

## Developing Controlled Temperature Tunnels



*Temperature tunnels can reduce overall packaging and distribution air-freight costs.*

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The perfectly controlled ambient atmosphere for temperature-sensitive products during distribution from the shipping dock to final destinations, known as the temperature tunnel, has been elusive, since shippers must deal with various modes of transportation. Temperature tunnels and appropriate packaging, however, can be devised as part of a total temperature packaging solution.

In a typical package journey, exposure to harmful temperatures is fairly certain during winter and summer seasons. The package queued for a truck pickup is driven to an airport, where it queues a second time during sorting, then waits to be placed on aircraft, often on the tarmac.

In the airplane cargo hold, recorded ambient temperatures may range from  $-20^{\circ}\text{C}$  to a high of  $50^{\circ}\text{C}$ , depending on how quickly the plane closes its doors. At cruising altitudes, packages in the highest stressed sections may be exposed to  $-20^{\circ}\text{C}$  to  $20^{\circ}\text{C}$ . And the above events are repeated in reverse as the package is unloaded, sorted, and trucked to its destination. If 30-day shipments are acceptable, ocean freighters may be used as an alternative to air transport. But for shorter deliveries, air-carrier solutions that ensure ambient temperature control are available.

Following is a review of typical methods of protection.

**Protective Packaging.** The most common method for controlling the

atmosphere inside of a package to a suitable temperature is the use of insulation and refrigerants. Protective package sizes range from small shippers (parcel) to larger ones (pallet shippers) for a number of products in the same container. Inside, the insulated package must incorporate some media to maintain the desired interior temperature. Gel packs, consisting mainly of preconditioned water, are typically the least expensive stabilizing media.

Alternative designs include evaporative systems, cold-air blowers with dry ice and a fan, or may employ more-sophisticated phase-change materials (PCMs) that phase or hold environments to very specific temperatures. Typically, the more complicated systems are more expensive. Multiple reuses must be employed to make economic sense of some sophisticated pallet shippers. Several suppliers have instituted programs for packing-material returns for refurbishment, but getting packages returned can be elusive, increasing shipper costs.

**Protective Equipment.** Another solution offered is renting equipment (i.e., a package that keeps its contents at desired temperatures with the use of battery-powered or other sophisticated energy sources). These products may include features that are not required for most shipments and may make one-way shipments unaffordable if reverse logistics is to be considered by the shipper without the supplier's network. Therefore, the shipper pays

for the supplier's maintenance and logistics overhead in some way.

**Special Handling by the Carriers.** Airline carriers have paid attention to the emerging cold-chain markets and now offer various services. Some major freight carriers offer temperature-controlled cargo holds that guarantee climate control during the trip segment aboard the aircraft. They also include battery changes and re-icing and more. However, even though the special service is even more expensive than normal services, it does not provide an answer to the temperature exposure occurring during all of the other shipping events. It is up to the shipper to provide protection to and from the aircraft. Thus, refrigerated trucks are employed or insulated protective packaging (IPP) including some sort of refrigerants must be utilized. Other, mainly passenger-oriented carriers, are now entering the cold-chain logistics segment and offering their cargo holds for upscale freight. However, the shipper again typically must provide dock-to-dock protection in special and expensive equipment. For regulated products, all of the handling operations, packaging components or equipment, and each segment event must be qualified as evidence that the whole system works as expected.

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## **COST-SAVINGS POTENTIAL: A TEMPERATURE TUNNEL**

Recently, we worked with major pharmaceutical companies that significantly reduced costs by employing third-party logistics providers (3PL) with cold-chain expertise, highly trained personnel, and an understanding of domestic and global regulations for biopharmaceutical products. One 3PL, Schenker, facilitated significant reductions in insulated protective packaging (small parcel and any type of pallet shippers) and in additional expenses from special handling procedures, and it eliminated the use of refrigerated devices. The total-systems approach, in conjunction with an appropriately downscaled-designed shipping container, constructs an effective temperature tunnel, protecting sensitive products against ambient weather conditions, hot or cold.

Utilizing this 3PL's procedures, services, and equipment, we have been able to qualify total cold-chain operations that meet regulatory requirements for temperature-sensitive, precious products. Services included documented temperature control, efficient and controlled transfers using trained personnel following rigorous quality guidelines, and aircraft that support stringent temperature control in each cargo area.

Routes were defined to the client's requirements, including provisions to quickly manage an unanticipated delay. Routing tended to avoid airports with known freight obstructions by targeting the use of midsize airports and the use of foreign trade zones. When necessary, transfer point freezers were validated and trucks calibrated. The global network maintains quality within ISO standards.

## **COST-EFFECTIVENESS**

If a 30-day delivery cycle can be used globally, shipping by ocean is the most cost-effective method. A major drug firm reported more than \$1.5 million annual savings and increased such shipments to 40% in 2008. However, if a 24-, 72-, or 120-hour delivery maximum time including customs delays during global shipments is required, air travel must still be used.

The protective tunnel system extensively reduces protective packaging, while addressing handling procedures and shipper coordination activities. A complete system may appreciably reveal bottom-line cost savings while shipping safely from dock to dock. ■

*Thermal Packaging Solutions (Ocean, NJ; [www.thermalpackagingsolutions.com](http://www.thermalpackagingsolutions.com).) is engaged in design, documentation, qualification, and regulatory aspects of packaging and distributing temperature-sensitive products* 📧