

Global Cryogen Free Dilution Refrigerator Supply, Demand and Key Producers, 2026-2032

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Abstracts

The global Cryogen Free Dilution Refrigerator market size is expected to reach \$ 1547 million by 2032, rising at a market growth of 26.6% CAGR during the forecast period (2026-2032).

In 2025, global Cryogen Free Dilution Refrigerator production reached approximately 457 units with average price of 656,000 USD/Unit.

A cryogen-free dilution refrigerator is an ultra-low-temperature refrigeration system that does not require a continuous external supply of liquid helium. It uses a mechanical cryocooler for precooling and the dilution process of helium-3 and helium-4 to provide continuous refrigeration at millikelvin temperatures. A pulse-tube cryocooler normally reduces the internal temperature to several kelvin, after which the endothermic transfer of helium-3 from the concentrated phase into the dilute phase lowers the mixing-chamber temperature to below 10 mK. Selected high-performance systems can reach approximately 5 mK or lower.

A typical system includes a pulse-tube cryocooler, compressor, vacuum chamber, radiation shields, helium-3/helium-4 circulation loop, condensation unit, still, continuous heat exchangers, mixing chamber, gas-handling system, temperature-control system and experimental platform. Optional configurations may include radio-frequency wiring, direct-current wiring, cryogenic filters, low-noise amplifiers, superconducting magnets, magnetic shielding and optical access. Compared with conventional liquid-helium-bath dilution refrigerators, cryogen-free systems eliminate routine liquid-helium filling, offer greater automation and support extended continuous operation. Major applications include quantum computing, quantum-chip testing, condensed-matter physics, quantum materials, quantum sensing and low-temperature detector research.

The upstream segment of the cryogen-free dilution refrigerator industry includes helium-3 and high-purity helium-4, pulse-tube cryocoolers, helium compressors, vacuum pumps, cryogenic heat exchangers, low-temperature valves, oxygen-free high-conductivity copper, stainless steel, vacuum seals, temperature sensors, vacuum gauges, radio-frequency coaxial cables, direct-current wiring, cryogenic filters, low-noise amplifiers, magnetic-shielding materials and control electronics. Helium-3 is relatively scarce, while low-vibration pulse-tube technology, efficient heat exchangers, high-purity copper processing and cryogenic thermometry directly affect base temperature, cooling power and operational stability.

The midstream segment consists of dilution-refrigerator manufacturers and ultra-low-temperature system integrators. Their activities include thermodynamic design, cryogenic mechanical design, vacuum-vessel fabrication, helium-mixture circulation integration, heat-exchanger and mixing-chamber manufacturing, pipeline welding, final assembly, control-software development, temperature calibration and reliability testing. Some suppliers also provide superconducting magnets, cryogenic probe stations, rapid sample-exchange modules, high-density microwave wiring, cryogenic electronics and quantum-processor mounting platforms, thereby evolving from standalone refrigerator suppliers into integrated quantum-cryogenic infrastructure providers.

Downstream customers include quantum-computing companies, universities, national laboratories, research institutes, quantum-chip and semiconductor developers, condensed-matter laboratories, quantum-sensing companies, and aerospace or defense research organizations. Sales are generally project-based and highly customized, involving requirement definition, system design, manufacturing, factory acceptance, on-site installation, cooldown commissioning and long-term maintenance. Base temperature, cooling power, cooldown time, wiring capacity, vibration performance, system stability and after-sales support represent the principal competitive barriers.

Over the next 5-10 years, the cryogen-free dilution refrigerator market will maintain rapid growth (global CAGR projected at 12-18%), primarily driven by increased global capital investment in quantum computing, advancements in quantum engineering projects worldwide, the tight supply of He-3 leading to the complete replacement of liquid helium systems with all-dry refrigeration, and the continued demand from research institutions for low-vibration, high-stability platforms. As superconducting quantum computing evolves from hundreds of qubits to thousands of qubits to tens of thousands of qubits, each machine requires larger sample spaces, higher cooling

power, lower vibration, and more measurement cabling, driving up system prices in tandem with demand. Simultaneously, dilution refrigerators are developing towards modularity, larger chambers, stronger filtration, high-precision temperature control, automated operation and maintenance, and integrated quantum cabinets, intensifying competition among high-end equipment suppliers. Overall, this market is one of the most indispensable hardware links in the quantum technology industry chain. Short-term demand is driven by research and quantum computing giants, while long-term demand is driven by the construction of commercial quantum computing clusters and quantum network infrastructure, characterized by strong certainty, high growth rate, and deep technological moats.

This report studies the global Cryogen Free Dilution Refrigerator production, demand, key manufacturers, and key regions.

This report is a detailed and comprehensive analysis of the world market for Cryogen Free Dilution Refrigerator and provides market size (US\$ million) and Year-over-Year (YoY) Growth, considering 2025 as the base year. This report explores demand trends and competition, as well as details the characteristics of Cryogen Free Dilution Refrigerator that contribute to its increasing demand across many markets.

Highlights and key features of the study

Global Cryogen Free Dilution Refrigerator total production and demand, 2021-2032, (Units)

Global Cryogen Free Dilution Refrigerator total production value, 2021-2032, (USD Million)

Global Cryogen Free Dilution Refrigerator production by region & country, production, value, CAGR, 2021-2032, (USD Million) & (Units), (based on production site)

Global Cryogen Free Dilution Refrigerator consumption by region & country, CAGR, 2021-2032 & (Units)

U.S. VS China: Cryogen Free Dilution Refrigerator domestic production, consumption, key domestic manufacturers and share

Global Cryogen Free Dilution Refrigerator production by manufacturer, production, price, value and market share 2021-2026, (USD Million) & (Units)

Global Cryogen Free Dilution Refrigerator production by Base Temperature, production, value, CAGR, 2021-2032, (USD Million) & (Units)

Global Cryogen Free Dilution Refrigerator production by Application, production, value, CAGR, 2021-2032, (USD Million) & (Units)

This report profiles key players in the global Cryogen Free Dilution Refrigerator market based on the following parameters - company overview, production, value, price, gross margin, product portfolio, geographical presence, and key developments. Key companies covered as a part of this study include Bluefors Oy, Oxford Instruments NanoScience, Shanghai Q-One Technology Co., Ltd., Hefei Zhileng Cryogenic Technology Co., Ltd., Leiden Cryogenics B.V., FormFactor, Inc. / JanisULT, Maybell Quantum Industries, The 16th Research Institute of CETC, Origin Quantum Computing Technology Co., Ltd., CSIC Pride (Nanjing) Cryogenic Technology Co., Ltd., etc.

This report also provides key insights about market drivers, restraints, opportunities, new product launches or approvals.

Stakeholders would have ease in decision-making through various strategy matrices used in analyzing the World Cryogen Free Dilution Refrigerator market

Detailed Segmentation:

Each section contains quantitative market data including market by value (US\$ Millions), volume (production, consumption) & (Units) and average price (K USD/Unit) by manufacturer, by Base Temperature, and by Application. Data is given for the years 2021-2032 by year with 2025 as the base year, 2026 as the estimate year, and 2027-2032 as the forecast year.

Global Cryogen Free Dilution Refrigerator Market, By Region:

United States

China

Europe

Japan

South Korea

ASEAN

India

Rest of World

Global Cryogen Free Dilution Refrigerator Market, Segmentation by Base Temperature:

Ultimate Temperature Range > 20 mK

Ultimate Temperature Range 5?20 mK

Ultimate Temperature

Global Cryogen Free Dilution Refrigerator Market, Segmentation by Power Range:

Low-Power Benchtop Models (0?10 ?W)

Medium-Power Standard Models (10?100 ?W)

High-Power Industrial-Grade Models (> 100 ?W)

Global Cryogen Free Dilution Refrigerator Market, Segmentation by Structure:

All-In-One Integrated Design

Modular and Expandable Design

Global Cryogen Free Dilution Refrigerator Market, Segmentation by Application:

Quantum Computing

Condensed Matter Research

Others

Companies Profiled:

Bluefors Oy

Oxford Instruments NanoScience

Shanghai Q-One Technology Co., Ltd.

Hefei Zhileng Cryogenic Technology Co., Ltd.

Leiden Cryogenics B.V.

FormFactor, Inc. / JanisULT

Maybell Quantum Industries

The 16th Research Institute of CETC

Origin Quantum Computing Technology Co., Ltd.

CSIC Pride (Nanjing) Cryogenic Technology Co., Ltd.

QuantumCTek Co., Ltd.

CAS Quantum Measurement Instrument Co., Ltd.

Taiyo Nippon Sanso Corporation

ICEoxford Ltd.

ULVAC CRYOGENICS INC.

Key Questions Answered:

1. How big is the global Cryogen Free Dilution Refrigerator market?
2. What is the demand of the global Cryogen Free Dilution Refrigerator market?
3. What is the year over year growth of the global Cryogen Free Dilution Refrigerator market?
4. What is the production and production value of the global Cryogen Free Dilution Refrigerator market?
5. Who are the key producers in the global Cryogen Free Dilution Refrigerator market?
6. What are the growth factors driving the market demand?

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