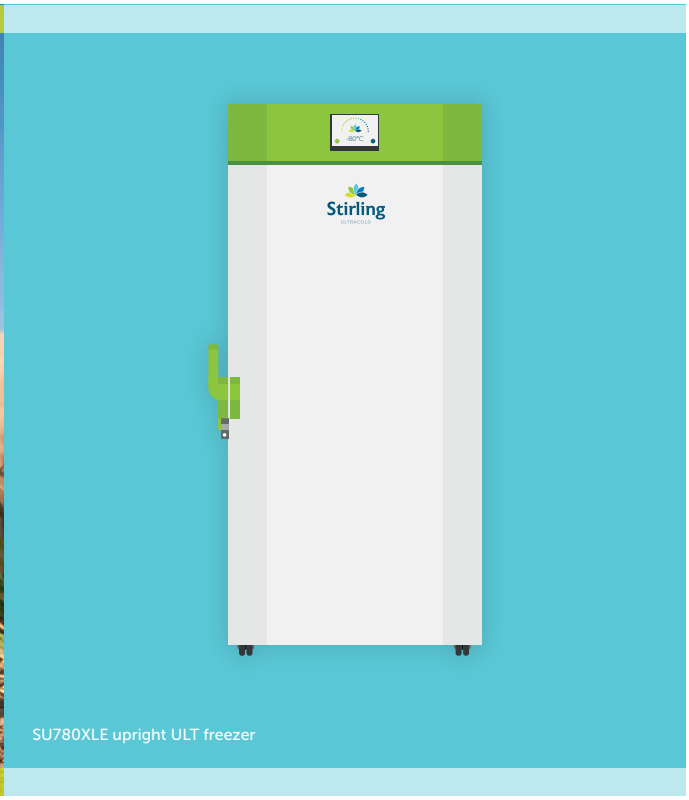
ANIMAL VACCINES CASE STUDY

Stirling ULTRACOLD



SU780XLE upright ULT freezer

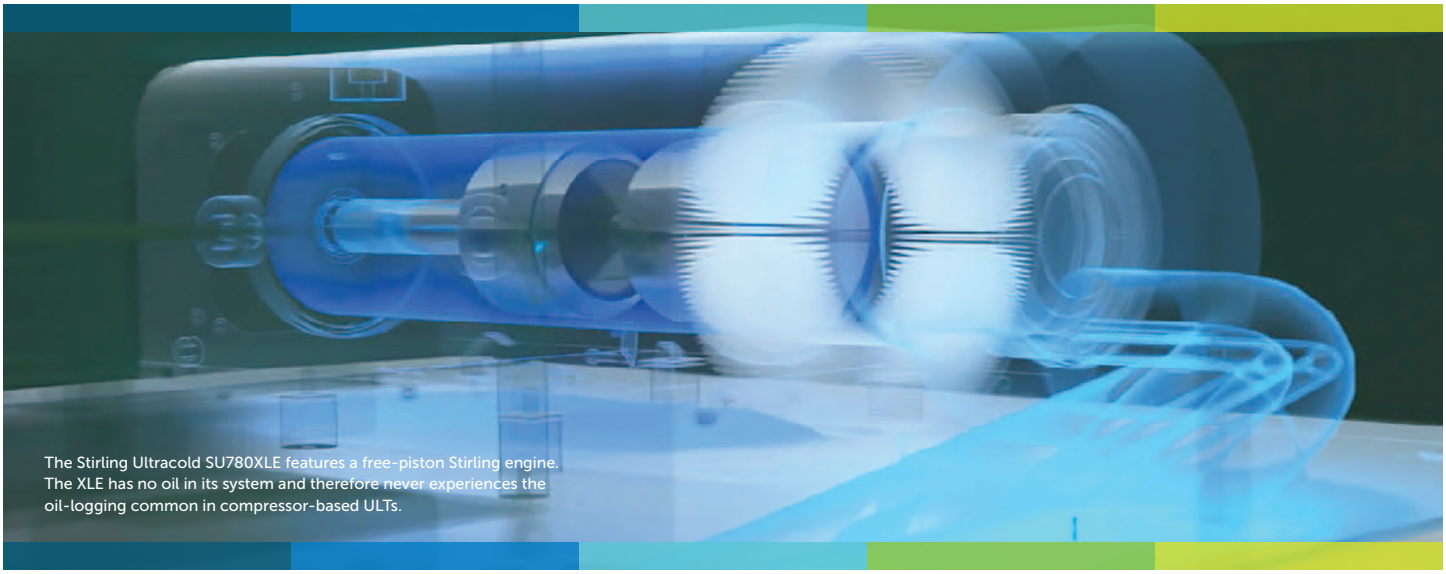
ANIMAL HEALTH PRODUCT MANUFACTURER IMPROVES VACCINE EFFICACY AND STORAGE RELIABILITY

Expanded Vaccine Storage Capacity, Increased Productivity, and Reduced Costs With Stirling Ultracold's SU780XLE.

For a leading manufacturer of biological and pharmaceutical animal health products, the ability to reliably store vaccines at ultra-low temperatures is vital to their product's integrity. Freezing down from ambient temperature and then storing these vaccines at -75°C are essential to ensure the vaccines' potency and efficacy. The company uses a fleet of more than 100 ultra-low temperature (ULT) freezers to freeze down animal vaccines at a production facility before shipping them to a central warehouse and then to customers.

This is a demanding application. Typically, the vials stored in ULTs are small (2 ml test tube size); however, this company stores vaccines in much larger containers, anywhere between 100 and 250 ml bottles, at a total volume of 118.4 to 182.4L. These larger containers apply high thermal loads, which requires more energy to remove the heat and places a greater strain on conventional compressor-based ULT freezers.

Reliable ULT storage at both the production facility and the warehouse is critical to ensure the vaccines work as intended. Prolonged storage above -75°C can deteriorate the vaccines' potency; should temperatures rise too high, the products must be discarded, which can be a significant financial loss.



The Stirling Ultracold SU780XLE features a free-piston Stirling engine. The XLE has no oil in its system and therefore never experiences the oil-logging common in compressor-based ULTs.

COMPRESSOR-BASED ULTS THREATENED VACCINE VIABILITY

It typically takes 72 hours to freeze down the vaccines to the required -75°C storage temperature. But after 10–15 freeze-downs, the company noticed that the performance of the production facility's compressor-based ULTs started to decline and fail sometimes. Some freezers were taking 90 hours to freeze down the vaccines, which threatened product potency and viability.

The company's maintenance technicians determined the decline in performance was due to oil in the freezer lines. All compressor-based ULTs require oil to lubricate internal components and reduce wear. Over time, oil leeches into the freezer lines, where it builds up and compromises ULT performance, commonly referred to as oil-logging.

To clear the freezer lines, maintenance technicians had to empty out the vaccines and turn off the ULTs to let the oil warm up so it could thaw out and drain back to the compressor. After clearing the oil, the technicians turned the freezers back on, waited for them to reach the pull-down temperature, and then restocked them with vaccines.

This process may have been a manageable solution for a single ULT freezer, but the company was losing three freezers a month. Taking so many freezers offline each month created capacity issues, as the company didn't have extra ULT space available to store the vaccines that were being pulled from the failing freezers. Without that capacity, the company couldn't ship enough vaccines to its warehouse to keep up with customer demand.

EXPLORING COMPRESSOR-FREE ALTERNATIVES

After realizing its current approach to maintaining its ULTs was not sustainable, the company began exploring other alternatives. After considering a variety of compressor-based models, including more expensive blast freezers, it turned to Stirling Ultracold. Stirling ULTs were appealing because they do not use a compressor; they use a free-piston Stirling engine. And since they don't have any oil in their systems, these ULTs wouldn't experience the issues inherent with standard compressor-based units.

To ensure the Stirling ULT performed as expected, the company conducted various tests on an early version Stirling upright model. During the tests, the company used vials of water for injection (WFI) to simulate its animal vaccines. The company was impressed with the Stirling freezer's performance — specifically that it froze down products faster than standard compressor-based units.

The company was also encouraged with the unit's performance in environments where ambient temperatures reached 90°F. Higher ambient temperatures require ULTs to work harder, which can cause compressor-based models to fail faster.

Based on the superior performance of the Stirling model, the company decided to purchase 15 next-generation SU780XLE upright units from Stirling Ultracold, which use the same free-piston Stirling engine technology as the model they tested.

RELIABILITY, FASTER FREEZE-DOWNS AND MORE EFFECTIVE VACCINES

The company experienced immediate benefits by incorporating the SU780XLEs into their production facility. The XLEs performed more reliably than compressor-based units. And since they have no oil in their systems, they did not experience the downtime or require the maintenance demands of the previous units.

The company estimates it saves 40 days of maintenance labor per year due to not having to respond to failures.

The XLEs also froze down the vaccines to the required storage temperature faster. With compressor-based ULTs, it took 72 hours to freeze down vaccines to -75°C; the XLEs can bring the vaccines down to this temperature in 58 hours. Faster freeze-down times help ensure the company's animal vaccines don't lose potency and enable the company to ship vaccines to its warehouses faster for long-term storage.

While ULT reliability and vaccine effectiveness were the company's primary concerns, it also experienced several other benefits by switching to the XLEs, including:

DOUBLED CAPACITY WITHOUT ADDING EQUIPMENT OR SPACE

The company has increased the number of vials it can freeze down in each ULT. Its compressor-based unit could freeze down 160 (250 ml) and 480 (100 ml) vials at a time. But by switching to the SU780XLE, the company can now freeze down 360 (250 ml) and 960 (100 ml) vials, doubling its product capacity per ULT freezer.

The XLEs also save building space. Three compressor-based units require the same amount of space as four XLEs. This allows the company to increase the number of ULTs — and capacity — without expanding its facility's footprint.

REDUCED ENERGY USE AND COST

Each SU780XLE can reduce energy use by 75% of the company's previous standard compressor-based ULTs. This savings is substantial, considering the company has replaced 20 compressor-based units with 16 energy-efficient, Stirling engine-powered upright models. The company calculated it is saving 545,000 kWh/per year, for an energy cost savings of $58,000 annually.

And because these 16 Stirling units are more energy-efficient, the company qualified for a $50,000 energy rebate.

REDUCED PRODUCT LOSSES

ULT failures have a direct impact on product losses, as the company has to discard vaccines for which it cannot maintain viability and potency at the required storage temperature. Since the XLEs do not experience the issues common with compressor based units, the company has not suffered the equipment failures or losses that it had with its previous ULTs.

A STRONG PARTNERSHIP

Over the years, the company has added more XLEs to its production facility and now sends older XLEs to its warehouse for long-term vaccine storage.

While conducting its research into compressor-based ULT alternatives, the company thought Stirling's SU780XLE was "too good to be true" and couldn't possibly live up to its promised performance. But after using the XLEs for so long and seeing their benefits firsthand, the company has become a believer.

To learn more about Stirling Ultracold's SU780XLE ultra-low temperature freezer, visit:

stirlingultracold.com

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