Газовые охладители PGC, криоохладители P-102, компактные охладители PCC, криочиллеры MaxCool, криочиллеры на основе водяного пара PFC

Технические характеристики

По вопросам продаж и поддержки обращайтесь:

Алматы (727)345-47-04
Ангарск (3955)60-70-56
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Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
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Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
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Красноярск (391)204-63-61
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Курган (3522)50-90-47
Липецк (4742)52-20-81
Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Омск (3812)21-46-40
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Оренбург (3532)37-68-04
Пенза (8412)22-31-16
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Псков (8112)59-10-37
Пермь (342)205-81-47
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Саранск (8342)22-96-24
Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
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Ставрополь (8652)20-65-13
Сургут (3462)77-98-35
Сыктывкар (8212)25-95-17
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эл.почта: ewc@nt-rt.ru || сайт: https://edwards.nt-rt.ru/

PRODUCT DATA SHEET

POLYCOLD®
PGC-152 GAS CHILLER

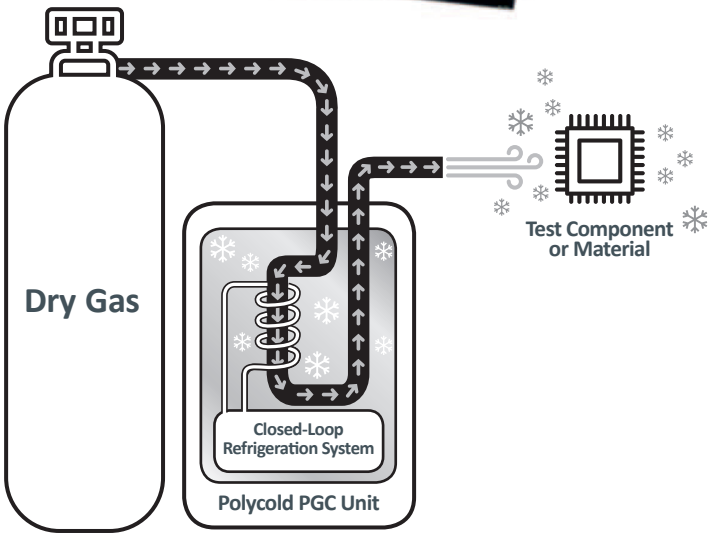
Polycold® Gas Chillers use Polycold®'s auto-cascade refrigerant cycle with a mixed gas refrigerant, to provide ultra-low temperatures without the cost, risk or inconvenience of liquid nitrogen. Now you can cool your dry gas to temperatures between –90° C and –125° C without sacrificing high flow rates.

The PGC-152 is CE marked and meets Semi S2 requirements. Polycold's proprietary and patented refrigerant mixtures are fully compliant with current European environmental regulations. The Polycold® PGC Gas Chillers are the most cost-effective systems available to cool a gas stream in this low temperature range.

Applications include:
Thermal Testing of Electronics, Cooling of Wafer Chucks in Semiconductor Process Tools, Cold Gas Venting of Vacuum Chambers, Rheology, Low Temperature Characterization of Materials, etc.

- Cools Compressed Dry Gas
- –90° to –125° C (–130° to –193° F, 183° to 148° K)
- Continuous Cooling
- Heat Removal to 810 Watts

Polycold® Gas Chillers cool dry gases (such as nitrogen, argon or air) from ambient to cryogenic temperature without precooling. The Gas Chiller is a closed-loop refrigeration system which cools a gas stream using a refrigerant to gas tube-in-tube heat exchanger. The gas stream is non-recirculating.



Features and Benefits

- Free standing, compact size
- Rated for continuous operation
- Air-cooled or water-cooled models
- Uses a single compressor for reliable performance
- 50 or 60 Hz operation, single phase
- CE marked, Semi S2 compliant
- Refrigerant gases are US EPA– SNAP approved
- CFC-Free and HCFC Free refrigerants meet European Union laws
- Patented refrigerant gases
- Flow control solenoid and flow sensor

Polycold® PGC-152 Gas Chiller Specifications

Typical Performance Specifications	
Maximum Gas Heat Load (Watts @ 25 C inlet)	810
Temperature Range C (F)	–90° C to –125° C (–130° F to –193° F)
Maximum Flow Rate (SCFH)	750
Time to Pre-Cool Heat Exchanger Prior to Initial Use	20 min.

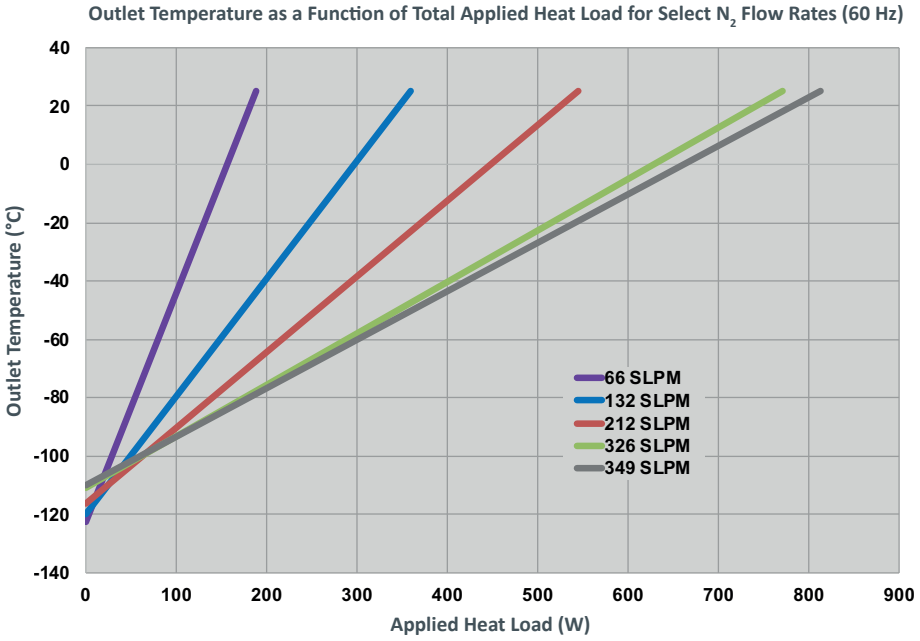
Typical Gas Flow Conditions:

N_2 Flow Rate (SCFH)	N_2 Flow Rate (SLPM)	Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	Pressure Drop (PSI)
140	66	5	3	2
280	132	23	18	5
450	212	45	36	9
690	326	75	65	10
740	349	80	68	12

Physical Data	
PGC Unit Dimensions:	
Width, mm (in.)	508 (20)
Depth, mm (in.)	457 (18)
Height, mm (in.)	889 (35)
Weight, kg (lb.) 108 (240)	
Gas Inlet/Outlet Tubing Diameter, mm (in.)	9.5 (3/8)
Max. Angle of Inclination (for moving, etc.)	45 degrees
Utilities	
Gas Source (Customer's Dry Gas) e.g.	Air, Nitrogen, Argon, etc.
Required Gas Source Dewpoint (for extended run times)	Colder than –80 C
Maximum Gas Source Temperature	30 C
Maximum Temperature Air Inlet to Condenser	32 C
Remote Reading Thermocouple on Gas Outlet	Type T
Voltage Range: At 50 Hertz	180-216
At 60 Hertz	187-253
Rated Load Amps	12.5

Specifications are subject to change without notice.

Polycold® PGC-152 Gas Chiller Performance



The outlet temperature of the PGC-152 is based upon the external heat load as well as the flow rate of nitrogen through the unit. Both the flow rate and the applied heat load can be varied to obtain the desired outlet temperature for the process.

PRODUCT DATA SHEET

POLYCOLD® PFC FAST CYCLE WATER VAPOR CRYOPUMP

The Polycold Fast Cycle Water Vapor Cryochillers (PFC) effectively captures water vapor, which comprises 65% to 95% of the residual gas in high-vacuum systems. Water vapor is typically the most reactive contaminant present. With the PFC cryochillers, you can expect to increase product throughput in your existing system 20% to 100% and improve quality of deposition.

The PFC Advantage

- High-vacuum pumpdown time cut by 25% to 75%
- High-speed pumping of water vapor: up to 75,000 l/sec in the workspace
- Increased product throughput of 20% to 100%
- Typical payback times of less than one year
- Lower water vapor partial pressure during processing for higher film quality, better adhesion and more reproducible deposition
- Superior in cost/performance to liquid nitrogen cooled Meissners

When added to your vacuum system, the PFC Cryopump can dramatically reduce pumpdown times and increase product throughput. The PFC will pump water vapor within minutes from "start" and can defrost in less than four minutes, giving true fast-cycle capability. For your system, this means more production cycles per shift. Pumpdown times are typically reduced by 25% to 75%, and increases in product throughput are 20% to 100%.

Using Polycold's patented cryogenic refrigeration process, and patented refrigerant mixtures, the PFC works on the principle of Meissner trapping. Water vapor is captured by condensation on a cryogenically cooled surface, called a Meissner coil. The Meissner (cryocoil) is mounted directly in the vacuum chamber so conductance is not limited by ports, manifolds, valves and baffles. The cryocoil is easy to install and can be adapted to fit any system. It does not need a high-vacuum valve.

PFC Cryopumps are the most cost-effective pumping upgrade you can add to any diffusion-pumped, turbopumped or helium-cryopumped system. A control module allows you to have either local or remote operation, enabling you to operate the PFC from your existing controller or processor.

The PFC is available in a variety of capabilities and cryocoil configurations. Models are available that control two cryocoils or the combination of a cryocoil and a baffle. Please refer to Product Specifications and to our PFC Price List for price and option details.

Features and Benefits

- -115˚ to-140˚C (158˚ to 133˚ K)
- Heat Removal to 1000 Watts
- Cryocondenses Water Vapor in Vacuum Systems with Speeds to 75,000 l/sec Vacuum Levels to 1.5 x 10-9 torr (2 x 10-9 mbar)
- Provides very fast pumping speeds for water vapor, which is typically 65% to 95% of the gas load in high vacuum systems.
- Based on Polycold's proven, innovative, dependable mixed-gas cryogenics
- ISO 9001:2015 certified manufacturer
- CE Marked to the PED
- Compliant with European Application Refrigerants (EC 1005/2009), the Montreal Protocol, and the US EPA SNAP

Features

All PFC Cryochiller models have the following features in common:

Self-Diagnostics: All PFC Cryochiller models include self-diagnostics to assist the user.

Compliance: PFC Cryochillers are compliant to EU PED, MD and RoHS. TUV Rheinland listed to NRTL/ Canada safety standards.

24V Remote: The PFC has an option for a 24V remote, which allows for direct wiring of inputs to and outputs from the unit. The 24V remote is Non-Isolated and may be for a Single Circuit or Dual Circuit system.

Temperature meter: Included as standard in this module is a digital temperature meter with a ten-position thermocouple select switch for easy temperature monitoring.

Options

VCR fittings: Optional VCR fittings for cyrocoil connection. Parker-compatible fittings are standard.

Dual Circuit: Enables the PFC to cool two cryosurfaces (two cryocoils, coil and baffle or two baffles) which can be cooled or defrosted separately.

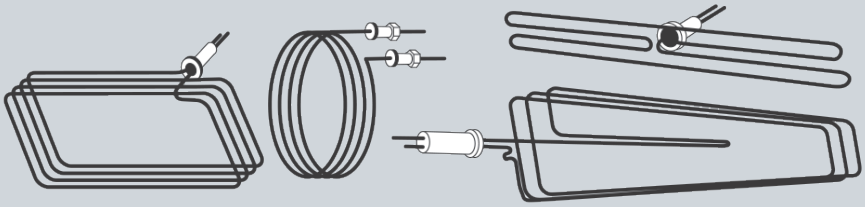
24V Isolated Remote: The PFC can be configured with an Isolated remote for backwards compatibility. This may be used for a Single Circuit or Dual Circuit system.

Temperature Setpoint Relay: Indicates that the selected temperature is colder than the predetermined setpoint. Inside the module, the setpoint can be adjusted between-80C and -160C. When the temperature from the input thermocouple drops below the defined setpoint, a thermocouple limit switch lights a lamp on the panel and closes a relay contact which completes a circuit to the remote connector.

System Accessories

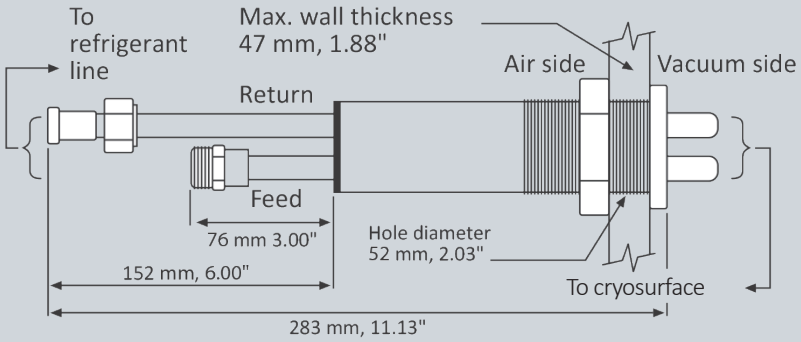
Cryocoil

The cryocoil can be designed to fit your specific vacuum chamber. Typical cryocoils have helical, spiral, serpentine or other simple shapes. We do not recommend cryopanels, due to slow cool/defrost times as a result of their increased mass and ineffective cryopumping on the rear side when positioned near the chamber wall.



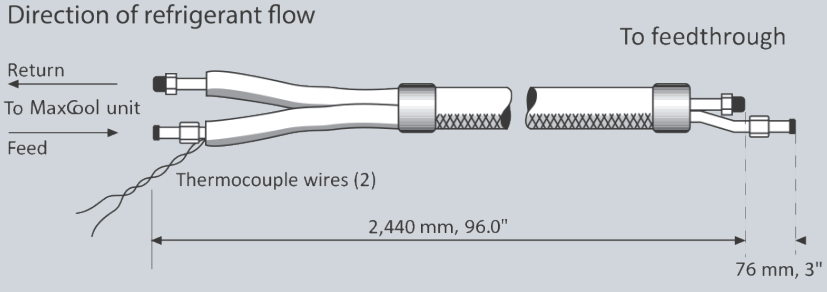
Feedthrough

The standard cryogenic feedthrough provides thermal isolation between the feed/return tubes and the O-ring seal. The dual-pass feedthrough requires a two inch diameter hole in the vacuum chamber. Couplings on the feedthrough mate with the refrigerant line. Optional feedthroughs fit one-inch diameter holes, but two are required (one for each tube).



Refrigerant Line

A standard refrigerant line set consists of a copper feed and return line, each with stainless steel couplings on both ends for connection to the PFC unit and to the feedthrough. Longer lengths of refrigerant line (more than the standard 8 feet/2.44 m) can be ordered from the factory, but will require our applications review.



Frequently asked applications questions

How do I select the right model of PFC to trap water vapour in my vacuum chamber?
Determining the appropriate PFC system depends upon the desired water vapour pumping speed and the ability of the chamber to accommodate the required amount of cold element (cryocoil) surface area.

The larger the cryocoil, the greater the pumping speed. Typically, we recommend an increase in chamber net speed of four times the existing (net in-chamber) water vapour pumping speed. This typically results in a pumpdown time reduction from 25% to 75%.

Once the approximate unit size and cryocoil surface area have been established, the required temperature and cooling capacity of the system are reviewed against the presence of any additional heat load (long refrigerant lines, process heat, etc.).

Can I use the PFC Cryochiller for thermal management?
The PFC Cryochiller cools components in a wide variety of process steps in diverse markets such as semiconductor, flat panel display, data storage and space simulation.

Applications include refrigerant-cooled chucks or platens that regulate the temperature of substrates during manufacturing processes. The PFC Cryochiller can also cool an external heat exchanger for open-loop or closed-loop gas chilling processes.

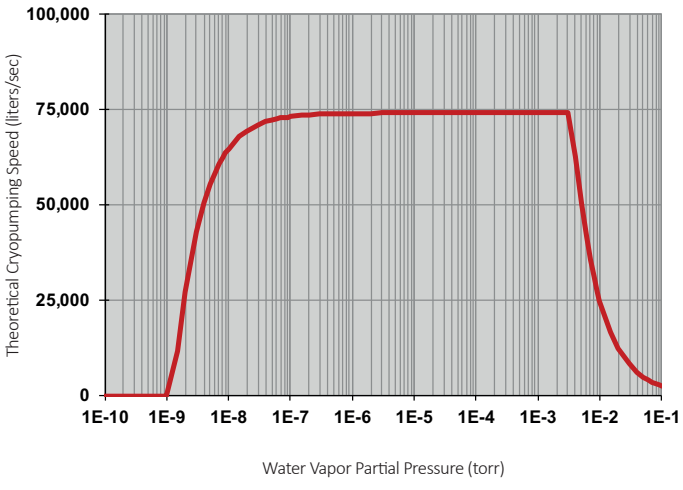
What is the best temperature to trap water vapour effectively?
To find the cryosurface temperature that is best for your vacuum system, look for the ultimate base pressure of your system in the table below. This temperature provides 90% water vapour trapping efficiency.

Desired water vapour partial pressure		Average cryosurface temperature needed
torr	mbar	°C
1×10^{-3}	1.3×10^{-3}	–89.6
5×10^{-4}	6.7×10^{-4}	–93.4
2×10^{-4}	2.7×10^{-4}	–98.2
1×10^{-4}	1.3×10^{-4}	–101.6
5×10^{-5}	6.7×10^{-5}	–104.9
2×10^{-5}	2.7×10^{-5}	–109.1
1×10^{-5}	1.3×10^{-5}	–112.2
5×10^{-6}	6.7×10^{-6}	–115.1
2×10^{-6}	2.7×10^{-6}	–118.1
1×10^{-6}	1.3×10^{-6}	–121.5
5×10^{-7}	6.7×10^{-7}	–124.1
2×10^{-7}	2.7×10^{-7}	–127.5
1×10^{-7}	1.3×10^{-7}	–129.9
5×10^{-8}	6.7×10^{-8}	–132.2
2×10^{-8}	2.7×10^{-8}	–135.2
1×10^{-8}	1.3×10^{-8}	–137.3
5×10^{-9}	6.7×10^{-9}	–139.5
2×10^{-9}	2.7×10^{-9}	–142.1
1×10^{-9}	1.3×10^{-9}	–144.1

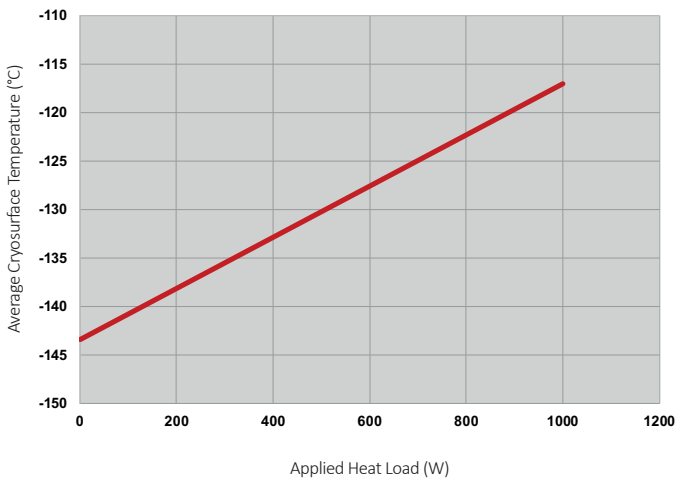
Helpful Information for Sizing Systems

- Radiation Heat Load on Cryocoil At 25°C
- At 25°C Ambient Conditions: 376.6 watts/m^2 (35 watts/ft^2)
- Refrigerant Line Heat Load: 26.3 watts/m (8 watts/ft)
- Vacuum Jacketed Line Heat Load: 1.0 watts/m (0.3 watts/ ft)
- Water Vapour Pumping Speed: 149,000 l/s/m^2 (13,842 l/s/ft^2)
- Liquid Nitrogen Cooling: approximately 45 watts/litre/hour

PFC Performance



Single-circuit models; 25- 28°C cooling water; 2.4m refrigerant line; advertised cryocoil surface areas only; larger cryocoils will give greater pumping speeds and can be used in some applications; 25°C temperature in line of sight with cryocoil; 60Hz.



Single-circuit models; 25- 28°C cooling water; temperature shown is average of inlet and outlet temperature using typical cryocoil size; temperature difference between inlet and outlet at maximum load is typically 20°C; end point of each curve is maximum load for that model; performance at 50Hz can be 3- 5°C warmer than 60Hz performance shown.

PFC Specifications

Model	PFC 552HC
Typical Performance [a]	
Maximum Load (Watts at warmest temperature)	1000
Theoretical max pumping speed l/sec[b]	74,500
Conservative pumping speed (in chamber) l/sec[b]	50,000
Ultimate Operating Pressure, torr[c]	2×10^{-9}
Ultimate Operating Pressure, mbar	3×10^{-9}
Maximum pump start pressure, atmd	1.0
Time to defrost, minutes	4.0
Cryocoils and Refrigerant Lines	
Total Cryocoil Surface area m^2 ($ft.^2$)	0.5 (5.4)
Single Circuit (PFC)	
Tube O.D., mm (in.)	12 (1/2)
Tube Length m (ft.)	13.3 (41.1)
Dual Circuit (PFC/PFC)	
Tube O.D., mm (in.)	12 (1/2)
Tube Length per coil, m (ft.)	6.6 (20.6)
Standard refrigerant line lengths m (ft.)	2.44 (8)
Utilities	
Cooling water, flow rate l/min. (gal./min.)	
at 13C (55F)	4.9 (1.3)
at 26C (79F)	12.3 (3.2)
at 29C (85F)	19.7 (5.2)
Power Input, at maximum load, kW	6.0
Nominal Power Requirements[e]	200/3/50-60 230/3/60 380/3/50 400/3/50 460/3/60 480/3/60
Max Operating Sound Level, dB(A)[f]	71
Minimum Room Volume m^3 ($ft.3$)[g]	13 (460)

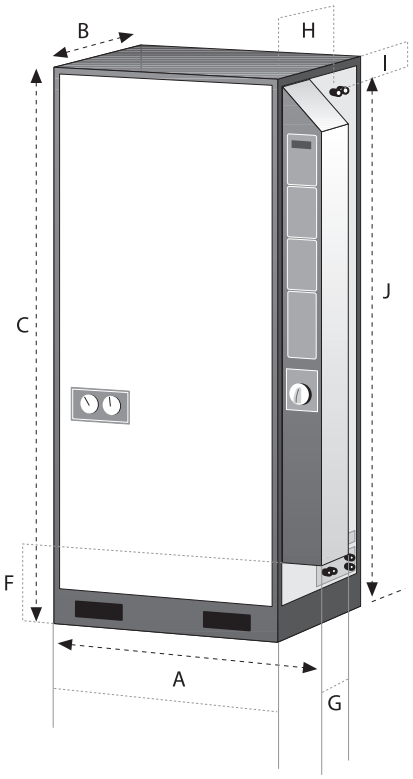
Footnotes: (a) Standard conditions for performance testing. (1) Cryocoil environment at 20˚C (2) Recommend cryocoils and line lengths (3) Cooling water temperature between 25˚C and 28˚C. (4) Operation at 60 Hz. (b) Larger cryocoils may give greater pumping speeds, and can be used in some applications. Contact your sales representative or the factory for application details. (c) Standard cryocoil at twenty five percent (25%) of maximum pumping speed. (d) Recommended cryopump start pressure is near normal "crossover." Mechanical roughing pumps and blowers are generally more effective for moisture removal above 1torr. (e) For nominal power requirements not on the table, please contact the factory. Please refer to the manual for operational voltage ranges. For 480 volt operation the maximum voltage is 506. (f) Units were tested in a manufacturing environment while under maximum load in the COOL mode. (g) To comply with the Safety Code for Mechanical Refrigeration, ANSI/ASHRAE-15-1994, the following units should be located in a room no smaller than listed. (h) 7.0 minute maximum defrost is for a 2 m2 coil. Most applications use smaller coils and achieve shorter defrost times. A 1 m2 coil with standard refrigerant lines will defrost in less than 4 minutes.

Notes: All units have cryocoils that may be decoupled from the refrigerant lines and remote control capability with built-in remote connector. Maximum angle of inclination for shipping or handling all units is forty-five degrees (45˚)

PFC Dimensions and Weight

Model	PFC 552
Dimensions mm(inches)	
A	953 (37.5)
B	660 (26)
C	1842 (72.5)
D	812 (32)
E	140 (5.5)
F	254 (10)
G	203 (8)
H	432 (17)
I	114 (4.5)
J	1727 (68)
Weight kg(lb)	408 (900)
Standard refrigerant line m(ft)	2.44 (8)

"Combination" or "Multi-Purpose" PFC Models have the same dimensions as the "Standard PFC" Models in the equivalent size unit. (For example, a PFC/PFC 1102 has the same dimensions as a PFC 1102). For PFC 552, and PFC 1102 (and corresponding "Combination" or "Multi-Purpose" PFC Models) allow 45 cm (18 inches) clearance for utilities, refrigerant line connection and controls on the right hand panel as seen viewing the front of the unit.



PRODUCT DATA SHEET

POLYCOLD®
PCC COMPACT COOLERS

EFFICIENT HEAT REMOVAL FOR DEMANDING APPLICATIONS

The Polycold® PCC is a compact, high-performance cooling system that brings efficiency and reliability to your applications. PCC delivers proven, dependable cooling and is designed to ensure repeatable performance and minimise maintenance costs. Its compact design and remote cold end give you a robust system with a small footprint. This low-vibration heat removal system is capable of maintaining temperatures as low as -203° C (70 Kelvin).

Polycold® PCC Compact Cooler Compressor, Gas Lines and Cold End

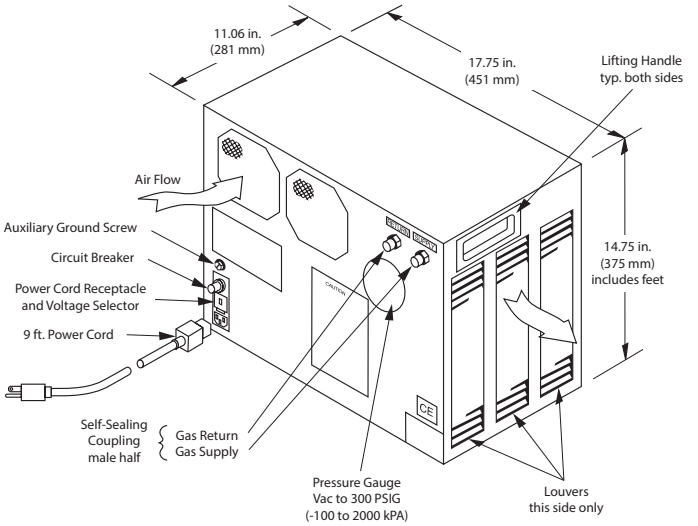
PCC Components

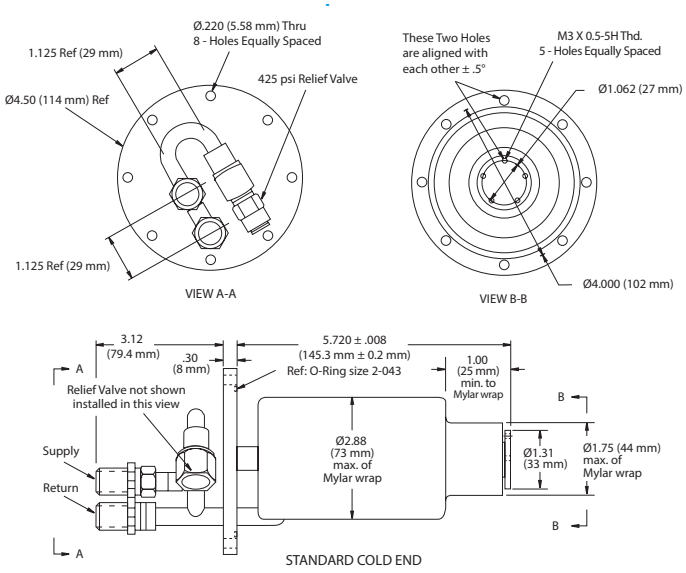
Cold End: The rugged, low-vibration PCC cold end can be used in any orientation, and located remotely from the compressor. Available nickel plated or Mylar wrapped. For PT blends, options include standard or high performance.

Compressor: The closed cycle PCC compressor uses patented gas blends and innovative oil management for quiet and reliable performance in a small footprint. Electricity is the only utility required for operation.

Gas Lines: Self-sealing couplings ensure quick and easy hook-up, and the compressor can be located up to 120 feet from the cold end. Refrigerant travels through the gas lines at room temperature.

Refrigerant Blends: Different patented mixed gas refrigerant blends tailor the temperature and cooling capacity for a wide variety of applications.





Features and Benefits

- Compact size, remote cold end and minimal connections make this a smart solution for most applications
- Low vibration
- Cooling to -203°C (70 K)
- Rapid cooldown
- Eliminates the need for liquid nitrogen

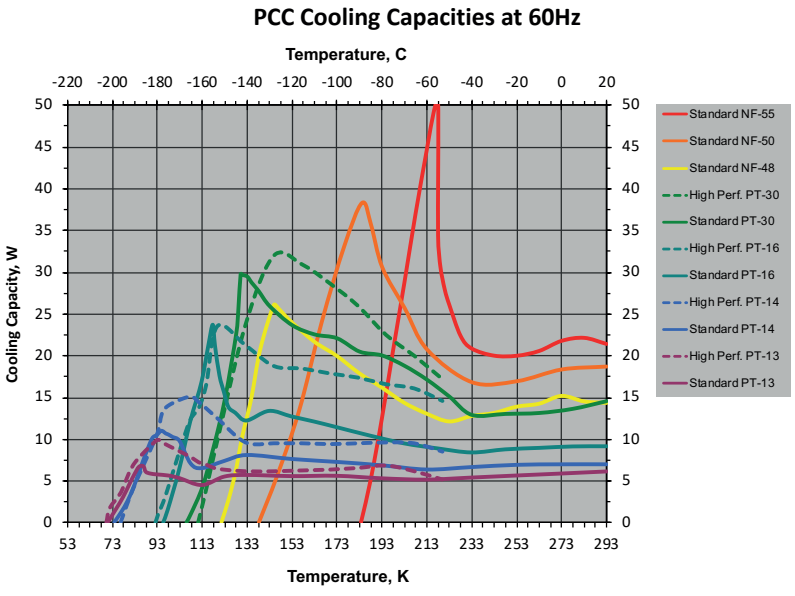
Compressor and Gas Lines

Compressor	
Weight	31.1 kg (68.5 lbs.)
Orientation	Base down required (level to within 10°)
Power requirement	Single phase, 50/60 Hz, 500 Watts nominal. External switch allows you to select 100, 120, 220, or 240 Volt operation.
Cooling	Air-cooled
Agency approvals	CE, NRTL, SEMI S2, SEMI F47
Gas Lines	
Construction	Braided stainless steel
Diameter	0.5 inch (12.9 mm) nominal
Lengths	5, 10, 25, 50 or 75 ft. (1.5, 3.1, 7.6, 15.2 or 22.9 m)
Minimum static centerline bend radius	4 in. (102 mm)
Maximum distance from cold end to compressor	120 ft

Accessories

Edwards provides a variety of accessories for the PCC system, including 90° adapters for gas lines, electrical line isolators and line-to-line connectors.

Performance



Standard Cold End Specifications

Weight	1.5 kg (3.2 lbs.)
Vacuum insulation requirement	≤ 10^{-4} torr
Weight supported at the cold tip	≤ 1.4 kg (3.0 lbs)
Orientation	Any

NF blends*

Cooldown Time (with no load):
NF-55: -55°C (218 K) in 7 minutes
NF-50: -89°C (184 K) in 11 minutes
NF-48: -128°C (145 K) in 19 minutes

Maximum cooling capacity for each gas blend:
NF-55: 50 Watts @ -55°C (218K)*
NF-50: 38 Watts @ -89°C (184K)*
NF-48: 26 Watts @ -128°C (145K)*

Temperature Stability:
+/- 1.0 K. Performance with 10' Gas Lines.

*NF indicates non-flammable gas.

PT blends

Cooldown Time (with no load):
PT-30: -144°C (129K) in 22 minutes
PT-16: -156°C (117K) in 26 minutes
PT-14: -177°C (96K) in 45 minutes
PT-13: -187°C (86K) in 61 minutes

Maximum cooling capacity for each gas blend:
PT-30: 29 Watts @ -144°C (129K)
PT-16: 23 Watts @ -156°C (117K)
PT-14: 10 Watts @ -177°C (96K)
PT-13: 6 Watts @ -187°C (86K)

Temperature Stability
+/- 1.0 K. Performance with 10' Gas Lines.

Note: 50 Hz operation may derate cooling capacity.

High Performance Cold End Specifications

Weight	1.8 kg (4.0 lbs.)
Vacuum insulation requirement	≤ 10^{-4} torr
Weight supported at the cold tip	≤ 1.4 kg (3.0 lbs)
Orientation	Any

Cooldown Time (with no load):
PT-30: -128°C (145K) in 19 minutes
PT-16: -153°C (120K) in 25 minutes
PT-14: -166°C (107K) in 35 minutes
PT-13: -179°C (94K) in 54 minutes

Maximum cooling capacity for each gas blend:
PT-30: 32 Watts @ -128 °C (145K)
PT-16: 24 Watts @ -153°C (120K)
PT-14: 15 Watts @ -166°C (107K)
PT-13: 7 Watts @ -179°C (94K)

Temperature Stability:
+/- 1.0 K. Performance with 10' Gas Lines.

Note: 50 Hz operation may derate cooling capacity.

EDWARDS

PRODUCT DATA SHEET

POLYCOLD®
P-102 CRYOCOOLER

Polycold® Cryocoolers provide compact, easy-to-use alternatives to liquid nitrogen in small vacuum systems. These cryogenerators use safe, non-flammable, non-toxic, HCFC-Free refrigerants in a closed-loop system. This means no moving of heavy dewars and no downtime due to running out of liquid nitrogen.

Installation is quick and easy. The cold trap is inserted into the housing, or the baffle is installed between the diffusion pump and the high-vacuum valve. Cold probes or chevron baffles (cryosurfaces) are integral to the refrigerant line and are not detachable from it without loss of refrigerant.

The P-102 can be used with a cold probe or chevron baffle

Applications

- Helium mass spectrometer leak detectors
- Mechanical pumps
- Chevron baffles for four-inch and six-inch diffusion pumps
- Small chamber cold/vapor trapping probes

Polycold® Portable Cryocoolers

- Replace liquid nitrogen in cold traps in high vacuum systems
- Provide high-speed pumping of water vapor to 10^{-8} torr
- Quick and easy installation
- Fast payback through savings on liquid nitrogen
- Effectively stop backstreaming
- Supply uninterrupted cooling of cryosurfaces

Features and Benefits

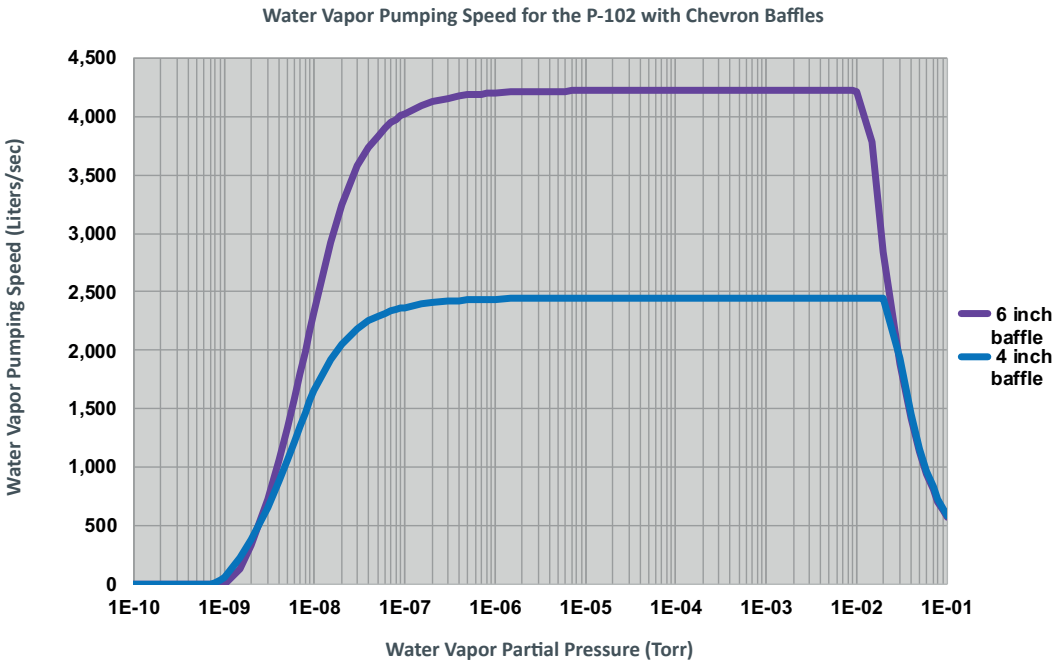
- Eliminate the cost, inconvenience and hazards of liquid nitrogen with comparable performance
- -110° to-135° C (163° K to 138° K)
- Continuous cooling
- Heat removal to 120 Watts
- Vacuum system cold trap cooling
- Mass spectrometer and leak detector cooling
- Cold traps
- Cooling of flange mounted cryocoils for turbomolecular pumps
- Parylene coating traps
- Compliant with european application refrigerants eC/1005/2009, The Montreal Protocol and The US EPA SNAP
- CE certified to Low Voltage and EMC Directive

Polycold® P-102 Cryocooler Specifications

Physical Data	
Initial Cooldown Time, hr.	1.5
Flex line length, in. (mm)	54 (1372)
Dimensions:	
Width, in. (mm)	20.5 (521)
Depth, in. (mm)	17.3 (440)
Height, in. (mm)	32.5 (826)
Weights, with lines, lb (kg)	180 (82)

Utilities	
Standard electrical, +/- 10%	208-230 /1 / 50-60
Current, amps	7.5
Cooling	Forced Air
Baffles and Cold Probes	
Chevron Baffles, opaque, low-profile, spool piece style	
	Part number
4 CB, nominal 4-inch chevron baffle	460514
6 CB, nominal 6-inch chevron baffle	460003
Cold Probes	
Trap housing for mechanical pump traps	461002
Cold probe, stainless steel, “Easy Clean”	462021

Polycold® P-102 Cryocooler Performance



PRODUCT DATA SHEET

POLYCOLD® MAXCOOL CRYOCHILLERS

Polycold® MaxCool Cryochillers are closed loop cryogenic refrigeration systems that provides up to 4,000 watts of cooling. They can be used to capture water vapour and other condensable substances on a cold surface such as a cryocoil or chevron baffle. The MaxCool Cryochillers are also used to cool objects to very low temperatures such as electrostatic chucks used in semiconductor wafer processing.

Water vapour pumping

Polycold® MaxCool Cryochillers effectively capture water vapour, which comprises 65% to 95% of the residual gas in high vacuum systems. Water vapour is typically the most reactive contaminant present. With our MaxCool Cryochillers you can expect an increase in product throughput in your existing system of 20% to 100% and an improvement in the quality of deposition.

The MaxCool advantage

- High-vacuum pumpdown time cut by up to 75%
- High-speed pumping of water vapour: typical pumping speeds of 164,000 to 328,000 l/sec based on the model
- Increased product throughput of 20% to 100%
- Lower water vapour partial pressure during processing for higher film quality, better adhesion and more reproducible deposition
- Superior in cost/performance to liquid nitrogen cooled Meissners
- Minimise cost of ownership with power management
- High capacity cooling and heating for a wide variety of processes

When added to your vacuum system, MaxCool Cryochillers can dramatically reduce pumpdown times and increase product throughput. The MaxCool will pump water vapour within minutes from start and can defrost in less than four minutes, giving true fast-cycle capability and enabling your system to perform more production cycles per shift.

Using patented Polycold® refrigerant mixtures, the MaxCool works on the principle of Meissner trapping. Water vapour is captured by condensation on a cryogenically cooled surface, called a Meissner coil.

The cryocoil is mounted directly in the vacuum chamber so conductance is not limited by ports, manifolds, valves and baffles. The cryocoil is easy to install and can be adapted to fit any system. It does not need a high vacuum valve.

MaxCool Cryochillers are the most cost-effective upgrade that you can add to any diffusion-pumped, turbo-pumped, or helium-cryopumped system.

Features and Benefits

- Cooling from -98°C (175 K) to -145°C (128 K)
- Heat Removal up to 4,000 watts
- Cryocondenses water vapor in vacuum systems with typical pumping speeds up to 329,000 l/ sec vacuum levels to 8 x 10^{-10} torr (1 x 10^{-9} mbar)
- Option for power management to minimise cost of ownership
- Patented Green refrigerant charge is globally compliant, non-toxic and non-flammable
- Based on Polycold®s proven, innovative, dependable mixed gas refrigeration
- Third party certified to EU PED, MD, and RoHS
- TÜV Rheinland Listed to NRTL/CANADA Safety Standards
- ISO 9001:2015 certified manufacturer

Features

All MaxCool Cryochiller models have the following features in common:

Ethernet and USB 2.0
Standard communications on each model to allow users to easily interface with each MaxCool.

HMI: Includes a manual interface with a display and a keypad for navigation and selection.

Rapid Balance Pressure Check: This feature enables the MaxCool unit to give a balance pressure reading in about 20 minutes, rather than the 48-hour warm-up required by the previous PFC models. This improvement maximises tool uptime.

Self-Diagnostics: All MaxCool Cryochiller models include self-diagnostics to assist the user.

Footprint: Most service access is needed only from the front, making the unit easier to position.

Compliance: MaxCool Cryochillers are compliant to EU PED, MD and RoHS. TUV Rheinland listed to NRTL/Canada safety standards. Semi S2 and Semi F47compliance are dependent on system configuration.

Options

VCR fittings: Optional VCR fittings for cyrocoil connection. Parker-compatible fittings are standard.

Dual Circuit: Enables the MaxCool to cool two cryosurfaces (two cryocoils, coil and baffle or two baffles) which can be cooled or defrosted separately.

Power Management: The Power Management option allows additional savings up to 15% in standby and 25% while cooling, as long as the full cooling capacity is not needed.

24V Remote: The MaxCool has an option for a 24V remote, which allows for direct wiring of inputs to and outputs from the unit in a manner similar to earlier PFC models. The 24V remote may be Isolated or Non-Isolated and may be for a Single Circuit or Dual Circuit system. Two setpoint relays are included.

Advanced I/O: EtherCAT, PROFINET, Profibus or DeviceNet.

Casters: Allow for ease of unit installation and removal.

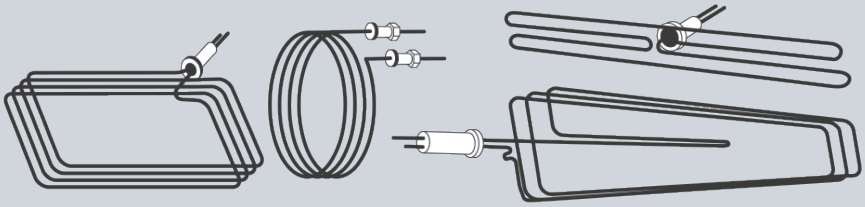
Lifting rings: Allow for ease of unit movement.

Sound attenuation option: Reduce unit sound through additional insulation.

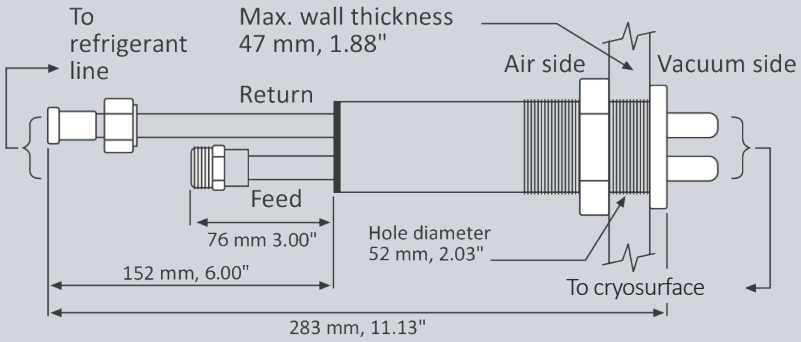
SEMI S2/F47: Includes remote EMO and DC Contactor.

System Accessories

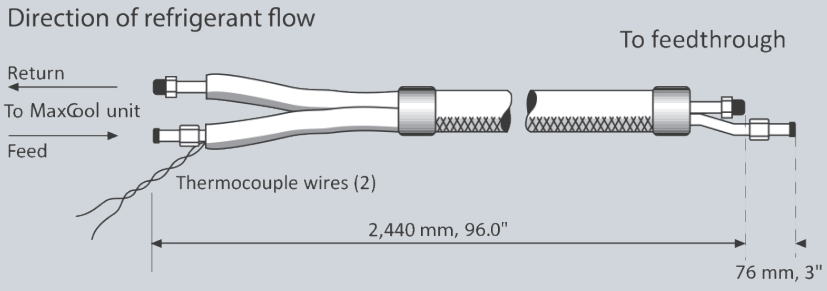
Cryocoil
The cryocoil can be designed to fit your specific vacuum chamber. Typical cryocoils have helical, spiral, serpentine or other simple shapes. We do not recommend cryopanels, due to slow cool/defrost times as a result of their increased mass and ineffective cryopumping on the rear side when positioned near the chamber wall.



Feedthrough
The standard cryogenic feedthrough provides thermal isolation between the feed/return tubes and the O-ring seal. The dual-pass feedthrough requires a two inch diameter hole in the vacuum chamber. Couplings on the feedthrough mate with the refrigerant line. Optional feedthroughs fit one-inch diameter holes, but two are required (one for each tube).



Refrigerant Line
A standard refrigerant line set consists of a copper feed and return line, each with stainless steel couplings on both ends for connection to the MaxCool unit and to the feedthrough. Longer lengths of refrigerant line (more than the standard 8 feet/2.44 m) can be ordered from the factory, but will require our applications review.



Frequently asked applications questions

How do I select the right model of MaxCool to trap water vapour in my vacuum chamber?
Determining the appropriate MaxCool system depends upon the desired water vapour pumping speed and the ability of the chamber to accommodate the required amount of cold element (cryocoil) surface area.

The larger the cryocoil, the greater the pumping speed. Typically, we recommend an increase in chamber net speed of four times the existing (net in-chamber) water vapour pumping speed. This typically results in a pumpdown time reduction from 25% to 75%.

Once the approximate unit size and cryocoil surface area have been established, the required temperature and cooling capacity of the system are reviewed against the presence of any additional heat load (long refrigerant lines, process heat, etc.).

Can I use the MaxCool Cryochiller for thermal management?
The MaxCool Cryochiller cools components in a wide variety of process steps in diverse markets such as semiconductor, flat panel display, data storage and space simulation.

Applications include refrigerant-cooled chucks or platens that regulate the temperature of substrates during manufacturing processes. The MaxCool Cryochiller can also cool an external heat exchanger for open-loop or closed-loop gas chilling processes.

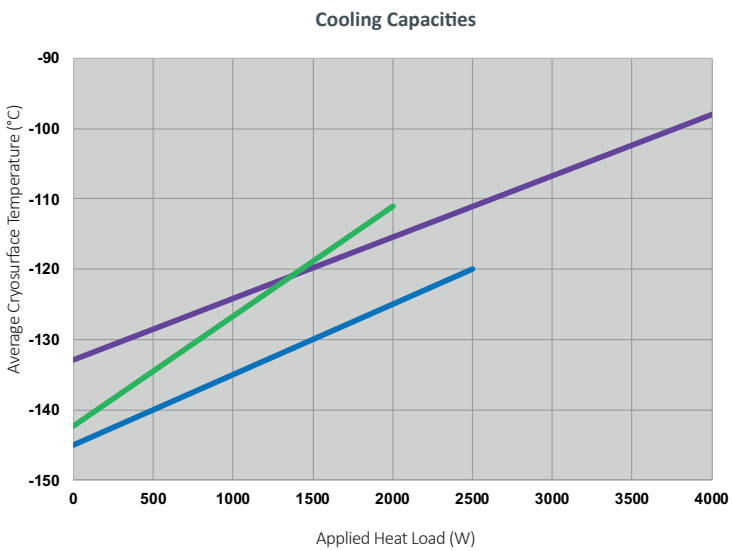
What is the best temperature to trap water vapour effectively?
To find the cryosurface temperature that is best for your vacuum system, look for the ultimate base pressure of your system in the table below. This temperature provides 90% water vapour trapping efficiency.

Desired water vapour partial pressure		Average cryosurface temperature needed
torr	mbar	°C
1×10^{-3}	1.3×10^{-3}	–89.6
5×10^{-4}	6.7×10^{-4}	–93.4
2×10^{-4}	2.7×10^{-4}	–98.2
1×10^{-4}	1.3×10^{-4}	–101.6
5×10^{-5}	6.7×10^{-5}	–104.9
2×10^{-5}	2.7×10^{-5}	–109.1
1×10^{-5}	1.3×10^{-5}	–112.2
5×10^{-6}	6.7×10^{-6}	–115.1
2×10^{-6}	2.7×10^{-6}	–118.1
1×10^{-6}	1.3×10^{-6}	–121.5
5×10^{-7}	6.7×10^{-7}	–124.1
2×10^{-7}	2.7×10^{-7}	–127.5
1×10^{-7}	1.3×10^{-7}	–129.9
5×10^{-8}	6.7×10^{-8}	–132.2
2×10^{-8}	2.7×10^{-8}	–135.2
1×10^{-8}	1.3×10^{-8}	–137.3
5×10^{-9}	6.7×10^{-9}	–139.5
2×10^{-9}	2.7×10^{-9}	–142.1
1×10^{-9}	1.3×10^{-9}	–144.1

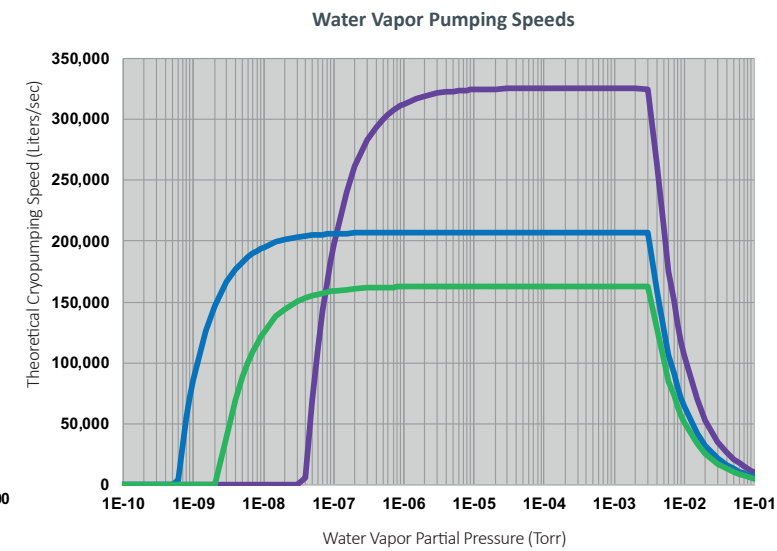
Helpful Information for Sizing Systems

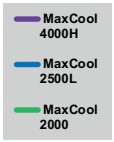
- Radiation Heat Load on Cryocoil At 25°C
- At 25°C Ambient Conditions: 376.6 watts/m^2 (35 watts/ft^2)
- Refrigerant Line Heat Load: 26.3 watts/m (8 watts/ft)
- Vacuum Jacketed Line Heat Load: 1.0 watts/m (0.3 watts/ ft)
- Water Vapour Pumping Speed: 149,000 l/s/m^2 (13,842 l/s/ft^2)
- Liquid Nitrogen Cooling: approximately 45 watts/litre/hour

MaxCool Performance



Single-circuit models; 25- 28°C cooling water; temperature shown is average of inlet and outlet temperature using typical cryocoil size; temperature difference between inlet and outlet at maximum load is typically 20°C; end point of each curve is maximum load for that model; performance at 50Hz can be 3- 5°C warmer than 60Hz performance shown.





Single-circuit models; 25- 28°C cooling water; 2.4m refrigerant line; advertised cryocoil surface areas only; larger cryocoils will give greater pumping speeds and can be used in some applications; 25°C temperature in line of sight with cryocoil; 60Hz.

MaxCool Specifications

Model	MaxCool 2000	MaxCool 4000H	MaxCool 2500L
Typical Performance [a]			
Maximum Load	2000 W	4000 W	2500 W
Average Temperature at Maximum Load	-111 °C	-98 °C	-120 °C
Coldest Temperature at No Load	-142 °C	-133 °C	-145 °C
Typical Water Vapor Pumping Speed (from Typical Cryocoil Surface Area)	163,900 l/s	327,800 l/s	208,600 l/s
Maximum Pump Start Pressure[b]	1 atm	1 atm	1 atm
Ultimate Operating Pressure [c]	3E-9 torr 4E-9 mbar 4E-7 Pa	5E-8 torr 7E-8 mbar 7E-6 Pa	8E-10 torr 1E-9 mbar 1E-7 Pa
Time To Defrost [d]	4 minutes	5.5 minutes	4 minutes
Cryocoils and Refrigerant Lines			
Typical Cryocoil Surface Area	1.1 m^2 (11.8 ft^2)	2.2 m^2 (23.7 ft^2)	1.4 m^2 (15.1 ft^2)
Conservative Maximum Cryocoil Surface Area [e]	1.5 m^2 (16.1 ft^2)	2.8 m^2 (30.1 ft^2)	2.0 m^2 (21.5 ft^2)
Typical Refrigerant Line Length	2.4 m (8 ft)	2.4 m (8 ft)	2.4 m (8 ft)
Typical Single Circuit Cryocoil Tube OD	16 mm (5/8 in)	16 mm (5/8 in)	16 mm (5/8 in)
Typical Single Circuit Cryocoil Tube Length	21.9 m (72.4 ft)	43.8 m (144.7 ft)	27.9 m (92.1 ft)
Typical Dual Circuit Cryocoil Tube OD	12 mm (1/2 in)	16 mm (5/8 in)	12 mm (1/2 in)
Typical Dual Circuit Cryocoil Tube Length	14.6 m (45.2 ft)	21.9 m (72.4 ft)	18.6 m (57.6 ft)
Utilities			
Cooling water flow for 13 °C (55 °F)	6.8 l/min	15.1 l/min	15.1 l/min
Cooling water flow for 18 °C (65 °F)	9.1 l/min	18.2 l/min	18.2 l/min
Cooling water flow for 24 °C (75 °F)	13.6 l/min	27.3 l/min	27.3 l/min
Cooling water flow for 29 °C (85 °F)	27.6 l/min	54.1 l/min	54.1 l/min
Power Input (Standby Mode)	5.5 kW	12.0 kW	11.4 kW
Power Input (Cool Mode, Low Load)	6.2 kW	12.4 kW	13.9 kW
Power Input (Cool Mode, Maximum Load)	8.8 kW	19.2 kW	19.2 kW
Nominal Power Requirements [f]	200-3-50 208-3-60 230-3-60 380-3-50 400-3-50 460-3-60 480-3-60	200-3-50 208-3-60 230-3-60 380-3-50 400-3-50 460-3-60 480-3-60	200-3-50 208-3-60 230-3-60 380-3-50 400-3-50 460-3-60 480-3-60
Safety and Compliance			
Certified by an Independent Third Party for European PED-Compliance	Yes	Yes	Yes
Nontoxic Refrigerant Blends	Yes	Yes	Yes
Nonflammable Refrigerant Blends	Yes	Yes	Yes
Minimum Room Volume per EN 378 [g]	37 m^3 (1307 ft^3)	43 m^3 (1519 ft^3)	39 m^3 (1377 ft^3)
Minimum Room Volume per ASHRAE-15 [g]	25 m^3 (900 ft^3)	34 m^3 (1200 ft^3)	40 m^3 (1400 ft^3)
Maximum Operating Sound Level [h]	72 dB(A)	78 dB(A)	78 dB(A)
Maximum Operating Sound Level with Sound Attenuation Option [h]	64 dB(A)	69 dB(A)	69 dB(A)
Refrigerants used in the blend	R-245fa, R-125, R-23, R-14, Argon		
(see product I.D. label for amounts) Total CO_2 equivalent emission (metric tons)	35.32	49.38	49.98

Footnotes: a) Under standard test conditions with a single-circuit model, 25°- 28°C cooling water, a 2.4m refrigerant line, a typical cryocoil surface area, 25°C temperature in the line of sight with the cryocoil, and 60Hz operation. b) Recommended cryopump start pressure is near normal "crossover." Mechanical roughing pumps and blowers are generally more effective for moisture removal above 1torr. c) Typical cryocoil at twenty five percent (25%) of maximum pumping speed. d) Many applications use smaller cryocoils and achieve significantly shorter defrost times. e) Larger cryocoils give greater pumping speeds, and can be used in some applications. Contact Edwards Vacuum for application details. f) For nominal power requirements not in the table, please contact Edwards Vacuum. Please refer to the manual for allowable voltage ranges. For 480 volt operation the maximum voltage is 506V. g) To comply with EN-378 or ASHRAE-15, the cryochiller should be located in a room no smaller than listed. h) Units were tested in a manufacturing environment while under maximum load in the COOL mode.

PRODUCT DATA SHEET

POLYCOLD® MAXCOOL 4000H CRYOCHILLER

The Polycold® MaxCool 4000H Cryochiller is a closed loop cryogenic refrigeration system that provides up to 4,000 watts of cooling. It can be used to capture water vapour and other condensable substances by freezing them onto a cold surface such as a cryocoil or chevron baffle. MaxCool 4000H Cryochiller is also used to cool objects to cryogenic temperatures such as electrostatic chucks used in semiconductor wafer processing.

Water vapour pumping

The Polycold® MaxCool 4000H Cryochiller effectively captures water vapour, which comprises 65% to 95% of the residual gas in high vacuum systems. Water vapour is typically the most reactive contaminant present. With our MaxCool Cryochiller you can expect an increase in product throughput in your existing system of 20% to 100% and an improvement in the quality of deposition.

The MaxCool advantage

- High-vacuum pumpdown time cut by up to 75%
- High-speed pumping of water vapour in the workspace: typically up to 328,000 l/sec
- Increased product throughput of 20% to 100%
- Lower water vapour partial pressure during processing for higher film quality, better adhesion and more reproducible deposition
- Superior in cost/performance to liquid nitrogen cooled Meissners
- Minimise cost of ownership with power management
- High capacity cooling and heating for a wide variety of processes

When added to your vacuum system, the MaxCool Cryochiller can dramatically reduce pumpdown times and increase product throughput. The MaxCool will pump water vapour within minutes from start and can defrost in less than six minutes, giving true fast-cycle capability. It also has an option called Rapid Cool to Cool, which eliminates the waiting period after defrost, enabling your system to perform more production cycles per shift.

Using patented Polycold® refrigerant mixtures, the MaxCool works on the principle of Meissner trapping. Water vapour is captured by condensation on a cryogenically cooled surface, called a Meissner coil. The Meissner cryocoil is mounted directly in the vacuum chamber so conductance is not limited by ports, manifolds, valves and baffles. The cryocoil is easy to install and can be adapted to fit any system. It does not need a high vacuum valve.

MaxCool Cryochillers are the most cost-effective upgrade that you can add to any diffusion-pumped, turbo-pumped, or helium-cryopumped system.

The Polycold® MaxCool 4000H is compliant with European Application Refrigerants (EU No 517/2014), the Montreal Protocol and the US EPA SNAP

Features and Benefits

- -98° to -133°C (183 to 140K)
- Heat removal to 4,000 watts
- Cryocondenses Water vapour in vacuum systems with speeds to 328,000 l/sec vacuum levels to 5 x 10^{-8} torr (7 x 10^{-8} mbar)
- Theoretical maximum pumping speed 328,000 l/sec
- Option for power management to minimise cost of ownership
- Patented Green refrigerant charge is globally compliant, non-toxic and non-flammable
- Based on Polycold®'s proven, innovative, dependable mixed gas refrigeration
- Third party certified to EU PED, MD, and RoHS
- TÜV Rheinland Listed to NRTL/CANADA Safety Standards
- ISO 9001:2015 certified manufacturer

MaxCool 4000H Specifications

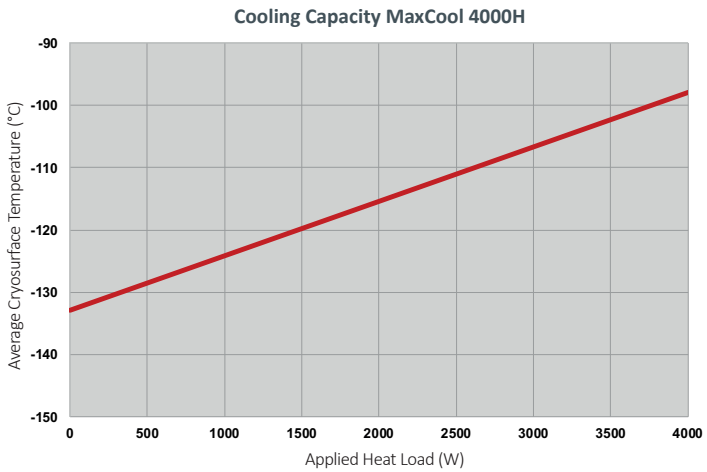
Typical Performance [a]	
Maximum Load	4000 W
Average Temperature at Maximum Load	-98 °C
Coldest Temperature at No Load	-133 °C
Typical Water Vapor Pumping Speed (from Typical Cryocoil Surface Area)	327,800 l/s
Maximum Pump Start Pressure[b]	1 atm
Ultimate Operating Pressure [c]	5E-8 torr 7E-8 mbar 7E-6 Pa
Time To Defrost [d]	5.5 minutes
Cryocoils and Refrigerant Lines	
Typical Cryocoil Surface Area	2.2 m^2 (23.7 ft^2)
Conservative Maximum Cryocoil Surface Area [e]	2.8 m^2 (30.1 ft^2)
Typical Refrigerant Line Length	2.4 m (8 ft)
Typical Single Circuit Cryocoil Tube OD	16 mm (5/8 in)
Typical Single Circuit Cryocoil Tube Length	43.8 m (144.7 ft)
Typical Dual Circuit Cryocoil Tube OD	16 mm (5/8 in)
Typical Dual Circuit Cryocoil Tube Length	21.9 m (72.4 ft)
Utilities	
Cooling water flow for 13 °C (55 °F)	15.1 l/min
Cooling water flow for 18 °C (65 °F)	18.2 l/min
Cooling water flow for 24 °C (75 °F)	27.3 l/min
Cooling water flow for 29 °C (85 °F)	54.1 l/min
Power Input (Standby Mode)	12.0 kW
Power Input (Cool Mode, Low Load)	12.4 kW
Power Input (Cool Mode, Maximum Load)	19.2 kW
Nominal Power Requirements [f]	200-3-50 208-3-60 230-3-60 380-3-50 400-3-50 460-3-60 480-3-60
Safety and Compliance	
Certified by an Independent Third Party for European PED-Compliance	Yes
Nontoxic Refrigerant Blends	Yes
Nonflammable Refrigerant Blends	Yes
Minimum Room Volume per EN 378 [g]	43 m^3 (1519 ft^3)
Minimum Room Volume per ASHRAE-15 [g]	34 m^3 (1200 ft^3)
Maximum Operating Sound Level [h]	78 dB(A)
Maximum Operating Sound Level with Sound Attenuation Option [h]	69 dB(A)
Refrigerants used in the blend (see product I.D. label for amounts)	R-245fa, R-125 R-23, R-14, Argon
Total CO_2 equivalent emission (metric tons)	49.38

Footnotes: a) Under standard test conditions with a single-circuit model, 25°- 28°C cooling water, a 2.4m refrigerant line, a typical cryocoil surface area, 25°C temperature in the line of sight with the cryocoil, and 60Hz operation. b) Recommended cryopump start pressure is near normal "crossover." Mechanical roughing pumps and blowers are generally more effective for moisture removal above 1torr. c) Typical cryocoil at twenty five percent (25%) of maximum pumping speed. d) Many applications use smaller cryocoils and achieve significantly shorter defrost times. e) Larger cryocoils give greater pumping speeds, and can be used in some applications. Contact Edwards Vacuum for application details. f) For nominal power requirements not in the table, please contact Edwards Vacuum. Please refer to the manual for allowable voltage ranges. For 480 volt operation the maximum voltage is 506V. g) To comply with EN-378 or ASHRAE-15, the cryochiller should be located in a room no smaller than listed. h) Units were tested in a manufacturing environment while under maximum load in the COOL mode.

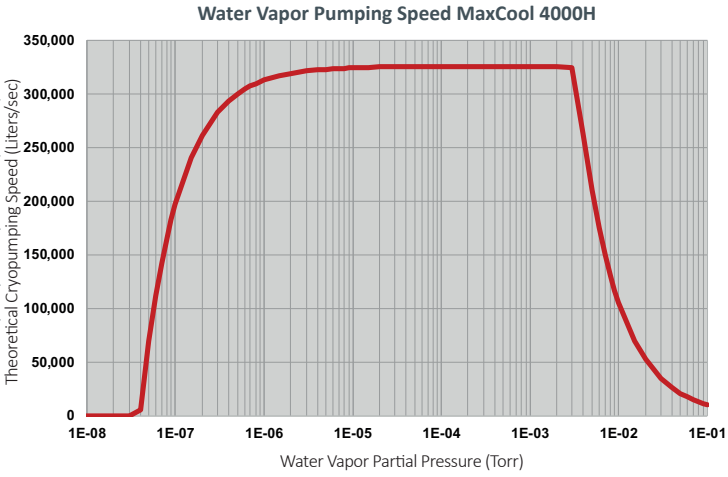
Helpful Information for Sizing Systems

- Radiation Heat Load on Cryocoil At 25°C
- At 25°C Ambient Conditions: 376.6 watts/m^2 (35 watts/ft^2)
- Refrigerant Line Heat Load: 26.3 watts/m (8 watts/ft)
- Vacuum Jacketed Line Heat Load: 1.0 watts/m (0.3 watts/ ft)
- Water Vapour Pumping Speed: 149,000 l/s/m^2 (13,842 l/s/ft^2)
- Liquid Nitrogen Cooling: approximately 45 watts/litre/hour

MaxCool 4000H Performance



Single-circuit models; 25- 28°C cooling water; temperature shown is average of inlet and outlet temperature using typical cryocoil size; temperature difference between inlet and outlet at maximum load is typically 20°C; end point of each curve is maximum load for that model; performance at 50Hz can be 3- 5°C warmer than 60Hz performance shown.



Single-circuit models; 25- 28°C cooling water; 2.4m refrigerant line; advertised cryocoil surface areas only; larger cryocoils will give greater pumping speeds and can be used in some applications; 25°C temperature in line of sight with cryocoil; 60Hz.

PRODUCT DATA SHEET

POLYCOLD® MAXCOOL 2500L CRYOCHILLER

The Polycold® MaxCool 2500L Cryochiller is a closed loop cryogenic refrigeration system that provides up to 2,500 watts of cooling. It can be used to capture water vapour and other condensable substances by freezing them onto a cold surface such as a cryocoil or chevron baffle. The MaxCool 2500L Cryochiller is also used to cool and heat objects such as electrostatic chucks used in semiconductor wafer processing.

Water vapour pumping

The Polycold® MaxCool 2500L Cryochiller effectively captures water vapour, which comprises 65% to 95% of the residual gas in high vacuum systems. Water vapour is typically the most reactive contaminant present. With our MaxCool Cryochiller you can expect an increase in product throughput in your existing system of 20% to 100% an improvement in the quality of deposition.

The MaxCool advantage

- High-vacuum pumpdown time cut by up to 75%
- High-speed pumping of water vapour in the workspace: typically up to 209,000 l/sec
- Increased product throughput of 20% to 100%
- Lower water vapour partial pressure during processing for higher film quality, better adhesion and more reproducible deposition
- Superior in cost/performance to liquid nitrogen cooled Meissners
- Minimise cost of ownership with power management
- High capacity cooling and heating for a wide variety of processes

When added to your vacuum system, the MaxCool Cryochiller can dramatically reduce pumpdown times and increase product throughput. The MaxCool will pump water vapour within minutes from start and can defrost in less than four minutes, giving true fast-cycle capability. It also has an option called Rapid Cool to Cool, which eliminates the waiting period after defrost, enabling your system to perform more production cycles per shift.

Using patented Polycold® refrigerant mixtures, the MaxCool works on the principle of Meissner trapping. Water vapour is captured by condensation on a cryogenically cooled surface, called a Meissner coil. The Meissner cryocoil is mounted directly in the vacuum chamber so conductance is not limited by ports, manifolds, valves and baffles. The cryocoil is easy to install and can be adapted to fit any system. It does not need a high vacuum valve.

MaxCool Cryochillers are the most cost-effective upgrade that you can add to any diffusion-pumped, turbo-pumped, or helium-cryopumped system.

The Polycold® MaxCool 2500L Cryochiller is compliant with European Application Refrigerants (EU No 517/2014), the Montreal Protocol and the US EPA SNAP

Features and Benefits

- -120° to -145°C (153 to 128K)
- Heat Removal to 2,500 watts
- Cryocondenses water vapour in vacuum systems with speeds to 209,000 l/sec vacuum levels to 8 x 10^{-10} torr (1 x 10^{-9} mbar)
- Theoretical maximum pumping speed 208,600 l/s
- Option for power management to minimise cost of ownership
- Patented Green refrigerant charge is globally compliant, non-toxic and non-flammable
- Based on Polycold®'s proven, innovative, dependable mixed gas refrigeration
- Certified by third party to EU PED, MD, and RoHS
- TUV Rheinland Listed to NRTL/CANADA Safety Standards
- ISO 9001:2008 certified manufacturer

MaxCool 2500L Specifications

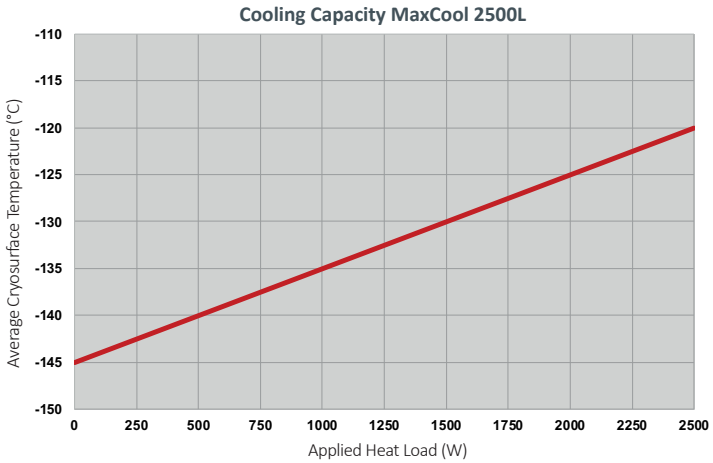
Typical Performance [a]	
Maximum Load	2500 W
Average Temperature at Maximum Load	-120°C
Coldest Temperature at No Load	-145°C
Typical Water Vapor Pumping Speed (from Typical Cryocoil Surface Area)	208,600 l/s
Maximum Pump Start Pressure[b]	1 atm
Ultimate Operating Pressure [c]	8E-10 torr 1E-9 mbar 1E-7 Pa
Time To Defrost [d]	4 minutes
Cryocoils and Refrigerant Lines	
Typical Cryocoil Surface Area	1.4 m^2 (15.1 ft^2)
Conservative Maximum Cryocoil Surface Area [e]	2.0 m^2 (21.5 ft^2)
Typical Refrigerant Line Length	2.4 m (8 ft)
Typical Single Circuit Cryocoil Tube OD	16 mm (5/8 in)
Typical Single Circuit Cryocoil Tube Length	27.9 m (92.1 ft)
Typical Dual Circuit Cryocoil Tube OD	12 mm (1/2 in)
Typical Dual Circuit Cryocoil Tube Length	18.6 m (57.6 ft)
Utilities	
Cooling water flow for 13 °C (55 °F)	15.1 l/min
Cooling water flow for 18 °C (65 °F)	18.2 l/min
Cooling water flow for 24 °C (75 °F)	27.3 l/min
Cooling water flow for 29 °C (85 °F)	54.1 l/min
Power Input (Standby Mode)	11.4 kW
Power Input (Cool Mode, Low Load)	13.9 kW
Power Input (Cool Mode, Maximum Load)	19.2 kW
Nominal Power Requirements [f]	200-3-50 208-3-60 230-3-60 380-3-50 400-3-50 460-3-60 480-3-60
Safety and Compliance	
Certified by an Independent Third Party for European PED-Compliance	Yes
Nontoxic Refrigerant Blends	Yes
Nonflammable Refrigerant Blends	Yes
Minimum Room Volume per EN 378 [g]	39 m^3 (1377 ft^3)
Minimum Room Volume per ASHRAE-15 [g]	40 m^3 (1400 ft^3)
Maximum Operating Sound Level [h]	78 dB(A)
Maximum Operating Sound Level with Sound Attenuation Option [h]	69 dB(A)
Refrigerants used in the blend (see product I.D. label for amounts)	R-245fa, R-125 R-23, R-14, Argon
Total CO_2 equivalent emission (metric tons)	49.98

Footnotes: a) Under standard test conditions with a single-circuit model, 25°- 28°C cooling water, a 2.4m refrigerant line, a typical cryocoil surface area, 25°C temperature in the line of sight with the cryocoil, and 60Hz operation. b) Recommended cryopump start pressure is near normal "crossover." Mechanical roughing pumps and blowers are generally more effective for moisture removal above 1torr. c) Typical cryocoil at twenty five percent (25%) of maximum pumping speed. d) Many applications use smaller cryocoils and achieve significantly shorter defrost times. e) Larger cryocoils give greater pumping speeds, and can be used in some applications. Contact Edwards Vacuum for application details. f) For nominal power requirements not in the table, please contact Edwards Vacuum. Please refer to the manual for allowable voltage ranges. For 480 volt operation the maximum voltage is 506V. g) To comply with EN-378 or ASHRAE-15, the cryochiller should be located in a room no smaller than listed. h) Units were tested in a manufacturing environment while under maximum load in the COOL mode.

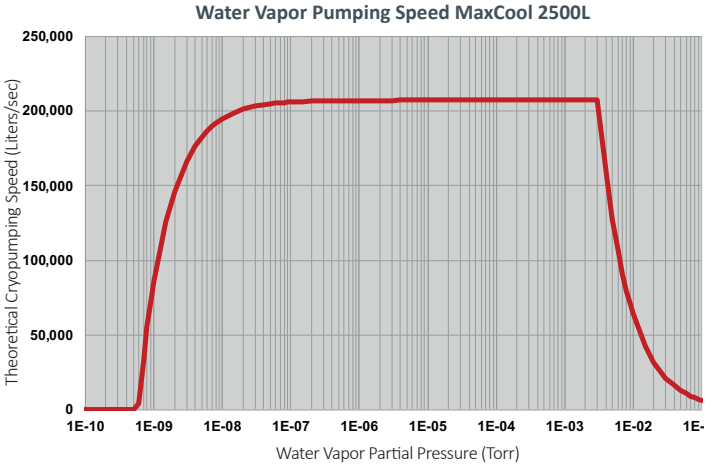
Helpful Information for Sizing Systems

- Radiation Heat Load on Cryocoil At 25°C
- At 25°C Ambient Conditions: 376.6 watts/m^2 (35 watts/ft^2)
- Refrigerant Line Heat Load: 26.3 watts/m (8 watts/ft)
- Vacuum Jacketed Line Heat Load: 1.0 watts/m (0.3 watts/ft)
- Water Vapour Pumping Speed: 149,000 l/s/m^2 (13,842 l/s/ft^2)
- Liquid Nitrogen Cooling: approximately 45 watts/litre/hour

MaxCool 2500L Performance



Single-circuit models; 25- 28°C cooling water; temperature shown is average of inlet and outlet temperature using typical cryocoil size; temperature difference between inlet and outlet at maximum load is typically 20°C; end point of each curve is maximum load for that model; performance at 50Hz can be 3- 5°C warmer than 60Hz performance shown.



Single-circuit models; 25- 28°C cooling water; 2.4m refrigerant line; advertised cryocoil surface areas only; larger cryocoils will give greater pumping speeds and can be used in some applications; 25°C temperature in line of sight with cryocoil; 60Hz.

PRODUCT DATA SHEET

POLYCOLD® MAXCOOL 2000 CRYOCHILLER

The Polycold® MaxCool 2000 Cryochiller is a closed loop cryogenic refrigeration system that provides up to 2,000 watts of cooling. It can be used to capture water vapour and other condensable substances by freezing them onto a cold surface such as a cryocoil or chevron baffle. MaxCool 2000 Cryochiller is also used to cool objects to cryogenic temperatures such as electrostatic chucks used in semiconductor wafer processing.

Water vapour pumping

The Polycold® MaxCool 2000 Cryochiller effectively captures water vapour, which comprises 65% to 95% of the residual gas in high vacuum systems. Water vapour is typically the most reactive contaminant present. With our MaxCool Cryochiller you can expect an increase in product throughput in your existing system of 20% to 100% and an improvement in the quality of deposition.

The MaxCool advantage

- High-vacuum pumpdown time cut by up to 75%
- High-speed pumping of water vapour: 10,000 to 164,000 l/sec in the workspace
- Increased product throughput of 20% to 100%
- Lower water vapour partial pressure during processing for higher film quality, better adhesion and more reproducible deposition
- Superior in cost/performance to liquid nitrogen cooled Meissners
- Minimise cost of ownership with power management
- High capacity cooling and heating for a wide variety of processes

When added to your vacuum system, the MaxCool Cryochiller can dramatically reduce pumpdown times and increase product throughput. The MaxCool will pump water vapour within minutes from start and can defrost in less than four minutes, giving true fast-cycle capability. It also has an option called Rapid Cool to Cool, which eliminates the waiting period after defrost, enabling your system to perform more production cycles per shift.

Using patented Polycold® refrigerant mixtures, the MaxCool works on the principle of Meissner trapping. Water vapour is captured by condensation on a cryogenically cooled surface, called a Meissner coil.

The Meissner cryocoil is mounted directly in the vacuum chamber so conductance is not limited by ports, manifolds, valves and baffles. The cryocoil is easy to install and can be adapted to fit any system. It does not need a high vacuum valve.

MaxCool Cryochillers are the most cost-effective upgrade that you can add to any diffusion-pumped, turbo-pumped, or helium-cryopumped system.

The Polycold® MaxCool 2000 Cryochiller is compliant with European Application Refrigerants (EU No 517/2014) and the US EPA SNAP

Features and Benefits

- -111° to -142°C (162 to 131K)
- Heat removal to 2,000 watts
- Cryocondenses Water vapour in vacuum systems with speeds to 164,000 l/sec vacuum levels to 3 x 10^{-9} torr (4 x 10^{-9} mbar)
- Option for power management to minimise cost of ownership
- Patented Green refrigerant charge is globally compliant, non-toxic and non-flammable
- Based on Polycold®'s proven, innovative, dependable mixed gas refrigeration
- Compliant to EU PED, MD and ROHS. Certified by an Independent Third Party
- TÜV Rheinland Listed to NRTL/CANADA Safety Standards
- ISO 9001:2015 certified manufacturer

MaxCool 2000 Specifications

Typical Performance [a]	
Maximum Load	2000 W
Average Temperature at Maximum Load	-111°C
Coldest Temperature at No Load	-142°C
Typical Water Vapor Pumping Speed (from Typical Cryocoil Surface Area)	163,900 l/s
Maximum Pump Start Pressure[b]	1 atm
Ultimate Operating Pressure [c]	3E-9 torr 4E-9 mbar 4E-7 Pa
Time To Defrost [d]	4 minutes
Cryocoils and Refrigerant Lines	
Typical Cryocoil Surface Area	1.1 m^2 (11.8 ft^2)
Conservative Maximum Cryocoil Surface Area [e]	1.5 m^2 (16.1 ft^2)
Typical Refrigerant Line Length	2.4 m (8 ft)
Typical Single Circuit Cryocoil Tube OD	16 mm (5/8 in)
Typical Single Circuit Cryocoil Tube Length	21.9 m (72.4 ft)
Typical Dual Circuit Cryocoil Tube OD	12 mm (1/2 in)
Typical Dual Circuit Cryocoil Tube Length	14.6 m (45.2 ft)
Utilities	
Cooling water flow for 13 °C (55 °F)	6.8 l/min
Cooling water flow for 18 °C (65 °F)	9.1 l/min
Cooling water flow for 24 °C (75 °F)	13.6 l/min
Cooling water flow for 29 °C (85 °F)	27.6 l/min
Power Input (Standby Mode)	5.5 kW
Power Input (Cool Mode, Low Load)	6.2 kW
Power Input (Cool Mode, Maximum Load)	8.8 kW
Nominal Power Requirements [f]	200-3-50 208-3-60 230-3-60 380-3-50 400-3-50 460-3-60 480-3-60
Safety and Compliance	
Certified by an Independent Third Party for European PED-Compliance	Yes
Nontoxic Refrigerant Blends	Yes
Nonflammable Refrigerant Blends	Yes
Minimum Room Volume per EN 378 [g]	37 m^3 (1307 ft^3)
Minimum Room Volume per ASHRAE-15 [g]	25 m^3 (900 ft^3)
Maximum Operating Sound Level [h]	72 dB(A)
Maximum Operating Sound Level with Sound Attenuation Option [h]	64 dB(A)
Refrigerants used in the blend (see product I.D. label for amounts)	R-245fa, R-125 R-23, R-14, Argon
Total CO_2 equivalent emission (metric tons)	35.32

Footnotes: a) Under standard test conditions with a single-circuit model, 25°- 28°C cooling water, a 2.4m refrigerant line, a typical cryocoil surface area, 25°C temperature in the line of sight with the cryocoil, and 60Hz operation. b) Recommended cryopump start pressure is near normal "crossover." Mechanical roughing pumps and blowers are generally more effective for moisture removal above 1torr. c) Typical cryocoil at twenty five percent (25%) of maximum pumping speed. d) Many applications use smaller cryocoils and achieve significantly shorter defrost times. e) Larger cryocoils give greater pumping speeds, and can be used in some applications. Contact Edwards Vacuum for application details. f) For nominal power requirements not in the table, please contact Edwards Vacuum. Please refer to the manual for allowable voltage ranges. For 480 volt operation the maximum voltage is 506V. g) To comply with EN-378 or ASHRAE-15, the cryochiller should be located in a room no smaller than listed. h) Units were tested in a manufacturing environment while under maximum load in the COOL mode.

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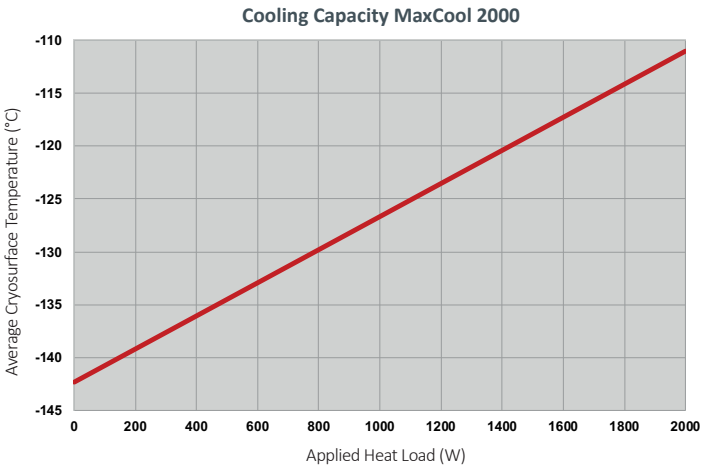
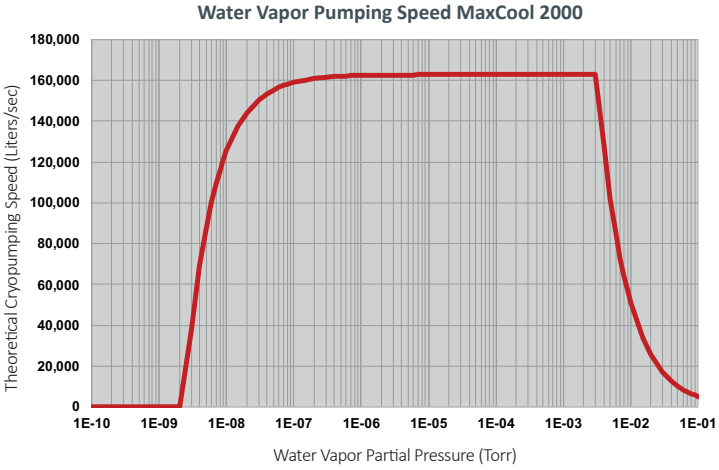
- At 25°C Ambient Conditions: 376.6 watts/m^2 (35 watts/ft^2)
- Refrigerant Line Heat Load: 26.3 watts/m (8 watts/ft)
- Vacuum Jacketed Line Heat Load: 1.0 watts/m (0.3 watts/ ft)
- Water Vapour Pumping Speed: 149,000 l/s/m^2 (13,842 l/s/ft^2)
- Liquid Nitrogen Cooling: approximately 45 watts/litre/hour

MaxCool 2000 Performance



Single-circuit model; temperature shown is average of inlet and outlet temperature using typical cryocoil size; temperature difference between inlet and outlet at maximum load is typically 20°C; end point of curve is maximum load; performance at 50Hz can be 3- 5°C warmer than 60Hz performance shown; 25- 28°C cooling water.



Single-circuit model; 2.4m refrigerant line; typical cryocoil surface area only; larger cryocoils will give greater pumping speeds and can be used in some applications; 25°C chamber temperature in line of sight with cryocoil; 60Hz; 25- 28°C cooling water.

По вопросам продаж и поддержки обращайтесь:

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Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
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Оренбург (3532)37-68-04
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Сочи (862)225-72-31
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Сургут (3462)77-98-35
Сыктывкар (8212)25-95-17
Тамбов (4752)50-40-97
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