SPOTLIGHT feature

Cooling & Freezing

Laboratory Temperature-Controlled Cold Storage Equipment

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Clinical laboratories have an ever-increasing demand for temperature-controlled cold storage equipment that is reliable, consistent, and accurate. In clinical environments, storage requirements call for laboratory refrigerators with a +1 to +8°C temperature range or lab freezers with a range of -18°C and below. These temperature ranges are required for vaccine, whole blood, plasma, enzymes and other temperature-sensitive materials. For long-term and indefinite storage, cryogenic storage vessels are needed (-140 to -196°C). No matter the temperature requirements, having a reliable cold storage product is a matter of the utmost importance for clinicians, blood banks and ultimately their patients to protect critical samples.

Valuable Samples Require Advanced Cold Storage Security

The requirements for laboratory cold storage can be as simple as needing to store individual samples in a freezer or refrigerator, or as complex as housing a variety of whole blood, plasma or vaccines in large quantities. Clinical laboratories are seeing an increased demand for refrigerators and freezers that offer an array of features that meet application requirements, take up less lab space, and that are consistently reliable.

Highly controlled environments such as pharmaceutical laboratories, IVF clinics and diagnostic laboratories require continuous, automated monitoring of the critical parameters for cold storage, including temperature, relative humidity, CO_2 concentration, and differential pressure.

To safeguard their work and ensure regulatory compliance, lab workers must be vigilant in closely watching these critical parameters. One way to achieve this is with the continuous, automated monitoring of wireless monitoring systems that monitor outside of the system that comes built into the cold storage unit. These systems keep watch in real-time, alerting scientists and lab workers immediately when parameters are breached so the issue can be addressed and remedied immediately.

The best freezers and refrigerators are designed so that the parts requiring upkeep are at the front of the unit to provide convenient access for maintenance protocols. This creates more efficient performance of the refrigerator or freezer, since lab personnel do not have to shut down the application and disturb sample protection in order to complete routine maintenance.

Many temperature control systems are designed to have a high level of configurability. This allows clinical labs to create the specifications to meet their needs and ensure the lab gets the most cost-effective and flexible temperature control systems available. In today's clinical laboratory, temperature control equipment is sophisticated enough to provide the specific temperature range, cooling capacity, and accessories to fit the applications, processes, or experiments the lab is performing. As when selecting a computer, there are multiple options when choosing temperature control products. Clinical laboratories have come to expect a high level of configurability in temperature control equipment, to be more cost-efficient and to use the equipment for multiple applications.

Example One: Blood Banking

The majority of patients who need blood transfusions are facing acute, life-threatening situations. Blood transfusions are a critical medical intervention for trauma, major surgery and chemotherapy patients, and for those who require chronic blood component replacement.

Blood bank refrigerators have an absolute requirement for temperature uniformity to ensure safe blood storage. Features designed to provide the highest level of temperature uniformity include 'smart' defrost (time and temperature) and directed airflow. Additional safety features include audio/visual warnings for temperature deviations or power failure, remote alarm contacts, controller battery backup systems, and alarm set points that warn of temperature deviations. Major challenges for blood banks today include the need for a high level of efficiency in terms of costs, staffing, and tight resources. These features are designed to work together so lab professionals can work at maximum efficiency with the absolute confidence that valuable samples are being properly stored.

Storage space is an important consideration for blood banks. Some blood bank refrigerators are designed to contain as few as 64 bags or as many as 770 units, while maintaining a consistent temperature. Furthermore, the design of these refrigerators makes it possible to quickly recover the set point temperature after the door has been opened and closed.

Technological innovations in monitoring and sample protection can help choose temperature control systems for blood bank applications. Improvements in constant temperature monitoring systems can be seen in remote wireless monitoring technologies like those mentioned previously, that provide continuous monitoring with immediate alarm notification and continuous data collection.

For more standard features in laboratory temperature control, look for attributes such as automatic alarm testing, simplified push-button alarm test functions, interactive on-screen temperature graphs, event logging, and downloading capabilities, which are all tools that can help protect samples and save valuable time for lab workers. Other features to consider are: capacity, pass-through features when multiple entry points are required, advanced microprocessor control systems, positive airflow systems, industrial-quality cabinet construction, and extra-strength refrigeration compressors.

Example Two: Plasma Freezers

The storage of plasma is critical to treating patients with burns, severe infections or clotting abnormalities. Plasma is used to treat burn victims by replacing the lost fluids and blood proteins patients loose after a traumatic burn. Plasma from donors is given to burn victims to replace blood volume and manage blood pressure. The body of a burn victim tries to heal itself from the burn but the skin loses its ability to contain body fluids, and blood is transferred out of circulation and into the tissues. This causes a reduction in blood pressure, a critical body function that delivers blood to the peripheral tissues. Plasma is also the portion of blood that contains clotting factors. Patients suffering from clotting factor deficiencies receive replacement clotting factors harvested from donor plasma.

When handling blood plasma, creating the proper environment for rapid freezing and storage is essential. Maintaining the exact temperature range takes a reliable storage enclosure in addition to a heavy-duty refrigeration system. Conditions of freezing and thawing have an impact on preservation, activation and inactivation of labile proteins (e.g. yields of Factor VIII) [1].

Product protection is essential to proper plasma storage. To make an informed decision on the selection of a plasma freezer, laboratory equipment purchasers must be sure to consider a few important factors to keep the integrity of transfusion and plasma products. The important factors to consider for product protection include cabinet design (refrigeration, cabinet construction, insulation, door seals, and electronics), performance (outstanding heat removal capabilities, quicker recovery after door openings combined with more efficient operation, and energy savings) and service (certified and trained technicians, service contracts, preventative maintenance, temperature mapping, and validation). Due to variations in application requirements, it is also worth ensuring that freezers are available in a wide range of sizes and configurations, as sizes can range from 3 cu. ft. chests to 32 cu. ft. high-capacity uprights.

Example Three: Vaccine Storage

Vaccines provide long-lasting defense against viral diseases by stimulating immune response. Influenza, more commonly known as 'the flu' is considered by many to pose the greatest threat and can lead to global pandemics. The flu spreads quickly in humans and reoccurs each year in a genetically modified form. Unfortunately, vaccines produced in prior years are often ineffective in preventing new virus strains. New flu vaccines are developed each year, with an estimated 23 billion doses produced by the vaccine industry in 2010. By 2015, vaccine demand is expected to increase to 35 billion doses [2].

The first outbreak of influenza in 1918 led to many of the laboratory procedures and public health measures that we still use today. The pandemic lasted from January 1918 to December 1920 [3] and killed between 20 and 50 million people, making it one of the deadliest natural disasters in human history [4]. In two years, approximately 3% of the world's population died as a result of the flu. It has been estimated that 500 million, or 27 % of the world population, were infected.

Tissue samples recovered from frozen victims of the 1918 pandemic have been used to reproduce the virus for study. In October 2005, an effort to recreate the 1918 flu strain (a subtype of avian strain H1N1) led to the successful determination of the virus's genetic sequence [5]. In January 2007, it was reported that monkeys infected with the recreated strain exhibited classic symptoms of the 1918 pandemic, and died from a cytokine storm - an overreaction of the immune system [6].

Product protection is also essential to vaccine storage. Accurate and uniform temperature distribution in cold storage units is a critical step to ensure vaccines are being stored at the proper

temperature. Research has shown that even minor variations in temperature an compromise the effectiveness of vaccines [7].

With vaccines stored in a multitude of locations – physician offices, hospital labs and pharmacies – it is important to have a broad choice of laboratory refrigeration units available in a wide range of sizes, from compact under-counter freezers and refrigerators, to large capacity and combination units in upright configurations.

An investigation in the US by ABC News found that vaccines that aren't stored at proper temperatures could potentially render them ineffective and place children at risk for contracting serious diseases.

"The temperature has to be monitored throughout the entire time, from the time it leaves the manufacturer, to the time it spends in transit, to the time it's delivered to the clinic and it's used in the clinic," said Dr William Schaffner, chair of preventive medicine at Vanderbilt University Medical Center. "We want every dose given to every child to provide the optimum protection as it's intended."

Technological Advances in Temperature Control Equipment

Remote monitoring systems provide medical professionals and lab workers with the ability to access (via client/server software) a state-of-the-art wireless data monitoring solution in order to assess the performance of the equipment for sample quality control, security and/or regulatory compliance. Supply chain professionals and clinicians need a remote wireless monitoring alarm system that provides continuous monitoring, alarm notification and intelligent data logging (battery operation allows continual monitoring even during power outages) for a wide range of parameters including temperature, relative humidity, CO_2 and differential pressure. All of this is done using globally recognised radio frequency (RF) transmissions.

Before any system is installed, there should be a team in place that understands the sample, the equipment, and the monitoring system. This team approach ensures that no aspect is overlooked. If something does go wrong, it is essential that all team members are gathered and briefed, and a plan of action is developed as efficiently as possible.

Conclusion

Clinical laboratories and the valuable samples and vaccines they store are a critical component of the healthcare industry. Without proper cold storage, a wide array of issues can arise, resulting from ineffective vaccines and ruined samples. Having reliable temperature controlled storage products to protect samples, enzymes, plasma and blood is a matter of the utmost importance for research consistency.

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Compact Recirculating Chiller Offers Wide Range of Performance Options

A compact, economical recirculating chiller designed to provide reliable heat removal for lasers and other precision laboratory equipment is now available from **PolyScience**. Capable of maintaining process temperatures from 41° to 95°F (5° to 35°C), the Durachill™ 1.5 HP Chiller provides up to 6328 watts of cooling at 68°F (20°C) ambient and is available with a built-in heater for use with equipment that must be brought up to elevated temperatures before operation can begin. For optimum operational versatility and flexibility, it comes with a wide variety of standard and optional features.

The DuraChill 1.5 HP Chiller offers exceptional performance, reliability, and operational simplicity. All models feature a microprocessor-based controller, digital temperature display, one-touch set point display, and digital pressure/flowrate display. Plus for optimal operational and process safety, these rugged chillers also feature user-adjustable fluid temperature, pressure, and flow rate alarms as well as a high ambient temperature alarm. Also standard are user-adjustable high and low temperature limits to help prevent unauthorised set point changes plus built-in compressor and pump protection. Among the many options available on the DuraChill 1.5 HP Chiller are remote temperature tracking capability, serial output, audible and visual alarms, DI water compatible wetted parts, and a low liquid level indicator/alarm.

MORE INFO. 520

New -86ºC Freezer Combines Improved Performance with Energy-Efficiency

The new **Panasonic** MDF-U76V ultra-low freezer combines improved cooling performance with outstanding energy efficiency. The advantages include greater security for precious research or clinical samples, as well as significantly lower running costs and added environmental benefits. A leading independent test institute in the Netherlands has measured the power consumption of the MDF-U76V at 13.77kWh/24hr. Based on current published data, this makes the MDF-U76V the most energy-efficient 700 litre -86ºC freezer on the market.

This latest -86ºC VIP upright freezer has been specifically designed by Panasonic to meet the growing demand for energy savings, without in any way compromising freezer performance. In fact, cooling efficiency, insulation characteristics and door-open recovery times have all been enhanced through exclusive Panasonic innovations: a capillary tube heat exchanger, next-generation VIP PLUS insulation, and the Cool Safe compressor. As a result, greater temperature uniformity throughout the freezer and faster temperature pull-down contribute to industry-leading sample security.

Panasonic's advanced new capillary tube heat exchanger significantly increases the overall efficiency of the freezer. By optimising the available heat exchange areas, system reliability is also increased and energy consumption is cut. In addition to helping minimise energy use, the high performance patented vacuum panels together with high-density foam insulation enable Panasonic VIP ULT freezers to provide up to 30 per cent more storage capacity than a conventionally insulated freezer, saving valuable lab space. These two Panasonic-developed technologies allow the use of smaller, high-efficiency 750W Cool Safe compressors in the MDF-U76V, which use less energy and reduce heat output. An optional water-cooled condenser is available for the MDF-U76V. This enables laboratories with a chilled re-circulating water system to reduce the requirement for air conditioning within the freezer facility, reuse heat energy elsewhere and achieve even greater savings.

MORE INFO. 521

Compact Refrigeration Circulators now with new Multi-Touch Controller

Huber Ministats are the smallest cooling circulators in the world! Despite their size Ministats have enough power to thermoregulate photometers, refractometers, viscosimeters, distillation apparatus, reactor vessels and mini plants and their compact form allows them to be placed in areas where space is at a premium, for example laboratory extraction hoods. Ministats can be used to control externally closed applications or alternatively objects can be thermoregulated directly within the bath.

The Ministat range consists of 3 models, which are available as either air or water cooled versions. Depending on the model, working temperatures are from -45°C to +200°C and cooling capacities of 600 watts can be achieved. The maximum admissible environmental temperature for continual operation is +40°C. A powerful variable speed pressure/suction pump allows optimum circulation and can be controlled using an optional pressure sensor, which protects delicate glassware. For energy saving and reduced heat dissipation all models have active cooling control, which regulates cooling in the event of a temperature rise or drop and ensures Ministats use only the energy they need.

The new Pilot ONE multi-touch controller comes as standard with 5.7" TFT display, 11 language options, USB and network interfaces as well as an user friendly touchscreen operation similar to modern smartphones.

Available in three software options, the Pilot ONE can be easily electronically upgraded to extend functionality and activate further features such as: programmer, cascade control, ramp function, user menus, calendar start and graphic display. Analogue connections according to NAMUR are available via the optional Com.G@te module which enables integration into plants and process control systems.

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