NEW

FormFactor™

# HPD XLF-600

## Cryogen-Free Dilution Refrigerators for Quantum Computing

The HPD XLF-600 Dilution Refrigerator, featuring the Aspect DR core and Frostbyte™ software, is designed for quantum computing research, development, and deployment. It offers high cooling power, expansive experimental access, and state-of-the-art secure software to meet the demands of quantum computing R&D and quantum data centers.

### High Cooling Power

600 µW at 100 mK
>15 µW at 20 mK

### Large Experimental Access

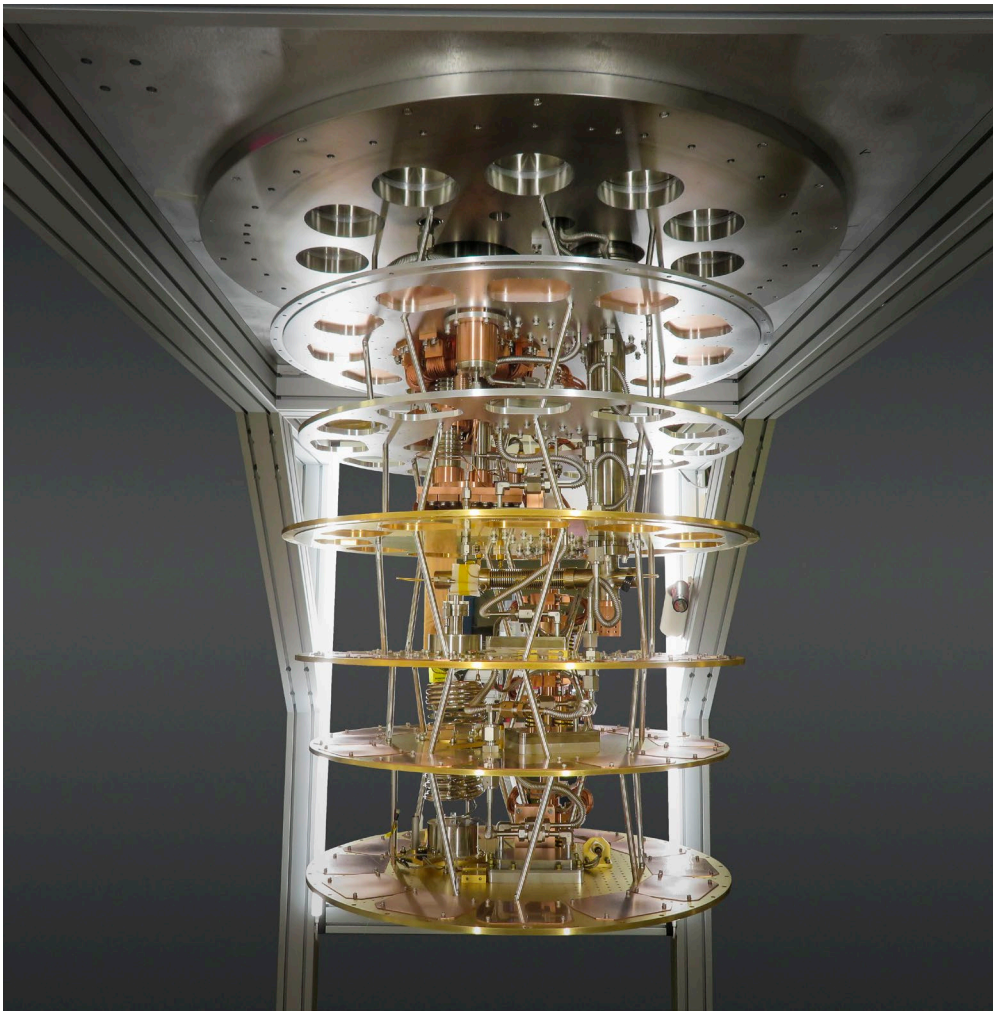
508 mm cold plate and 12 ISO 100 line-of-sight for up to 300 SMA

### Frostbyte™ Software

Automated. Robust. Secure.

### Ease of Service

Ergonomically designed for long-term reliability



*Aspect DR core with laser-weld heat exchangers provide high reliability with best-in-class cooling power and He3 efficiency.*

## High Cooling Power with the New Aspect Dilution Refrigerator (DR) Core

At the heart of the HPD XLF-600 is the new Aspect DR core. The Aspect DR core combines proprietary high-efficiency heat exchangers with repeatable and robust laser-welding manufacturing to enable the highest cooling power and most reliable DR core in the field. The HPD XLF-600 base temperature is 10 mK and it provides a best-in-class cooling power of 600 µW at 100 mK and >15 µW at 20 mK.

## Large Experimental Access

The HPD XLF-600 features a spacious 508 mm diameter MC plate. The generous cold sample space, nearly 50 liters in capacity, is enclosed by a light-tight all-copper welded MC shield with an IR black coating. Additional space is provided by a nominal 4 K plate and a specialized 10 K plate. These plates accommodate cold electronics and further enhance thermalization of experimental components. The system also offers 12 ISO100 line-of-sight ports, providing a significant 900 $cm^2$ cross-sectional area for coaxial wiring and accommodating up to 300 SMA coaxial lines.

## Engineered for Easy Servicing and Long-Term Reliability: Additional Features

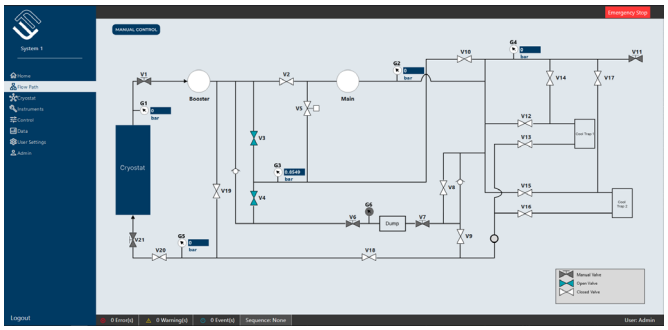
- Support stand option enables ergonomic, single-user lifting of vacuum cans.
- All-metal seals within the helium (He) flow path and valve position monitoring.
- Accelerated warm-up with a multi-level safety system to prevent overheating.
- Convenient access to pumps, vacuum pump-out ports, and LN2 precool connections.
- Utilizes a single PTR and a mechanical heat switch for dependable and swift pre-cooling.
- Operates without external scroll pumps to ensure safe and long-lasting performance.

## Powered by Frostbyte™

Frostbyte™ is designed to enable fully automated system operation and secure access. It supports comprehensive system automation, and its intelligent sensing capability actively monitors all DR system diagnostics, logging data and events extensively. Built on a robust security architecture featuring four distinct user permission levels, Frostbyte is particularly well-suited for multi-user laboratories and quantum data centers.

## SmartGHS powered by Frostbyte

- Complete system automation includes vacuum chamber pump-out, cooldown, control, and warmup processes.
- Intelligent diagnostics: Monitors helium flow path (pressure, temperature, flow rate) and facilities (air, cooling water, exchange gas).
- Comprehensive data logging of all information and system events.
- Secure individual logins with four user permission levels:
  - Read (access system data)
  - Basic (initiate/start/stop cooldown)
  - Advanced (full manual control)
  - Admin (user management)
- Security architecture validated through a third-party risk assessment conducted by Leviathan Security Group.
- Capable of operating in an air-gapped environment with no external network access or can be remote operated over web browser with the same GUI as on the GHS.
- Control by and coordination with external software can be done through REST API.
- Runs on Windows or Linux platforms.




***Frostbyte:*** *Robust and secure control software*


*Smart Gas Handling System (SmartGHS) powered by Frostbyte Control Software*

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