



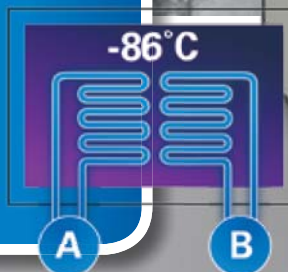
Twin Guard Series™ -86°C Ultra-Low Freezer Featuring SANYO -86 Dual°Cool Independent Refrigeration Systems

MDF-U500VXC



The Industry's Safest Ultra-Low Storage Solution for High Value Biologicals

The 18.3 cu.ft. V.I.P. PLUS™ insulated MDF-U500VXC holds up to 352 two-inch boxes. Includes integrated LCD performance monitor and digital controller for comprehensive system management, data logging, remote communications, alarms, predictive performance and validation. Maintenance free, filterless design.



For interactive product demo visit: www.twinguardseries.com

General Features & Benefits

What It Is	What It Does	Why It Is Important
-86 Dual°Cool Refrigeration Technology	Two independent refrigeration systems operate together or individually, depending on demand and performance environment.	One refrigeration system is always available to back-up the other in the event of a component failure.
EcoMode™ Performance	Two independent refrigeration systems running in overlapping cycles,	EcoMode™ optimizes run time, minimizes energy costs and maximizes interior temperature uniformity.
Environmentally Friendly Refrigerants	Eliminates potential for ozone depletion while maintaining cooling capacity.	Complies with the Montreal Protocol and IEC for safety and efficiency.
Filterless Condenser Design	Transfers energy from the refrigeration system with minimal heat output.	Eliminates the need for an air filter; optimizes heat exchange and minimizes compressor heat built-up over time.
Patented V.I.P. PLUS™ Vacuum Panel Composite Insulation	Combines high-efficiency vacuum-panels with conventional polyurethane structural foam and barrier film into a high-tech wall assembly.	Increases interior volume within conventional dimensions offering more storage capacity per sq.ft. of occupied floor space.
Integrated Graphical LCD Control Center	Combines all control, alarm, monitoring and data management functions into a single door-mounted system controller.	High visibility LCD display provides a convenient user interface to setpoints, current and previous temperature status, alarm parameters, internal diagnostics, communications and security.
Structural Enhancement	Integrates inventory management, access and site installation.	Cabinet design attributes include high-strength, lockable door latches and doors, latchable inner doors, adjustable shelves, vacuum release ports, locking casters and seismic restraints to simplify operation, installation and to satisfy local codes.
Compliant to International Standards	Assures quality standards, safety and performance criteria are met or exceeded.	Essential for compliance with LEEDs, RoHS, UL and other third-party standards and recommended practices.

Product Features



Service



V.I.P. PLUS™
Vacuum Insulation Panel



Filterless Design



Rechargeable Battery



CPU and Touch Pad



CFC Free



Automatic Alarm System



Remote Alarm



Energy Savings



Power Failure Alarm



LCD Digital Display



Quiet, Reliable Compressors



Insulated Inner Doors



Patented SANYO refrigerants are non-ozone depleting, non-flammable and environmentally safe in compliance with the Montreal Protocol.



The SANYO Twin Guard Series™ Ultra-Low Freezer for Ultra-Critical Installations and Applications

Application	Sensitivity	Benefit
Stem Cells, Cord Blood, T-Cells, Engineered Tissue, Organ/Tissue, Vaccines, Bone Marrow, Hybridomas, Lymphocytes, Cancer Cells, Clinical Specimens, Fibroblasts, Ova, Sperm	Highly sensitive to temperature fluctuations or uneven storage temperatures at different positions within the interior chamber.	Enhanced temperature uniformity, top-to-bottom, front-to-back, assures stability at all inventory locations.
BSL4 or Highly Secured Labs	Restricted access to the contained laboratory limits serviceability.	Twin Guard Series™ extends critical time necessary to react in the event of mechanical failure.

The SANYO MDF-500VXC Twin Guard Series™ ultra-low freezer is designed for -86°C storage of high-value biologicals. Ideal for critical material storage in repositories, highly secure BSL4 labs, hospitals, clinics and medical research facilities. The Twin Guard Series™ introduces the concept of dual, independent, auto cascade refrigeration systems contained within a single cabinet.

- The innovative design utilizing two independent systems allows the unit to continue to run continuously at -65°C in the unlikely event of one compressor failure.
- The combination of additional refrigeration intelligently managed by intuitive microprocessor controls and integrated into SANYO's patented V.I.P. PLUS™ vacuum panel cabinet make the most efficient use of available floor space.
- Twin Guard Series™ freezers significantly increase ultra-low protection while minimizing energy costs through a unique EcoMode™ function. EcoMode™ optimizes power consumption by orchestrating run times for each refrigeration system in response to cooling demands.
- Either circuit will maintain -65°C. In the unlikely event of a compressor failure in one system, the remaining system will automatically maintain a minimum of -65°C for an indefinite period.
- In the event of a facility power failure with optional CO₂ or LN₂ backup system installed, the freezer will maintain -65°C storage temperature for up to 8 hours (CO₂ backup system) and -65°C storage temperature for up to 15 hours (LN₂ backup system)
- A unique EcoMode™ deploys both systems in overlapping cycles to maintain -86°C and to reduce energy consumption by as much as 15%.
- Evaporator coils embedded in the patented, high-tech, SANYO V.I.P. PLUS™ vacuum-insulated thin-wall cabinet are strategically oriented to deliver the best temperature uniformity at all shelf levels, top-to-bottom and front-to-back.
- New SANYO designed Cool Safe™ refrigeration compressors feature innovative refrigerant feedback processes to reduce compressor temperature, thereby extending compressor life and minimizing heat output.

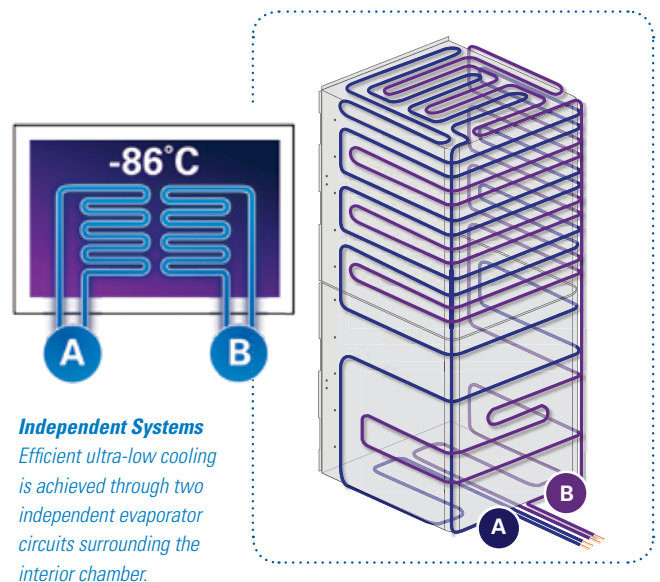
The Safest Ultra-Low Freezer for Long-Term Storage of Ultra-Critical Biologicals

The SANYO Twin Guard Series™ satisfies the industry demand for safe, long-term storage for the most high-valued materials. Two, independent refrigeration systems, combined with optional liquid nitrogen or liquid CO₂ back-up systems, offer a circle of protection unmatched in the marketplace. Developed for use with conventional inventory racks and boxes, the Twin Guard Series™ is ideal for storage of sensitive stem cells, embryos, cell lines, and other rare specimens.

Twin Guard Series™ -86 Dual°Cool™ Refrigeration System

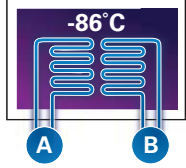
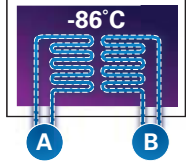
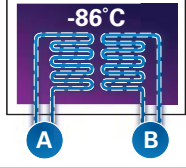
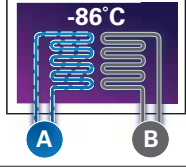
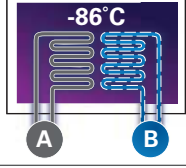
The Twin Guard Series™ Ultra-Low Freezer avoids conventional cascade refrigeration technology by using two completely independent one-compressor, autocascade cooling systems, each capable of maintaining ultra-low temperatures.

- Each refrigeration circuit includes a closed-loop cold-wall evaporator configured in parallel to the other.
- Independent evaporators and cooling fans assure back-up status at all times, eliminating system failure due to sub-component failure in conventional cascade systems configured of mutually dependent high- and low-stage systems.



Twin Guard Series™ Dual°Cool Refrigeration System

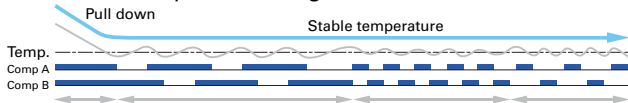
Dual, independent refrigeration systems operate in Normal or energy-saving EcoMode™ which is selected by the user and engaged through the LCD controller. Normal Mode is used for the strictest of GMP applications. EcoMode™ is applicable to 90-95% of applications.

Status	Function	Performance	
System A and B ON	Maximum Pull-Down and Recovery Capacity	Establishes highly uniform -86°C storage temperature; maximizes recovery following door openings and heat load additions	
System A and B ON, Cycling On/Off	EcoMode™	Maintains better energy management at high or low ambient temperatures as well as excellent top-to-bottom uniformity.	
System A and B ON, Cycling On/Off	Normal Mode	Maintains excellent top-to-bottom uniformity. Maintains most repeatable, cycling wave form for the strictest of GMP applications.	
System A ON	Back-Up for System B	Maintains minimum -65°C reserve temperature	
System B ON	Back-Up for System A	Maintains minimum -65°C reserve temperature	

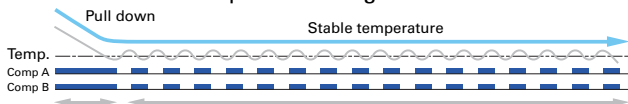
EcoMode™ vs. Normal Mode



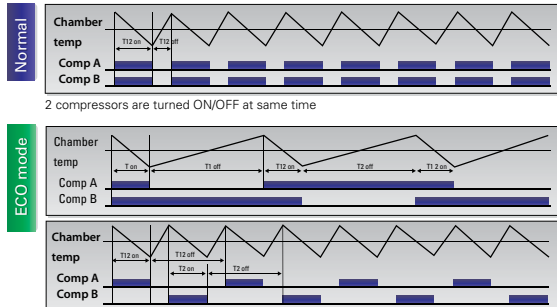
ECO mode operation image



NORMAL mode operation image



This chart shows the repeatable cycling wave form of normal mode vs. eco mode. Normal mode is for strict GMP applications.

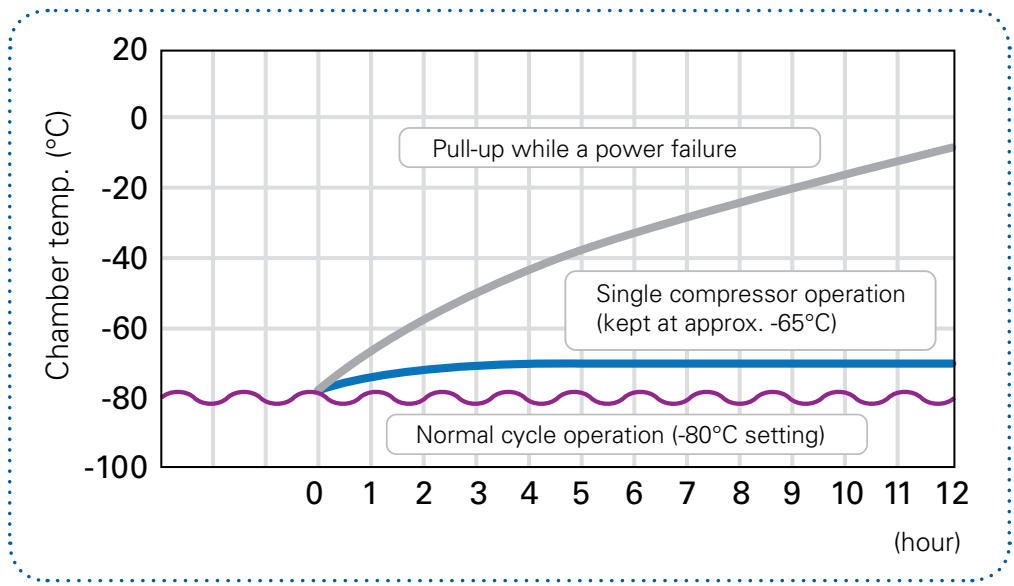


The SANYO Twin Guard Series™ Freezer can be set for Normal or EcoMode™ operation. EcoMode™ establishes an overlapping cycle to significantly reduce energy consumption.



Failure Mode Comparison: Twin Guard Series™ vs. Conventional Cascade Freezer

Event	Conventional Freezer, No Back-Up	Conventional Freezer, With Back-Up System	SANYO Twin Guard Series™
Fan Failure			If one fan fails, the second fan automatically maintains energy exchange.
High Stage Compressor Failure	Freezer fails.	Freezer fails, CO ₂ or LN ₂ back-up system offers short term protection until contents can be removed and repairs initiated.	No high or low stage used. Two refrigeration systems, each with a single compressor, operate independently in overlapping cycles during normal operation. If one compressor fails internal temperature is maintained indefinitely at -65°C. Optional LN ₂ or CO ₂ back-up system offers additional protection.
Low Stage Compressor Failure			



Performance Chart, power-failure situation Normal operation and Twin Guard Series™ backup.

SANYO Twin Guard Series™ Energy Savings vs. Conventional Freezers

Power Consumption Benefits

Ambient Temperature	Power Consumption Benefits	
	Conventional Cascade System	SANYO Twin Guard Series™
15°C	---	Normal Savings: -9.7% EcoMode™ Savings: -16.8%
23°C	---	Normal Savings: -7.8% EcoMode™ Savings: -14.1%

Reduced Power Consumption

The SANYO Twin Guard Series™ Freezer can be set for Normal or EcoMode™ operation, depending on ambient temperature and load. EcoMode™ is recommended for 90-95% of applications. Although both refrigeration systems are completely independent, EcoMode™ establishes an overlapping cycle to significantly reduce energy consumption while optimizing interior uniformity from top-to-bottom and front-to-back for protection of high value materials.

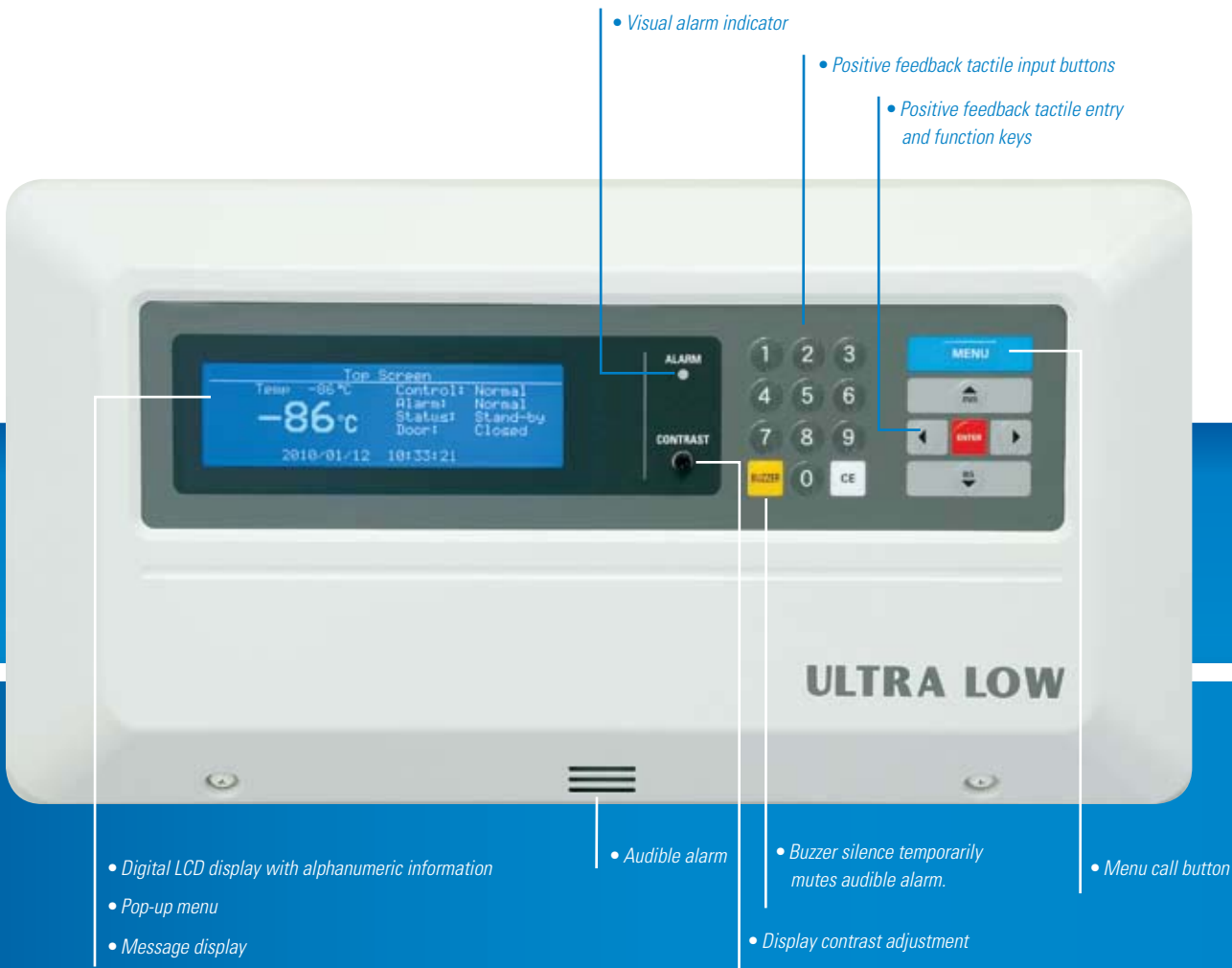
Control, Alarm and Monitoring

Integrated LCD Control with Graphical Display

The Twin Guard Series™ MDF-U500VXC is managed by an integrated microprocessor controller with LCD information center to simplify all freezer functions. Uniform ultra-low temperature is achieved through a combination of performance systems supervised by the controller complete with alarm, programming and diagnostic protocols.

- The control panel is center mounted in the outer door for easy, eye-level access.
- Control and information center includes an intuitive pop-up menu, high resolution LCD for inputs, outputs and performance at-a-glance.
- Multi-point data logging offers a graphical display for temperature verification at-a-glance.
- Precise logic systems control and adjust to temperature setpoints and alarm parameters.
- Setpoint, alarm and programmable inputs are established through pop-up menus and function keys.

- Standard parameters are factory-set for quick start-up, and all parameters can be changed as required.
- Logged parameters can be exported to remote databases, off-site alarm or data capture systems through optional communications board module for compliance monitoring. An optional PC interface permits remote transmission; see Accessories.
- A remote alarm terminal mounted at the side of the cabinet can be connected to an external alarm system.
- Tactile feedback, touch pad data shift and entry keys simplify operation. All setpoint and alarm functions are entered through an intuitive keypad with visual prompts.
- Both refrigeration systems, including compressors and fan motors are background monitored for performance.
- Out-of-compliance notifications and warnings are automatically displayed with audible warnings when necessary.





Graphical Information Center



All performance attributes are displayed on a large, visually intuitive LCD display.



Internal temperature log files are expressed in graphical form over time.



Out-of-compliance events are announced by visual and audible warnings. Error codes quickly identify problem sources and permit fast diagnosis and remediation.



Alarm Status Functions

The integrated microprocessor control aggregates information from the entire system and compares to normal or setpoint values. Out-of-compliance events are announced by visual and audible warnings, and remote alarm when connected to an external system.

Alarm and Safety Features	Event	Visual	Audible	Signal to Alarm Contact
Status Alert	Abnormal ambient (too high or too low), or abnormal freezer loading (too much warm product at one time).	Notification of Error on Graphical Display	None	None
High Temperature	Interior chamber warms beyond high temp setpoint		Intermittent tone. Time delay of 15 minutes after reaching alarm setpoint avoids false alarms. Intermittent tone.	Yes
Low Temperature	Interior chamber warms beyond low temp setpoint			N/A
Power Failure	Loss of Power		Solid tone	No
Control Temperature Sensor Failure	Sensor probe disconnect, short circuit or failure		Reverts to chamber temp display	None
Auto Return	Touch key is not pressed for 90 seconds	Notification of Error on Graphical Display	Solid tone sounds after 2 minutes (adjustable)	Yes
Door Alarm	Door open			

Twin Guard Series™ Features

- 1. SANYO patented V.I.P. PLUS™ vacuum insulation panel** cabinet construction for high insulating value and increased interior volume in the same footprint. The V.I.P. PLUS™ minimizes energy transfer to and from the ultra-low temperature interior. The composite construction, complete with reflective barrier film and structural closed-cell foam, is used on all walls and the outer door.
- This advanced insulation technology offers structural stability to eliminate distortion, and inhibits moisture accumulation that can lead to icing. Aggregate insulation efficiency minimizes compressor cycle run-time to lower energy costs.
- 2. Easy-In/Easy-Out™ door latch** for smooth, one-handed operation, positive seal against gasket. Key lock provision standard.
 - 3. Universal keyed door lock** offers added security.
 - 4. Integrated, microprocessor-based control system** and LCD display information center includes comprehensive setpoint, alarm, monitoring, diagnostic and communications functions.

- 5. Circular-chart temperature recorder** (optional) mounts easily in pre-engineered mounting space.
- 6. Insulated and gasketed inner doors** seal inside to offer additional protection, improve uniformity. Inner door latches are standard.
- 7. New, air-cooled Super Condenser** energy transfer technology maintains optimum condenser air flow and eliminates the need for an air filter or periodic cleaning and maintenance required by other manufacturers.
- 8. High impact, recessed casters** and leveling feet simplify installation.
- 9. Seismic restraints** secure cabinet to building superstructure to meet local codes.
- 10. New generation SANYO designed Cool Safe™ compressors** are specifically designed for one-compressor, autocascode applications.
- 11. Twin Guard Series™ redundant refrigeration -86 Dual°Cool™ circuits** offer two systems in one, each providing back-up for the other, or working together in EcoMode™ operation for additional energy savings.



The SANYO Patented V.I.P. PLUS™
Vacuum Insulation Panel thin-wall composite is a high-efficiency design that yields more interior storage volume in a conventional freezer footprint.



SANYO V.I.P. PLUS™ Series freezers offer high-density storage that effectively reduces the volumetric unit costs of ultra-low storage.

- 12. **Multiple access ports** permit insertion of independent probes, instrumentation or liquid nitrogen or liquid CO₂ back-up injectors.
- 13. **CFC-refrigerants** are highly efficient, environmentally safe, non-ozone depleting.
- 14. **Internal voltage and power management systems** assure component protection over wide voltage ranges.
- 15. **A vacuum relief valve** is mounted in the left wall.
- 16. **Remote alarm** contacts and optional communication port available; see Accessories.

Cabinet Construction

The Twin Guard Series™ cabinet features a patented SANYO V.I.P. PLUS™ vacuum insulated panel design which optimizes interior volume in the smallest footprint possible. The high-tech, composite thin-wall cellular construction combines the vacuum panel insulation with polyurethane foam for structural stability and high insulation values to minimize energy use.

- An Easy-In/Easy-Out™ outer door latch permits one-handed operation. A locking provision is designed for use with a conventional padlock.
- A universal keyed door lock prevents the outer door from opening.
- The outer door closes uniformly against a multi-point gasket to form a tight seal and prevent moisture migration leading to frost or ice build-up.
- The interior inventory system is based on a center shelf and two latching insulated inner doors designed for one-handed operation. Inner doors minimize exposure during routine door openings.
- The two primary compartments can be sub-divided by adjustable shelves to accommodate standard stainless steel inventory racks for 2" or 3" boxes (see Accessories).

- Rounded interior corners enhance temperature uniformity and simply cleaning and decontamination when required.



Green Design and Performance

Because modern laboratories are energy-intensive, SANYO has developed a corporate-wide energy savings and environmental impact approach to new product development. The Twin Guard Series™ ultra-low freezer offers significant benefits through a balance of refrigeration power, cabinet construction and intelligent control over all functions.

- The Twin Guard Series™ is designed to support LEED certification associated with the U.S. Green Building Council recommendations.
- Components are compliant with RoHS directives on the use of hazardous materials in electrical and electronic equipment.
- The SANYO V.I.P. PLUS™ vacuum insulated panel cabinet design offers high-density storage in a minimal footprint, optimizing available laboratory space and storage volume efficiencies as well as reducing energy consumption.
- Noise reduction and operating cost efficiencies are integrated into the refrigeration system.
- Heat output is limited to minimize the impact on facility HVAC demands.
- A microprocessor controller oversees the refrigeration system to regulate cooling cycle on/off times, reducing energy consumption in normal and EcoMode™ operating. EcoMode™ is selectable through the LCD controller by the end user and is recommended for use in most applications.



The SANYO ergonomic design features a high-security Easy-In/Easy-Out™ door latch designed for simplicity and safety. Also allows for one handed operation.

A vacuum relief valve is mounted in the left wall.



Rack Positions MDF-U500VXC

Inventory Capacity, Nominal*

Rack Positions, Standard Configuration

MDF-U500VXC

4 racks across x 4 elevations

Microplates in Racks, Standard SBS Footprint

Plates with foil tape cover	2112
Plates with cover lid	1632

Fiberboard Boxes in Racks

Boxes, 2" (5cm) high	352
Vials, 2" (5cm), 1.8-2.0ml, in 100 cell grid	35,200
Boxes 3" (7.6cm) high	224
Vials, 2" (5cm), 1.8-2.0ml, in 100 cell grid	22,400

*Maximum storage volume varies according to storage vessel, vial configuration, preservation protocol, laboratory technique and user preference. Contact SANYO for detailed information on inventory racks, boxes and storage options.

Specifications

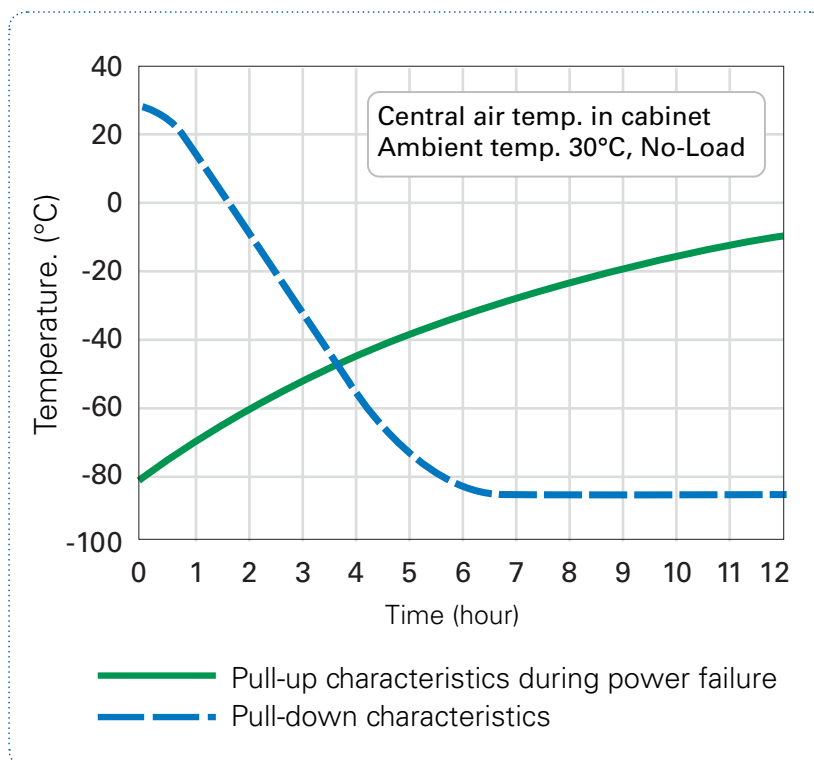
Model	Twin Guard MDF-U500VXC
Temperature Setpoint Range	-50°C to -86°C
Design Cooling Performance -86 Dual°Cool (both compressors)	-86°C (ambient temperature 30°C)
Single System Cooling Performance (Indefinite)	-65°C (ambient temperature 30°C)
Cabinet Design and Construction	
Cabinet Insulation	Patented V.I.P. PLUS™ composite wall, energy savings
Exterior Dimensions (W x F-B x H)	35.3" x 34.1" x 78.3" 890 x 870 x 1990mm
Interior Dimensions (W x F-B x H)	25.6" x 23.6" x 54.3" 650 x 600 x 1380mm
Volume	18.3 cu.ft./519 liters
Shelves	3, adjustable, stainless steel (4 compartments)
Access Port	diameter = 0.5"/17mm; 3 locations
Vacuum Release Port	Standard, manual.
Refrigeration System	
Refrigeration Technique	SANYO -86 Dual°Cool independent, redundant cooling systems with automatic switchover
Compressors	Per system: Single, hermetically-sealed 1100W SANYO Cool Safe compressor, air-cooled.
Refrigerant	Environmentally safe HFC
Air Exchange	Dual condenser fans with particulate trap; no filters are required
Cycle Options	Standard or energy-saving EcoMode™ operation
Controls, Alarm, Monitoring	
Controller	SANYO microprocessor-based, door-mounted control with graphical LCD information center
Data Management	Internal data log with log file memory.
Communications	Data can be transmitted via RS485 interface.
Alarms	High/Low temperature, door ajar, power failure, remote alarm contact, part replacement notification, fan motor lock, individual cooling circuit check.
Remote Alarm Contacts	Standard; Normally Open and Normally Closed, dry contacts.
Electrical	208V-230V, AC, 60Hz, 1 phase, NEMA 6-15, 15 amp; separate breaker recommended.

Options & Accessories

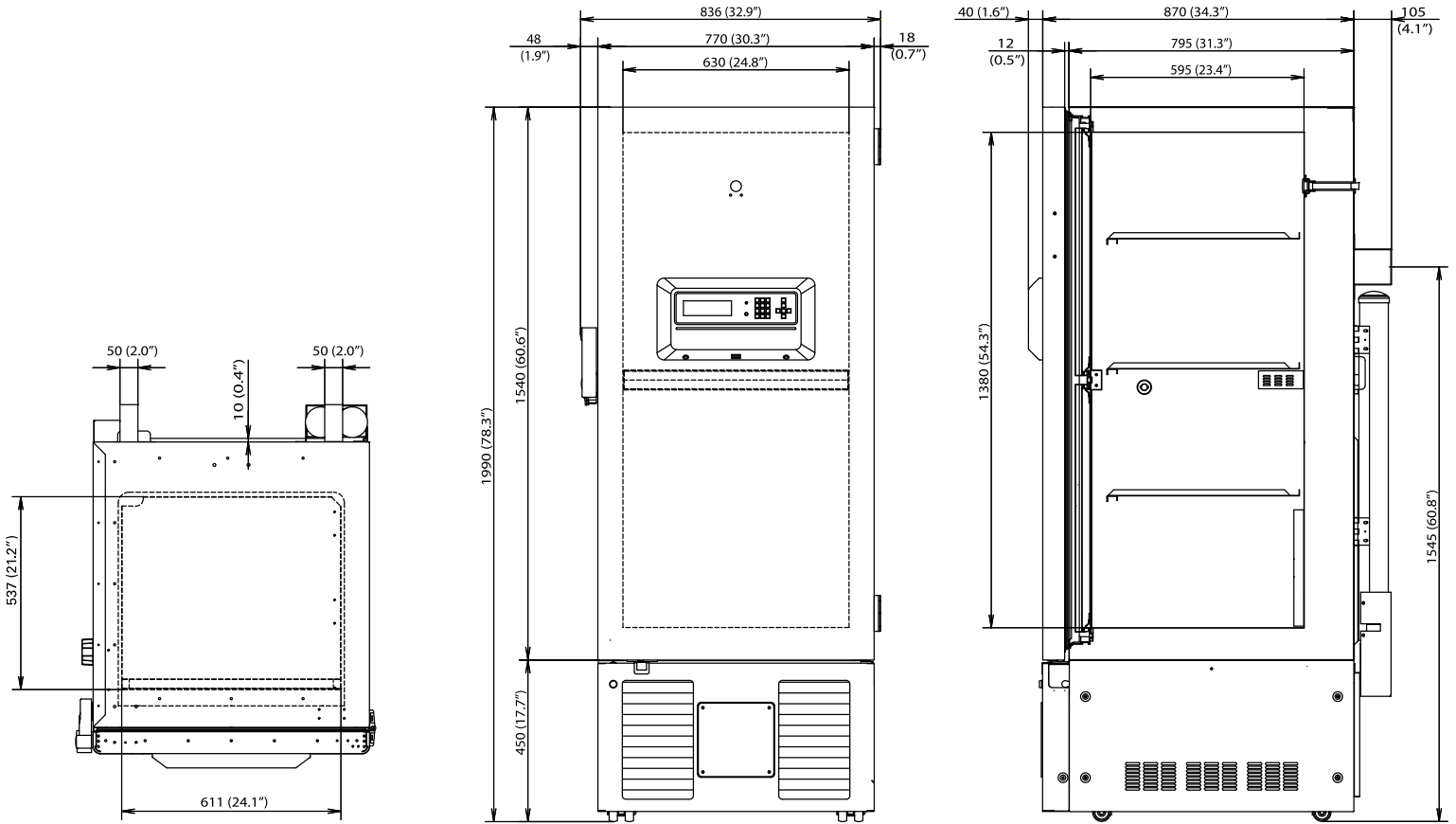


SANYO Biomedical products include a broad range of accessories to meet specific applications requirements. For accessory requirements or options not listed herein, contact SANYO or your authorized SANYO sales representative.

Accessory	Description	Catalog Number
Inner Door Configurations	See icons and key to catalog numbers.	MDF-5ID
Liquid CO ₂ Back-Up System	Auxilliary tank back in event of power failure	CVK-UB2(I)
Liquid N ₂ Back-Up System	Auxilliary tank back in event of power failure	CVK-UBN2
Chart Recorder	Circular Chart Temperature Recorder, 7 Day	MTR-C954
Chart Paper	6" Diameter, 7 Day Chart	C7100386REV
Replacement Pen, Red	Felt tip pens, 6 per pack	R252
Replacement Pen, Blue	Felt tip pens, 6 per pack	R253
Digital Temperature Recorder	Auxilliary Data Logger	HAMSTERDT2



Dimensional Drawing



SANYO is committed to developing green technologies that provide energy efficiency resulting in lower operational costs with less impact on the environment.

SANYO Electric Co., Ltd., Biomedical Division, Gumma is certified for Quality management system:ISO9001/Medical devices Quality management system:ISO13485/Environmental management system:ISO14001

For interactive product demo visit: www.twinguardseries.com



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