Portable Temperature Recorders for Refrigerated Containers

Introduction
Carriage of goods in refrigerated containers is an important part of international commerce. Usually, items shipped in refrigerated containers (reefers) are high value and prone to damage by slight changes of temperature and humidity. When considering these elements, it is vital that shippers using reefers to transport commodities to market develop astute control processes and procedures with a clear grasp of the capabilities and design specifications of the equipment used.

Most all refrigerated containers use equipment that automatically records refrigeration system functions and the container’s air temperature. This information provides a detailed record of refrigeration system performance during a trip. Certain specially-built containers have probes to monitor specific interior temperatures, but this data is usually available only to the ocean carrier, unless cargo owners specifically arrange with the carrier before the trip.

If a potential cargo loss and insurance claim (or, even worse, a health issue related to the cargo) arises, these records become even more difficult to obtain. If shippers have not maintained their own temperature records for when the products were inside the container, they will have a very difficult time proving where and when possible temperature fluctuation occurred.

Thus, Allianz Risk Consultants (ARC) Marine recommends that high-value or highly-sensitive commodities, e.g. frozen seafood and perishable fruits, vegetables and flowers, use protective controls. One recommendation is to implement portable temperature recorders under certain conditions to provide a higher level of surety and ‘cold-chain’ integrity. In the past several years improvements in miniaturization have created a wide variety of choices of portable temperature recorders to ensure that they have an accurate and reliable record under their control.

Portable Temperature Recorders: Data Loggers and Strip Charts:

Portable Temperature Recorders are electronic instruments that record information over a period of time for later use. Because of the importance of keeping accurate, ongoing temperature and humidity records, data loggers of various types have been in the transportation industry for many years.

With new technology, it is possible to produce battery-operated, miniature electronic devices that can automatically record information either directly imprinted on paper, called a Strip Chart, or recorded as data for later retrieval by computer, known as a Data Logger. Both types collect temperature measurements at intervals and chronologically record them.

A variety of different makes and models of the new miniaturized temperature recorders are available on the market. Some models are inexpensive enough that they are considered to be disposable (one-use) recorders. Other models are designed for multiple-use. The primary consideration for choosing disposable over multi-use is cost, but there is also the logistical issue of returning the multi-use model back to loading-points, which may be thousands of miles away.
Technical Considerations:
Each shipper has unique temperature-recording needs. Among the many things to consider are:
- **Temperature Range:** Many units can operate in temperatures ranging from -40°C to +80°C
- **Accuracy:** Many units are accurate to +/- 0.5°C
- **Calibration:** Units must be factory-calibrated or capable of calibration onsite
- **Memory Samples:**
  - **Disposable:** One trip units are often limited to less than 3000 samples
  - **Multi-Use:** Reusable units often can record 30,000 to 50,000+ samples
- **Sample Rate:** Many units can adjust sample rates from mere seconds to once/twice a day
- **Battery Life:**
  - **Disposable:** One trip units are often limited to 20-30 days battery life
  - **Multi-Use:** Reusable units have battery life of up to 3 years, and can be recharged
- **High/Low Alarms:** Many units have visual alarms if temperature ranges are exceeded
- **Downloadable:** Many data loggers can be downloaded via USB/serial port to a computer.

Costs
Costs of temperature recorders and strip charts are quite competitive. Re-usable recorder prices range from around US$100 to over US$500 depending on functions, ruggedness and other factors. Disposable (One-Trip) recorders range from around US$10 to more than US$20 each.

Placement of Recorders
The diagram above shows how cooling air cycles through a reefer. While it is critical to understand this, it is as important to stow cargo so it favors proper circulation. Further research and testing should be done prior to shipment. Assistance can be provided by an ocean carrier’s sales team, a marine surveyor and/or a cargo insurer.