Ultra-low temperature freezers

I need to store samples within the temperature performance range of a ULT freezer.

How does the initial pull-down time of a freezer differ from the door opening recovery, and which specification helps best protect my samples?

When a new ultra-low temperature (ULT) freezer is installed, a manufacturer provides an estimate for the total time required for the interior to reach its –80°C setpoint from ambient temperature. It is typical for the controlled pull-down time to be under 8 hours for many large, high-performance cabinet freezers (Figure 1). A carefully monitored unit will consume a lot of energy to achieve this state of stable ULT quickly and quietly. This pull-down is typically a one-time event; however, it may prove useful to know if a freezer can be thawed and reorganized around a tight schedule.

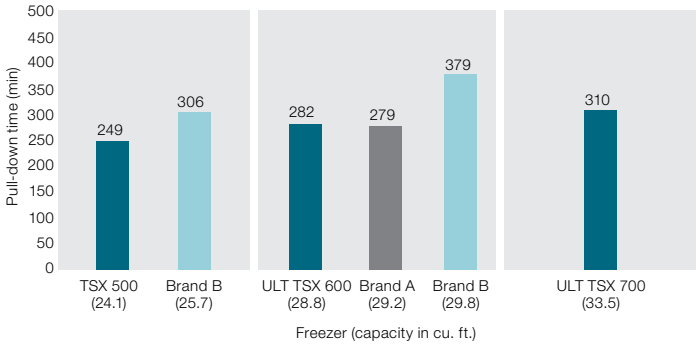

Figure 1. Pull-down time of a TSX Universal ULT Freezer 20°C from ambient conditions (20°C) compared to brands A and B freezers across different cabinet sizes (cubic feet).

The main reason a Thermo Scientific™ TSX™ Universal ULT Freezer can quickly bring down and maintain a cabinet temperature steadily is because of an adaptive variable speed compressor (Figure 2). This innovative technology helps to hold consistent and uniform cold temperatures at –40°C or lower,

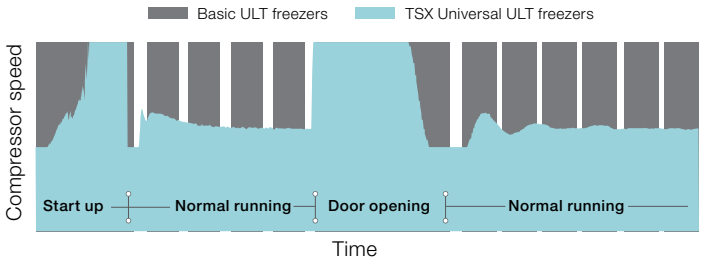

Figure 2. TSX Universal ULT freezers' next-generation V-drive technology vs. standard on/off compressor systems.

giving customers confidence that the visual output and data logging remain precise and accurate. When considering sample protection, having our newest hardware with enhanced firmware algorithms equates to maximizing performance with reliable ULTs in everyday usage.

The next-generation V-drive technology, comprising new variable speed hardware and enhanced intelligent algorithms, helps ensure that the compressor remains on at all times when operating at –80°C, providing constant cooling and optimal performance when the door is closed. When the door is opened, the constant cooling allows the system to quickly ramp compressor speed and cooling capacity, providing rapid temperature recovery. Overall, with the V-drive system, TSX Universal ULT freezers deliver improvements in performance, reliability, energy efficiency, and an expanded set point compared to the previous generation of TSX ULT freezers.

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Another major factor when storing samples at ULTs is accessibility for later retrieval. In many cases, a predetermined picklist of specimens or labeled product is recommended to mitigate excursions. In a dynamic collection facility, the door of a ULT freezer may encounter upwards of 20 door openings, lasting 1–2 minutes each, in a single day. As a result of this necessary activity, a substantial heat load burden from the ambient environment can enter the upright freezer each time. The door opening recovery (DOR) speed is a key specification, listing the average minutes taken to return to a safe cabinet temperature. Some of the very best ULT freezers can provide a DOR of less than 20 minutes, including the TSX Universal ULT Freezer (Figure 3). This information helps determine how quickly to re-enter a ULT freezer, knowing the surrounding samples are protected.

Working with samples often requires paying careful attention to a single ULT freezer, quickly opening and closing its door to select a specific vial. Doing so allows for more extended searching time outside the freezer, helping minimize the risk of the cold temperature rising and a lengthy DOR. However, this action may still pose a risk of creating a tight seal, which can make the user feel locked out.

The technological advancements of TSX Universal ULT freezers have increased vacuum pressure relief, allowing users to re-enter their freezers in 30 seconds. These enhancements make TSX Universal ULT freezers more efficient and accessible across different cabinet sizes, allowing customers to preserve the integrity of their specimen while making the freezers easier to operate.

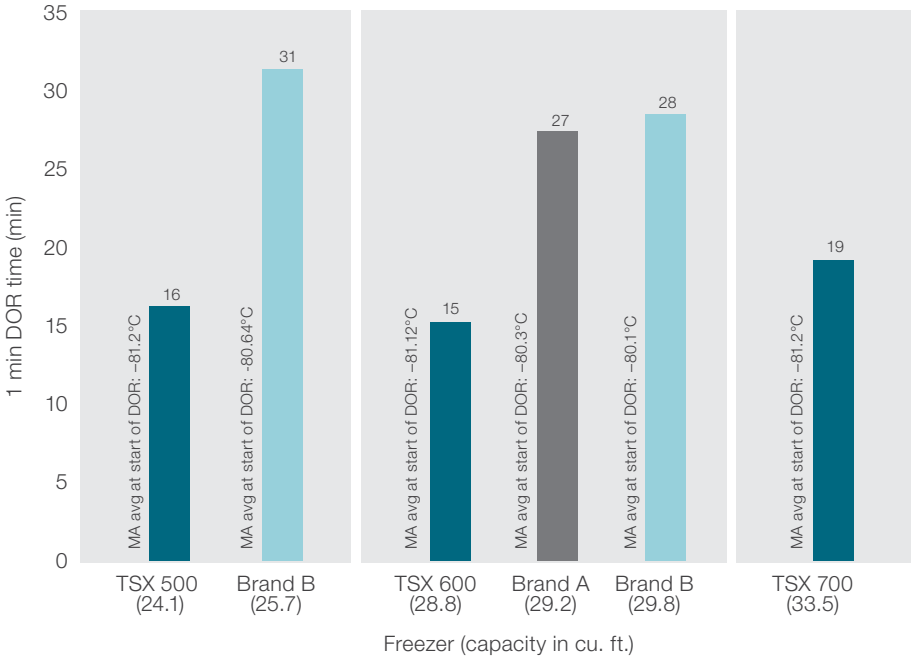

Figure 3. TSX Universal ULT Freezer 1 min door-opening recovery times compared to brands A and B across different cabinet sizes (cubic feet).

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