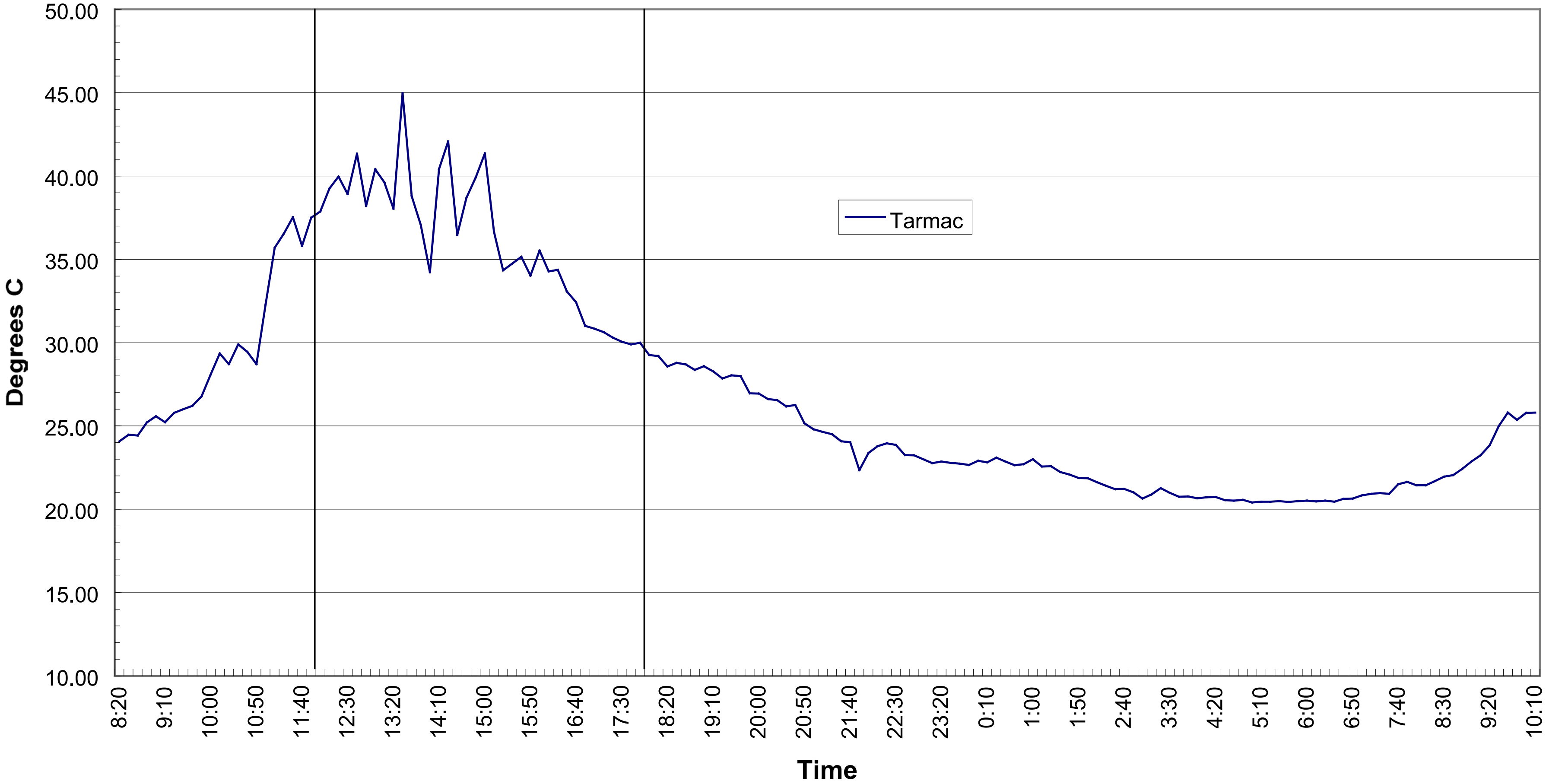
APPENDIX 3 – EXTERNAL ROOF SURFACE TEMPERATURES



APPENDIX 4 – INSULATE SURFACE (ABOVE / BELOW)

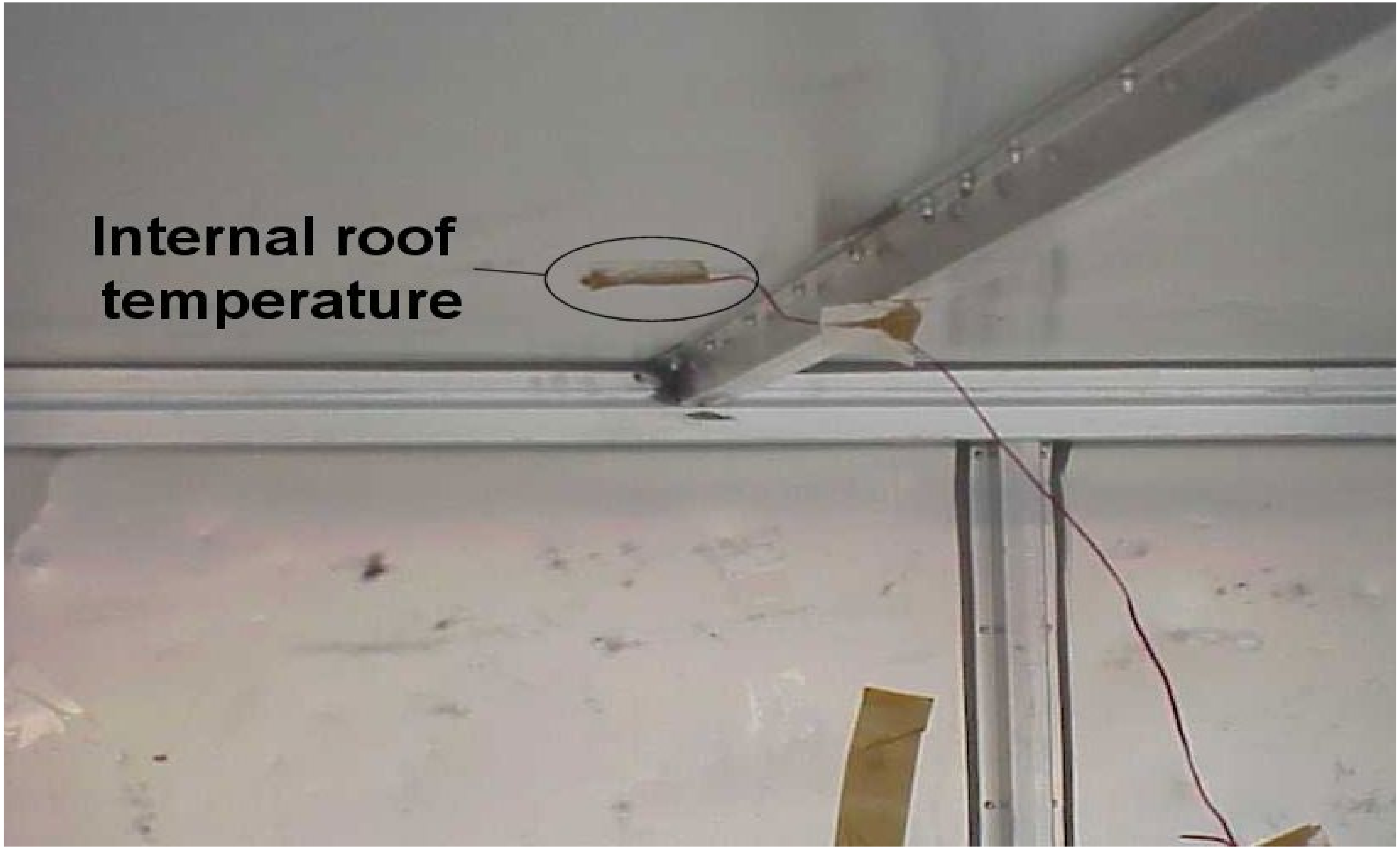


APPENDIX 5 – TARMAC TEMPERATURE



EXTERNAL PROBE POSITIONING

INTERNAL ROOF PROBE POSITIONING



INTERNAL AIR PROBE POSITIONING