WHITE PAPER

Hybrid Thermal protection for Tarmac

« La Couverture »

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la COUVERTURE
INNOVATIVE THERMAL SOLUTIONS

Hybrid Thermal protection specifically designed and developed to protect temperature sensitive cargo from Tarmac hazards can be a valid alternative to thermal dollies.

Background

It is a matter of fact that the airfreight cold chain is not a closed cold chain and that due to the very high number of actors, temperature excursions are happening daily. This risk factor is impacting heavily on the pharma Industry that is forced to maintain the product integrity from manufacturing site up to the final patient. Temperature excursions can have sometimes a devastating impact on the product integrity and create huge damages.

From an analysis of IATA, one of the weakest points in the airfreight cold chain is the Tarmac. This area, where the aircrafts are parked is defined from the ICAO "Apron"
This area around the aircraft parking position, is mostly the hottest or coldest of all other places where the freight is temporarily positioned during the entire transport. The transport and the exposure of the temperature sensitive pharmaceuticals up to the apron is depending on the airline procedures and can vary from airport to airport and from terminal to terminal.

Time and Temperature are becoming the most important variables for pharmaceuticals that are travelling worldwide via air.

Shippers are using as much as possible active container, passive packaging solutions and thermal covers on top of special airline services that should minimize excursions till the destination.

Facts

Ground handlers are offering, in more and more airports an expensive active tarmac transport solution that can be a refrigerated truck or a thermal dolly. Those solutions have high extra costs and are powered with gasoline or rechargeable batteries which produce an CO2 emission. In addition, those are special equipment that needs to be maintained and monitored and have a long Return Of Investment.

Refrigerated trucks are normally subject to special airport authorities, for autorizations because they are an additional vehicle around the aircraft and consequently another risk factor for damages to the aircraft.

Normally, time & temperature sensitive cargo procedures are moving the freight in the direct solar sunlight from 30 min. up to 120. min or longer, depending on how far away the airplane is positioned from the cargo warehouse. This is a risk not only for solar radioation but also for extreme cold wind, snow and rainfalls.

Airports are sometimes using covers, as individual solutions, mostly developed previously for other requirements or transportation modes and designed and tested for other purposes.

Another very big issue for tarmac covers is the location where they are left. Normally the ground handling activity is done from a different company as the cargo handling company and this makes the return of the cover to the warehouse a challanging process. When a cover is left behind somewhere on the airfield this makes its location quite diffcult.

Introduction

Thermal covers are not only used from shippers to protect pharmaceutical products on single skids but are also used sometimes in airport facilities to protect entire ULD (Unit Load Devices) up to the apron area.
These covers are normally the same covers and the same insulated material used to protect shipments from loading and unloading of trucks from temperature excursions and are sometimes not designed for the high /low temperatures on Tarmac. They are normally very light and developed to be under the net and not ideal to protect from temperature and timings of an airport handling perspective.

Requirements:

The scope of an airport thermal cover is to protect the temperature sensitive ULD from direct solar radiations, heat convections and thermal conduction. These 3 heat transmissions can be very challenging if we need to protect the goods for several hours in airports based in regions that are extreme hot or cold. In addition, the cover must be very robust due to multiple handling requirements of airport movements.

Extreme situations need extreme and tailormade solutions.

Solution:

Mitigate temperature excursions of time and temperature sensitive pharmaceuticals requires specific tailormade solutions. For unique situations we cannot “adopt” general thermal insulating solutions, the risk would be to spend huge amounts of money and “overprotect” the freight with big increase of packaging costs and freight rates, or vice versa under protect the products with inefficient insulated solutions.

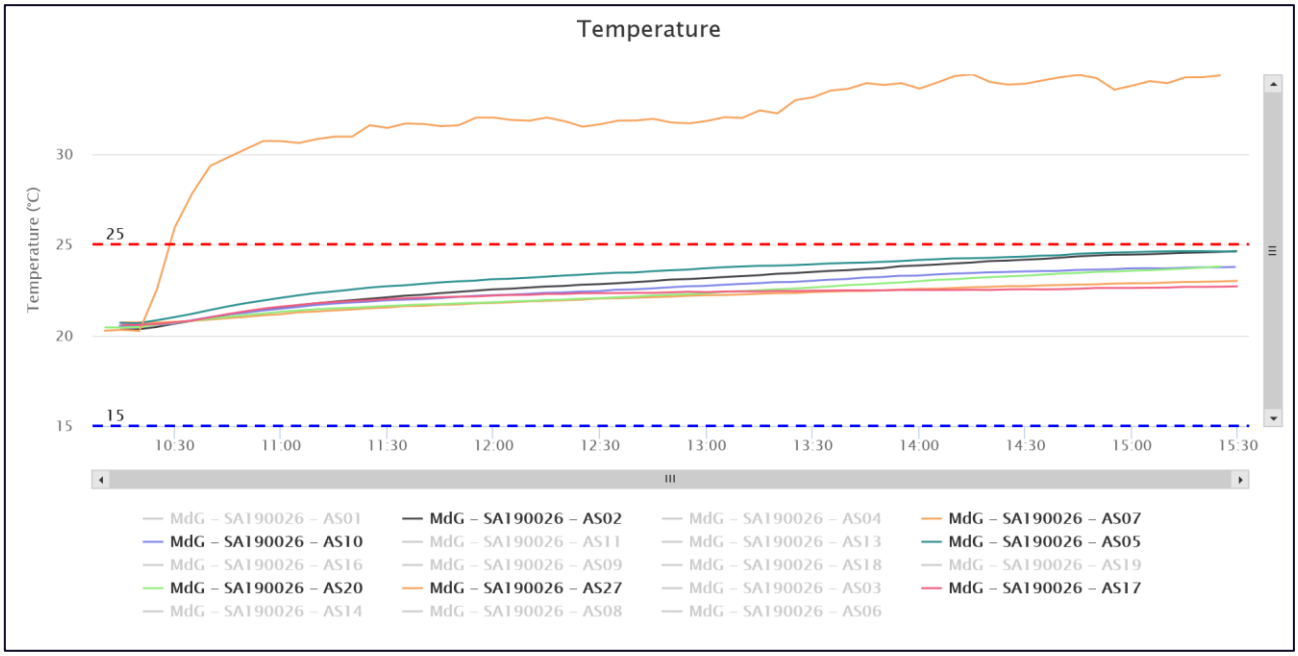
La Couverture was developed specifically to solve temperature excursions on the airfield limiting at the same time CO2 emissions and maintenance costs that thermal dollies must undergo. Parts of the cover are made with recycled material and the min 3 years shelf life makes the product eco-friendly.
The hybrid protection is composed of 2 parts.
Top:
The top is a made of 4 layers of different materials.

The first and the fourth layers are a double coated PVC with 0,48mm thickness, robust, and washable. The second Layer is made of recycled fleece with 22mm of thickness.
The third layer is made of 22kgs of PCM cooling elements *(Phase Change Material)* sewed together into the top of La Couverture.
Side:
The side layer goes all around the ULD and is basically composed the same way as the top without the PCMs.
Both layers (top and side) are joined by several Velcro bands all around the ULD.
The Velcro band of the top part is very large in order to regulate the height of the ULD that can be regulated from 120cm up to 160cm. even the side layer can be adjusted with a 30cm Velcro band in case the ULD will have some "oversize's".

This flexible passive solution gives an alternative option to the thermal dolly and can protect the pharmaceuticals up to 5 hours in extreme Summer that in an average is normally enough also to cover an unexpected offloading. (Please refer to the test)

Test

Normally passive packaging systems and thermal cover are tested in a climate chamber and exposed to different temperature ramps in order to simulate as much as possible a real shipment scenario and to see how the insulating performance of the packaging is.
In the case of the ***La Couverture*** hybrid protection, it was decided to adopt another approach. Since it will not be used in an entire shipment but only for a few hours from the warehouse to the aircraft and back, it has been opted to carry out tests with a linear temperature trend and exposure to direct sunlight without using a climatic chamber. The exposure was done in a summer condition in Rome airport area.
In order to have an as real as possible scenario, the thermal mass was maintained at +20°C and not at +15°C range. The result of the series of the test was very positive and showed that the range **+20+25°C was maintained for 5 hrs**, due to the PCMs that absorbed the direct solar heat on the top of La Couverture and the thick insulated material surrounding the freight.
The internal loggers were placed next to the thermal mass but also inside the boxes (away from the thermal mass) measuring the internal airflow.



If we consider that the average of the tarmac timings are approx. 120min (for temperature sensitive pharmaceuticals) and we consider also another 120min in case of offloads (worst scenario) we will reach a total time of 4 hours (240min) From the graph we can see that the cover protects the products from temperature excursions 5 hours.

Geofence :

Thanks to the innovative IoT Tracker installed in the product, it is always possible to look where the cover was in the last 15min. With a battery lifetime of 3 years that makes the solution energy efficient, eliminating useless power consumption of recharging. Via an App the covers are always located in the airport area without any additional monthly data transmission fees.

How does it work?

The outer colour white is reflecting the direct solar radiation lowering the heat transfer process.
The internal cooling elements (PCMs) sewed in the top of the cover are absorbing the remaining heat creating a barrier between the warm air coming from the solar radiation and the product. The fleece in the sides is acting as an additional thermal barrier that lowers the internal temperature increase.

The velcros sewed on the top of the cover makes the height if the cover adjustable and flexible to the operation requirements depending on how the ULD is build.

The double layer of PVC and the seams make the cover very robust and washable.

The recyclable materials and the recycled fleece are making the Apron cover sustainable.

In case little damages will occur a repair kit will be delivered on request