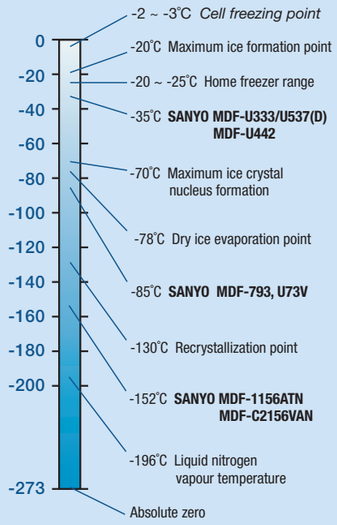


Until recently, liquid preservation containers were mainly used when preserving valuable samples over long periods. This method however, involved troublesome liquid control and the dangers of a liquid supply. In addition, mycoplasma etc. could cause cell and tissue contamination in liquid phase preservation. As a solution to this problem, demand for vapour phase preservation has increased. In preservation with liquid nitrogen vapour, temperatures can rise to approximately -150ºC, almost the same as the ultra-low temperature freezer's inner cabinet temperature of -152ºC. And freezer preservation provides users with numerous advantages; no worries about sample contamination, no liquid supply problems, no danger of sudden liquid eruptions, and low operational costs. This freezer provides easier and more stable long-term storage below the recrystallization point than ever before.

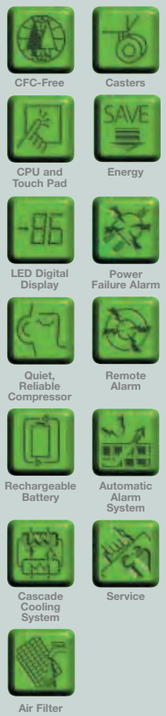
Applications

Preservation
- Cancer research: Tumor Cell Preservation
- Blood or Bone Marrow Preservation
- Bacteria Research: Virus Preservation
- Sperm & Fertilized Ovum (Bull, Goat, Horse, Pig, Chicken) Preservation
- Plant Cell Preservation (ie. Pollen)
- Monoclonal Antibody Preservation

Environmental Experiment
- Superconductivity & Electronics Experimentation (-148ºC)

User
- University
- Private Institute
- Public Research Center
- Hospital

PICTOGRAM
[FOR EXPL. P.3]

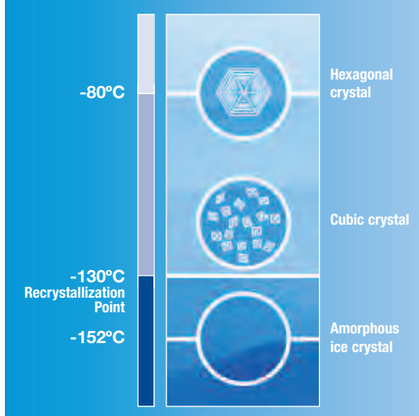


The world of -152°C

Achieves stable long-term preservation of cells and tissues.
In preserving cells or tissues at ultra-low temperatures, the point is to prevent amorphous ice crystals from recrystalizing within and outside the cells. These ice crystals have smaller diameters than the smallest substances (4,000 to 7,000A) that compose cells or tissues.
When ice crystals become amorphous, they are stored using cryoprotective agents such as glycerine and dimethyl sulfoxide (Me_2SO). The speed of ice crystal formation is thus further restricted during preservation below a certain temperature, and complete vitrification is possible. -130°C is the recrystallization point of pure water in the ultra-low temperature zone. This is the temperature at which amorphous ice crystals recrystallize.

For a mixed solution containing Me_2SO and other cryoprotectants, recent research confirms that recrystallization occurs around -115°C. Thus samples maintained in an ultra-low temperature freezer at -152° C, far lower than the recrystallization point, can be semi-permanently preserved. Such preservation maintains vitrification without further crystallization within and outside cells. Other recent findings show that preserving cattle sperm at -135°C is insufficient, and also that superconductivity experiments require temperatures of at least -148°C. These cases show the increased necessity of -152°C freezing.

Why freeze to –152°C ?
Recrystallization mechanism



Features

CFC-Free special mixed refrigerant
SANYO has developed a special mixed refrigerant, replacing chlorofluorocarbons (CFCs) that deplete the ozone layer. This new cooling system virtually eliminates damage to the earth's environment.

Specially designed compressor and cascade refrigeration system for an ultra-low temperature of -152ºC
A highly efficient, exclusive compressor has been specially developed and incorporated in the freezing unit. A refrigeration circuit with the Cool Safe compressor cascade refrigeration system enhances reliability of long-term preservation. With a powerful low noise design afforded by traditional ultra-low temperature technology, this freezer delivers durable, stable cooling.

Microprocessor temperature control with LED digital display allows accurate temperature control
Accurate temperature setting, confirmation and operation are all possible through microprocessor temperature control with a LED digital display and flat key data entry. The world's first electronically controlled freezer, this model maintains inner

cabinet temperature at an ultra-low -152ºC (ambient temperature of 30ºC), far lower than the recrystallization point for pure water (-130ºC). This low temperature provides an ideal preservation environment for long-term storage.

High-efficiency oil separator for stable ultra-low temperature environments
Compressors continuously repeat highly compressed operations, so lubricant oil is essential to prevent abrasion and seizure. But when lubricant oil circulates in the refrigeration circuit, piping becomes clogged and results in compressor damage. Incorporating an exclusive high-efficiency oil separator, the MDF-1156ATN effectively separates lubricant oil from refrigerant, offering a stable ultra-low temperature environment.

Special foamed-in-place polyurethane insulation material
The temperature difference between the inside and outside of the MDF-1156ATN unit reaches a maximum of 182ºC. In the ultra-low temperature range below -100ºC, ordinary foamed-in-place polyurethane insulating material can become cracked and warped. Specially designed to withstand low temperatures, Sanyo's foamed-in-place polyurethane is 170 mm thick and highly resistant to extreme temperature differences, thus helping maintain inner temperature stability.

Various alarm and safety devices for protecting valuable samples
Microprocessor-controlled filter-clogged check function protects the refrigeration circuit.
High temperature warning equipment automatically indicates when the temperature deviates 15ºC from the set temperature. The power failure alarm lamp and buzzer are activated in case of power failure or irregular temperature increase. A remote alarm contact is fitted. ATN models are also equipped with an auxiliary back-up system for liquid nitrogen.

Inner cabinet's easy-to-use design
Accommodates world standard 2"and 3"boxes.

SANYO Harmonious Society

sustainable future

Specifications

Model	MDF-1156ATN/1156
External dimensions (mm)	W1400 x D800 x H945 (W55.1 x D31.5 x H 37.2 inch)
Internal dimensions (mm)	W500 x D450 x H572 (W19.6 x D17.7 x H22.5 inch)
Effective capacity	128 L (4.5 cu.ft)
Door	1 door, Painted steel, Acrylic finish baked
Inner lid	1 lid
Insulation	Rigid polyurethane foam in place (HCFC Free)
Exterior	Acrylic finish baked on painted steel
Interior	Aluminium (Alumite treated)
Outer door latch	1 pc
Outer door lock	1 pc (latch integrated lock)
Casters	6 pcs (leveling leg 2pcs)
Access port	1 *Left side (Dia. 40mm)
Weight	Approx. 285 kg
Cooling performance	-152ºC(AT 30˚C,Inner air temp.1/2h)
Refrigeration circuit	Secondary cooling system
Compressor	High stage side : 1100 W (hermetic type) Low stage side : 1100 W (hermetic type)
Oil separator	SPK-0S02S2
Refrigerant	High stage side : HFC refrigerant (R407D+6pt) Low stage side : HFC mixed refrigerant
Refrigerating oil	Ze-NIUS32SA
Evaporator	High stage side : Cascade condenser Low stage side : tube on sheet type (Interior and exterior)
Condenser	High stage side : Fin and tube condenser Low stage side : Cascade condenser
Power supply	Local voltage *Single phase 220V, 50/60Hz *Single phase 230V, 50Hz *Single phase 240V, 50Hz

* The back-up system does not include container for liquid nitrogen. Required for the ATN model. MDF-1156 has no recorder.
* Specifications subject to change without notice.

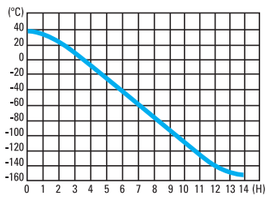
Specification / Function

Temperature controller		Microcomputer control system : keypad input Temperature setting range : from -125˚ to -155˚C (set by 1˚C) Setting value memory : non volatile memory
Temperature sensor		Pt. 1000
Temperature indication		LED display (1˚C increments)
Alarm	Temperature alarm	Temperature setting +15˚C (default) or +10˚C selectable ALARM lamp flashes and intermittent buzzer sounds (15 min. of delay) Remote alarm interface : Normal/Open, Normal/Close Interface rating DC30V, 2A Temperature alarm turns ON during power failure Alarm ring back function (OFF: 0, 10-60: by the minute)
	Filter alarm	FILTER check lamp flashes, intermittent buzzer sounds
	Power failure alarm	ALARM lamp flashes and intermittent buzzer sounds, Remote alarm operates
	Remote alarm	Remote alarm terminal 3P : DC30V, 2A NC-COM, NO-COM (Output at temperature alarm or power failure alarm)
Controller		Lamp: ALARM, FILTER, BACK-UP Display: LED BUZZER : buzzer stop key ALARM TEST : alarm test key SET : to switch the setting value and the inner temperature > : to shift the setting digit ∧ : to change the setting value ENT : entry key Battery SW (Shared power supply SW for MDF-1156/1156ATN) Remote alarm contact ON/OFF switch Back-up injection test switch Back-up ON/OFF switch
Self-diagnostic function		When either the temperature sensor, filter sensor, cascade sensor, A.T. sensor is faulty, error code and inner temperature is alternately displayed and remote alarm interface operates and intermittent buzzer sounds.
Power switch		Breaker switch
Compressor protection function		* Cascade sensor L-Compressor turns ON at under -24˚C L-Compressor turns OFF at over -10˚C * Overload relay and H-Compressor control (Pressure SW substitution function)
Options		Inventory rack : IR-209C for 2"box (Max.9pcs), IR-306C for 3"box (Max.9pcs) Storage case : MDF-49SC Recorder : MTR-155H Back-up kit : CVK- ATN2 (for LN_2) / AT2 (for LCO_2)

* Specifications subject to change without notice.

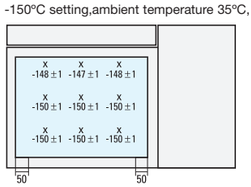
Performance data

Pull-down characteristics



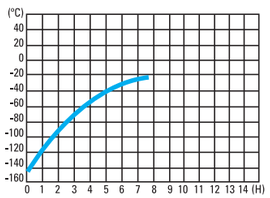
Temp. distribution inside cabinet

-150ºC setting,ambient temperature 35ºC, no load

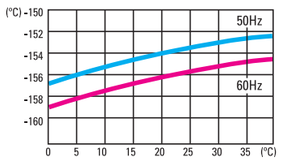


at: 20ºC low-temp. side operation rate 72%
ON: 10min OFF: 4 min

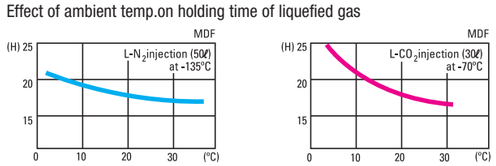
Pull-up characteristics during power failure



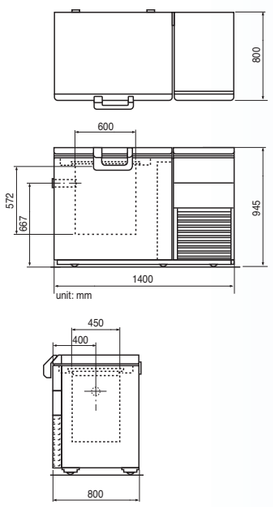
Effect of ambient temp. on inside temp.



Effect of ambient temp.on holding time of liquefied gas



Dimensions



Optional accessories

- Storage case MDF-49SC
- Recording paper RP-155
- Felt recording pen
- Recorder MTR-155H