

# Laboratory EQUIPMENT®

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## Considering Laboratory Cold Storage

*Temperature stability, sample integrity, safety and security matter*

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▶ *Lost samples can result in weeks, if not months, of lost work and hundreds of thousands of dollars.*

### AT A GLANCE

- Neither household nor commercial cold storage equipment address the demands of storing precious samples
- A system's ability to deliver and maintain stable, uniform temperature is influenced by multiple factors
- Alarms that notify users of deviation from set-points protect sample integrity
- Laboratory refrigerators are now more energy efficient

### Introduction

Researchers today spend countless lab hours developing valuable samples, reagents, cells and enzymes. Lost samples can result in weeks, if not months, of lost work and hundreds of thousands of dollars. Many are irreplaceable. Refrigeration problems have recently been cited as a major cause for the \$20 million per year wasted from ruined vaccines in the U.S. Federal Vaccines for Children Program.<sup>1</sup>

To this end, there is now heightened awareness and focus on the importance of protecting valuable research samples. Selecting the right cold storage equipment has become a business-critical purchasing decision.

Laboratories today are recognizing the fundamental differences between cold



Thermo Scientific Revco® laboratory refrigerators offer temperature-recorder and alarm options.

storage solutions and standard refrigerators and freezers. Household systems are designed to store groceries for occasional access while commercial systems, still suited for grocery storage, withstand the rigors of a local store or restaurant. Yet neither household nor commercial units address the crucial

demands of storing DNA, RNA and other precious samples.

Laboratory cold storage systems are purpose-built and tested for lab environments with the precise temperature controls required for sample preservation and integrity. This means they typically feature advanced alarm

systems, tighter adherence to set-temperatures, faster temperature recovery, storage flexibility and a range of optional security features.

Several selection criteria should be considered when evaluating the proper laboratory cold storage solution:

- Temperature Stability and Recovery
- Sample Integrity and Protection
- Environmental Dividends
- Safety and Security

## Temperature Stability and Recovery

In order to maintain temperatures below ambient, heat is extracted from the storage space for controlled cooling. A system's ability to deliver and maintain stable, uniform temperature is influenced by a number of factors, including:

- *Ambient temperature:*

This may vary considerably during a 24-hour period.

- *Inventory access:* This might be none one day and every few minutes on another day, depending on what is stored in the space, what time of day it is, what project is running, etc.

- *Electrical supply:* Brown-outs, black-outs, power surges and spikes are becoming more common. Although back-up power systems ideally should be in place, they are not always installed.

- *Changing interior cabinet space:* The more space available, the more energy needed to cool it. Thus, if a refrigerator or freezer is full of samples, it is far more efficient at maintaining temperature.

Laboratory refrigerators and freezer systems deliver precise temperature control



*Today there is heightened focus on the importance of protecting valuable research samples.*

and uniformity. This coupled with an advanced design ensures tighter control over the temperature range than household or commercial units, which is especially important when -20 C and -30 C freezers are regularly accessed. Cold storage systems employ other advanced features to ensure temperatures remain as close to the set-point as possible. For example, high performance compressor technologies found in laboratory-specific systems deliver quicker temperature recovery times after door openings, ensuring sample integrity.

## Sample Integrity and Protection

It is important to set the sample's tolerance range (i.e. -20 C  $\pm$  2 C), but what proves this range is adhered to? The majority of laboratory-specific cold storage units are now supplied with a series of alarms (standard or optional) to notify users of any deviation from the set-points that could affect

sample integrity. When used properly, alarms can help keep samples safe through almost all situations as staff will know which procedures are required to remedy the problem. This could be from simply closing the door properly to moving samples to temporary storage during a prolonged power failure.

Household and commercial refrigerators and freezers are perfectly suited for storing food and beverages, all of which are easily replaceable. They are not, however, designed to ensure the integrity of valuable samples. On the other hand, laboratory refrigeration is constantly evolving to keep pace with laboratory requirements. For example, microprocessor controls ensure that the temperature is maintained within the set range. If the temperature deviates, an alarm sounds, indicating changes that need attention.

## Environmental Dividends

Increasing refrigeration efficiency is not only good for the system but also for the environment because a reduction in power use means a drop in CO<sub>2</sub> emissions. At present, laboratory refrigeration systems are not rated under the Department of Energy's ENERGY STAR ratings for household or commercial-grade refrigerators and freezers because their use is different. However, a number of companies are working with the relevant bodies to develop a similar energy classification for laboratory systems with environmental impacts in mind.

The local working environment also benefits

when a designated laboratory refrigeration system is used because the drive for efficiency has made them quieter and they produce less heat. As a result, more and more systems are being installed directly in research laboratories rather than in dark corners down the corridor. This makes access much easier, and samples can quickly be transported between storage and benchtop.

## Safety and Security

There are many reasons why access to a refrigerator or freezer may need to be limited. Some external regulations require that certain biological, chemical or radio-labeled samples be locked away from unauthorized access. Another reason could be to save precious storage space or to prevent people from influencing sample integrity. Whatever the reason, laboratory refrigerators and freezers are more easily adapted (or are already fitted) with locking systems than household and commercial units. At one end of the spectrum, a simple padlock and loop system will suffice. At the other end, the systems can be fitted with the same access-control technology used for existing electronic room-entry control systems (swipe cards, proximity recognition and pin codes). Security systems allow access to be controlled down to the individual researcher and even to specific times of the day. Reporting is also becoming an increasingly important requirement for GLP/GMP. Therefore, downloading and showing the temperature

profile of a refrigerator or freezer over any specified period can be achieved easily.

The stringent health and safety requirements of the modern laboratory are also considered in developing a laboratory system. For example, many models are available without internal spark sources (such as pushbutton light switches) as many reagents are flammable and some are explosive.

Laboratory refrigeration systems are generally very flexible. There are many different sizes and shapes

available within most models and internal racking/compartment systems make organizing samples simpler, allowing you to maximize equipment investment.

### Audits and Oversight

It is becoming more common for institutes, departments or even groups to have oversight committees to audit their equipment in an attempt to provide purchase guidance and cost/benefit analyses. A number of these committees' reviews have shown that buying

household and/or commercial refrigerators and freezers is a false economy and that they cannot provide suitable short- or long-term cold storage for research samples.

### Conclusions

How much do samples, reagents, cells or enzymes mean to a lab? Could research continue if everything in a laboratory refrigerator or freezer was lost? If the answer is "No," then a sample-storage solution designed, built and tested for laboratory use should

be considered. Investment is critical for performance, functionality, dependability and, most of all, peace of mind that samples are safe and secure and thus research can continue. ●

### References

1. Welte, Melanie. 2007. "Vaccines ruined by poor refrigeration." USA Today. [http://www.usatoday.com/news/health/2007-12-04-spoiled-vaccines\\_N.htm](http://www.usatoday.com/news/health/2007-12-04-spoiled-vaccines_N.htm) (accessed April 2008).

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