Temp-Ex®

SINGLE USE BREATHABLE THERMAL COVERS

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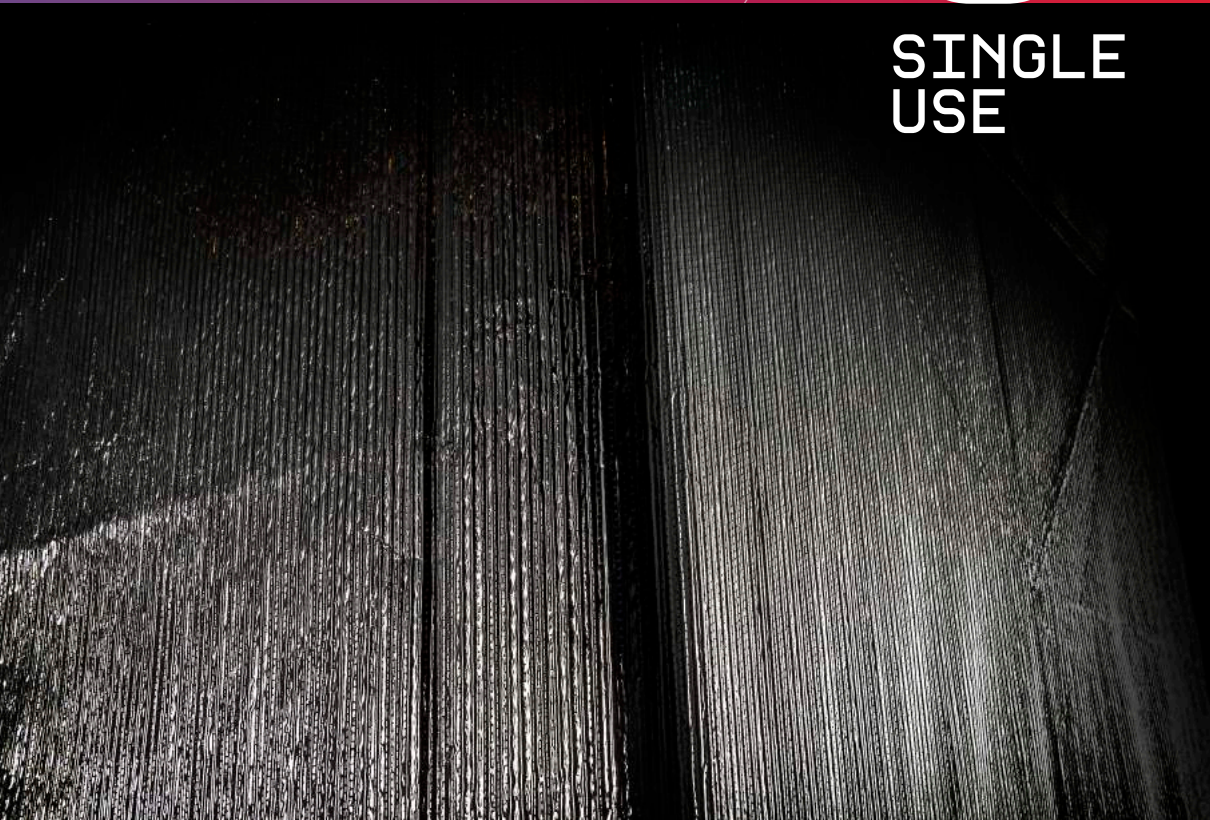
SINGLE USE



Single-use, Breathable Temp-Ex Thermal Cover

Protects thermal chain in one-way air, land and sea shipment of sensitive goods such as;

- Pharmaceuticals and Life Sciences
- Fresh vegetables and fruits
- Cut flowers

by allowing passage of O2 and removing hazardous gases and excess moisture from the environment.

Breathable Temp-Ex; Why?

Provides sustained thermal insulation against temperature fluctuations due to its high insulative and reflective qualities and prevents accumulation of hazardous gases which cause early ripening in respirating commodities such as fresh vegetables, fruits and cut flowers.

Breathable micro-pores reduce condensation and moisture caused by transition to/from hot and cold environments.

Protects against climatic conditions (rain, wind, etc.) and environmental contaminants (dust, pollen, insects, etc.).

Lightweight, thin and durable. Reduces loading and storage costs of covers.

Besides standard products, client-specific designs and dimensions are possible.

Fast and easy application. Facilitates operational flow.

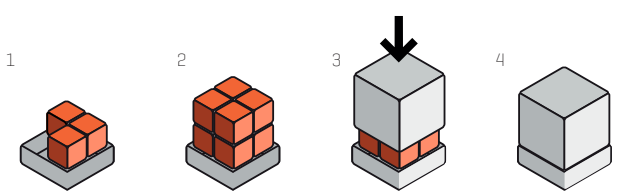
Made of 100% recyclable materials, Temp-Ex prevents spoilage of protected goods and reduces cargo's footprint.

WHO, IATA and GDP compliant.

How to Use?

Temp-Ex products with different protection levels, depending on the shipping duration and required temperature range, are offered:

1LYD: Single layer, thermal barrier and reflective surface, extra lightweight.
2LYD: Double layer, extra thermal barrier, reflective surface on the inside and outside, lightweight.
3LYD: Triple layer, high insulation, reflective surface on the inside and outside.



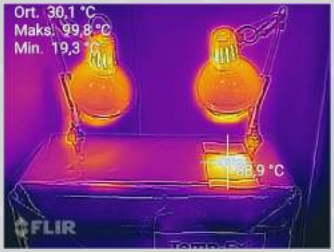
Breathable material with micro-pores, is optional.

Temp-Ex®

Performance testing of thermal covers is a crucial step in ensuring product protection throughout the whole cool chain. This critical step is nowadays carried out experimentally, which is a time and resource-intensive method. During these tests, thermal cover manufacturers are using different experimental setups and data processing methods. This non-standardized approach leads to numerous incomparable products in the market and confused clients with questions like "How many data loggers were used?", "Where were the data loggers positioned?", "How were the temperatures statically obtained?".

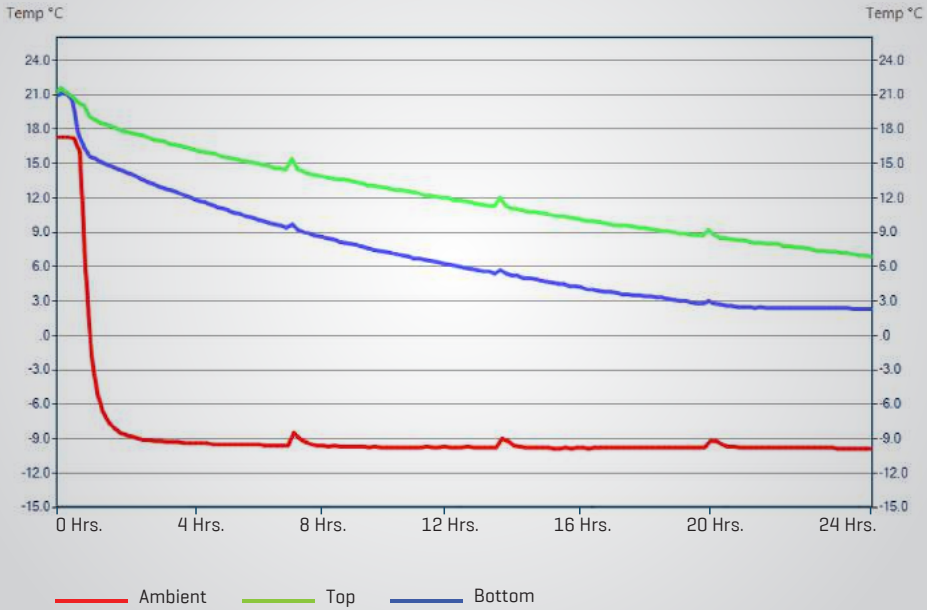
Besides the experimental performance tests, Sedef also utilizes also the numerical performance tests using computational fluid dynamics (CFD) simulations. These simulations are carried out within an hour, which makes it less time and resource consuming compared to the experiments. Continuous validation studies exhibit an excellent agreement between experimental and numerical performance tests.

A result of such a CFD simulation is shown above. The high resolved temperature field in the product allows obtaining the minimum, maximum and average temperature statically. Flow simulation around the product leads to a more accurate convection calculation under different scenarios like in the cold store, on the tarmac and in the aircraft. The solar radiation calculation is carried out wavelength-dependent so that the direct, diffuse and ground-reflected radiation can be modelled. Such a detailed radiation calculation is crucial for an accurate assessment of the thermal covers reflectivity performance. Numerical performance tests are also capable of calculating complex tasks like phase change phenomena (e.g., PCMs).



AR-GE

1 LYD 15-25^{0}C
Cold Chamber Test at (-)10^{0}C

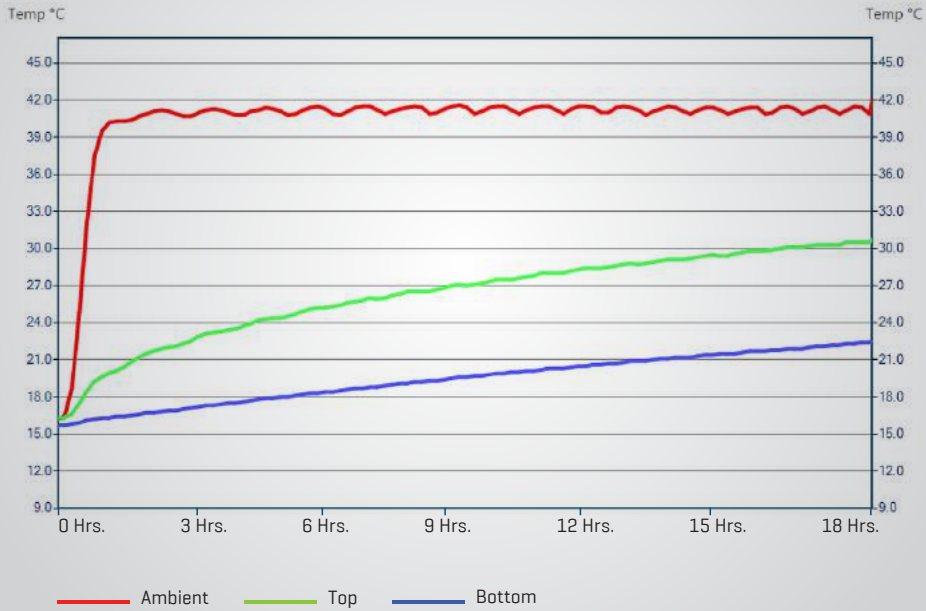


Product Start Temperature 21^{0}C	Duration	1 Hrs	4 Hrs	8 Hrs	12 Hrs	16 Hrs	20 Hrs
	Product Temp	18.5^{0}C	16^{0}C	13.4^{0}C	11.3^{0}C	9.3^{0}C	8.3^{0}C
	Difference	2.5^{0}C	5.0^{0}C	7.6^{0}C	9.7^{0}C	7.7^{0}C	8.1^{0}C

1 LYD 2-8°C / 15-25°C
Direct Sunlight Real World Test at 81°C

Product Start Temperature 4.4°C	Duration	1 Hrs	5 Hrs	10 Hrs	15 Hrs	20 Hrs	25 Hrs
	Product Temp	6.3°C	12.1°C	16.7°C	18.6°C	20.1°C	23.9°C
	Difference	1.9°C	7.7°C	12.3°C	14.2°C	15.7°C	19.5°C

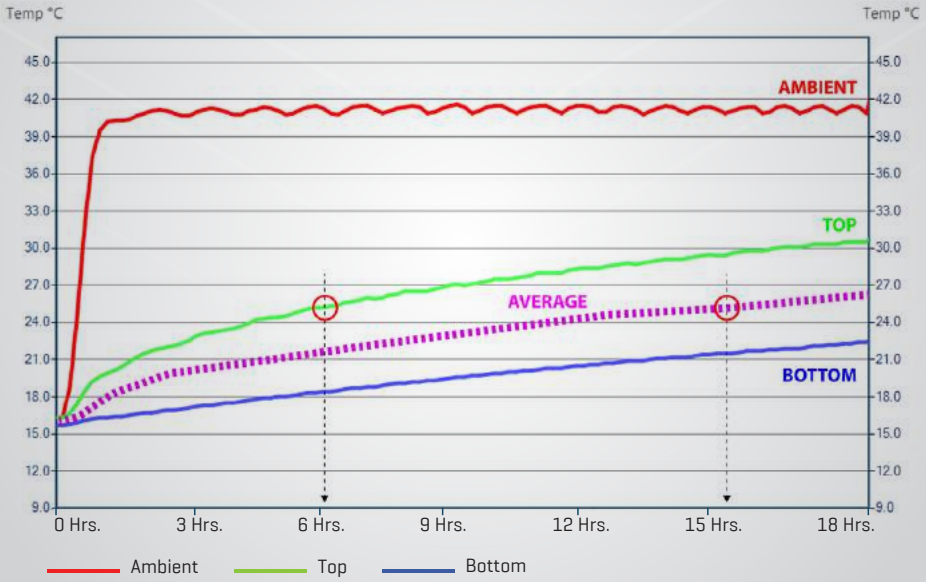
1 LYD 15-25°C
Hot Chamber Test at 40°C



Product Start Temperature 16,5°C	Duration	1 Hrs	3 Hrs	6 Hrs	9 Hrs	12 Hrs	15 Hrs
	Product Temp	19.6°C	22.5°C	25.2°C	27°C	28.4°C	29.4°C
	Difference	3.1°C	6.0°C	8.7°C	10.5°C	11.9°C	12.9°C

The Average Dilemma

As shown in the figure below, the most critical point of the thermal cover is its top surface. The temperature value on this surface exceeds the 15-25°C critical range circa after six hours. On the other hand, if the average value of the experimental temperature data is considered, the limit value of 25°C is reached after circa 15 hours. In other words, considering average temperature values result in thermal performance which is more than doubled compared to the thermal performance determined using particular temperature values.



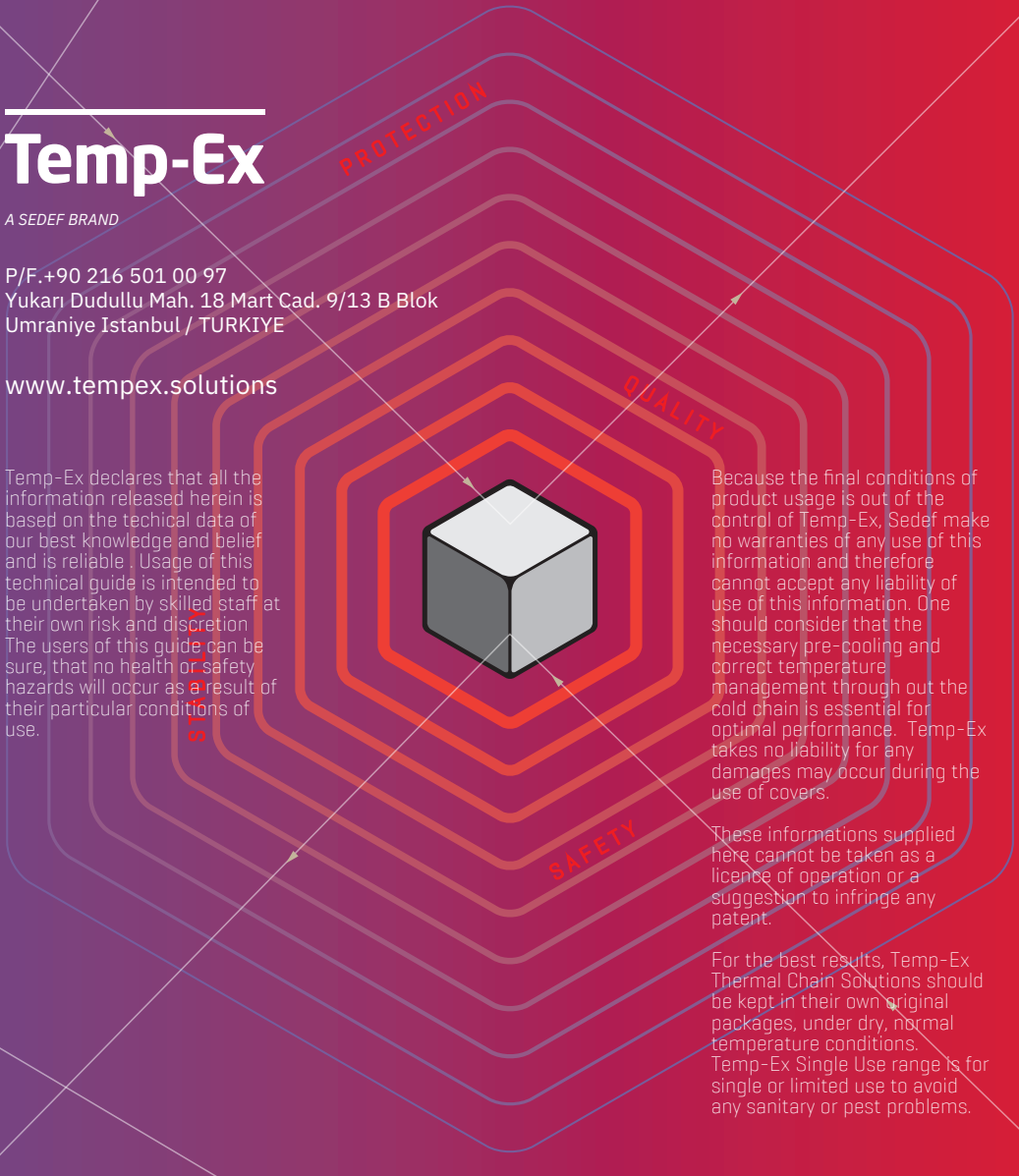
In order to avoid such statistical illusions, SIL simulations are utilized to identify the critical points in the system. Following these results, the thermal performance is then validated using these critical points (points with the maximum and/or fastest deviation from the critical range).

Temp-Ex

A SEDEF BRAND

P/F.+90 216 501 00 97
Yukarı Dudullu Mah. 18 Mart Cad. 9/13 B Blok
Umraniye Istanbul / TURKIYE

www.tempex.solutions



Temp-Ex declares that all the information released herein is based on the techical data of our best knowledge and belief and is reliable . Usage of this technical guide is intended to be undertaken by skilled staff at their own risk and discretion The users of this guide can be sure, that no health or safety hazards will occur as a result of their particular conditions of use.

Because the final conditions of product usage is out of the control of Temp-Ex, Sedef make no warranties of any use of this information and therefore cannot accept any liability of use of this information. One should consider that the necessary pre-cooling and correct temperature management through out the cold chain is essential for optimal performance. Temp-Ex takes no liability for any damages may occur during the use of covers.

These informations supplied here cannot be taken as a licence of operation or a suggestion to infringe any patent.

For the best results, Temp-Ex Thermal Chain Solutions should be kept in their own original packages, under dry, normal temperature conditions. Temp-Ex Single Use range is for single or limited use to avoid any sanitary or pest problems.