HYBRID WATER COOLED ULTRA LOW TEMPERATURE AND CRYOGENIC FREEZERS

Models:
MDF-DU502VHW-PE | MDF-DU702VHW-PE
MDF-C2156VANW-PE

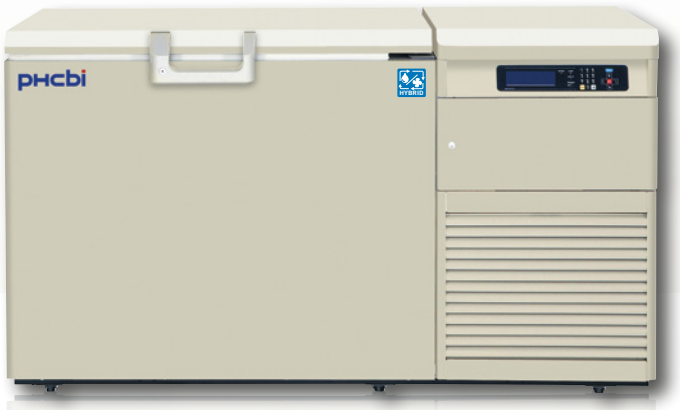
Hybrid water cooling improves the performance of the refrigeration system leading to reduced pull-down times. This provides faster temperature recovery after door opening and sample loading, thereby protecting samples by helping to maintain the correct temperature.

PHC Europe B.V.

www.phchd.com/eu/biomedical

Model: MDF-DU702VHW-PE

Model: MDF-DU502VHW-PE



Model: MDF-C2156VANW-PE

HYBRID ULTRA LOW TEMPERATURE FREEZERS

HYBRID VIP ECO Upright Freezers

526 litres Freezer (up to 384 2"boxes)
729 litres Freezer (up to 576 2"boxes)

MDF-DU502VHW-PE
MDF-DU702VHW-PE

HYBRID VIP Cryogenic Freezer

231 litres Freezer (150 2"boxes)

MDF-C2156VANW-PE

AN INTRODUCTION TO PHCbi HYBRID COOLING

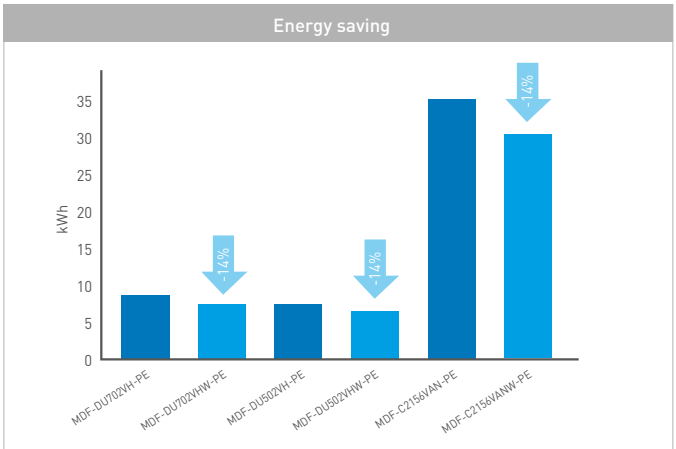
When a high-quality ultra low temperature or cryogenic freezer is equipped with a Hybrid water cooling option, the unit can handle a chilled water circuit to extract the generated heat from the condenser or use the traditional air-cooled way with a fan motor. With this new setup, the freezer can switch from water cooled to air cooled in case the water system is not operated. A Hybrid water cooled freezer will contribute to a significant reduction in power consumption and will also reduce the amount of heat dissipated into the air.

Compared to an air cooled freezer a Hybrid water cooled freezer will also have an improved temperature stability.

Benefits of Hybrid technology

LOWER ENERGY USE AND RUNNING COSTS

- Water has a greater heat absorption capacity than air. Therefore a water cooled condenser is more efficient than a conventional air cooled condenser. As a result, the compressor efficiency is improved, and the power consumption of a Hybrid ULT can be reduced by typically 10~12% compared to the equivalent air cooled model.
- Compared to an air cooled freezer a Hybrid water cooled freezer will reduce the heat dissipation into the air. This results in the reduction of air conditioning requirements for further cost savings.
- Potential to re-use the energy in the Hybrid water cooling system for other purposes within the facility to reduce site-wide energy costs.



IMPROVED FREEZER PERFORMANCE AND SAMPLE PROTECTION

- The greater cooling capacity of water compared to air improves the performance of the refrigeration system leading to reduced pull-down times. This provides faster temperature recovery after door opening and sample loading, thereby protecting samples by helping to maintain the correct temperature.
- Should the room air-conditioning fail, the room with Hybrid water cooled freezers will not warm up so quickly so samples in the freezers will remain safe for longer.
- The installation of a water cooled system to remove heat from ultra-low temperature and cryogenic freezers can assist organisations to reduce running costs and to meet environmental and energy reduction objectives.
- If the water system stops for any reason (failure or maintenance) the Hybrid water cooled freezer will start to work automatically on the air cooled condenser. This provides the best protection for your samples.
- The inverter compressors inside the MDF-DU502VHW-PE and MDF-DU702VHW-PE are developed for the best performance with the lowest energy consumption.

REDUCED HEAT DISSIPATION

COMPARISON MDF-DU702VH-PE VS MDF-DU702VHW-PE

Model	Heat dissipation	Power consumption (kWh/day)	Power consumption (W/hour)	Heat dissipation (kcal/hour)	Percentage (%)
MDF-DU702VH-PE	Total (air)	9.4	391.7	336.8	100%
MDF-DU702VHW-PE	Total (air+water)	7.8	325.0	279.4	100%
	Air			105.4	38%
	Water			174.0	62%

Reduction of Heat Dissipation into the air (MDF-DU702VH-PE vs MDF-DU702VHW-PE)	69%
Reduction of Power Consumption (MDF-DU702VH-PE vs MDF-DU702VHW-PE)	17%

Data measured with freezers running at Setpoint -80°C, Ambient Temperature 27.2°C, No Load inside the freezers

Conclusion: The hybrid cooling system of a MDF-DU702VHW-PE contributes in the reduction of Power Consumption and Heat Dissipation to the air compared to a standard air cooled MDF-DU702VH-PE. Especially at high ambient temperatures like 27.2 °C the reduction in Power Consumption and Heat Dissipation into the air is significant.

VIP ULT Freezers

PHCbi DESIGN & ULTIMATE RELIABILITY

VIP ultra low temperature freezers offer advanced cabinet design, reliable refrigeration systems and easy-to-use controllers making them ideal for the long-term secure storage of valuable samples. Every component is carefully selected and matched for optimum operation under demanding laboratory conditions, while the internal layout of the refrigeration system is meticulously designed for maximum heat removal, reducing stress on the system and therefore providing the highest levels of reliability and durability.

SUPERIOR PERFORMANCE

All PHCbi freezers are designed to provide the highest quality construction with superior performance. Key features such as strategically placed evaporator coils, VIP panels and insulated inner doors contribute to the unrivalled temperature uniformity and stability of VIP freezers, allowing the freezers to conform to the strictest standards and validation protocols.
Quieter operation is achieved through condenser fan blade design, noise reduction insulation, anti-vibration systems and internal compressor noise reduction.

EFFICIENT COOLING

Cascade refrigeration systems within the VIP upright freezers provide efficient cooling with optimized heat exchange pathways and increased cooling capacity for reliable sample protection and cost effective operation at ultra low temperatures.
With a Hybrid setup, the unit can switch from water cooled to air cooled when the water system is not operated. This is the best possible sample safe security on this system.
When the water chiller system of the Hybrid water cooled Freezers is linked to share heat with other resources, this could well be multiplying the use of the absorbed heat by the water chiller system. To be re-used for other purposes.

ENHANCED USE & INTELLIGENT SECURITY

Our freezers are managed and monitored by an integrated microprocessor controller with a comprehensive alarm system and diagnostic functions.
A Status Alert feature constantly monitors ambient and system conditions and notifies the user of any abnormalities before a problem occurs.

SUPERIOR FOOTPRINT

PHCbi ultra low temperature freezers with space-saving VIP insulation offer outstanding energy efficiency, whilst delivering exceptional cooling performance and durability for storing valuable research and clinical samples.

HYBRID TECHNOLOGY

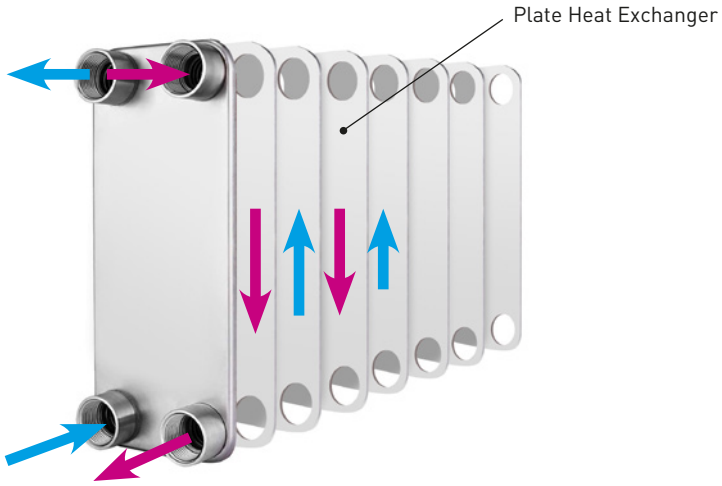
PHCbi's Hybrid water cooled technology on VIP ultra low temperature and cryogenic freezers improves the compressor efficiency. The power consumption of a Hybrid ULT can be reduced by typically 10~12% compared to the equivalent air-cooled model.

VIP PLUS INSULATION

PHCbi's patented VIP PLUS technology has resulted in a revolutionary vacuum insulation cabinet construction with improved thermal properties for superior temperature performance.

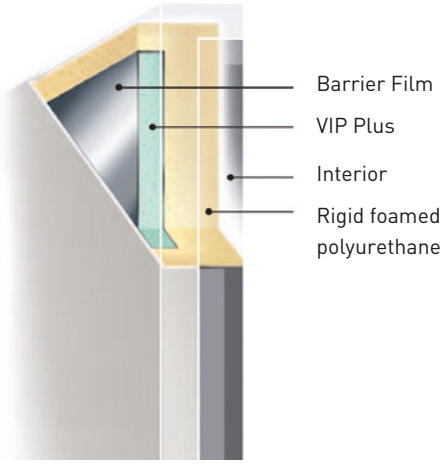
PLATE HEAT EXCHANGER

Heat energy from inside the freezer compartment is transferred by refrigerant gasses to a plate heat exchanger. Inside the plate heat exchanger energy is transferred from the refrigerant to a closed water circuit. The greater cooling capacity of water compared to air improves the performance of the refrigeration system leading to reduced pull-down times. This provides faster temperature recovery after door opening and sample loading.



INNOVATIVE DESIGN

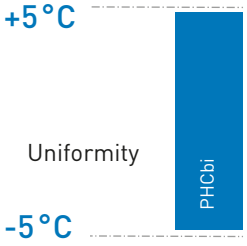
PHC was the first company to introduce vacuum insulation panels to ultra low temperature nd cryogenic freezers. The PHCbi patented VIP vacuum insulation panel thin-wall composite is a high-efficiency design that yields more interior storage volume in a conventional freezer footprint. The PHCbi VIP Freezer range typically provide 30% more storage capacity for a given floor area saving valuable laboratory space.



OPTIMUM UNIFORMITY

Uneven interior temperatures can lead to a loss in sample integrity. PHCbi freezers with uniform, stable temperatures and quick recovery times provide the best protection for your samples, ensuring reliable preservation while guarding against degradation.

Surpasses the customer preference of +/-5°C*

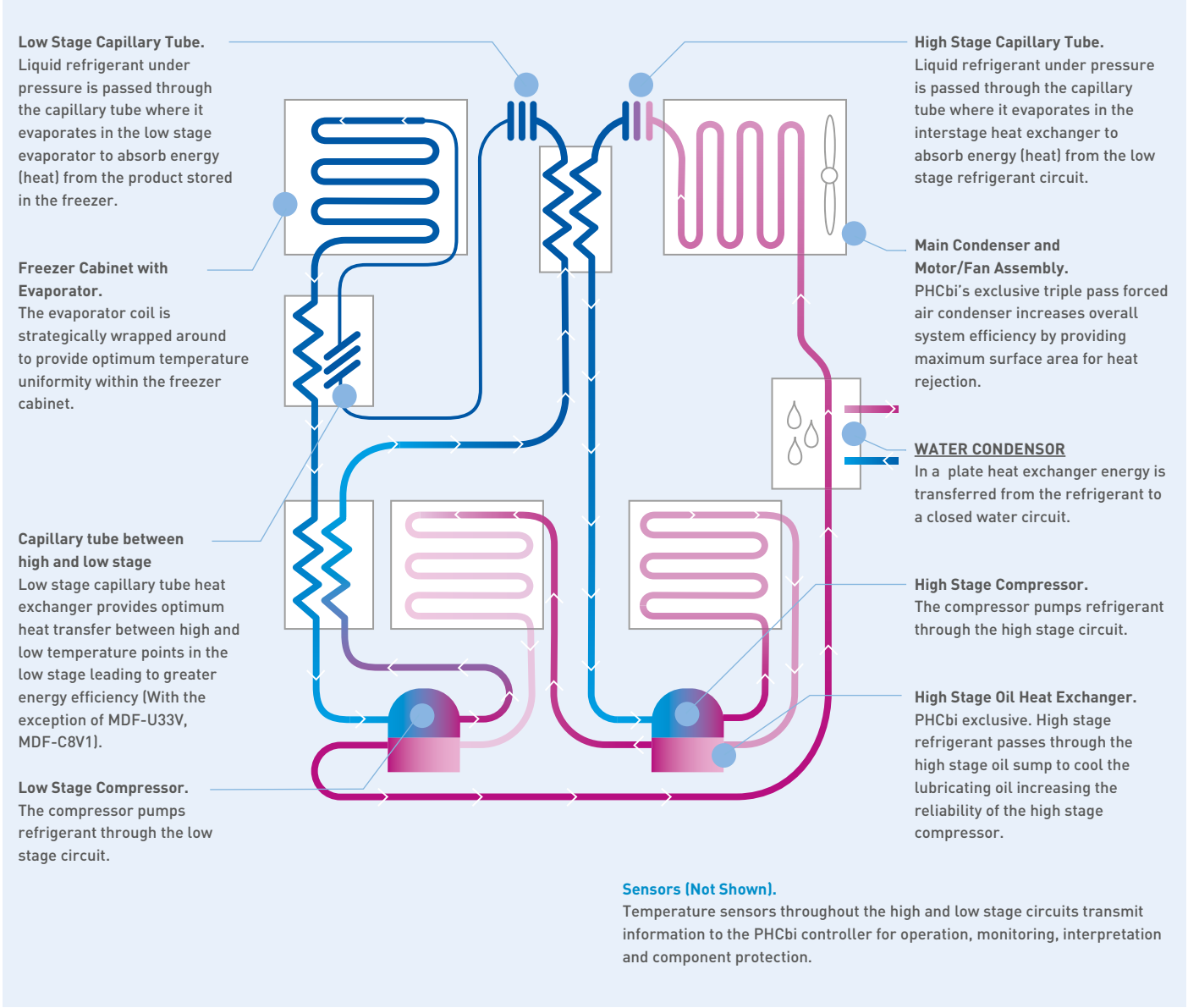


* Based on internal validation data tested at -80°C setpoint, in an empty chamber with 23°C ambient temperature.

* The data may vary depending on the use, circumstances and optional accessories. Validation documents can be provided for each serial number for an additional fee.

HYBRID CASCADE COOLING SYSTEM

Example of MDF-C2156VANW-PE



Ultra low temperature refrigeration systems can be extremely demanding with high operating pressures, increased temperatures and stresses and adverse effects on lubricant oil.

PHCbi refrigeration systems are specifically designed for their application. Two of the most important concepts in designing a superior energy saving ultra low freezer are the heat exchange pathways and the compressors:

- By providing optimum heat exchange pathways in the design, it not only increases efficiency of the system, leading to greater energy savings, but it will also have an effect of reducing stress on the compressors leading to greater overall system reliability. PHCbi's new capillary tube heat exchanger is the latest step in increasing the available heat exchange areas in the system.
- The compressors used within the VIP freezers are designed with special features to ensure low running temperatures. This reduces stress on the overall system for extremely reliable operation and exceptional durability.

HOW DOES WATER COOLING WORK?

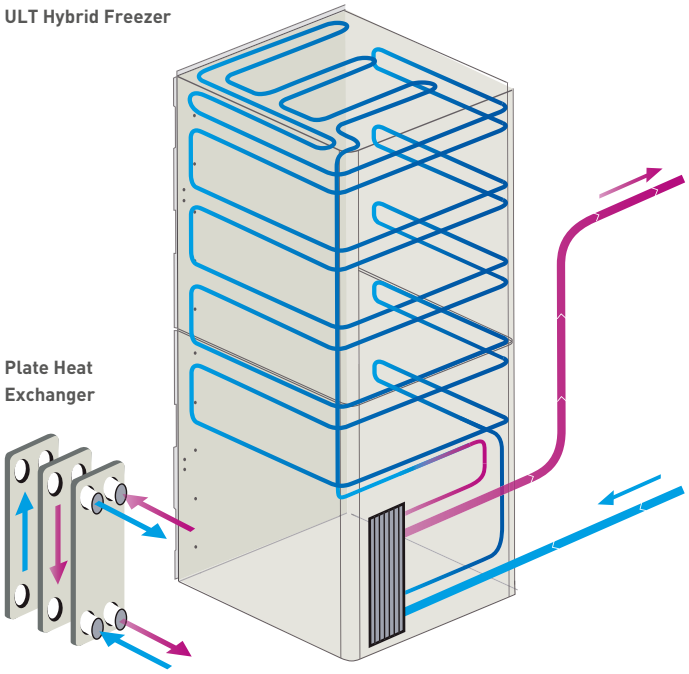
Stage 1

Heat energy from inside the freezer compartment is transferred by refrigerant gasses to a plate heat exchanger in the high-stage circuit, in front of the conventional air cooled condenser.

Inside the plate heat exchanger energy is transferred from the refrigerant to a closed water circuit.

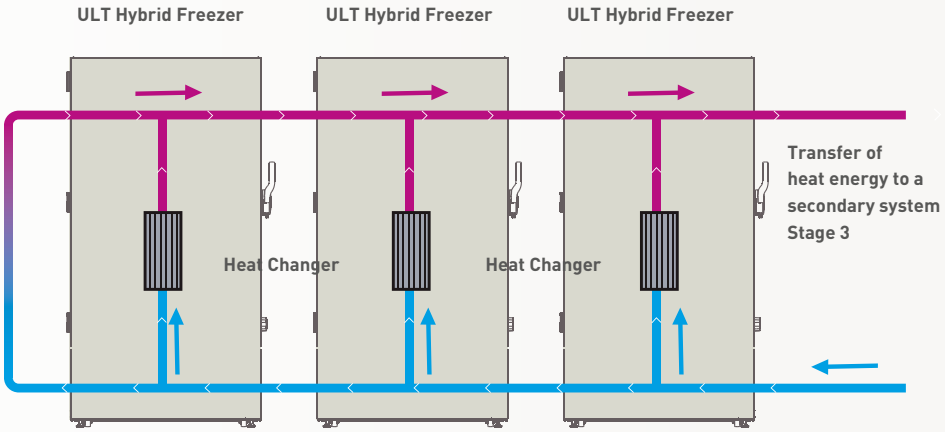
In the PHC design, heat is transferred from multiple points in the high-stage refrigeration circuit using a custom heat exchanger to maximise energy transfer and optimise freezer performance.

Note: using a water-cooled condenser, approximately 30% of the total heat energy generated by the freezer will be transferred to the water circuit. The remaining 70% will be dissipated in the room.



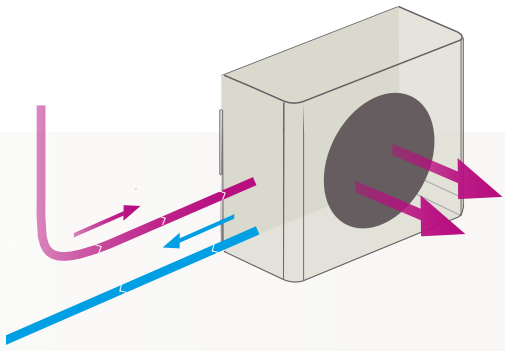
Stage 2*

The heat energy absorbed by the water is transported by the closed recirculating water circuit away from the freezers.



Stage 3*

The heat energy in the water circuit may be utilized for other uses within the building or wider facility, which require heat. Examples include heating of tap water, etc.



Stage 4*

Any remaining (unused) heat energy is removed from the building into the outside air.

VIP ECO ULT Freezers

VIP ECO Ultra Low Temperature Freezers with natural refrigerants minimise energy consumption, reduce environmental impact and save money. Innovative technology and Class IIa Medical Device Certification provide secure storage of valuable research and clinical samples. The VIP vacuum insulation ensures an optimal footprint to storage capacity ratio.

Model: MDF-DU702VHW-PE

The **VIP ECO** ULT Freezers use vacuum insulation panel (VIP) technology reducing wall thickness by around 50%, achieving 30% more storage capacity, and reducing the average cost per box stored. Leveraging the power of natural hydrocarbon refrigerants also allows the **VIP ECO** ULT Freezers to use smaller compressors, and reduce energy consumption. The natural hydrocarbon refrigerants combined with VIP insulation technology also help the environment by reducing the carbon footprint with up to 40% fewer emissions.

VIP ECO FREEZERS FEATURES

Model: MDF-DU502VHW-PE

Model: MDF-DU702VHW-PE

The new EZLatch door handle on the MDF-DU502VHW-PE, MDF-DU702VHW-PE makes access to stored samples even easier. Designed to open with minimal effort and repeatedly stress tested to ensure endurance.

1. Multiple access ports permit insertion of independent probes, instrumentation or liquid CO_2 back-up injectors.
2. Universal keyed door lock offers added security.
3. A vacuum release port (available on the MDF-DU502VHW-PE, MDF-DU702VHW-PE) allows smooth door opening when the door seal is tightened by negative pressure generated from temperature difference between chamber and ambient.
4. Insulated and gasketed inner doors seal inside to offer additional protection, improve uniformity.
5. EZlatch for smooth, one-handed operation and positive gasket seal.
   Provision for padlock.
6. Temperature recorder (optional) mounts easily in pre-engineered mounting space.
7. PHCbi designed compressors are specifically designed for ultra low temperature applications.
8. High impact, recessed casters and leveling feet simplify installation.
9. An integrated microprocessor controller with LCD Touch Screen to simplify all freezer functions.
10. Front access to washable, electrostatic condenser filter for routine condenser air filter cleaning.
11. Heated outer door gaskets and a 'hot line' circulating hot refrigerant gas around the door frame ensure minimal ice build-up.
12. In and out-port for water condenser

VIP ECO SERIES TOUCH SCREEN

1. **Present temperature display field:**
   The current chamber temperature is displayed.
2. **Set temperature value display field:**
   The set value of chamber temperature is displayed.
   Default setting: -80°C.
3. **Message display field:**
   Alarms, errors or messages are displayed when a fault occurs.
4. **Filter display:**
   Lights when the condenser filter has excessive dust accumulated on it and requires cleaning.
5. **Alarm display:**
   Normal condition: "Normal" is displayed.
   Alarm-activated, buzzer-delayed: "Alarm" is displayed.
   Alarm-activated, buzzer-sounding: "Warning" is displayed.
6. **Outer door (opening / closing display)**

VIP -150°C Cryogenic Chest Freezer

Cryogenic Freezers are well-known for maintaining uniform temperatures at -150 ºC for the reliable, long-term preservation of cells and tissues. With thin vacuum insulation panel (VIP) walls, the MDF-C2156VANW-PE **Cryo**genic Freezer can achieve more storage capacity than a conventionally insulated freezer without increasing footprint, while also maintaining superior temperature uniformity.

Model: MDF-C2156VANW-PE

CRYOGENIC FREEZERS PROVIDE SAMPLE STABILITY

A uniformity of +/-5ºC in our mechanically refrigerated **Cryo**genic Freezers is far superior to the top-to-bottom temperature uniformity provided by liquid nitrogen vapour phase storage, without the concern of cross-contamination often associated with liquid nitrogen (liquid phase storage).

APPLICATION SPECIFIC COMPRESSORS

The MDF-C2156VANW-PE is equipped with compressors that are specifically designed for ultra-low temperature applications. These compressors achieve a 10% reduction in energy consumption and the aerodynamically designed and placed components in the refrigeration compartment provide superior airflow, significantly reducing the stress to the freezer and contributing to excellent durability.

ULTRA-LOW -150ºC FREEZER WITH VIP PLUS INSULATION

Cryogenic Freezers with VIP PLUS vacuum insulation provide up to 30% more storage capacity than a conventionally insulated freezer, without increasing the footprint. A glass fibre core provides advanced thermal properties. This results in a large capacity -150ºC freezer for storage of up to 150 world standard 2" boxes with a minimal footprint.

VIP -150°C CRYOGENIC CHEST FREEZER LCD SCREEN

All alarm functions, self-diagnostic notifications and a graphical display of temperature performance over time are available in the specially designed LCD control panel. The blue display provides a clear view of the temperature and gives a notification in the case of abnormalities in temperature, ambient temperature, power supply etc.

SPECIFICATIONS

		Hybrid VIP ECO Upright ULT Freezers	
Model Number		**MDF-DU502VHW-PE**	**MDF-DU702VHW-PE**
Dimensions			
External dimensions (WxDxH) [1]	mm	790 x 870 x 1990	1030 x 882 x 1993
Internal dimensions (WxDxH)	mm	630 x 600 x 1400	870 x 600 x 1400
Volume	litres	528	729
Capacity	2" boxes	384	576
Net weight (approx)	kg	246	278
Performance			
Cooling performance [2]	°C	-86	
Temperature setting range	°C	-40 ~ -90	
Temperature control range [2]	°C	-40 ~ -86	
Control			
Controller		Microprocessor non-volatile memory	
Display		LCD Touch Screen	
Temperature sensor		Pt-1000	
Refrigeration			
Refrigeration system		Cascade	
High-stage compressor	W	750	
High-stage refrigerant		HC	
Low-stage compressor	W	750	
Low-stage refrigerant		HC	
Insulation material		PUF / VIP PLUS	
Insulation thickness	mm	80	
Construction			
Exterior material		Painted steel	
Interior material		Painted steel	
Outer door lock		Y	
Inner door/lid	qty	2 (insulated)	
Shelves	qty	3	
Max. load - per shelf	kg	50	
Max. load - total	kg	415	515
Vacuum release port		2 (1 automatic, 1 manual)	
Access port	qty	3	
- position		Back x 1 / bottom x 2	
- diameter	Ø mm	17	
Casters	qty	4 (2 levelling feet)	
Alarms			
Power failure		V-B-R	
High temperature		V-B-R	
Low temperature		V-B-R	
Filter		V-B	
Door open		V-B	
Electrical and Noise Level			
Power Supply		230V 50Hz single phase	
Noise Level [3]	dB(A)	52	
Options			
Liquid CO_2 back-up		MDF-UB7-PW	
Liquid N_2 back-up		-	
Temperature recorders			
- Circular type		MTR-G85C-PE	
- Chart paper		RP-G85-PW [8]	
- Ink pen		PG-R-PW	
- Continuous strip type		MTR-85H-PW	
- Chart paper		RP-85-PW [8]	
- Ink pen		DF-38FP-PW	
- Recorder housing		MDF-S3085-PW	
Drawers	qty	-	
Small inner door kit	set of 2	-	
	set of 5	MDF-5ID5-PW	MDF-7ID5-PW
	set of 4	MDF-5ID4-PW[6]	MDF-7ID4-PW [7]

1) Exterior dimensions of main cabinet only, excluding handle and other external projections - See dimensions drawings on website for full details
2) Air temperature measured at freezer centre, ambient temperature +30°C, no load
3) Nominal value - Background noise 20dB
4) Requires sensor cover MTR-DU700SF
5) Requires sensor cover MTR-C8-PW
6) Installation of small inner door kit may affect usable storage capacity

Cryogenic Freezers
MDF-C2156VANW-PE
1730 x 765 x 1010
760 x 495 x 615
231
150
318
-150
-125 ~ -152
-125 ~ -150
Microprocessor non-volatile memory
LCD
Pt-1000
Cascade with auto-cascade low-stage
1100
HFC
1100
HFC mixed
PUF / VIP PLUS
135
Painted steel
Aluminium
Y
2
-
207
-
1
Right
40
6 (3 levelling feet)
V-B-R
V-B-R
V-B-R
V-B
V-B
230V 50Hz single phase
51
-
Supplied as standard
-
-
-
-
MTR-155H-PW
RP-155-PW
DF-38FP-PW
MDF-S30150-PW

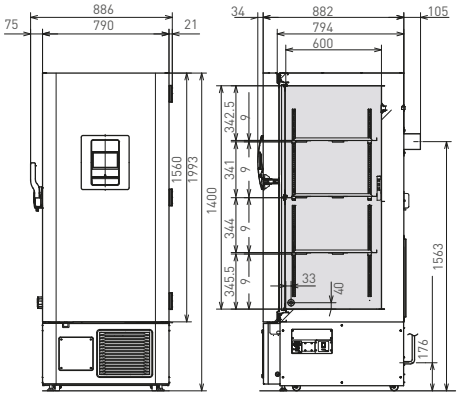
Technical Specifications	
Chilled Water Circuit requirements (Supplied by others, not PHC)	
System description	Closed loop recirculating chilled water circuit with pressure-controlled flow valve and by-pass, and isolating valves at each freezer connection point.
Water inlet temperature	Recommended: +15° ~ +20°C Maximum: +5° ~ +28°C
Target ΔT (return temperature)	+7~12°C
Water pressure	10 bar (maximum)
Water flow rate (on control)	8 litres/hour by 15°C water temperature. 23°C Ambient. Setpoint -80°C. ΔT8,7°C.
Freezer Specification	
System overview	PHCbi Ultra-low temperature freezer fitted with water cooled double plate heat exchanger. An internal pressure-controlled valve regulates water flow through the heat exchanger to optimize freezer performance. The valve can switch off completely during normal operation and therefore to protect the external recirculating chilled water system a pressure-controlled by-pass should be installed in the supply circuit (by others).
Monitoring & system protection	Secondary condenser outlet temperature (using filter sensor – shut-off high-stage compressor).
Connections	Male ½" 60 degrees boll HP NPT(P) located at the left back side of the freezer at a maximum height of 40cm from ground level, depending on model.
Power consumption*	Typical reduction of 10~12%
Heat dissipation / transfer*	Transfer to water cooling system: Typically, 30% Dissipation to room: Typically, 70% at AT 20°C

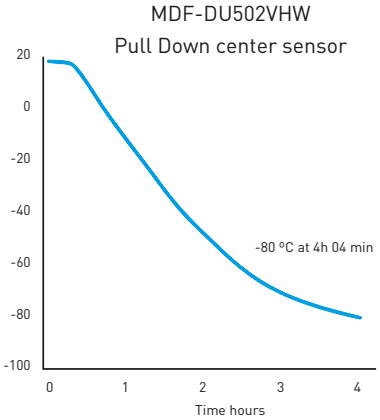
* Actual power consumption and heat dissipation depend on model and ambient conditions.

SPECIFICATIONS

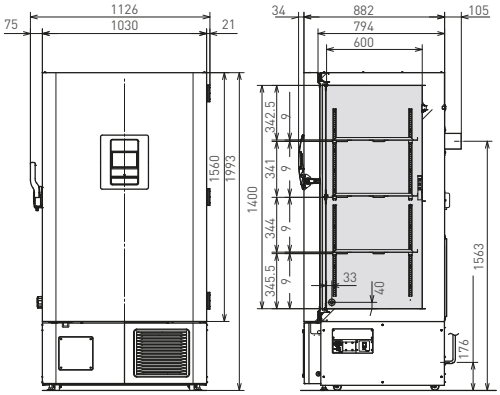
Dimensions & Performance Data

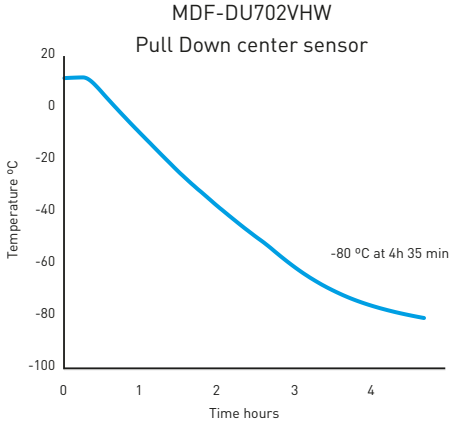
MDF-DU502VHW-PE - **526 LITRES**



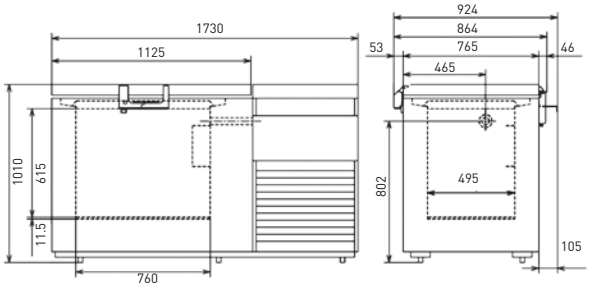


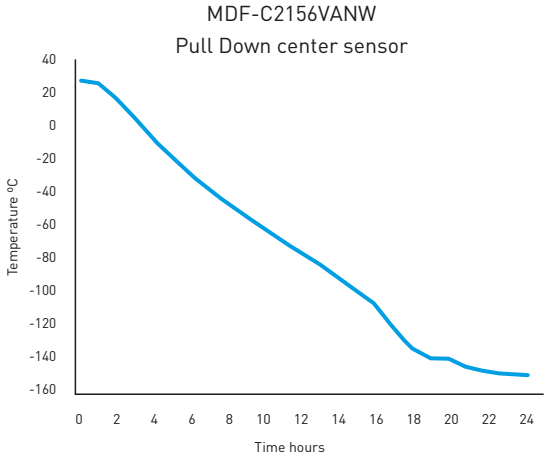
MDF-DU702VHW-PE - **729 LITRES**





MDF-C2156VANW-PE - **231 LITRES**





RACK CONFIGURATIONS

Models: MDF-DU502VHW-PE | MDF-DU702VHW-PE | MDF-C2156VANW-PE

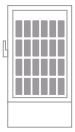
Example with SDR-624-P

MDF-DU502VHW-PE

Volume	528 Liter
Columns x rows	4 x 4
Total rack capacity	16

Example with SDR-624-P

MDF-DU702VHW-PE



Volume	729 Liter
Columns x rows	6 x 4
Total rack capacity	24

ALUMINIUM RACK SOLUTIONS

Vertical rack type	Box type	Rack/quantity Aluminium	Freezer layout (Columns x Rows)	Total boxes	Rack dimensions*			Maximum box dimensions: Footprint of box max width*	Maximum box dimensions: Lid of box max width*	Maximum box dimensions: Box height max height*
					Width	Depth	Height			
MDF-DU502VHW-PE										
with trays	2 inch	4 x HCS-296	2x2	384	280	560	685	133	136	52
with trays	2 inch	16 x HCS-6564	4x4	384	140	560	339	130	133	52
side opening	2 inch	16 x NIR-224U	4x4	384	139	559	334	135	135	52
with trays	3 inch	16 x HCS-4804	4x4	256	140	560	320	130	133	75
side opening	3 inch	16 x NIR-316U	4x4	256	139	560	334	135	135	75
MDF-DU702VHW-PE										
with trays	2 inch	6 x HCS-296	3x2	576	280	560	685	133	136	52
with trays	2 inch	24 x HCS-6564	6x4	576	140	560	339	130	133	52
side opening	2 inch	24 x NIR-224U	6x4	576	139	559	334	135	135	52
with trays	3 inch	24 x HCS-4804	6x4	384	140	560	320	130	133	75
side opening	3 inch	24 x NIR-316U	6x4	384	139	559	324	135	135	75

STAINLESS STEEL RACK SOLUTIONS

Vertical rack type	Box type	Rack/quantity Stainless steel	Freezer layout (Columns x Rows)	Total boxes	Rack dimensions*			Maximum box dimensions: Footprint of box max width*	Maximum box dimensions: Lid of box max width*	Maximum box dimensions: Box height max height*
					Width	Depth	Height			
MDF-DU502VHW-PE										
with trays	2 inch	16 x SDR-624-N	4x4	384	139.45	565.4	325.12	134	137	52
		16 x SDR-624-P	4x4	384	139.45	565.4	339.59	134	137	54,5
side opening	2 inch	16 x SUR-624-N	4x4	384	139.7	569.72	320.29	136	137	52
		16 x SUR-624-P	4x4	384	139.7	569.72	332.74	136	137	54,5
with trays	3 inch	16 x SDR-434-N	4x4	256	139.45	565.4	320.54	134	137	78
side opening	3 inch	16 x SUR-434-N	4x4	256	139.7	569.72	320.29	136	137	78
MDF-DU702VHW-PE										
with trays	2 inch	24 x SDR-624-N	6x4	576	139.45	565.4	325.12	134	137	52
		24 x SDR-624-P	6x4	576	139.45	565.4	339.59	134	137	54,5
side opening	2 inch	24 x SUR-624-N	6x4	576	139.7	569.72	320.29	136	137	52
		24 x SUR-624-P	6x4	576	139.7	569.72	332.74	136	137	54,5
with trays	3 inch	24 x SDR-434-N	6x4	384	139.45	565.4	320.54	134	137	78
side opening	3 inch	24 x SUR-434-N	6x4	384	139.7	569.72	320.29	136	137	78

* Unit: mm

MDF-C2156VANW-PE

Volume	231 Liter
Columns x rows	5 x 3
Total rack capacity	15

ALUMINIUM RACK SOLUTIONS

Vertical rack type	Box type	Rack/quantity Aluminium	Freezer layout (Columns x Rows)	Total boxes	Rack dimensions*			Maximum box dimensions: Footprint of box max width*	Maximum box dimensions: Lid of box max width*	Maximum box dimensions: Box height max height*
					Width	Depth	Height			
MDF-C2156VANW-PE										
opening	2 inch	15 x NIR-210C	5x3	150	142	141	590	133	133	53
side opening	3 inch	15 x NIR-307C	5x3	105	142	141	590	133	133	78

STAINLESS STEEL RACK SOLUTIONS

Vertical rack type	Box type	Rack/quantity Stainless steel	Freezer layout (Columns x Rows)	Total boxes	Rack dimensions*			Maximum box dimensions: Footprint of box max width*	Maximum box dimensions: Lid of box max width*	Maximum box dimensions: Box height max height*
					Width	Depth	Height			
MDF-C2156VANW-PE										
side opening	2 inch	15 x SCR-102-N	5x3	150	139.7	144	564.13	136	142	54
side opening	3 inch	15 x SCR-073-N	5x3	105	139.7	144	575.31	136	142	75

PHC Europe B.V.
Nijverheidsweg 120 | 4879 AZ Etten-Leur | Netherlands
T: +31 (0) 76 543 3833 | F: +31 (0) 76 541 3732
www.phchd.com/eu/biomedical