

Controlling Temperature in the Delivery of COVID-19 Vaccines

Pharmaceutical companies all over the world are diligently working overtime to produce an accepted COVID-19 vaccine. While this work continues, other companies are already planning how to distribute a potential vaccine. Perhaps the most significant challenge exists in temperature control, as some COVID-19 vaccine candidates will require ultra-low temperatures (ULT), typically ranging from -86°C to -45°C .

For COVID-19 vaccines requiring ULTs, maintaining these freezing temperatures throughout the process, from manufacturing to delivery to patients, is necessary. Failure at any point to do so can result in wasted vaccines, which are so desperately needed.

Because the temperature level is critical to keeping the COVID-19 vaccine at maximum efficacy, the equipment to monitor and document temperature levels is essential. In particular, the ability to document storage conditions is critical. Temperature sensors help monitor and provide documentation, but they drift over time. To assure maximum efficacy and reduce waste, these temperature sensors must remain accurate. This is where high-quality temperature calibrators come into effect.



Manufacturing Facilities



Facilities that manufacture or house the potential COVID-19 vaccine may need to invest in infrastructure improvements and storage freezers if they don't already exist. As keeping the temperature inside these super freezers at correct ULT levels is a must, advanced HVAC systems might be needed to properly control the room temperature. Even the slightest unexpected change of ambient temperature could cause a significant extra workload for the HVAC system, shortening its life cycle. An overworked HVAC system also means an increase in electricity, further adding to an expensive undertaking.

Because of the significant monetary investment that companies will make in each facility, they will want to base their decisions on accurate temperature readings. This burden falls on temperature sensors mounted inside the freezers. If these sensors are faulty, they could indicate incorrect temperatures, causing the system to react unnecessarily, thus wasting money and time.



Transportation



After a COVID-19 vaccine leaves the manufacturing facility, it will embark on potentially the most challenging of segments on its way to the patient. Transferring the vaccine from the storage freezer to a container to a portable freezer and then to the distribution center must occur while maintaining the optimal freezing temperatures. After the distribution center, it will make its second trip, ultimately culminating in its arrival at a health care provider or a pharmacy.

As multiple transfers of the COVID-19 vaccine occur, audited temperature tracking will ensure the correct temperature control. Just like at the manufacturing facility, temperature sensors will play the crucial role of measuring and reporting the temperature at all times. If even one of these transfers breaks down and temperatures rise outside ULT levels, the COVID-19 vaccine is lost.

Some companies will use advanced temperature sensors with wireless capabilities or datalogging, allowing them full-time access to the current temperatures inside the containers. These records will provide proof of transit temperatures, protecting the transportation companies. However, even these advanced temperature sensors require calibration to remain accurate.



Health Care Providers



The final leg in delivering a COVID-19 vaccine to the patient will take place at health care providers or pharmacies. The burden of keeping the vaccine at ULTs now falls to locations that won't typically have the equipment to store vaccines at this low temperature. Many will opt for portable freezers rather than the expense of a more permanent solution.

Regardless of the selected option, the freezer will contain sensors to continue the COVID-19 vaccine temperature's constant record keeping. Like every stage before this, ensuring proper calibration of these temperature sensors is essential.



Temperature Sensors



From manufacturing to distribution to patient delivery, temperature sensors play a critical role in maintaining the efficacy of the COVID-19 vaccine. They assist in preventing waste, maintaining proof of temperature control, and most importantly delivering a working vaccine to patients. Because they are the source trusted to measure and provide important temperature data, some users might make the mistake of thinking they are automatically accurate. In reality, temperature sensors drift and degrade over time, so periodic checking and adjustment or complete replacement is a critical step that cannot be forgotten. However, finding the equipment to accurately test and calibrate to ULT temperatures of -86°C is a challenge.



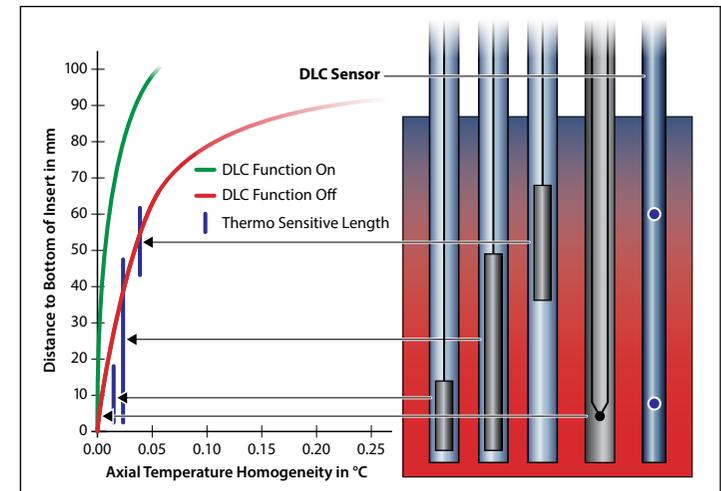
JOFRA Solution



AMETEK STC has a solution in its JOFRA RTC Reference Temperature Calibrator Series, in particular the RTC-159 model. The RTC-159 has a low temperature range of -100°C, giving it plenty of available range to calibrate temperature sensors used in ULT measurement. Apart from its range, the RTC-159 features accuracy to 0.06°C, stability to 0.03°C, and two patents making it the ideal calibrator to verify these critical sensors.

The first of the patents is the DLC system, which brings unmatched temperature uniformity and accuracy in the insert. All temperature sensors have a thermo sensitive area where the sensor collects its readings. In standard temperature calibrators, if the temperature sensor's sensitive area isn't in the same place as the calibrator's reference sensor, differences in temperature may occur, and create calibration errors. This is because temperature dissipates the further towards the top of the insert you go. JOFRA's patented DLC removes this difference by measuring the temperature homogeneity inside the insert at multiple places, then provides feedback to the RTC calibrator to implement tiny temperature adjustments as needed. This feature assures that accurate calibration occurs no matter where the sensing element is located inside the insert.

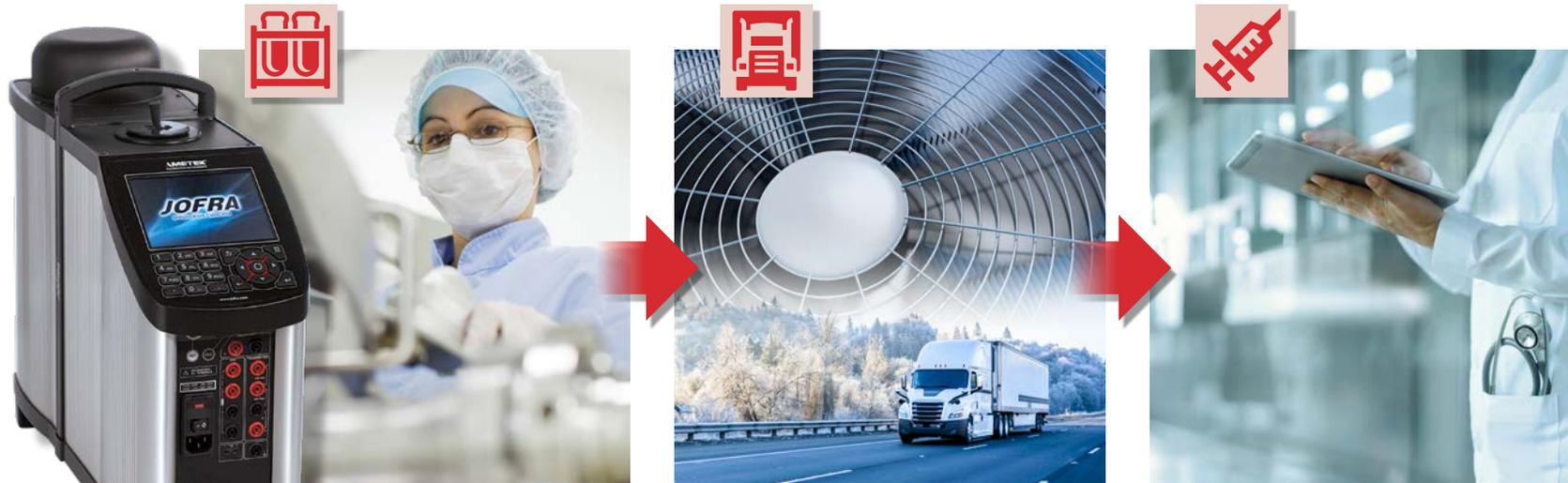
The second patent covers the very broad temperature calibration range of -100 to 155°C. This means that the same calibrator trusted for ULT sensor calibration may also be used for other, higher temperature sensor applications.



This diagram displays axial temperature curves for an RTC calibrator with and without the DLC functionality activated. When the DLC function is enabled, the RTC-159 automatically equalizes the temperature homogeneity inside the insert.

Conclusion

While the world anxiously anticipates a COVID-19 vaccine, the infrastructure around ultimately delivering the vaccine to patients is already underway. Temperature control and audits must be in place, both for the safety and efficacy of the vaccine, and to limit spoilage and waste. JOFRA temperature calibrators are already trusted throughout the pharmaceutical industry for their reliability, accuracy, and ease-of-use. As we enter this critical moment of public health, only the best should be trusted to provide reliable temperature calibration.



The JOFRA RTC-159

AMETEK's reference and DLC sensors are specially designed. Both are angled at 90° and have been customized to fit RTC Series Temperature Calibrators. Their unique design allows easy calibration of threaded sensors and sensors with connection heads.

