

During the process of evolution, nature has developed perfect designs. Every detail is an example of perfect engineering, 100% dedicated to its task. Every form in nature has been created through its function. SANYO tries not to equal nature but learn from its dedication to make every aspect of engineering an evolution of ideas. We do not imitate we innovate. Think and re-think design and its purpose.

function creates form

conservation

incubation

sterilization

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A guide through the maze of ultra low freezers

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TECHNOLOGY FEATURES

| | |
|--|--|
|  <p>CFC-Free SANYO has developed refrigerants, which are not destructive to the ozone layer. SANYO is committed to CFC-free refrigerants by the year 2020-NOW!</p> |  <p>Air Filter The air filter used is specially located to give easy access for removal. The filter has the extra bonus of being washable for economy and easy maintenance. There is even a filter indicator to tell you it is time.</p> |
|  <p>CPU and Touch Pad The computer control system designed for low temperature application ensures accurate setting with touch-pad controls.</p> |  <p>Casters All models are mounted on wheeled casters to make any moving required easy.</p> |
|  <p>LED Digital Display The strategically located LED digital display is very easy to read. Specially linked to the CPU computer control for instant reaction.</p> |  <p>Energy The combination of efficient technology and construction bring the added benefit of considerable energy savings, freeing your funds for other purposes.</p> |
|  <p>Quiet, Reliable Compressor SANYO is the only company in the world to design and manufacture individual compressors exclusively for specific ultra low temperature freezers. SANYO's compressors ensure rapid pulldown and uniformity for every model every time.</p> |  <p>Insulated Inner Doors SANYO's unique doors are fully insulated to provide better uniformity and guarantee an airtight seal. Two inner doors ensure that exposure to incoming air is kept to a minimum when the outer door is opened.</p> |
|  <p>Rechargeable Battery A rechargeable battery is built in as the backup battery for alarms.</p> |  <p>Power Failure Alarm The backup battery sounds the alarm in the event of power failure, AC interruption or other abnormalities.</p> |
|  <p>VIP (Vacuum Insulation Panel) Up to 35% more space by use of the patented Vacuum Insulation Panels (developed by SANYO).</p> |  <p>Remote Alarm An alarm is sounded at a remote location if ever a breakdown occurs. A peace of mind feature for off-hour times in particular.</p> |
|  <p>Cascade Cooling System SANYO built compressors feature time-tested refrigerants and lubricating oils</p> |  <p>Automatic Alarm System Provides both an audible and visual temperature alarm when the temperature goes up more than 10°C from the set point.</p> |
|  <p>Service Always a top priority with SANYO is a proper service and maintenance program. SANYO guarantees a quick response if there is ever a need.</p> |  <p>Service Always a top priority with SANYO is a proper service and maintenance program. SANYO guarantees a quick response if there is ever a need.</p> |

Note: Specifications can vary - please check individual model specifications for details.

SANYO has established a worldwide reputation as a manufacturer of high-quality medical equipment over the past twenty years. In 1974 we introduced our first -40°C chest freezer, followed in 1975 by our first automatic tablet dispensing systems for hospitals. Since then we have expanded our range to include pharmaceutical refrigerators, ovens, incubators, bio-clean rooms and plant growth chambers. One of our greatest achievements was the development in 1991 of the world's first -152°C ultra-low temperature freezer.

SANYO automatic tablet dispensing systems have had a major impact in the automation of hospital management and the separation of dispensary from medical

practice. SANYO medical appliances can now be found all over North America, Europe and Asia, in particular South Korea, Hong Kong and Taiwan.

SANYO is the only company in the market that can provide all the elements for its medical equipment from its own research and manufacturing resources, which cover everything from original refrigeration and electronics technologies to compressors and semiconductors.

In 1993, SANYO led the world again as the first manufacturer to offer a complete range of CFC-free medical equipment using original patented CFC-free refrigerants, R-412a, R-509 and R-508 which were developed jointly with the

UK company, ICI Chemicals & Polymers Ltd. In 1994 our factories received ISO recognition. In 1995 ultra low temperature freezer HFC refrigerant TP5R3 registered with ASHRAE as R-508A. In 1996 MIR-D30 authorized DNA amplifier. ISO 9001 obtained. In 1997 MDF-U70V -86°C ultra low temperature freezer with Vacuum Insulation Panels. In 1998 vacuum chamber method automatic leak detection in refrigeration units. ISO 14001 obtained

The evolution of SANYO Biomedical Equipment Development (Main products, launch year)

- 1966 Pharmaceutical fridge
- 1969 Incubator
- 1973 Medical autoclave
- 1974 -40°C freezer MDF-400
- 1975 Pharmaceutical fridges MPR-110/210
Cooled incubator MIR-150/250/550
- 1977 -86°C ULT freezer MDF-230
-30°C medical freezer MDF-390
- 1978 Upright medical freezer MDF-300
- 1979 -86°C ULT freezer MDF-290
Bloodbank fridge MBR-505
- 1980 -86°C upright ULT freezer MDF-380
Prefab refrigerator MCU-1000
Cooling unit MCU-5020
- 1981 -30°C medical freezer MDF-130
Compact bloodbank fridge MBR-105T
- 1982 PI controlled oven MOV-102/202
Large pharmaceutical fridges MPR-510/1010
Pharmaceutical refrigerator with -30°C freezer MPR-211F
- 1983 Compact -86°C ULT freezer MDF-190
PID controlled heated incubators MIR-160/260
- 1984 Water jacketed CO₂ incubator MCO-165
- 1985 Dry heat steriliser MOV-102S/202S
- 1986 HEPA-filter unit MBCR-717
Cleanroom unit MBCR-2220C
Air jacketed CO₂ incubator MCO-95
- 1987 -135°C ULT freezer MDF-2135
Pharmaceutical fridges MPR 161D/311D
- 1988 Bio-clean bench MCV-9/13/16
- 1989 Programmable cooled incubators
MIR-152/252/552
- 86°C double-door upright ULT freezer MDF-U581
- Establishment of own SANYO bio-soft laboratory at the Tokyo plant
- 1990 Plant growth cabinet MLR-350
SANYO Gallenkamp PLC factory and SANYO Gallenkamp BV sales organisation established.
- 1991 Multi-gas Incubator MCO-175M
World's lowest temperature freezer produced (-152°C), MDF-1155(ATN)
Bench-top clean bench MCV-711ATS
- 1992 Programmable high-temperature oven MOV-313P
Plasma blast freezer MDF-U460B
- 1993 4-door pharmaceutical refrigerator with -30°C freezer MPR-411F/411FR
A complete range of CFC-free medical equipment
- 1994 ISO 9002 recognition
- 1995 CFC free refrigerants recognised by ASHRAE, EPA Stratospheric Ozone Protection Award.
- 1996 ISO 9001
- 1997 World's first vacuum insulated -85°C freezer MDF-U70V introduced.
- 1998 Pharmaceutical refrigerator MPR-512/1012
ISO 14001 (environmental recognition)
- 2000 Introduction of InCu-saFe active background contamination control in CO₂ incubators
- 2001 Establishment of SANYO Electric Biomedical Co. Ltd.
- 2002 Introduction of SAFE-CELL revolutionary UV sterilisation in CO₂ incubators
- 2003 -86° VIP freezers MDF-U32V/52V
Multi-gas Incubator MCO-18M
- 2004 Introduction of SANYO Biomedical Europe BV



SANYO's Medical Equipment Technologies effectively answer the needs of the modern age

A complete range of advanced products in support of medicine and research

The philosophy behind SANYO's overall product development strategy can be summed up as "human-oriented design". Taking into consideration such themes as food, clothing, housing, health and knowledge, the company is actively working on a wide range of projects aimed at making life in our complicated modern society more comfortable and rewarding.

Fully utilising the world's most advanced compressor technology and the company's state-of-the-art electronics technology, SANYO has steadily pushed freezer temperatures down from -45°C to an ultra-low -86°C. In addition, the company has successfully developed the first ever ultra-low temperature freezer capable of achieving temperatures as low as -152°C. At these low temperatures, the ultra-low temperature freezer can preserve live organisms for a period of 10 years or more.

Environmental experiments are vital for biotechnology research, and SANYO's experimental control technology supports a wide variety of experiments in fields such as cytophysiology, genetics, virology, pharmacodynamics, etc.

Through full use of the latest electronics technology and control systems, temperature, humidity, cleanliness, CO₂ concentration and pressure can all be automatically controlled and maintained at user-designated levels.

By providing products based on the three technological supports of ultra-low temperature, culture and clean technology, SANYO has increased the possibility of biotechnology becoming the representative technology of the 21st century.



-152°C/-135°C/-86°C ultra-low temperature freezers (MDF)
 -40°C/-35°C/-30°C medical freezers (MDF)
 Blood bank refrigerators (MBR)
 Pharmaceutical refrigerators (MPR)
 Cooling room (MCU)

Freezers/refrigerators with totally reliable internal temperatures.

CO₂ incubators (MCO)
 Cooled incubators (MIR)
 Heated incubators (MIR)
 Plant growth chamber (MLR)

Incubators for advanced research and testing.

Bio-clean room (MBCR)
 Safety cabinet (MCV)
 Bio-clean bench (MCV)
 Clean bench (MCV)
 Hepa-filter unit (MBCR)

SANYO's knowledge extends to bio and industrial clean rooms

Electric ovens (MOV)
 Dry heat sterilizers (MOV)
 Autoclave (MAC/MLS)

Equipped with electronic control systems, these models limit temperature fluctuations

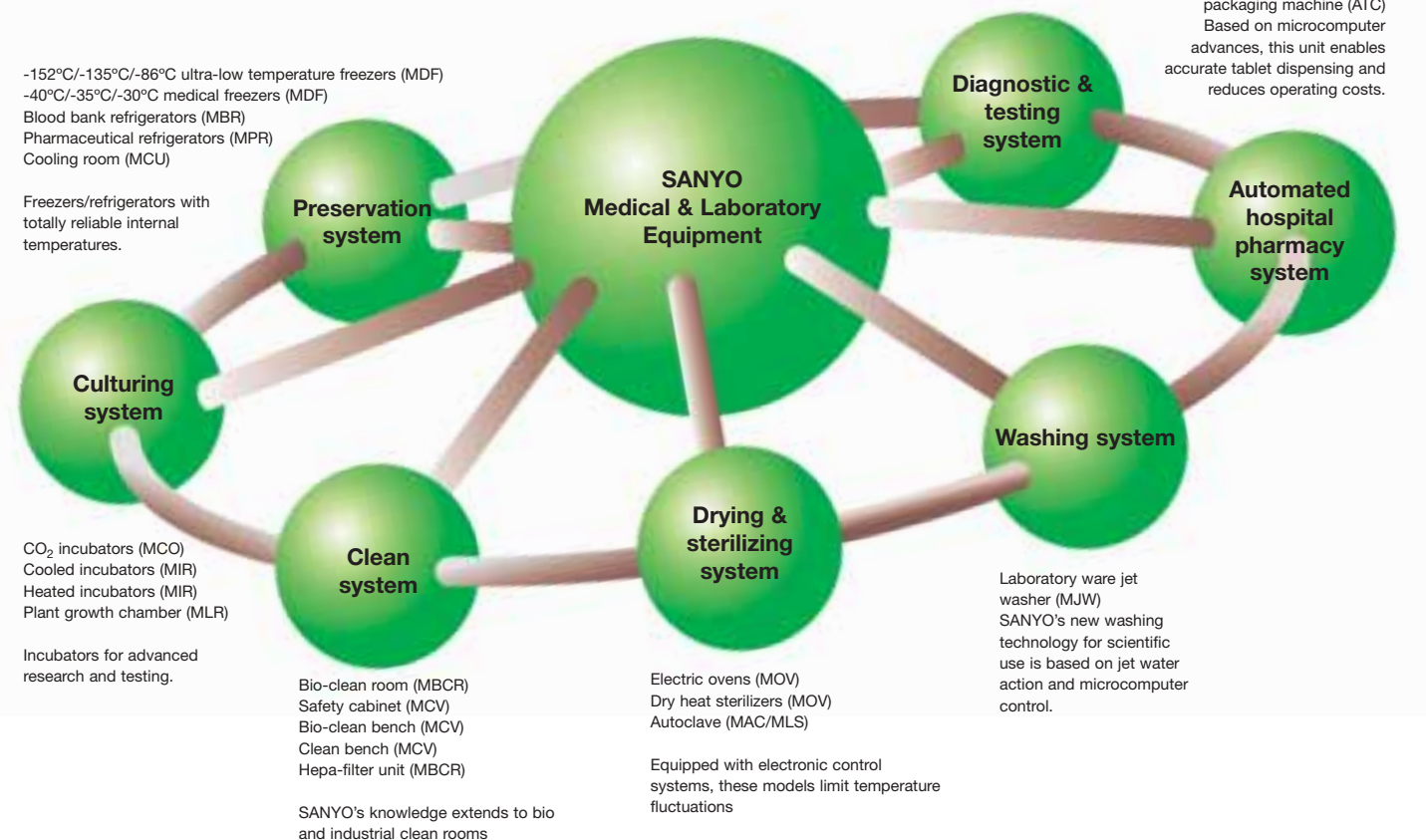
Diagnostic & testing system

Automatic tablet counting and packaging machine (ATC)
 Based on microcomputer advances, this unit enables accurate tablet dispensing and reduces operating costs.

Automated hospital pharmacy system

Washing system

Laboratory ware jet washer (MJW)
 SANYO's new washing technology for scientific use is based on jet water action and microcomputer control.





A guide through the *maze*
of ultra low freezers



Questions to ask:

1. Do you manufacture or develop your own key refrigeration components (i.e. refrigerants, compressors)?
2. Are your refrigerant(s) CFC-free and how long have you been using them?
3. What is the Global Warming Potential (GWP) of your refrigerant(s)?
4. Has any of your innovative technology won environmental awards?
5. What is the electrical requirement of your laboratory freezer?
6. Do you have ISO14001 certification (the ISO14000 series of standards have been developed to provide business management with the structure for managing environmental impacts)?

symbiosis

Strike One!

Scientists have determined that the atmosphere's ozone layer is being eaten away by the release of chlorine-containing compounds. In 1987 the industrial countries of the world decided to do something about it. They met in Montreal, Canada and agreed on the elimination of certain compounds such as chlorofluorocarbon (CFC) refrigerant gases.

Strike two!

CFC's are also greenhouse gases and they contribute to global warming. In 1997, 160 nations reached a historic agreement in Kyoto, Japan, on limiting emissions of CO₂ and other greenhouse gases.

Strike three, You're out!

Older refrigeration systems that use CFC's may not be energy efficient. This requires more electrical power, meaning more fossil fuels are burned at the power plant. This leads to higher emissions of air pollutants including CO₂ which contributes to global warming.

Now that CFC refrigerants are out of the game, it is important to find out how laboratory freezer manufacturers have replaced them. Though the replacement refrigerants are environmentally friendly, their chemical properties have challenged freezer manufacturers and forced them to redesign their products.

Unfortunately, most freezer manufacturers do not have the resources to develop their own key components required for freezer production. This caused many problems replacing CFC's.

Two such components are refrigerants and compressors.

With only "off the shelf" components available, many manufacturers ended up compromising performance, reliability and field serviceability just to keep freezer production up and units moving out the door.

Customers armed with a few strategic questions will be able to choose a laboratory freezer manufacturer that is proactive in developing environmentally friendly technologies that do not compromise performance, reliability and field serviceability.



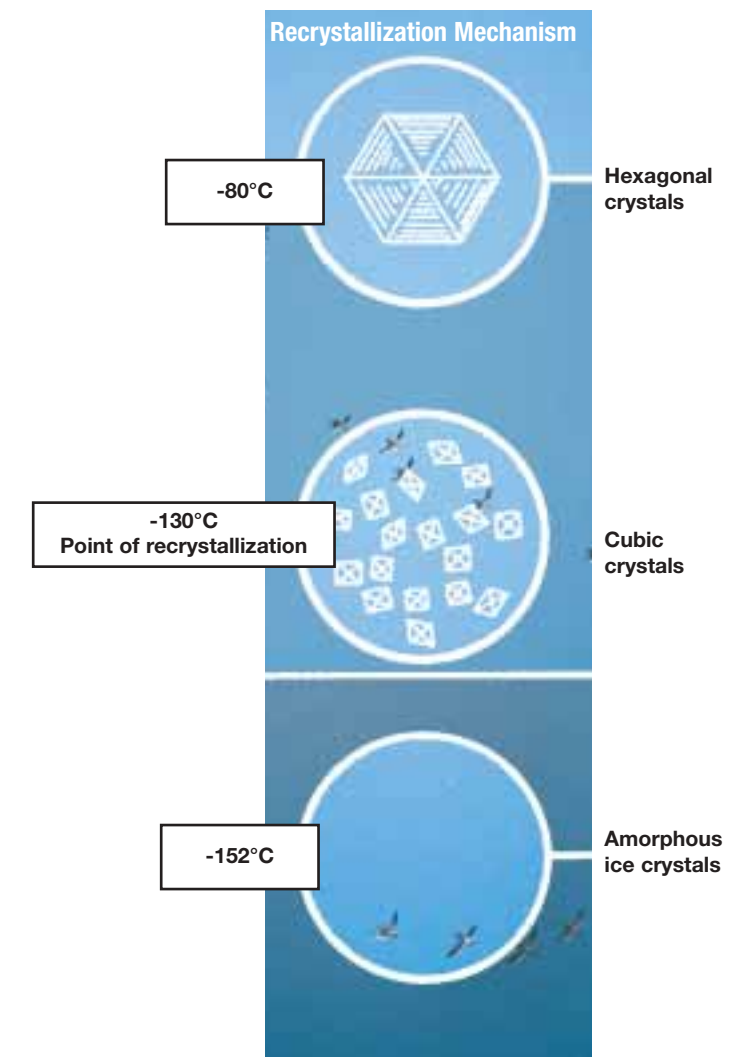
| °C | Blood | Plant & animals | Micro-organisms | Pharmaceutical | Industrial products | Notes |
|------|------------------|-----------------|-----------------|----------------|---------------------|---|
| 0 | | | | | | |
| -10 | | | | | | |
| -20 | | | | | | |
| -30 | | | | | | Point of fastest growth of ice crystals |
| -40 | Bloodplasma | | | | | |
| -50 | | Enzyme | | | | |
| -60 | | | Microbes | Reagents | | |
| -70 | | | Yeast | Medicines | | |
| -80 | | | Bacteria | Serum | | |
| -90 | | | DNA | Vaccines | | |
| -100 | | | Viruses | Radioisotopes | | |
| -110 | Red blood cells. | Cells, Skin | | | Industrial products | |
| -120 | Blood platelets | Organs | | | Components | Recrystallization point (-130 °C) |
| -130 | Lymph cells. | DNA | | | Behavioral tests | |
| -140 | Granulocyte | Embryos | | | | N ₂ critical temp. (-147°C) |
| -150 | | Corneas | | | | |
| -160 | | Bone marrow | | | | |
| -170 | | Sperm | | | | |
| -180 | | Cell culture | | | | |
| -190 | | Cancer cells | | | | |
| -200 | | | | | | Liquid nitrogen evaporates (-196°C) |

the way to the right temperature

Manufacturers have designed freezers in a variety of styles, sizes and operating temperatures to meet today's stringent validated storage requirements for laboratory products.

When choosing a laboratory freezer, the required storage temperature of your product including the defined tolerances, should be verified.

Why freeze to -152°C?



You don't have to be a physicist to understand the basic operation of a refrigeration system. Refrigeration is defined as the transfer of heat energy from an unwanted place to a place where it is tolerated. This is accomplished by using a liquid which absorbs heat as it turns to a gas.

This will allow the lubrication oil to return to the compressor without collecting in small tubes or corners thus causing a blockage of the gas or liquid refrigerant flow. (commonly referred to as oil logging).

The above explains the common single compressor system, which can achieve temperatures of -40°C to -50°C.

To achieve this goal there are a number of key components that must work in harmony.

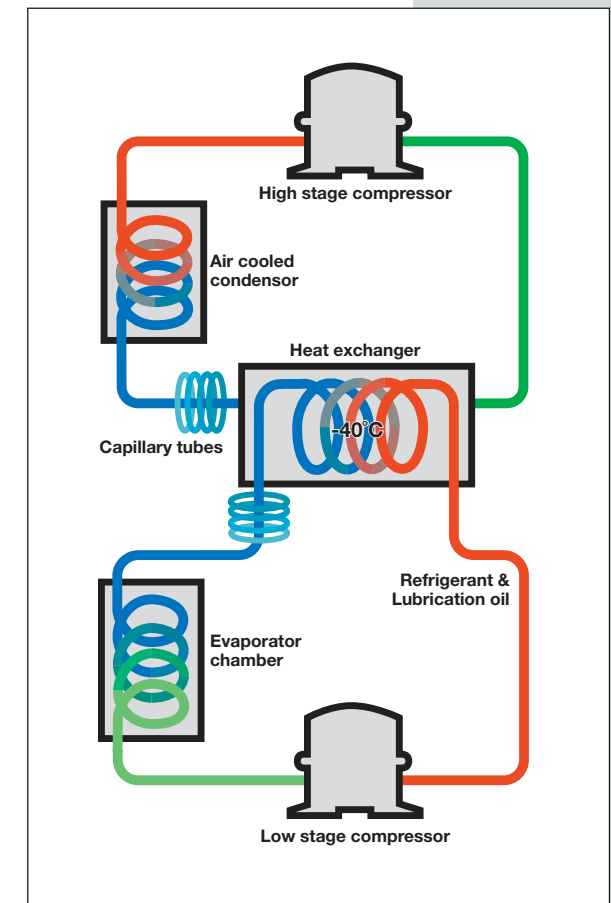
1. **EVAPORATOR:** surrounds the chamber to be cooled
2. **CONDENSER:** transfers unwanted heat energy to ambient air
3. **REFRIGERANT:** the fluid that carries the heat energy from where we don't want it to where we do.
4. **COMPRESSOR:** device that assists the refrigerant to turn from a gas to a liquid
5. **CAPILLARY TUBE:** reduces pressure of liquid refrigerant before entering the evaporator.
6. **LUBRICATING OIL:** ensures the moving parts do not fail in the compressor

To achieve temperatures down to -86°C it is common to use a dual or cascade refrigeration system. A cascade system utilizes two separate refrigeration systems called the low and high stages. These stages share a common heat exchange area. The condenser of the low stage is the evaporator of the high stage. This means the low stage is responsible for removing the heat from the storage chamber and the high stage removes the heat from the low stage.

Refrigeration cycle

The compressor compresses refrigerant gas and sends it to the condenser which transfers heat energy to the air. Under pressure, this allows the gas to change state to a liquid. The now cool refrigerant liquid travels to the capillary tube, which reduces the pressure. When the cool liquid refrigerant enters the evaporator at a reduced pressure it will want to turn back into a gas. The only way it can do this is to absorb heat energy, thus cooling the evaporator chamber. The now warm refrigerant gas returns to the compressor to begin the cycle again.

As mentioned, the role of the lubrication oil is to prevent the moving parts of the compressor from failing. Lubrication oil will exit the compressor with the refrigerant making it important that these two are able to mix.





There are two different cabinet styles available for laboratory freezers, chest and upright. Chest freezers have the potential to provide the best overall performance and reliability.

Two conditions that can adversely affect freezer performance are ambient temperature and door openings.

Door openings

Every time an upright freezer door is opened, the cold air in the freezer tumbles out and is replaced by warm, humid ambient air. This stresses the refrigeration system and increases frost build up. When the lid of a chest freezer is opened, the majority of the cold air remains in the cabinet thus making it easier on the freezer.

Though chest freezers typically outperform upright freezers, uprights are the most popular due to their ease of product access and efficient use of laboratory floor space.

Freezer manufacturers have engineered constructional features for their uprights, to help compensate for inherent performance issues such as frost build-up and temperature stability:

- Insulated, gasketed inner doors to help keep cold air in.
- Multiple independent gasket layers to ensure proper door seal.
- Heated mullions to maintain gasket pliability and an effective seal.
- Plug design doors to minimize the amount of room air that is trapped after a door opening.

Ambient temperature

The ambient temperature of the laboratory has a huge effect on freezer performance. A -86°C freezer has its work cut out to maintain its operating temperature in a high ambient temperature. The insulation used in the freezer's walls plays a vital role in maintaining the operating temperature.



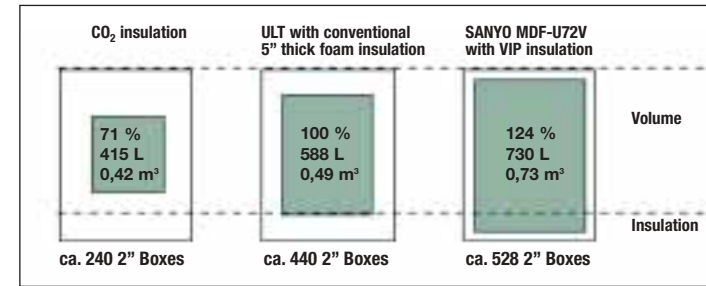
good construction



Questions to ask:

1. Would you like to use a chest or upright freezer?
2. Will the freezer capacity meet your future storage needs?
3. Is the freezer guaranteed to work in the ambient temperature of your lab?
4. How often do you open the freezer door?
5. What design features does the unit have to deal with the inherent performance issues?
6. Is the freezer available with VIP panels?

perfect insulation



Insulation

Many people do not know that foamed in-place urethane insulation which is used by most freezer manufacturers, utilizes a refrigerant as the "blowing agent".

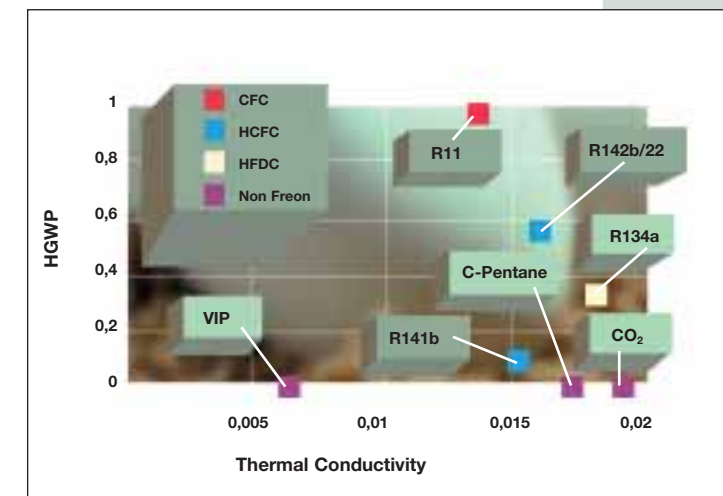
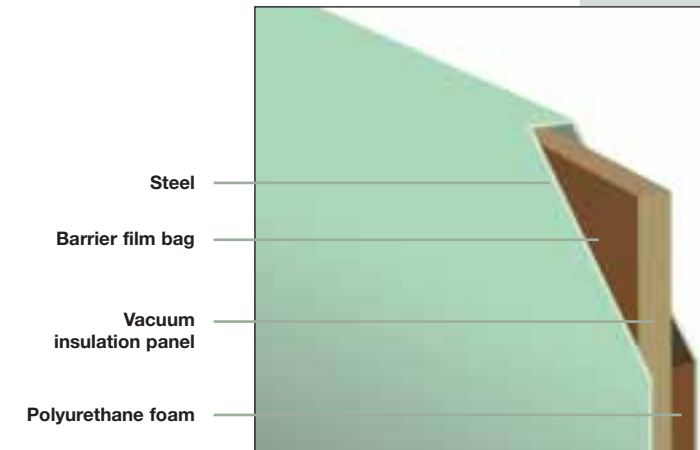
It has been a challenge for manufacturers to find a CFC-free blowing agent that performs as well as the CFC ones.

Some manufacturers have used the refrigerant R141b but due to its higher ODP* value it was phased out in 2003. A second refrigerant used is a combination of R142b/R22 which can be used until 2010 and performs exceptionally at ultra-low temperatures.

The next generation insulation is called Vacuum Insulation Panels (VIP).

This new technology dramatically enhances the insulation capability of the freezer, while reducing wall thickness thus increasing storage capacity with the same size freezer footprint. VIP panels are not like a LN2 tank or thermos bottle which will completely lose their thermal insulation in the event of a puncture. If a VIP panel is punctured, the decrease in thermal insulation performance is kept to a minimum. Using 5 or 6 independent VIP panels in one freezer minimizes the effect of a panel puncture.

* ODP = Ozone Depleting Potential





To achieve operating temperatures of -86°C to -152°C the key refrigeration components consisting of the compressor, refrigerant and oil, must work in harmony if there is to be performance and reliability.

The best way to ensure this harmony is to use components that were specifically designed for the job, not “off the shelf” components whose original design was for a completely different application.

Ultra low freezers are available in different operating voltages. The powerful compressors, typically used in Ultra Low freezers, will use far less current at 230V than 115V. In fact many 115V Ultra Low freezers require a 30 amp supply, which is more expensive and harder to find than a 230V supply. Think efficient, think 230V.

Maintaining energy efficiency with CFC-free refrigerants has been yet another challenge for freezer manufacturers. Costs associated with your freezer do not stop with the purchase price.

The power required to run your freezer is an ongoing operating expense that can run into the hundreds of euros annually.

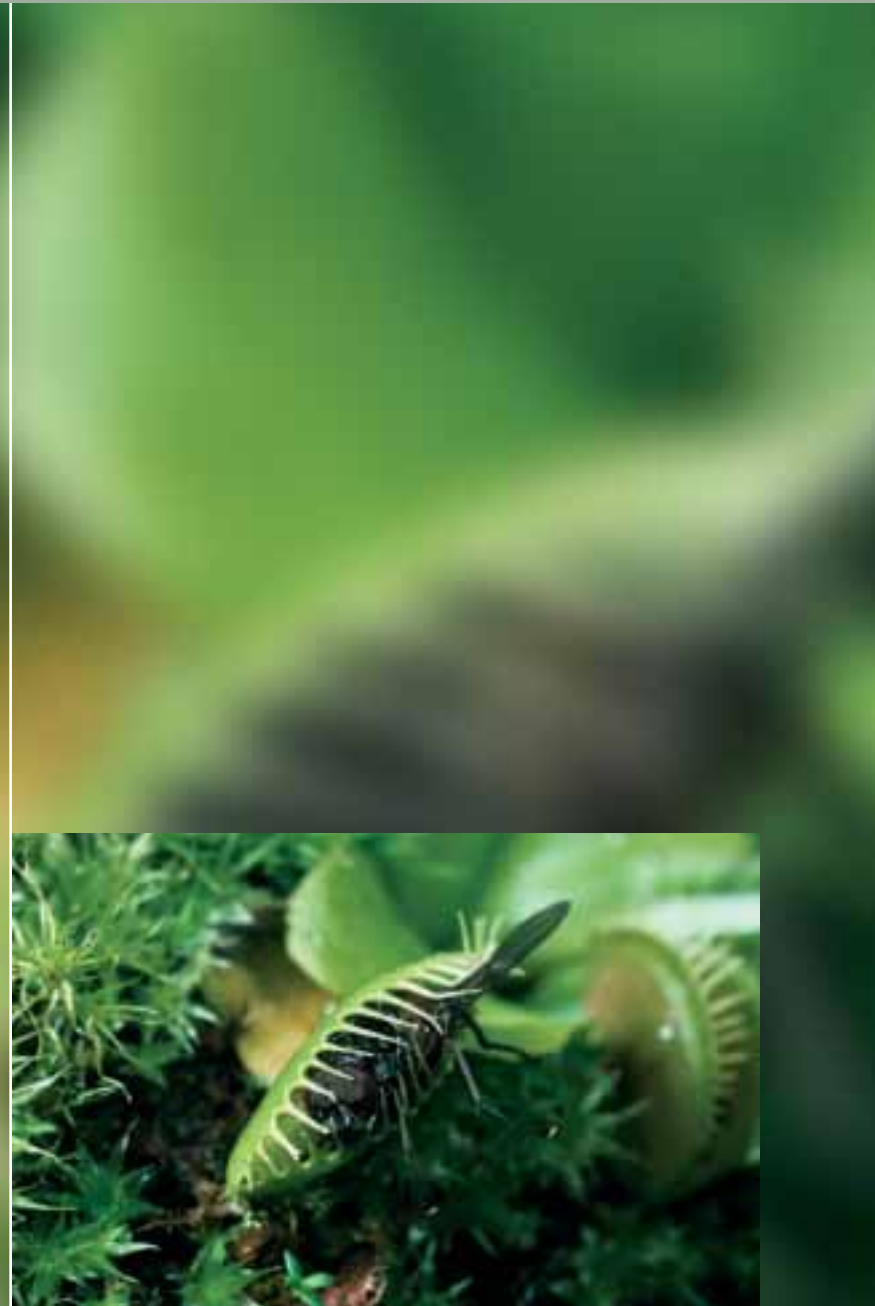
The CFC-free era for Ultra Low freezers has witnessed the introduction of exciting new technologies. Some manufacturers have risen to the occasion and have evolved as market leaders. At first their innovation and designs were met with scepticism and ridicule.

Now, those competitors who mocked them are scrambling to implement their designs. It is easy to pick out who are the industry leaders and who are the followers. Just identify a manufacturer’s new features and determine if they are new to the industry or just a copy of what others have been doing for years.

Questions to ask:

1. Was your refrigerant designed specifically for the Ultra Low application? If so, how long has it been used?
2. Is your compressor designed specifically for the ultra low application? Do you manufacture it yourself and how long have you been using it?
3. Can I use your current compressor and refrigerant in your older units?
4. Does your current system use conventional alkylbenzene oil or polyester oil, which could prevent older units from being upgraded to the new technologies?

well thought-out



Questions to ask:

1. How valuable is the product you are storing?
2. Does the freezer manufacturer provide temperature uniformity test results for their freezer?
3. Does the freezer utilize microprocessor controls?
4. Does the control system monitor key components and advise of any performance anomalies with audible and visible alarms?
5. Will the freezer meet validation protocols for FDA, GLP or GMP specifications?
6. Where does the manufacturer place the indicating/controlling temperature probes?
7. Are there auxiliary back-up systems available?

safe guards

Until the recent requirements of validated storage, temperature uniformity was not a consideration for cold storage. End users were not aware that temperatures in a -86°C freezer could vary from -65°C to -90°C.

Also, looking at the temperature indicator or chart recorder could give the indication that the entire freezer was operating at the set temperature. If you look closer, you may find that the indicating/controlling and recording temperature probes were placed in the coldest section of a freezer (i.e. bottom rear of an upright). In fact the top front of the same freezer may be as much as 20°C warmer. The temperature indicating/controlling probes should be in the best place for the user, not for the manufacturer.

It is important for the freezer manufacturers to provide data from uniformity tests conducted with no door openings and data from tests with door openings.

Most Ultra Low freezer manufacturers are now using microprocessor controls. Just because it is microprocessor controlled does not mean it has to be complicated to use. The microprocessor should be user friendly whilst running the alarm, temperature control, component monitoring and error diagnosing systems. Should there be any performance anomalies, they should be brought to the user's attention with visual and audible alarms.

If the product you're storing in an Ultra Low has any value you should consider a temperature recorder and LCO₂/LN₂ backup system.



measuring point is at 1/2h. centre of each shelf

Temperature recording can be accomplished with an individual recorder on each freezer or a centralised recording system. Either way you have a printed record of equipment performance for validation purposes.

Ideally, LCO₂/LN₂ backup systems should be on every Ultra Low freezer. An Ultra Low is a mechanical device that may require repair at some point in time. Failure could be due to component malfunction or loss of electrical power. Though prolonged power losses are not common it is a possibility. One Ultra Low can contain millions of euros worth of product or represent years of research and deserves the extra protection of a LCO₂/LN₂ backup system.



durability

The consumer has the final decision on what freezer goes in the lab. That freezer is going to store years of research or millions of euros worth of product. How do you know if you have made the right decision?

To begin with, look for trademarks or symbols indicating that the freezer or manufacturer is certified by, or registered with, industry accepted agencies such as ISO (International Standards Organization). ISO has established quality management systems under the 9000 series, which reinforces the freezer manufacturer's commitment to provide the highest quality, and the 14000 series, which provides business management with the structure for managing environmental impact.

Let's assume that all manufacturers subject their products to internal quality control (QC) inspections or they would not be in business very long. Some manufacturers go a little further than others to ensure you are purchasing the very best freezer.

For example, there are many ways in the industry to inspect the refrigeration system for gas leaks. Some of the most common ones are:

1. Pressurize the refrigeration system, submerge it in a bath, then look for bubbles.
2. Pressurize the refrigeration system and rub soap solution over welds and joints looking for bubbles.
3. Pressurize the refrigeration system with helium gas, place it in a vacuum chamber, then activate a helium detector to determine if there are any leaks (this method is 100 times more accurate than method #1 and 1000 times more accurate than method #2).

Which method would you like your freezer manufacturer to use?
Why is this important?

Minute leaks in a refrigeration system can be very difficult to locate without the most modern test procedures. This means your freezer could develop problems outside of warranty.

Do you know how long a freezer compressor or controller should last? An end user may not know the answer but the manufacturer should. Component "life cycle" data is information that manufacturers should make available. When considering a laboratory freezer find out how long it should last by asking to see the life cycle data.

Temperature uniformity in a laboratory freezer is important but seldom discussed. The main reason for this is that many freezers on the market today have very poor temperature uniformity. Some -86°C freezers may vary as much as 20°C from indicating/set point temperature to various parts of the freezer. Has the freezer manufacturer provided uniformity test results on any freezer you are considering purchasing?

Quality is tangible. Have the manufacturer prove its claims. Look for third party certification/ registration stickers. Ask for the component Life Cycle data and the results of temperature uniformity tests. Find out how production QC procedures are performed, as you know they can make a difference.

If the lowest priced freezer is going to win your business, then don't worry about quality. If reliability, performance, longevity and value are important, then find out the differences between the various manufacturers on the market.



strong focus

SANYO, LEADING THE WAY FOR THE INDUSTRY

SANYO means “THREE OCEANS” and in the industry SANYO has always ridden high on an ever-evolving wave of innovative new technologies. SANYO focuses on customer needs and improves on our latest achievements, while our competition may wait to see what the industry standards are.

SANYO is the first manufacturer to bring advanced and new freezer technologies to the industry.

- First to design application specific compressors for ULT freezers.
- First to co-develop application specific CFC-free refrigerants for ULT freezers.
- First to develop application specific Vacuum Insulated Panels (VIP) for ULT freezers.

SANYO’s strength comes from its vast resources. We do not have to rely on third party manufacturers to develop our technology. We are here in the forefront as an innovator and industry leader.

ULT (Ultra Low)

Who is responsible for keeping your laboratory freezer running after it is delivered, installed and commissioned?

Manufacturer

The manufacturer assumes the cost for parts and labour repairs during the warranty period (as laid out in the warranty agreement) and maintains adequate parts supply for the service groups. The manufacturer should also provide service training on the products it offers. The manufacturer should provide an acceptable migration path for older freezers to new technology and not just abandon them.

Sales group

Keep in touch with the end user ensuring the unit is running in concurrence with performance specifications and keep abreast of user requirements for accessories and after-sales requirements.

Service group

Supplies the parts and labour to service the freezer as required. To satisfy the end user’s needs, both parts and labour should be supplied in acceptable time frames. With the changes to CFC-free refrigerants, the service group should have the necessary manufacturer training to provide competent field service.

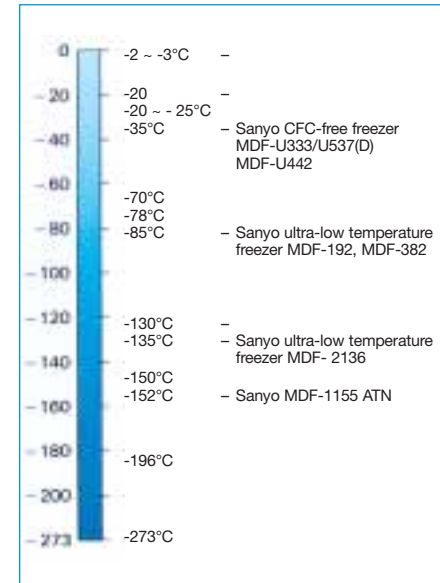
The better equipped service groups will offer loan freezers in the event of a freezer failure.

End user

Make sure the unit is installed in an appropriate location in the laboratory that is not subjected to unusual ambient heat, does not restrict laboratory work flow and the normal operating sounds do not distract laboratory staff.

Perform routine maintenance such as cleaning condenser filters and defrosting. Restrict door openings to minimize frost build up and refrigeration system stress. Perform routine tests on back up control/systems and temperature alarms.

MDF-1155ATN
MDF-1155AT
MDF-1155



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 vapor phase preservation has increased. In preservation with liquid nitrogen vapor, temperatures drop to approximately -150°C, almost the same as the ultra-low temperature freezer's inner cabinet temperature of -152°C. 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 (-148°C)
- User**
- University
 - Private Institute
 - Public Research Center
 - Hospital

PICTOGRAM [FOR EXPL. P.3]

- CFC-Free
- Casters
- CPU and Touch Pad
- Energy
- LED Digital Display
- Power Failure Alarm
- Quiet, Reliable Compressor
- Remote Alarm
- Rechargeable Battery
- Automatic Alarm System
- Cascade Cooling System
- Service
- Air Filter

The world of -152°C

Achieves stable long-term preservation of cells and tissues.

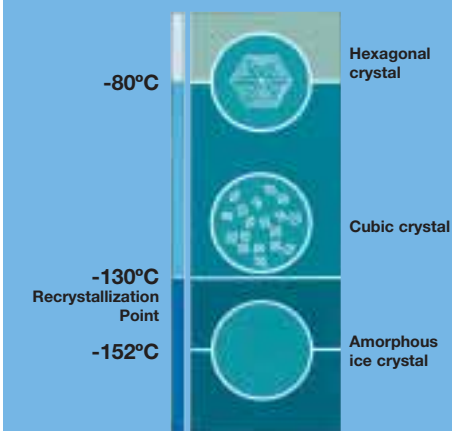
In preserving cells or tissues at ultra-low temperatures, the point is to prevent amorphous ice crystals from recrystallizing within and outside the cells. These ice crystals have smaller diameters than the smallest substances (4,000 to 7,000Å) that compose cells or tissues. When ice crystals become amorphous, they are stored using cryoprotective agents such as glycerine and dimethyl sulfoxide (Me₂SO). 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 Me₂SO 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 super-conductivity experiments require temperatures of at least -148°C. These cases show the increased necessity of -152°C freezing.

Until recently, liquid preservation containers were mainly used when preserving valuable samples over long

Why freeze to -152°C ? Recrystallization mechanism



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 -152°C
A highly efficient, exclusive compressor has been specially developed and incorporated in the freezing unit.

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



A refrigeration circuit with Sanyo's original cascade refrigeration system enhances reliability of long-term preservation.

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-1155 ATN 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-1155ATN

unit reaches a maximum of 182°C. In the ultra-low temperature range below -100°C, 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 15°C 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 that works for 16 consecutive hours.

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

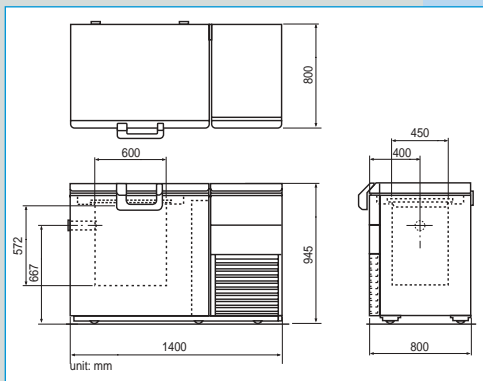
MDF-1155ATN
MDF-1155AT
MDF-1155

| Article | | MDF 1155ATN/1155 | | |
|-----------------------------|---|------------------|--------|---------|
| Cabinet | | | | |
| Exterior dimensions (wxdxh) | 1,400x800x945mm (frame) (55.1"x 31.5"x 37.2") | | | |
| Interior dimensions (wxdxh) | 500x450x572mm (19.7"x17.7"x22.5") | | | |
| Cooling performance | -152°C (AT: 30°C, no load, no direct sunlight) | | | |
| Effective capacity | 128 ltr. (4.5 cu.ft.) | | | |
| Exterior finish | Baked acrylic finish on galvanized steel | | | |
| Interior finish | Aluminium plate | | | |
| Door (inside lid) | Baked acrylic finish on galvanized steel (styrene foam) | | | |
| Insulation | Foamed-in-place rigid polyurethane(one layer insulation) | | | |
| Access hole | One with 40mm dia. (on the side, at left) | | | |
| Refrigeration cycle | | | | |
| Compressor | Full hermetic type with output 1,100W(high temp.side) Semi hermetic type with output 1,500W(low temp.side) | | | |
| Evaporator | Tube-on-sheet type | | | |
| Condenser | Forced air-cooling, fin & tube type | | | |
| Refrigerant | CFC-Free special mixed refrigerant | | | |
| Power | Voltage | 220 | 240 | 220/230 |
| | Hz | 60 | 50 | 50 |
| Source | Phase | 1 | 1 | 1 |
| | Amps/Breaker | 9.3/15 | 7.8/15 | 8.5/15 |
| Rated power consumption | 1,8 kW (50/60 Hz) | | | |
| Temperature control | Microprocessor digital (-100°C to -159°C, 1°C increments) | | | |
| Temperature display | LED digital | | | |
| Sensor | Platinum resistance thermo-sensor (PT100 Ω) | | | |
| Alarm and back-up devices | | | | |
| Alarm system | Lamp & Buzzer indicate power failure or sudden internal temperature increase (rechargeable Cadnica battery and remote alarm terminal are equipped) | | | |
| Recorder | Recording chart for 2 months (ATN) | | | |
| *Back-up systems | Liquid nitrogen (ATN) | | | |
| Weight | 285kg (627lbs.) | | | |
| Accessories | | | | |
| Accessories | Recording chart, recording pen, connecting pipe for back-up system, 1 battery (MDF-1155ATN only) | | | |
| | 1 set of keys, 2 rubber caps, 1 inside lid, 1 defrost spatula, 1 mat(SUS-304) | | | |

* The back-up system does not include container for liquid nitrogen. Install MDF-135N for the ATN model.
MDF 1155 does not have recorder
* Specifications subject to change without notice.



Dimensions

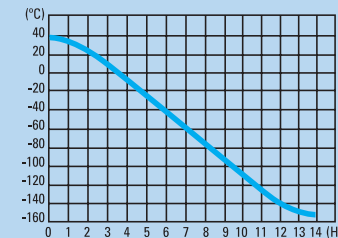


Optional Accessories:

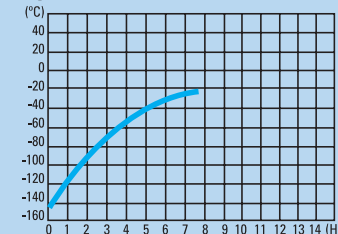
- Storage case MDF-49SC
- Recording paper RP-155
- Felt recording pen
- Recorder MTR-155H

Performance Data

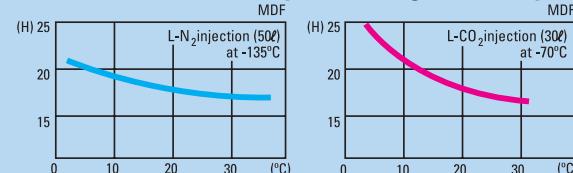
■ Pull-down characteristics



■ Pull-up characteristics during power failure

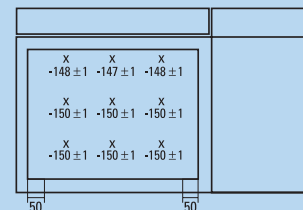


■ Effect of ambient temp.on holding time of liquefied gas



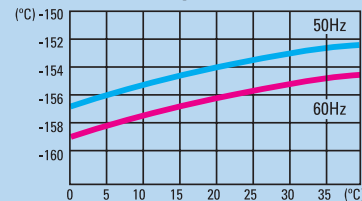
■ Temp.distribution inside cabinet

-150°C setting, ambient temperature 35°C, no load



at: 20°C low-temp. side operation rate 72%
ON:10min Off 4 min

■ Effect of ambient temp. on inside temp.



Ultra Low -135°C Storage Freezer

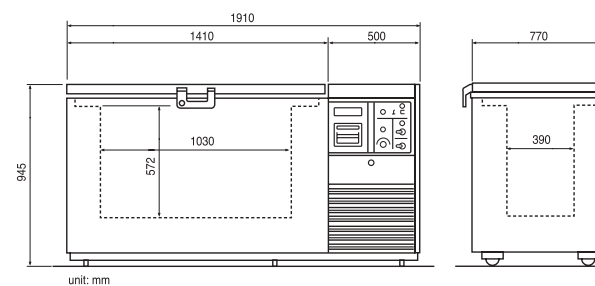
Microprocessor temperature control with extremely accurate easy-to-read LED digital display. New cascade cycle compressor, highly efficient, extremely dependable. Double-Insulation wall with foamed polyurethane. Highly conductive, easy to clean aluminium wall interior.

2 inner doors guard against sudden rises in temperature. The lid has a balanced hinge and is lockable. Power failure alarm (lamp and buzzer). Option for back-up system and temperature-recorder.

Control range -85°C / -135°C
Inner dimensions 1030W x 390D x 572H mm.
Outer dimensions 1910 W x 770D x 945H mm.
Weight 323 kg

Optional accessories

- CVK-A CO₂ – back-up system
- CVK-ATN N₂ – back-up system with recorder
- MTR-135H Temperature recorder
- RP-135 Recording paper



MDF-2136

PICTOGRAM [FOR EXPL. P.3]



CFC-Free



Casters



CPU and Touch Pad



Energy



LED Digital Display



Power Failure Alarm



Quiet, Reliable Compressor



Remote Alarm



Rechargeable Battery



Automatic Alarm System



Cascade Cooling System



Service



Air Filter

MDF-U32V
MDF-U52V
MDF-U72V



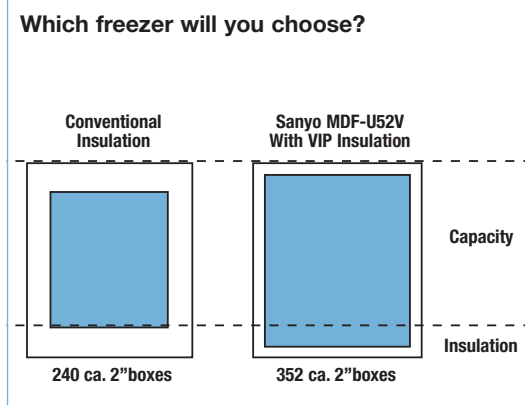
MDF-U72V
728 LITER
528 2" BOXES
280 3" BOXES

MDF-U52V
519 LITER
352 2" BOXES
224 3" BOXES

Ultra-Low temperature V.I.P.™ Freezer

- Maximised storage capacity with V.I.P.™ technology
- Safe operation with continuous condition monitor Status Alert
- Enhanced security
- Improved accessibility
- Ergonomic quiet operation

V.I.P. (Vacuum Insulation Panel)
VIP panel is the innovative insulation component developed and manufactured by Sanyo. VIP panels contain densely packed, open cell foam insulation under vacuum. This configuration dramatically enhances the insulation capability of the freezer while reducing the wall thickness. This in turn provides greater interior volume and structural stability.

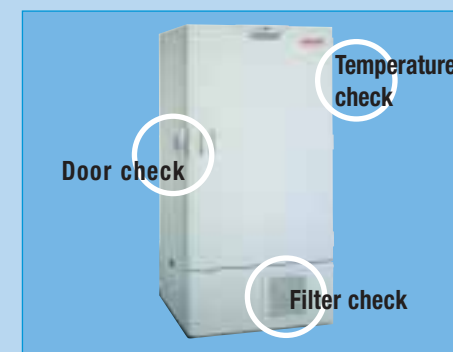


- CFC-Free
- VIP (Vacuum Insulation Panel)
- CPU and Touch Pad
- Energy
- LED Digital Display
- Insulated Inner Doors
- Quiet, Reliable Compressor
- Power Failure Alarm
- Rechargeable Battery
- Remote Alarm
- Cascade Cooling System
- Automatic Alarm System
- Air Filter
- Service
- Casters

WHAT MAKES THE SANYO V.I.P. ULTRA LOW FREEZER SPECIAL?

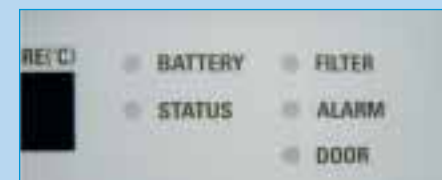
New design

■ Evolution and Revolution
Sanyo V.I.P. Evolution Series -86°C ultra-low temperature freezers use patented revolutionary Vacuum Insulation Panels (VIP) that reduces the wall thickness from 14cm to 7cm (5.5" to 2.7") and achieves up to 30% more storage capacity than a conventionally insulated freezer without increasing the footprint. This series also combines various cutting edge technologies to evolve and enhance user convenience.



Reliability

■ Status Alert (Condition monitor)
Monitors ambient and system conditions continuously and notifies of any abnormalities before a problem happens.



■ Safe Storage

Super cooling technology with alarm systems ensures accurate storage conditions. Insulated inner doors prevent cool air leakage.

■ Security

Along with a standard door lock, the new rugged outer door latch has a hole to allow a padlock to securely protect valuable samples.



Accessibility

■ Eagle Latch (New)

A new beak style inner door latch tightly closes the inner door against the freezer frame. It also helps make opening and closing the door smoother.



■ Large Control Panel



■ Multiple Inner Doors (New Option)

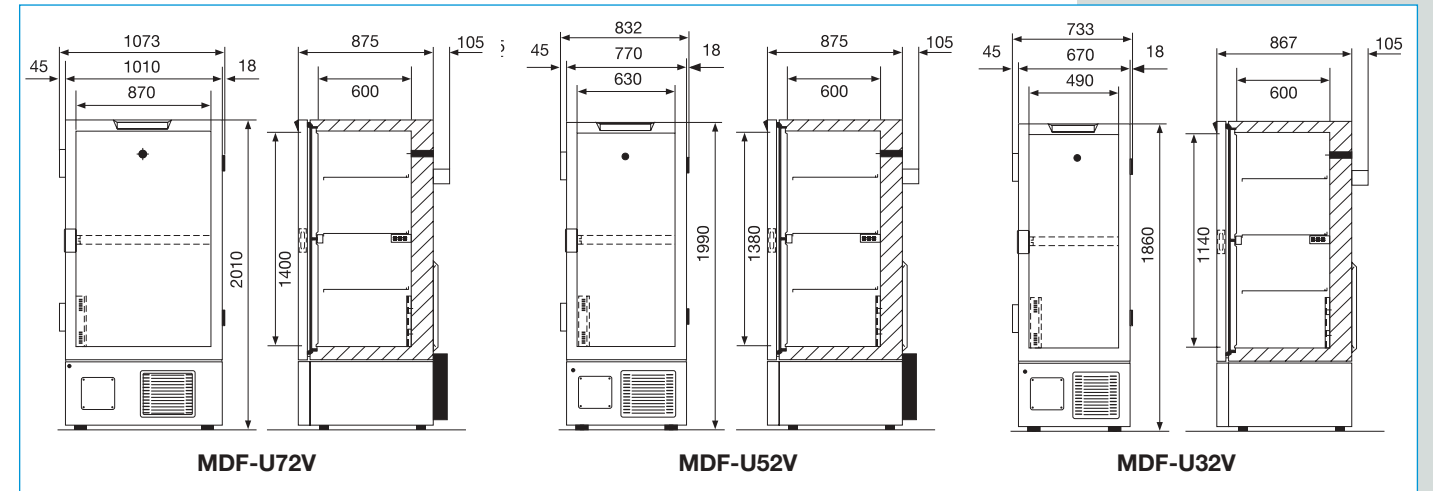
Field-installable insulated multiple inner doors greatly enhance flexibility. Set of 2 doors. Up to 2 sets can be installed.



MDF-U32V
MDF-U52V
MDF-U72V



MDF-U32V
333 LITER
216 2" BOXES
168 3" BOXES



Specifications

| Model | MDF U32V | MDF U52V | MDF U72V |
|---------------------------|---|---|---|
| Exterior dimensions wxdxh | 670 x 867 x 1860 mm | 770 x 875 x 1990 mm | 1010 x 875 x 2010 mm |
| Interior dimensions wxdxh | 490 x 600 x 1140 mm | 630 x 600 x 1380 mm | 870 x 600 x 14 mm |
| Effective capacity | 333 l 2"boxes 216 pcs 3"boxes 168 pcs | 519 l 2"boxes 352 pcs 3"boxes 224 pcs | 728 l 2"boxes 528 pcs 3"boxes 280 pcs |
| Net weight | 258 kg | 304 kg | 345 kg |
| Interior finish | Painted steel | | |
| Insulation | CFC-free Rigid polyurethane foamed-in-place vacuum insulation panel | | |
| Door | 1 with built in latch | | |
| Inner door | 2 insulated type with latch | | |
| Shelves | 3 | | |
| Temperature range | -50°C ~ -86°C (Ambient Temp.30°C) | | |
| Standard Voltage | 230/240V | 230/240V | 230/240V |
| Voltage | HZ | 50 Hz | 50 Hz |
| | Phase | 1 | 1 |
| | AMPS | - | - |
| | Breaker | 15 | 15 |
| Microprocessor control | Yes | | |
| Temperature alarm | Audible and visual indication | | |
| Filter alarm | Filter check lamp | | |
| Power failure alarm | Audible and visual indication | | |
| Self diagnostic function | Audible and visual indication | | |
| Remote alarm contact | Yes | | |
| Temperature display | Digital display, Door mounted | | |
| Accessories | Key 1 set, Scraper 1 pce | | |
| Refrigerant | HFC | | |

* Appearance and specification are subject to change without notice.

Alarms & Safety functions

| Alarm & Safety | Situation | Indication | Buzzer | Safety operation |
|------------------------|---|---|--|---|
| High temperature alarm | If the chamber temperature is higher than the temperature at which the high temperature alarm is activated. | Alarm lamp flashes. Temperature indicator flashes. | Intermittent tone with 15 minutes delay. | Remote alarm with 15 minutes delay. |
| Low temperature alarm | If the chamber temperature is lower than the temperature at which the low temperature alarm is activated. | Alarm lamp flashes. Temperature indicator flashes. | Intermittent tone with 15 minutes delay. | Remote alarm with 15 minutes delay. |
| Power failure alarm | When the power to the unit is disconnected. | Alarm lamp flashes. | Intermittent tone. | Remote alarm. |
| Filter check | When the condenser filter is clogged. | Filter check lamp lights. | --- | --- |
| Auto-return | When there is no key pressing in each setting mode for 90 seconds. | Chamber temperature is displayed. | --- | Finishing of each setting mode Remote alarm. |
| Key lock | When the key lock is "ON". | --- | --- | Change of setting is disabled. |
| Sensor abnormality | If the thermal sensor is disconnected. | Alarm lamp is flashed. E01 and chamber temp. are displayed alternately. | Intermittent tone. | Unit keeps continuous running. Remote alarm. |
| | If the thermal sensor is short-circuited. | Alarm lamp is flashed. E02 and chamber temp. are displayed alternately. | Intermittent tone. | Unit keeps continuous running. Remote alarm. |
| | If the cascade sensor is disconnected. | Alarm lamp is flashed. E03 and chamber temp. are displayed alternately. | Intermittent tone. | Unit keeps running. |

Options

■ MTR G85
Circular recorder



■ CVK-UB2
CO₂ back-up system
■ CVK-UBN2
N₂ back-up system



■ MDF-50R
3 drawers (for MDF U52V)

- MDF-U5086W
- MDF-U6086S
- MDF-U5186S
- MDF-U4086S
- MDF-U3086S
- MDF-U2086S



MDF-U5086W
497 LITER
192 2"-BOXES
144 3"-BOXES



MDF-U6086S
580 LITER
440 2"-BOXES
280 3"-BOXES



MDF-U5186S
518 LITER
320 2"-BOXES
192 3"-BOXES

Ultra-low temperature upright freezer -86°C

MDF-U5086W

- Developed with two outer and four inner doors to provide maximum security. Contents are not exposed to large influxes of warm air as compared with single door models plus Sanyo offers the extra protection of four fully insulated inner doors ensuring pulldown is achieved quickly.
- Space saving upright design requires 40 % less floor space than chest type of comparable size, fitting into floor space of 0.94m² (10.1 sq.ft).
- Large 497 liter (17.6 cu.ft.) capacity divided into four by the inner doors provides four freezers in one. Each area can be used for general storage or assigned for specific research or user.

■ -86°C microprocessor controlled temperature. Eye-level easy to read LED digital display. Uniform temperature feature combined with rapid pulldown ensures safe and reliable storage.



- CFC-free Sanyo refrigerant, cascade cooling system, and a compressor custom-made for the MDF-U5086W makes it one of Sanyo's most advanced models and sets a new level of performance.
- Optional accessories available.

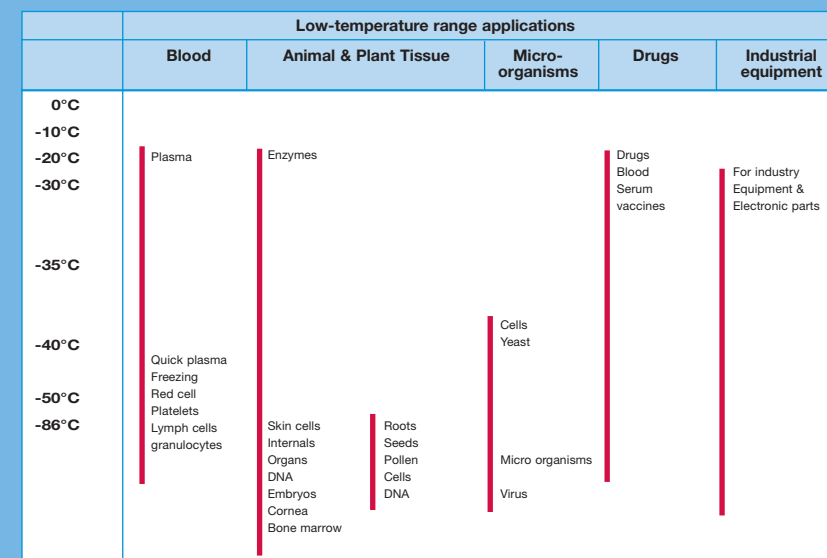
MDF-U6086S

- HFC refrigerants with Sanyo made compressor
- More effective capacity using the latest CFC-Free insulation technology
- 440 x 2"boxes/280 3"boxes
- Microprocessor control
- Temperature alarm
- Door key lock
- Casters
- Adjustable levellers

MDF-U5186S

- HFC refrigerants with Sanyo made compressor
- More effective capacity using the latest CFC-Free insulation technology
- 320 x 2"boxes/192 3"boxes
- Microprocessor control
- Temperature alarm
- Door key lock
- Casters
- Adjustable levellers

APPLICATIONS



Potential users:

- Universities, Pharmaceutical departments
- Private enterprises, Pharmaceutical companies
- Medical institutions, Hospitals
- Public research centers, research institutes

PICTOGRAM [FOR EXPL. P.3]

- CFC-Free
- Casters
- CPU and Touch Pad
- Energy
- LED Digital Display
- Insulated Inner Doors
- Quiet, Reliable Compressor
- Power Failure Alarm
- Rechargeable Battery
- Remote Alarm
- Cascade Cooling System
- Automatic Alarm System
- Air filter
- Service



MDF-U4086S
382 LITER



MDF-U3086S
301 LITER

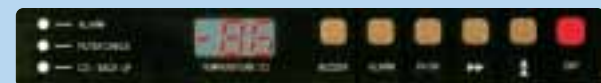


MDF-U2086S
216 LITER

PICTOGRAM [FOR EXPL. P.3]

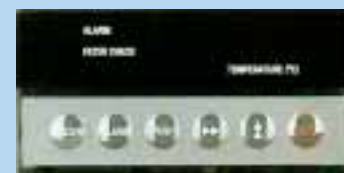
MDF-U4086S

- Super 382 liter (13.5 cu ft) capacity with a single door and two inner doors.
- -86°C microprocessor controlled temperature. Eye-level for precise setting and greater operational ease. Interconnected to all alarm systems for security.
- 45% less floor space required than chest type of same capacity with no compromise on ease of use.
- Specially designed outer and inner doors are computer matched to ensure that the temperature is maintained with minimum fluctuation when the doors are opened.
- Features the technology, construction and reliability of all Sanyo freezers.
- Optional accessories available.



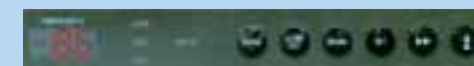
MDF-U3086S














- Unique design and size targets the growing trend to personal freezers and compact size. While this is a spacesaver there is no compromise on features. Units can be installed side by side if a second or third freezer is acquired over time due to expansion.
- Easy access for quick placement or locating of samples makes uniformity and pulldown outstanding features of this model.
- The foamed-in-place rigid polyurethane is CFC-free as in all other Sanyo freezers.
- Features all of the technology, construction, and reliability you have come to expect from Sanyo freezers.



MDF-U2086S

- Sanyo refrigeration technology maintains biological specimens in perfect condition by preventing physical and chemical changes from occurring in DNA, plant and animal cells, bacteria, enzymes, vaccines, antibodies, blood etc.
- -86°C temperature in an ultra slim design combines a small footprint with a large capacity, uniform stable temperature and the latest technology.
- Two inner doors plus one full outer door makes the 216 liter (7.6 cu.ft.) model highly efficient. Very compact, it fits almost anywhere.



| | |
|---|---|
|  CFC-Free |  Casters |
|  CPU and Touch Pad |  Energy |
|  LED Digital Display |  Insulated Inner Doors |
|  Quiet, Reliable Compressor |  Power Failure Alarm |
|  Rechargeable Battery |  Remote Alarm |
|  Cascade Cooling System |  Automatic Alarm System |
|  Air Filter |  Service |

MDF-U5086W
MDF-U6086S
MDF-U5186S
MDF-U4086S
MDF-U3086S
MDF-U2086S

Options

Real-Life-System

■ The way any freezer is used affects the performance, uniformity and pulldown. And the way items are stored can dramatically alter uniformity and reliability of temperature. Researchers demand their needs be met not only in the freezer but also with the interior fittings and accessories. Perfection is a must. Therefore the "Real Life System" was designed and engineered to operate with Sanyo freezers. The Sanyo freezer factory has tested and approved these systems. Consult your sales representative for details. Some items offered in the "Real Life System" include:

- Analogue temperature recorders
- Inventory rack sets
- Aluminium stocker containers
- Full shelves
- Set of drawers



MDF-792
MDF-592
MDF-492
MDF-392
MDF-293
MDF-192



PICTOGRAM [FOR EXPL. P.3]

Specifications

| Model no. | Upright Series | | | | | |
|-----------------------------|---|--|--|---|--|--|
| | MDF-U2086S | MDF-U3086S | MDF-U4086S | MDF-U5086W | MDF-U5186S | MDF-U6086S |
| Outer dimensions wxdxh | mm. 630 x 780 x 1880 inch 24.8 x 30.7 x 74.0 | 800 x 832 x 1810 31.5 x 32.8 x 71.3 | 870 x 780 x 1945 34.3 x 30.7 x 76.6 | 1200 x 780 x 1880 47.2 x 30.7 x 74.0 | 900 x 900 x 2010 35.4 x 35.4 x 79.1 | 990 x 875 x 2015 39.0 x 34.4 x 79.3 |
| Inner dimensions wxdxh | mm. 370 x 490 x 1200 inch 14.6x19.3x47.2 | 520x517x1120 20.5 x 20.4 x 44.1 | 620 x 520 x 1200 24.4 x 20.5 x 47.2 | 930 x 490 x 1130 36.6 x 19.3 x 44.5 | 690 x 625 x 1300 27.2 x 24.6 x 51.2 | 740 x 600 x 1310 24.4 x 20.5 x 47.2 |
| Effective cap. | 216 liter | 301 liter | 382 liter | 497 liter | 518 liter | 580 liter |
| Interior finish | Painted steel | | | | | |
| Door | 1 door | 1 door | 1 door | 2 door | 1 door | 1 door |
| Inner doors | 2 | 3 | 2 | 4 | 2 | 2 |
| Shelves | 3 | 6 | 3 | 6 | 3 | 3 |
| Temperature (amb.temp 30°C) | -86°C | -86°C | -86°C | -86°C | -86°C | -86°C |
| Standard Voltage | 220/240V | 220/240V | 220/240V | 220/240V | 220/240V | 220/240V |
| Microprocessor Control | 0 | 0 | 0 | 0 | 0 | 0 |
| Temperature Alarm | 0 | 0 | 0 | 0 | 0 | 0 |
| Filter indicator | 0 | 0 | 0 | 0 | 0 | 0 |
| Washable air intake filter | 0 | 0 | 0 | 0 | 0 | 0 |
| Door key lock | 0 | 0 | 0 | 0 | 0 | 0 |
| Power failure alarm | 0 | 0 | 0 | 0 | 0 | 0 |
| Remote alarm contact | 0 | 0 | 0 | 0 | 0 | 0 |
| Temperature display | Digital door top | Digital bottom panel | Digital top panel | Digital top panel | Digital bottom panel | Digital bottom panel |

Ultra-Low Temperature Chest freezers:

- A wide range of ultra-low temperature freezers to suit your needs.
- Ideal -86°C freezing environment by means of double insulation walls.
- Specially designed compressor for ultra-low temperature.
- Microprocessor temperature control with digital design for precise setting and control.
- Built-in temperature and power failure alarms (lamp/buzzer).

Control Panel



- 1 Power switch
- 2 Back-up system switch
- 3 Back-up system test switch
- 4 Remote alarm switch
- 5 Temperature setting key
- 6 Digit shift key
- 7 Figure shift key
- 8 Entry key
- 9 Alarm test key
- 10 Buzzer key
- 11 Alarm lamp and buzzer
- 12 Filter clog check lamp
- 13 Temperature display
- 14 Temperature recorder



MDF-792
MDF-592
MDF-492
MDF-392
MDF-293
MDF-192

- Constant -86°C
- Microprocessor Temperature Control
- Improved Design
- Temperature & Power Failure Alarms
- Digital display.

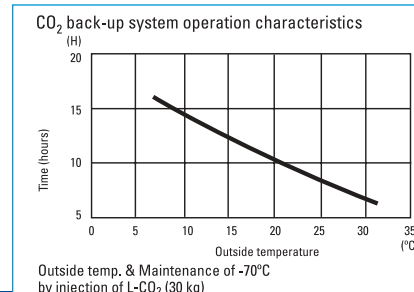
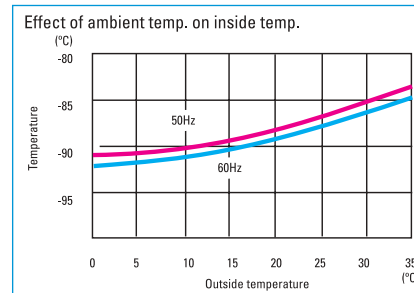
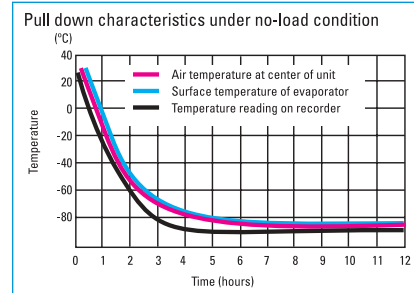
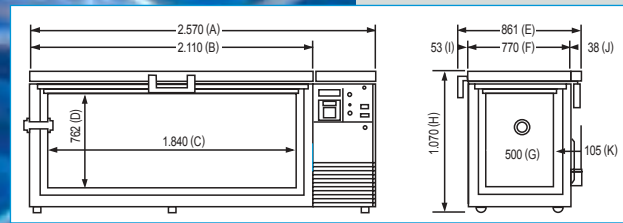
These ultra-low temperature freezers are designed by Sanyo to maintain internal temperature as low as -86° C (-123°F), at an ambient temperature of +30°C (86°F). They are ideally suited for use in hospitals and laboratories, for long-term preservation and storage of blood, specimens and components, and in testing of various types. Ranging in size from economical chest freezer to large-capacity, one of these models is sure to be suitable for your needs.

Advanced features include a microprocessor temperature control system with digital temperature display, a platinum resistance sensor for extra precision and reliability, a power failure warning system with built-in audible and visible indicators, double-insulation polyurethane walls and easy-open/easy-close hinged door. AT models also offer automatic temperature recording and CO₂ back-up system.

Dimensions

| Model | MDF-792 | MDF-592 | MDF-492 | MDF-392 | MDF-293 | MDF-192 |
|--------|---------|---------|---------|---------|---------|---------|
| Symbol | | | | | | |
| (A) | 2.570 | 2.010 | 1.870 | 1.860 | 1.500 | 750 |
| (B) | 2.110 | 1.550 | 1.410 | 1.400 | 1.040 | - |
| (C) | 1.840 | 1.280 | 1.140 | 1.120 | 760 | 480 |
| (D) | 762 | 762 | 632 | 530 | 565 | 420 |
| (E) | 861 | 861 | 861 | 891 | 791 | 791 |
| (F) | 770 | 770 | 770 | 800 | 700 | 700 |
| (G) | 500 | 500 | 500 | 520 | 420 | 430 |
| (H) | 1.070 | 1.070 | 945 | 945 | 945 | 945 |
| (I) | 53 | 53 | 53 | 53 | 53 | 53 |
| (J) | 38 | 38 | 38 | 38 | 38 | 38 |
| (K) | 105 | 105 | 105 | 105 | 105 | 658 |

Note: This diagram is for MDF 792 AT.



MDF-592

**-86°C
487 LITER**

Ideal for Quality Control in manufacturing Drugs

Operating conditions: outside temp = 30°C
Inside temp. setting: -80°C no load

MDF-792

**-86°C
701 LITER**

Operating conditions: outside temp = 30°C
Inside temp. setting: -80°C no load

MDF-492

**-86°C
360 LITER**

Chest Freezer-Large Capacity in a Small Space.

Operating conditions: outside temp = 30°C
Inside temp. setting: -80°C no load

MDF-392

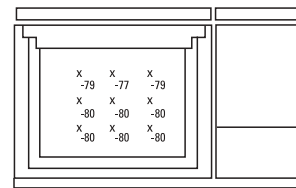
Dependable, Quiet Cascade System



-86°C
309 LITER

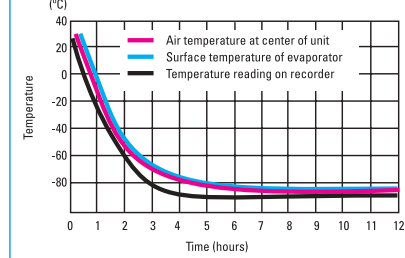


Temp.distribution inside cabinet

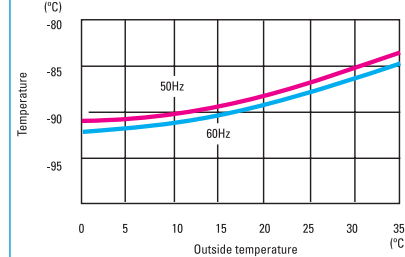


Operating conditions: outside temp = 30°C
Inside temp. setting: -80°C no load

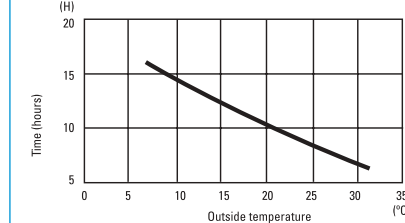
Pull down characteristics under no-load condition



Effect of ambient temp. on inside temp.

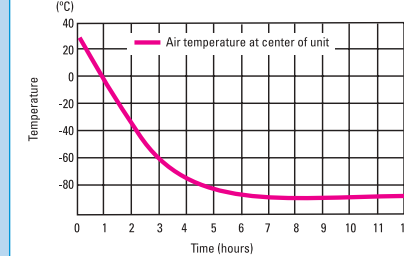


CO₂ back-up system operation characteristics

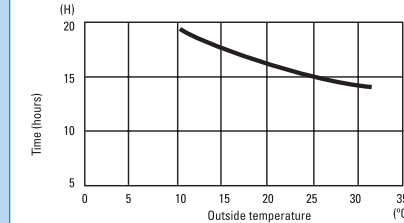


Outside temp. & Maintenance of -70°C by injection of L-CO₂ (30 kg)

Pull down characteristics under no-load condition

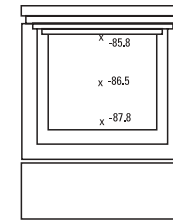


CO₂ back-up system operation characteristics



Outside temp. & Maintenance of -70°C by injection of L-CO₂ (30 kg)

Temp.distribution inside cabinet



Operating conditions: outside temp = 30°C
Inside temp. setting: -80°C no load

Ultra-Freezing in Minimal Space

MDF-192

Super freezing capability below -86°C (-123°F)

Even with ambient temperature of 35°C (95°F), ultra-low temperature of -86°C (-123°F) can be maintained. This is made possible by means of a compact and super-efficient freezing circuit employing a miniature heat exchanger in combination with a 3 gas mixed refrigerant freezing circuit.

Low-profile design for easier loading and unloading.

The chest-type design provides relatively stable inside temperature and occupies a mere 29.5"(W) x 27.6"(D) (75cm x 70cm) of space. The low profile greatly facilitates loading and unloading.



-86°C
86 LITER

MDF-293

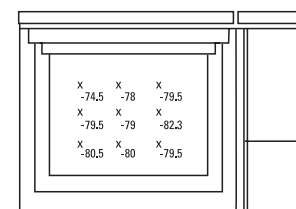
Economical -520W/50Hz Power Consumption



-86°C
180 LITER

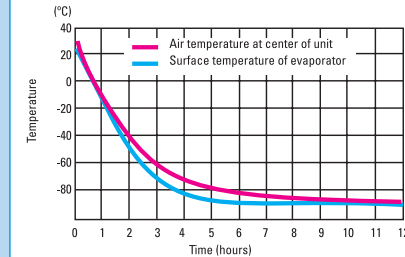


Temp.distribution inside cabinet

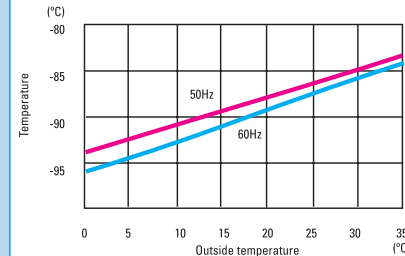


Operating conditions: outside temp = 30°C
Inside temp. setting: -80°C no load

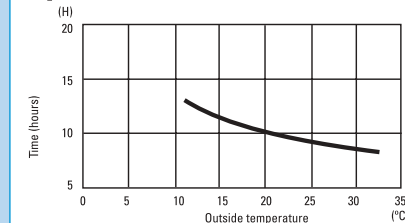
Pull down characteristics under no-load condition



Effect of ambient temp. on inside temp.



CO₂ back-up system operation characteristics



Outside temp. & Maintenance of -70°C by injection of L-CO₂ (30 kg)

Specifications

| Sanyo Ultra-Low Temperature Freezers | | | | | | |
|--------------------------------------|---|------------------------|-----------------------|-----------------------|-----------------------|----------------------|
| Type | MDF-792 | MDF-592 | MDF-492 | MDF-392 | MDF-293 | MDF-192 |
| Outer dimensions (wxdxh) | 2570 x 770 x 1070 (mm) | 2010 x 770 x 1070 (mm) | 1870 x 770 x 945 (mm) | 1860 x 800 x 945 (mm) | 1500 x 700 x 945 (mm) | 750 x 700 x 945 (mm) |
| Inner dimensions (wxdxh) | 1840 x 500 x 762 (mm) | 1280 x 500 x 762 (mm) | 1140 x 500 x 632 (mm) | 1120 x 520 x 530 (mm) | 760 x 420 x 565 (mm) | 480 x 430 x 420 (mm) |
| Effective cap. | 701 Liter | 487 Liter | 360 Liter | 309 Liter | 180 Liter | 86 Liter |
| Exterior cabinet | Baked-on acrylic finish on galvanized steel | | | | | |
| Interior cabinet | Stainless steel (SUS-304) | | | | | |
| Door | Baked-on acrylic finish on galvanized steel | | | | | |
| Insulation | Rigid polyurethane foamed-in place | | | | | |
| Compressor | Hermetic type | | | | | |
| High side | 1100W | 750 W | 400 W | 400 W | 250W | 400 W |
| Low side | 1100W | 750 W | 600 W | 400 W | 350W | |
| Evaporator | Tube on sheet type | | | | | |
| Condenser | High temp.side:fin tube, low temp. side:shell tube | | | | | |
| Temperature Controller | Microprocessor controller (digital display 1°C graduation) | | | | | |
| Temperature display | Digital thermometer (50°C to -100°C) | | | | | |
| Sensor | Platinum resistance thermo-sensor Pt 100 | | | | | |
| Alarm | Rechargeable Sanyo CADNICA battery, buzzer, lamp, remote alarm contact | | | | | |
| Recorder | MTR-85H: dry cell driven recording (for 2 months)cartridge type recording pen | | | | | |
| Back-up system | CVK-UB2 (liquid CO ₂ system) | | | | | |
| Weight | 370 kg | 310 kg | 278 kg | 248 kg | 196 kg | 121 kg |
| Attachments | Key - 1 set, Rubber caps - 2pcs., defrost spatula- 1 pc. | | | | | |

Options:

- CVK-UB2 Back-up system
- MTR 85H recorder

Performances

| Type | MDF-792 | MDF-592 | MDF-492 | MDF-392 | MDF-293 | MDF-192 |
|-------------------------|--|----------|----------|----------|----------|----------|
| Cooling performance | Center part of freezing room -86°C. ambient temperature 30°C | | | | | |
| Control range | -20°C to -90°C | | | | | |
| Recording range | + 50°C to -100°C (AT type only) | | | | | |
| Rated power consumption | 1120/1240W | 940/970W | 720/800W | 665/670W | 505/502W | 550/600W |
| Alarm duration | 9 hours for power failure | | | | | |

The Heart of Ultra-Low Temperature Freezing

A wide range of Ultra-low temperature freezers.

We've selected a line-up of different types and models of ultra-low freezer which can achieve and maintain temperatures down to -86°C (-123°F) (operating on 50Hz), at ambient temperature of 30°C (85°F). It's a wide selection, offering a variety of sizes and types suitable for uses such as long term preservation, testing, frozen storage etc.

Specially Designed Compressor for Ultra-Low Temperature.

The refrigeration unit is at the heart of producing ultra-low temperature freezing. In the process of solving various technical problems in order to achieve and maintain ultra-low temperatures, Sanyo designed a



compressor especially for ultra-low temperature use. Sanyo is the only manufacturer of ultra-low temperature freezers that develops and produces all its

own components, from the refrigeration units to the micro-chips.

An Ideal Freezing Environment By Means of A Double-Insulation Wall and the "Hot Line".

In Ultra-Low temperature freezers, effective insulation is extremely critical since the temperature difference between the outside and the inner compartment can be as high as 115°C. The insulation used in Sanyo's ultra-low temperature chest freezers is two layers of rigid, foamed in place polyurethane. The outer

layer is 80mm thick and the inner is 60mm thick, placed together to form a double-insulation wall. This design prevents the insulation layers from distortion and cracking that might occur due to temperature differences inside and out, and creates the most efficient insulation material available today. Moisture condensation at the top edges of the cabinet due to differences in temperature inside and out causes frost and icing problems, which may reduce heat insulation efficiency and obstruct door movements. They are prevented by the "hot line" by means of which hot gas from the higher temperature circuit is circulated through the problem areas.

A Special Refrigerant and Oil to Maintain Stability and Reliability.

In order to expand refrigeration capacity, a special compound refrigerant has been used. This refrigerant relieves the refrigeration system of much of its load by evaporating at a lower temperature level within the circuit. Also, a special grade of refrigeration machine oil is used with the superior properties of high rate of recovery and outstanding resistance to heat and wear. This contributes to the long life and dependability of the freezer unit as a whole.

Microprocessor Temperature Control With Digital Design.

Precise setting and control is possible. The temperature inside the freezer can be set and monitored easily by means of very accurate microprocessor temperature control with digital display. The thermostat utilizes a platinum resistor (Pt 100) sensor which is precise and extremely durable.

Built-In Temperature & Power Failure Alarms(Lamp/Buzzer).

Protecting Contents from Trouble. In case of power failure or an irregular rise in temperature, a rechargeable, Cadnica battery-operated indicator lamp and alarm will be activated. Also the AT models come equipped with a compact recording unit which automatically records the inside temperature, and a LCO₂ back-up system which is self-activated when a power outage occurs. This equipment helps ensure that the contents will be protected in the event of any power failure or mechanical trouble.

Innovative New Design Easy to Operate.

Overall operability and dependability are greatly enhanced by improved design details. Highly durable hinges are used to support the large door so both opening and closing are facilitated. Door handles are equipped with a latch-locking system, and the control panel comes with a transparent resin cover.

A Wide Range to Choose From. Large, Small, Chest and Upright- A freezer to suit your Need.

Chest type freezers can maintain stable inner temperatures. Moreover, their low-profile design makes the placement and removal of contents very convenient. The upright type is designed to accommodate a large capacity in a limited space. Even very narrow spaces can be readily utilized.



MDF-U460BR

-50°C
390 LITER

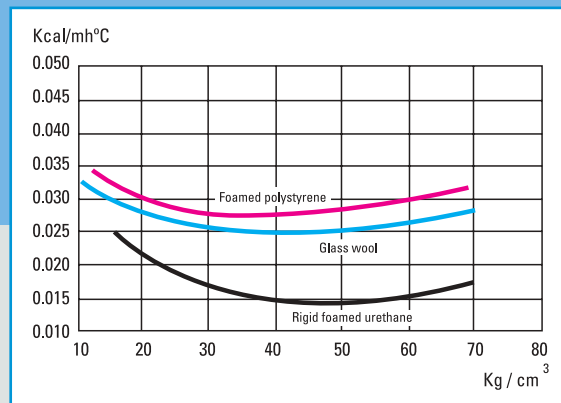
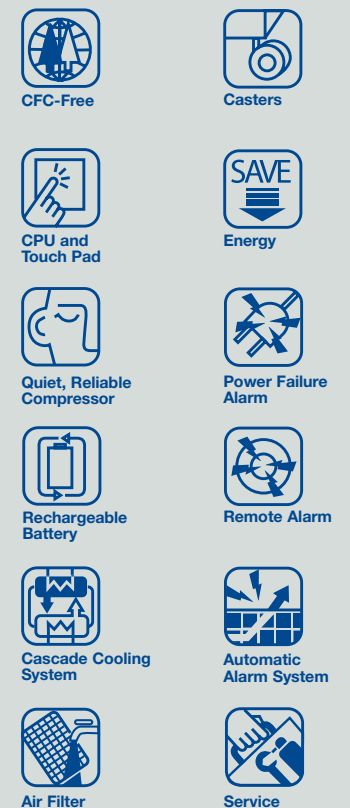
PICTOGRAM [FOR EXPL. P.3]

CFC-Free Blast Freezer

The Sanyo Blast Freezer provides High Speed Freezing of Plasma that Ordinary Low Temperature Freezers are unable to achieve.

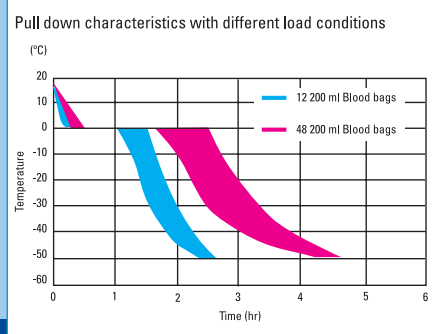
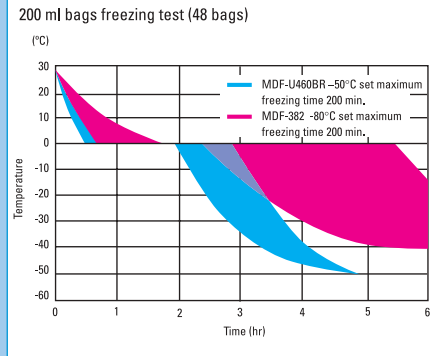
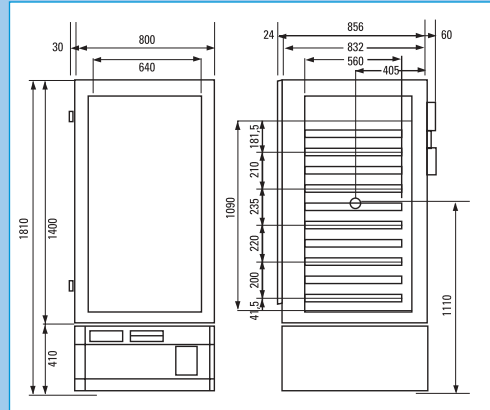
Features

- Highspeed freezing by cascade cooling system and double fans in chamber. Period 200 ml blood bag is frozen to -20°C: 48 bags within 3 hours, 12 bags within 2 hours.
- Microcomputer control Temperature setting by keyboard entry. Various alarm functions.
- Defrosting is either by automatic or manual operation.





Dimensions



-30°C/-40°C-Freezers

MDF-U5411

PICTOGRAM [SEE PAGE 3]

Specifications

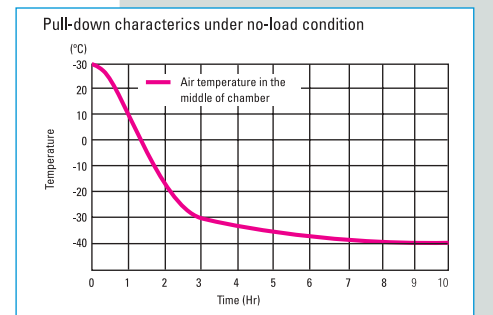
| | |
|---------------------------------------|--|
| External dimensions | 800(W) x 832(D) x 1.810 (H) |
| Internal dimensions | 640(W) x 560 (D) x 1.090(H) |
| Effective capacity | 390 liter |
| Interior Temperature | -50°C (at 35°C no load temperature in the middle) |
| Cooling method | Cascade cooling system, forced air circulation with double fans |
| Cooling Speed | Period 200 ml blood bags is frozen to -20°C 48 bags within 3 hours, 12 bags within 2 hours |
| Type | Upright |
| External Materials | Baked on acrylic finish on galvanized steel |
| Internal Material | Stainless steel (SUS 304) |
| Insulation | Foamed-in-place rigid polyurethane |
| Door | Baked-on acrylic finish on galvanized steel |
| Inner door | 2 acrylic resin plates |
| Shelves | 5 polyester coated wire shelves (ability to draw out) |
| Compressor | High side: 600W hermetically sealed Low side: 1.100W hermetically sealed |
| Refrigerant | High side/Low side :mixed gas (CFC-free) |
| Cooler | High side: cascade condenser Low side: fin & tube type evaporator |
| Condenser | High side: fin & tube type condenser Low side: cascade condenser |
| Temperature control | Microcomputer temperature control (digital setting, display). Temperature range: -15°C -59°C (Tentative setting -50°C). Digital setting with keylock |
| Alarms | <ul style="list-style-type: none"> ■ High-temperature alarm: lamp flash and buzzer ■ Power failure alarm: lamp flash and buzzer ■ Door ajar: lamp flash and continuous buzzer (after 2 minutes door ajar) ■ Filter check: lamp flash, thermistor sensor ■ Remote alarm contacts: high temperature and power failure, alarm output |
| Defrosting system | <ul style="list-style-type: none"> ■ Thermistor sensor ■ Automatic defrost: defrosts every twelve hours ■ Manual defrost: by pushing a key for 5 seconds |
| Self-check system (When error occurs) | Temperature control sensor, defrost sensor, filter sensor error display, continuous buzzer (when codes are cut or short) |
| Monitor ports | Left side 040, back side 030 (for op, recorder) |
| Power source/Voltage | AC220,240V/50Hz, 60Hz 1ø |
| Accessories | 1 defrost spatula, 1 key, 2 rubber stoppers for monitoring ports, 1 insulation for monitoring port. |
| Options | Automatic temperature recorder MTR-85H (-100°C - +50°C) |
| Roller casters | 4 |
| Net Weight | 225 kg |

Plasma Freezer

This unit provides an ideal freezing environment for the preservation of vaccines, blood plasma, test samples and specimens.

| | |
|--------------------------------|--|
| External dimensions (mm) WxDxH | 804 x 772 x 1802 |
| Interior dimensions (mm) WxDxH | 658 x 607 x 1272 |
| Net Weight | 131 Kg (288.8 lbs) |
| Effective capacity | 482 Liter (17.0 cu ft.) |
| Exterior cabinet | Polyester finish baked on galvanized steel |
| Cabinet insulation | Foamed-in-place rigid polyurethane |
| Outer door | 2, Insulated and magnetic sealed |
| Door lock | 1 door lock, 2 lockable door latches for each door |
| Storage container | 6 pcs. Upper room, 4 pcs. Lower room |
| Casters | 4 |
| Adjustable leveling feet | 2 |
| Compressor | Hermetic rotary type 350W |
| Refrigerant | R404A (HFC refrigerant) |
| Temperature control | -20°C to -40°C (Ambient temp. 30°C) |
| Temperature alarm | High/low (app. 10°C, adjustable), Buzzer and lamp |
| Power failure alarm | Buzzer and lamp (Automatic rechargeable battery) Memory back up |
| Remote alarm contact | DC30V, 2A, Normal open, temperature alarm or power failure alarm |
| Access hole | Rear side (ø 30 mm) |
| Accessories | Door lock key, Defrost spatula, Storage containers |
| Options | <ul style="list-style-type: none"> SANYO data acquisition software (MTR-2000) Interfaceboard RS232C & RS485 (MTR-480) Recorder mounting kit (MPR-S7) Circular recorder (MTR-G85) Recording paper (RP-G85) Recording pen (PG-R) for upper room (MDF-05SC) for lower room (MDF-05LC) |

- CFC-Free
- Energy
- CPU and Touch Pad
- Power Failure Alarm
- Quiet, Reliable Compressor
- Remote Alarm
- Rechargeable Battery
- Automatic Alarm System
- Casters
- Service



* Appearance and specifications are subject to change without notice

MDF-136
MDF-236
MDF-436
MDF-U537
MDF-U537D
MDF-U333
MDF-U442



PICTOGRAM [SEE PAGE 3]

- CFC-Free
- Casters
- CPU and Touch Pad
- Energy
- Quiet, Reliable Compressor
- Power Failure Alarm
- Rechargeable Battery
- Remote Alarm
- Cascade Cooling System
MDF-U442 only
- Automatic Alarm System
- Air Filter
MDF-U442 only
- Service

Biomedical Freezers

SANYO's MDF Series Biomedical freezers offer the outstanding reliability and performance required in a wide variety of storage and research applications. In the medical field, they provide effective storage of life-saving blood supplies and vaccines, as well as samples for diagnosis.

In the biotechnology field, the freezers provide effective storage of enzymes for genetic research, as well as culture media, reagents and samples for testing. In the industrial field, they are ideal for ageing and temperature tests on electronic components, precision devices, and compound resins.

As a storage environment, with excellent safety features, easy operability, and a host of other features, these freezers offer unsurpassed reliability and functionality. If you are looking for precision temperature controlled storage equipment, look to SANYO.

Enhanced Operation

- Front-mounted display/control panel (with new microprocessor) located at convenient height.



Photo is MDF-U537D

- Memory backup.
- Temperature display.
- Front access calibration for 7-day temperature recorder.
- The control panel, alarm system and non-volatile memory are the same for all models in the series.
- Single electrical box makes servicing simpler.
- The chamber temperature is displayed for five seconds if BUZZER key is depressed during power failure alarm.
- After a power outage, operation resumes at pre-outage settings (non-volatile memory for temperature and alarm temperature settings).
- Control panel can be reset to zero for validation.
- Access ports.
- Four casters and two adjustable feet.

Recording Features (Optional)
Recorder can be fitted in a convenient position that will not interfere with installation. Choice of optional recorders.

- 7-day circular recorder (MTR-G85).
- 7-day temperature recorder with auto recharging battery.
- Removable Pt100 sensor for recorder.
- Front access calibration for 7-day temperature recorder.
- Chart recorder (MTR-4014LH) is also available.

Environment Friendly

- HFC refrigerant R-404A (non-CFC, non-HCFC refrigerant) is environment-friendly and offers superb performance.
- Pre-coated metal body causes less environmental damage than conventional paint coating.

- Safety Features**
- Alarm & recording system.
 - High/low temperature alarm ($\pm 5^{\circ}\text{C}$ to $\pm 15^{\circ}\text{C}$, adjustable)
 - Power failure.
 - Remote alarm contact
 - Self diagnostics ("E" messages shown in red figures).
 - Breaker switch turns power off in event of over current abnormality.



Balance hinge door stops at any angle from 35° to 90° for convenience and safety.

Balance hinge allows a free choice of opening angle (Chest type)
To make this chest freezer

easier to use, the balance hinge keeps the door open at whatever angle you choose. That means you have both hands free for work.

Lockable door latch for extra security (Upright type)
By adding a commercially available lock, you can safeguard the contents of the freezer and keep hazardous items out of harm's way.

Temperature Monitoring Features

- Unified remote monitoring system for SANYO Biomedical products (optional).

SANYO Data Acquisition Software MTR-2000
(Except MDF-U442)

Interface board MTR-480
Exclusive option for



SANYO Biomedical Products RS232C & RS485 Selectable Easy installation (except MDF-U442)

Chest type Power to cope with frequent door openings

- Data transmission
- Balance hinge
- Temperature alarm
- Power failure alarm



Small size suitable for personal use.

- Digital temperature display as standard feature.
- Compact, personal size.



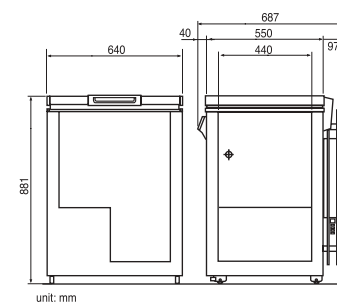
Versatile mid-size model.

- Digital temperature display as standard feature.
- Easy-to-use 200-liter mid-size model

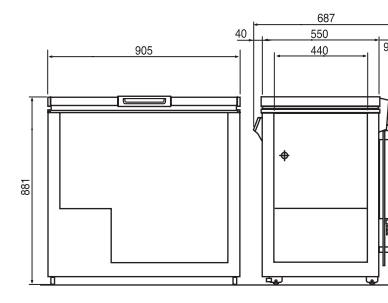


Jumbo-size 400-liter class.

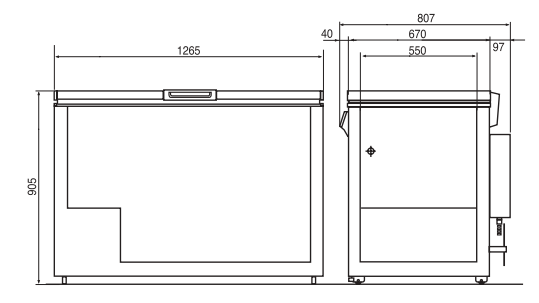
- Digital temperature display as standard feature.
- Large-capacity, economical size.



MDF-136



MDF-236



MDF-436

Upright type Maximum capacity in minimum installation space

- Door latch
- Data transmission
- Temperature alarm
- Power failure alarm



Powerful fan ensures temperature uniformity throughout the freezer cabinet.

Large-capacity, economical, space-saving model

- Top/bottom twin door design prevents cold air from escaping.
- Individual freezer circuits for each of the five drawers.

Independent top/bottom control meets differing freezer need simultaneously.

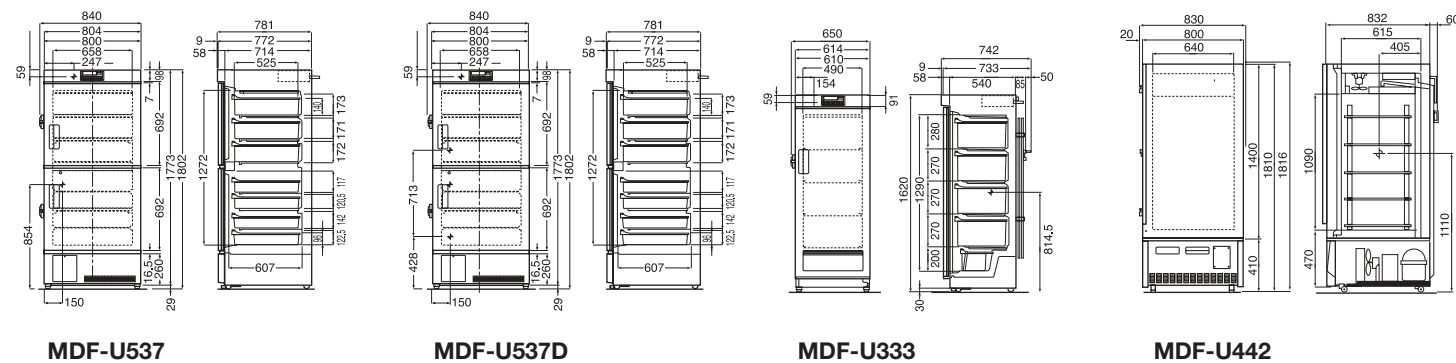
- Two independent freezer cabinets in one body, with separate defrost and operation.
- Individual freezer circuits for each of the five drawers.

Easy-to-use, compact upright model.

- Microprocessor digital temperature display.
- Convenient storage drawers.

Forced air circulation & auto defrost.

- High freezing power increases temperature uniformity.
- Auto defrost for easy maintenance.



| Model | MDF-136 | MDF-236 | MDF-436 | MDF-U537 | MDF-U537D |
|---------------------------------|---|--------------------|---------------------|---|--|
| Exterior dimensions (W x D x H) | 640 x 687 x 881 mm | 905 x 687 x 881 mm | 1265 x 807 x 905 mm | 800 x 772 x 1802 mm | 804 x 775 x 1800 mm |
| Interior dimensions (W x D x H) | 525 x 440 x 715 mm | 790 x 440 x 715 mm | 1140 x 550 x 735 mm | 658 x 607 x 1272 mm | 658 x 607 x 589 mm 658 x 607 x 603 mm |
| Capacity | 138 Liter | 221 Liter | 426 Liter | 482 Liter | 452 Liter |
| Control range | -20°C to -35°C | | | -20°C to -30°C | |
| Baskets | 2 (MDF-13B2/13B3) | 3 (MDF-13B2/13B3) | 4 (MDF-43B2/43B3) | Top: 6 medium. Bottom: 8 small | |
| Access ports | 17 mm diameter, right-hand side and bottom left | | | 30mm diameter, rear Two 30mm diameter, rear | |
| Cooling System | Hermetic rotary compressor | | | | |
| Refrigerant | R 404A | | | R 407 D | |
| Alarm System | ■ High/low temperature alarm (SV ±5°C to ±15°C adjustable) ■ Power failure ■ Remote alarm contact | | | | |
| Calibration | Zero adjustment via control panel | | | | |
| Options | 7-days recorder (MTR-G85), recorder mounting kit (MDF-S740), Baskets (MDF-13B2/13B3/43B2/43B3) | | | 7-days recorder (MTR-G85), recorder mounting kit (MPR-S7) | |

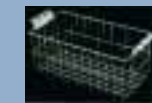
| Model | MDF-U333 | MDF-U442 |
|---------------------------------|--|---|
| Exterior dimensions (W x D x H) | 610 x 733 x 1620 mm | 800 x 832 x 1810 mm |
| Interior dimensions (W x D x H) | 490 x 485 x 1290 mm | 640 x 615 x 1090 mm |
| Capacity | 274 Liter | 426 Liter |
| Cooling performance | -30°C | -40°C (AT:±35°C) |
| Control range | -20°C to -35°C | -15°C to -40°C |
| Baskets | 4 large, 1 small | -- |
| Access ports | 30mm diameter, left-hand side | 40mm diameter, left-hand side |
| Cooling System | Hermetic rotary compressor | |
| Refrigerant | R 134A | R134A/R404A |
| Alarm System | ■ High/low temperature alarm (SV ±5°C to ±15°C adjustable) ■ Power failure ■ Remote alarm contact | ■ High temperature alarm ■ Power failure |
| Calibration | Zero adjustment via control panel | |
| Options | 7-day recorder, Recorder mounting kit (MDF-S740T) | Chart recorder (MTR-85H) |

* Appearance and specifications are subject to change without notice

Options



Storage Baskets
For MDF-136/236
MDF-13B2 (set of two)
MDF-13B3 (set of three)
Outer dimensions: 255(W) x 420(D) x 205(H)mm
Inner dimensions: 210(W) x 370(D) x 200(H)mm



Storage Baskets
For MDF-436
MDF-43B2 (set of two)
MDF-43B3 (set of three)
Outer dimensions: 275(W) x 530(D) x 205(H)mm
Inner dimensions: 230(W) x 480(D) x 200(H)mm



Temperature recorder :
MTR-G85 (except MDF-U442)
-100°C to +40°C
■ Mounting kit for chest:

- MDF-S740
- Mounting kit for Upright: MPR-S7 (for MDF U333: MDF-S740T)
- Recording paper: RP-G85
- Recording pen: PG-R



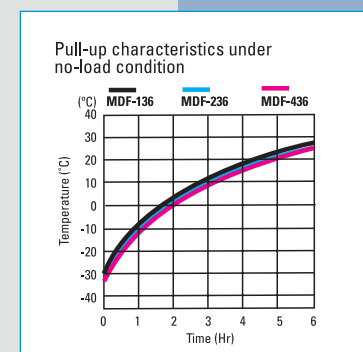
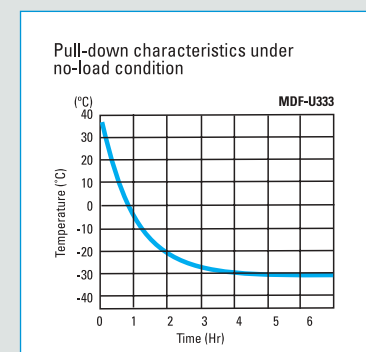
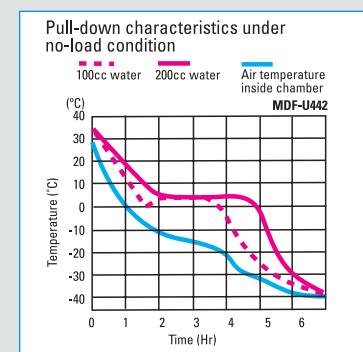
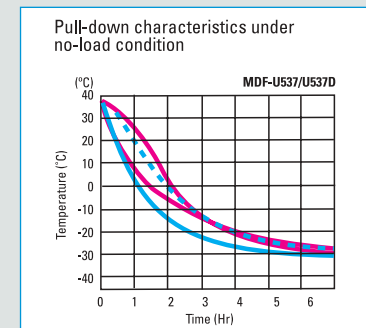
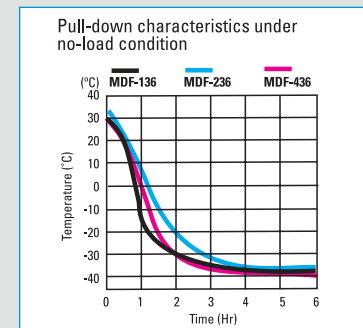
Temperature recorder:
MTR-4014LH (except MDF-U442)
-40°C to +14°C
■ Mounting kit for chest:

- MDF-S3040
- Mounting kit for upright: MPR-S30 (No kit required for MDF-U333)
- Recording paper: RP-40



Temperature recorder:
MTR-85H (for MDF-U442 only)
-100°C to +50°C
■ Recording paper: RP-85
■ Recording pen: DF-38FP

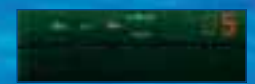
Performance data



MPR-414F
MPR-414FS
MPR-214F



LED display for easy-to-read temperature and alarms



Triple pane window for viewing (MPR-414F)



Sample and blood serum preservation

Center pillarless design for easy access



Restriction enzyme and reagent preservation

Direct cooling freezer compartment for stable temperature



Fresh frozen human blood plasma and vaccine preservation

Optional Drawers (MPR-41R)

Pharmaceutical Refrigerator with Freezer.

Validated Storage of Reagents, Pharmaceuticals and Biological samples.

MPR-414F/MPR-414FS

| | Effective capacity | Temperature range |
|--------------|--------------------|------------------------------------|
| Refrigerator | 340 Liter | 2 to 14°C |
| Freezer | 82 Liter | -10 to -30°C ambient temp: 30°C |

MPR-414F

BENEFITS:

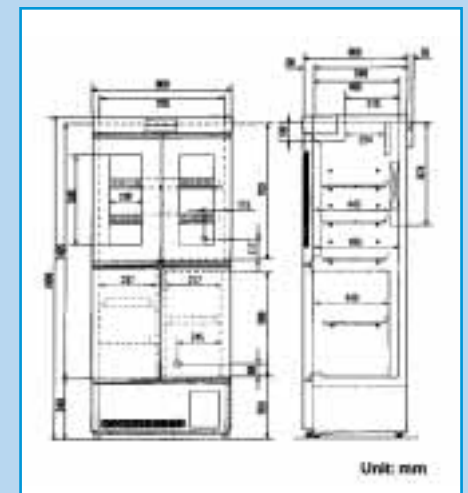
Stored product integrity guaranteed by:

- Microprocessor control system that provides accurate temperature.
- Mechanical convection system in refrigerator employs ducting and plenums that provide uniform temperature throughout the cabinet regardless of product loading.
- Unique refrigerator defrost system prevents temperature variations during defrost cycles by activating after each compressor cycle, thus minimizing the duration of the defrost cycle.
- Secondary temperature deviation safety device that prevents warm-up or excess cooling.

- Open door indicator light with 15 min. delayed audible alarm.
- Low/high temperature audible and visual alarms and remote alarm.
- Door locks.

Energy efficient and Environmentally friendly operation:

- Two specially designed low wattage/energy consuming hermetic compressors.
- Four door design reduces air loss on entry and makes efficient use of space in front of the unit.
- Hot gas heated mullions prevent condensation, icing and subsequent loss of gasket sealing efficiency.
- Very quiet operation.



Unit: mm

- CFC-free foamed-in-place insulation.
- HCFC/CFC-free refrigerant.
- Efficient use of material is demonstrated by the low overall weight 126 kg (MPR-414F).

PICTOGRAM [SEE PAGE 3]



CFC-Free



Energy



CPU and Touch Pad



Remote Alarm



Quiet, Reliable Compressor



Automatic Alarm System



Casters



Service

MPR-414F
MPR-414FS
MPR-214F

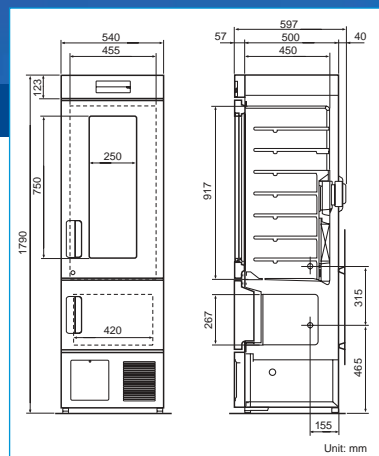


LED display for easy-to-read temperature and alarms

Double pane window for viewing.

Direct cooling freezer compartment for stable temperature.

Dimensions



MPR-214F

With the growing emphasis on proper storage of laboratory refrigerated products the market requires state-of-the-art equipment to provide unyielding parameter control. In order to achieve this goal Sanyo totally redesigned the refrigerator/freezer.

Design features which enhance user operation:

- Two full width and three half width shelves provide 1.23m² (13.5ft²) of refrigerator storage with 200mm (8") height clearance. Shelves adjustable on 100mm (4") centers.
- One freezer shelf permits two levels of storage on 0.2m² (2.6ft²) of shelf area.
- The top refrigerated section has a pillarless design for easy access and double pane windows for viewing.

- Small radius door design.
- Interior incandescent light.
- 30mm wall port for the refrigerator and freezer sections.

Field support, operational peace of mind and future serviceability is assured by:

- Microprocessor self-diagnosing electronics.
- The use of safe HCFC/CFC-free refrigerant.

Specifications

| Name | Enviro-Center | | | |
|----------------------------|--|--------------------------------------|--|--------------------------------------|
| Model | MPR-214F | | MPR-414F/MPR-414FS | |
| | Refrigerator | Freezer | Refrigerator | Freezer |
| External dimensions | 540 x 557 x 1.790 mm | | 800 x 600 x 1.805 mm | |
| WxDxH | 21.2x21.9x70.4(inch) | | 31.5x23.6x71.0 (inch) | |
| Effective capacity | 176 liters (6.2 cu.ft.) | 39 liters (1.4 cu.ft.) | 340 liters (12.0 cu.ft.) | 82 liters (2.9 cu.ft.) |
| Weight | 80 kg | | 414F: 126 kg / 414FS: 119 kg | |
| Exterior | Polyester resin finish baked on zinc galvanized steel | | | |
| Interior | Styrol resin | Colored aluminium plate | Stainless steel | Colored aluminium plate |
| Insulation | CFC-free rigid polyurethane foamed in place | | | |
| Temperature range | 2 to 14°C Ambient temp. : 35°C | -20 to -30°C Ambient temp. : 30°C | 2 to 14°C Ambient temp. : 35°C | -20 to -30°C Ambient temp. : 30°C |
| Temperature control | Microprocessor control | | | |
| Cooling method | Fan-Forced air circulation | Direct cooling | Fan-Forced air circ. | Direct cooling |
| Compressor | 60W | 60W | 160W | 160W |
| Refrigerant | R-134A (HFC) | | R-134A (HFC) | R-407D (HFC) |
| Shelves | 3(20kg/shelf) | 1(10kg/shelf) | large: 2(25kg/shelf) small: 3(15kg/shelf) | 1(15kg/shelf) |
| Access port | Ø 30mm (left) | Ø 30mm (left) | Ø 30mm (rear) | Ø 30mm (rear) |
| Casters | 4 casters with 2 adjustable leveling feet | | | |
| Alarm and safety | High/low temperature alarm, Door ajar alarm, Memory back up during power failure | | | |
| | Self diagnostics, remote alarm contact (DC30V,2A), Door key lock | | | |
| Options | 2-pen type circular recorder (MTR-G3504), Mounting kit (MPR-S7) | | | |
| | Drawers for the bottom left compartment (MPR-41R): MPR-414F/FS only | | | |
| | SANYO DAQ System (MTR-480 & MTR-2000) | | | |

These models are not explosion-proof/safe. DO NOT preserve chemicals that are highly volatile or corrosive.

The benefits of Enviro-center (compared to typical domestic refrigerators)

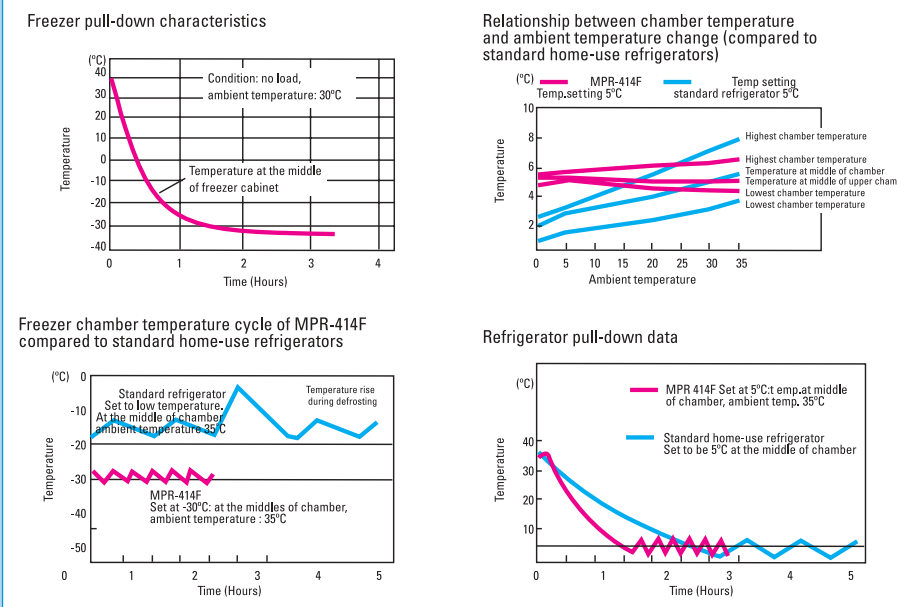
| | Enviro center | Domestic refrigerator |
|--|---------------|-----------------------|
| CFC-free, Reliable temp. control not Affected by ambient temp. | ■● | ▼ |
| Digital display of chamber Temperature | ■● | ▼ |
| Precise temperature setting of chamber | ■● | ▼ |
| Variable temp. control of Refrigerator (2 to 14°) | ■● | ▼ |
| Variable temp. control of Freezer (-20°C to -30°C) | ■● | Max/ Mid/Min |
| Separate operation of Refrigerator and freezer | ■● | -18°C |
| Windows for viewing | ■● | ▼ |
| Racks (SUS-304, MPR-41R) | ■● | ▼ |
| Monitoring hole/port | ■● | ▲ |
| Temperature recorder (option) | ■● | ▼ |
| Door ajar alarm | ■● | ▲ |
| High/low alarm and Overheating protection | ■● | ▼ |
| Remote alarm terminal | ■● | ▼ |
| Set temp. deviation protection | ■● | ▼ |
| Self diagnostic function | ■● | ▼ |
| Condensate evaporator | ■● | ● |

- Necessary function, construction or performance for preservation of reagents and pharmaceuticals
- Yes
- ▲ Some models are Yes
- ▼ NO

Alarm and safety functions

| | MPR-414F/414FS | MPR-214F |
|--------------------------|----------------|----------|
| Temperature alarm | Yes | Yes |
| Overheating protection | Yes | Yes |
| Memory back-up function | Yes | Yes |
| Door Ajar | Yes | Yes |
| Self-diagnostic function | Yes | Yes |
| Key lock switch | Yes | Yes |

MPR-414F / 414FS performance data



MPR-1410
MPR-1410R
MPR-720
MPR-720R











Large capacity enviro-centers

Stable and reliable refrigerated environment for exacting laboratory requirements.

Adjustable shelves and wide range set point for varying laboratory applications including chromatography and pharmaceutical storage.

Drawers for convenient storage.

PICTOGRAM [SEE PAGE 3]

-  CFC-Free
-  Energy
-  CPU and Touch Pad
-  Remote Alarm
-  Quiet, Reliable Compressor
-  Automatic Alarm System
-  Casters
-  Service

Environmental laboratory wide temperature range

2°C to 23°C

(ambient temp. 0°C to 35°C).



Easy access front control panel.

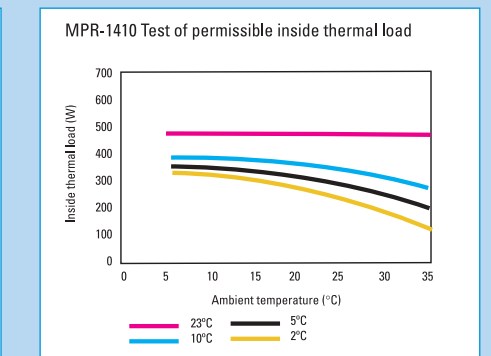
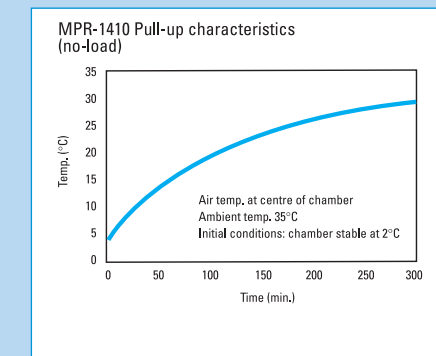
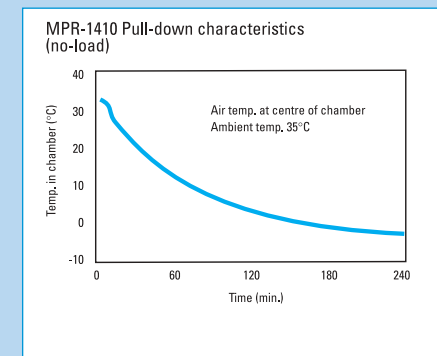
It is common knowledge that product should be stored in stable conditions below ambient temperature. Domestic refrigerators are capable of storage at +4°C, but they suffer from the following drawbacks:

1. Temperature varies every time the door is opened
2. Temperature rises during defrosting
3. Cabinet temperature is easily effected by ambient temperature, with the risk of contents freezing if ambient drops below 0°C
4. Temperature setting by dial is inaccurate (no digital temperature indication)

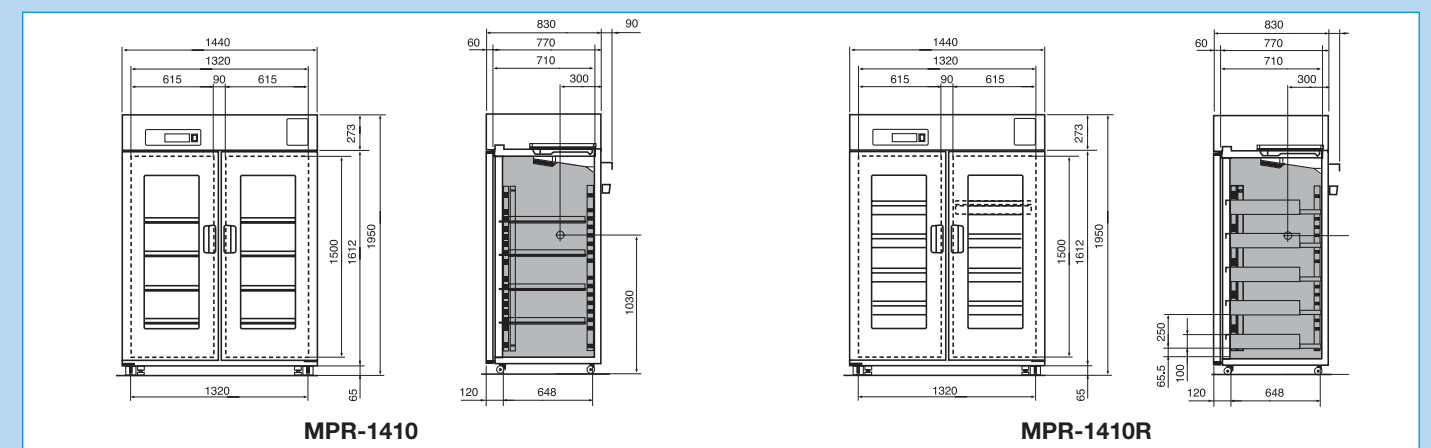
Sanyo has built solutions for all these problems into its medical refrigerators, which have been well received in hospitals, laboratories and research facilities around the world. Main Features:

1. Stable, uniform, and controlled cabinet temperature is unaffected by ambient temperature.
2. Cycle defrost with heater allows defrosting without increases in cabinet temperature.
3. Standard alarm and safety features prevent irregular temperature fluctuations in cabinet.

Performance data (Reference data)



Dimensions (mm)



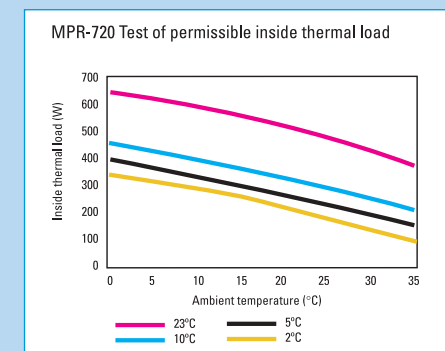
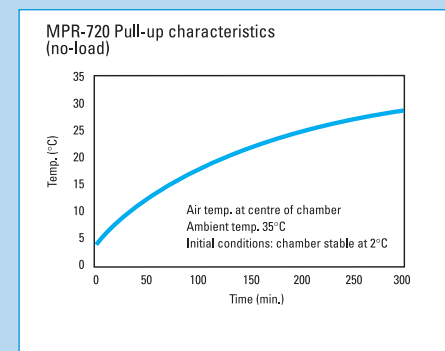
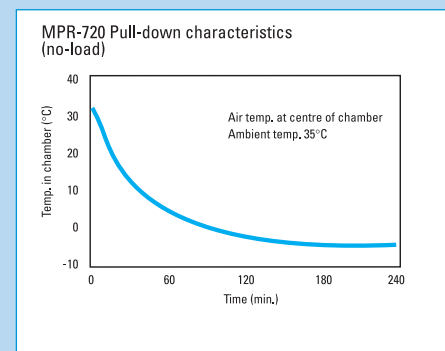


MPR-720
684 LITER

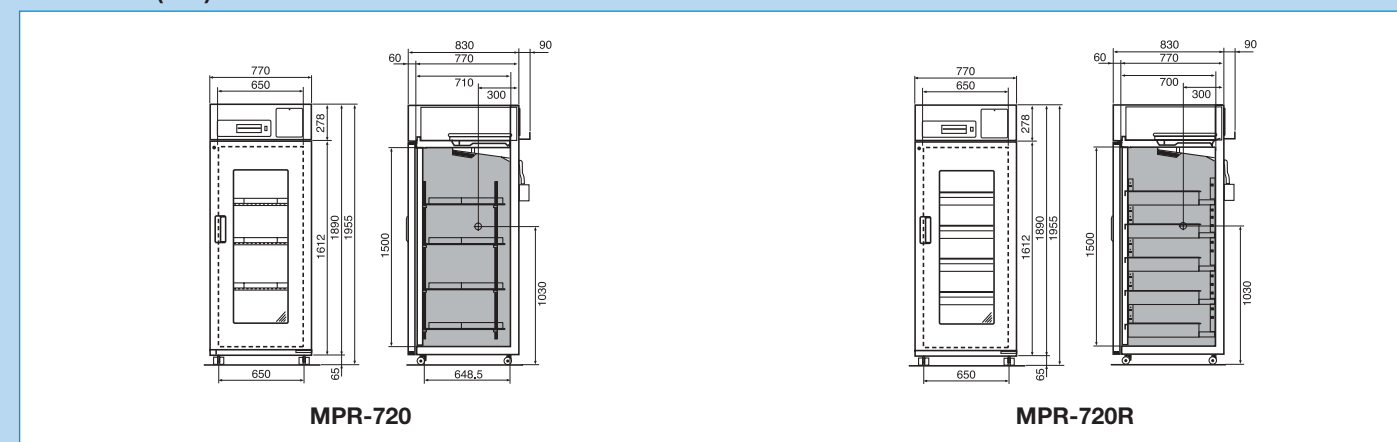
MPR-720R
671 LITER

Movable wire shelves for test apparatus and storage flexibility. Pull-out drawers for convenient filing of storage items.

Performance data (Reference data)



Dimensions (mm)



Adjustable shelves (MPR-720/1410)

The shelves can be arranged to accommodate tall apparatus such as fraction collectors. These shelves are deep enough [620mm front to back] and strong enough (50kg load for the MPR-720, 40kg for the MPR-1410) to hold most apparatus.



Drawer type (MPR-720R/1410R)

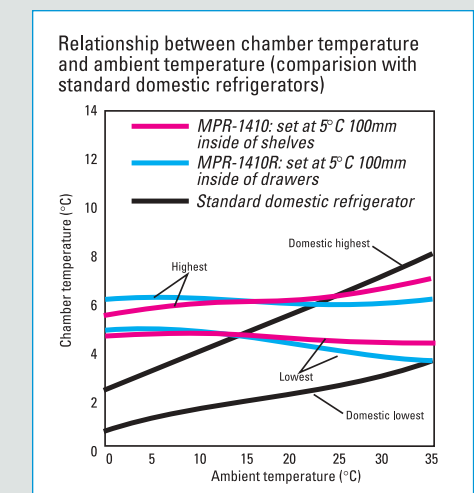
The "R" models are fitted with pull-out drawers. With a profile of 100mm and 530mm front to back, these drawers are deep enough to hold large bottles or reagent kits. They also allow convenient,

| Model | Shelves/Drawers |
|-----------|-----------------|
| MPR-1410 | 8 wire shelves |
| MPR-1410R | 10 drawers |
| MPR-720 | 4 wire shelves |
| MPR-720R | 5 drawers |

space-efficient storage and management of patient medications and other items. The MPR-720R is shipped with five drawers, while the MPR-1410R is shipped with ten drawers, five in each half of the cabinet.

Temperature Stability

SANYO's temperature control system with thermistor monitor and microprocessor control reliably maintains cabinet temperature at the set level and is unaffected by ambient temperature. Forced air circulation ensures that the cabinet temperature returns to the set point immediately after door openings and remains uniform throughout the cabinet.



Speedy & Powerful refrigeration

To cope with frequent door openings, Enviro-Centers are equipped with powerful, hermetically sealed compressors. These purpose-built compressors ensure superior pull-down characteristics and precise temperature control.

Alarm and safety features

| Features | Trigger | Type of alarm/response |
|--------------------------------|---|--|
| High temperature alarm | 1410R: 5°C more above set point 720R: 2°C to 14°C (selectable) above set point | Flashing LED & buzzer after 15 minutes |
| Low temperature alarm | 1410R: 5°C more below set point, 0°C or lower 720R: 2°C to 14°C (selectable) below set point, 0°C or lower | Flashing LED & buzzer |
| Over heating protection | Interior temperature rises to 40°C | Fan motor & heater OFF |
| Temperature lock | Lock ON | Set temperature can not be altered |
| Memory backup | Power failure | Memory of settings |
| Door ajar | Door not closed | Door ajar lamp ON |
| Self diagnostics | Sensor open or short | Error code shown (E1,E2) |
| Remote terminal alarm | Operation can be checked from office or control room away from the lab | |
| Temperature recorder | Optional | |

Easy-to-manage layout

The interior layout flexibility of Enviro-Centers makes them ideal for running experiments that require stable cool conditions, as well as storage.

Standard alarm & safety features

Enviro-Centers are fitted with buzzers and flashing lights to warn of high and low temperature problems. In the event of an irregular rise in cabinet temperature, the heater automatically shuts off and forced air circulation brings the temperature down. Door locks are fitted to safeguard valuable contents.

Large Capacity (1365Liters)

With a modular width of 770mm the MPR-720 offers capacity of 684 liters (MPR-720R: 671 liters), while the 1440mm-wide MPR-1410 offers capacity of 1370 liters (MPR-1410R: 1365 liters). The interior is spacious enough to accommodate column chromatography apparatus or large volumes of reagents, test samples and biologicals.

Wide temperature range

With a temperature range of 2°C to 23°C, Enviro-Centers are ideally suited for tests that require a stable, cool temperature.



Large fans

The 120mm-diameter fan ensures an even temperature throughout the cabinet (MPR-1410/R models have a double flow system with two fans). Heat spots from powered test apparatus are minimized and pull-up characteristics after door openings are outstanding.

HFC Refrigerant & CFC free insulation

SANYO biomedical equipment is designed for low environmental impact. The MPR-720 and 1410 series use HFC refrigerant, R-134a and the foamed-in-place insulation is also CFC free.

Cycle defrost

In the 5°C range, frost build-up on the evaporator is inevitable. This can affect the performance of the heat exchanger. SANYO has solved this problem with a cycle defrost and evaporator temperature sensor system. This system runs automatically, so there is no need to turn

off the power for defrosting. Temperature rise during defrost is minimal. The evaporation heater also doubles as protection against drops in cabinet temperature caused by a low ambient temperature.

New features (MPR-720/720R)

New concept features have been added to the MPR-720 and 720R. The filterless condenser cuts down on cleaning maintenance. All glass doors now include a protective film to prevent shattering in the event of accidental collisions.

User friendly design and double function door

Easy to read and operate control panel featuring a full array of alarm and safety

functions. Access ports are standard to allow access for power cords. Aesthetically attractive exterior colour blends well in most lab colour schemes. The “catch-free” rounded corners are safe and attractive. Doors open smoothly and close automatically. Some laboratory refrigerators have solid doors for temperature stability, while others have glass doors for easy viewing. SANYO Enviro-Centers give you the best of both versions. The broad, solid frames with effective gaskets ensure excellent temperature stability, and the double-pane glass windows offer an excellent view of the interior without compromising temperature stability.



Specifications

| Large capacity Enviro-center environmental laboratory refrigerator | | | | |
|--|--|--|--|---|
| Model No. | MPR-1410 | MPR-1410R | MPR-720 | MPR-720R |
| Exterior dimensions WxDxH | 1440 x 830 x 1950mm | | 770 x 830 x 1955mm | |
| Interior dimensions WxDxH | 1320 x 710 x 1500mm | | 650 x 710 x 1500mm | |
| Effective capacity | 1370 Liters | 1365 Liters | 685 Liters | 671 Liters |
| Exterior | Acrylic finish baked on zinc galvanised steel | | | |
| Interior | Acrylic finish baked on zinc galvanised steel | | | |
| Doors | 2 x double pane glass doors, self closing | | 1 x double pane glass doors, self closing | |
| Insulation | CFC-free rigid foamed-in-place polyurethane | | | |
| Shelves/Drawers | 8x polyethylene-coated wire shelves. Max. load: 40kg/shelf | 10x coated steel drawers. Handles with card holder. Max. load: 40kg/drawer | 4x polyethylene-coated wire shelves. Max. load: 50kg/shelf | 5x coated steel drawers. Handles with card holder. Max. load: 40kg/drawer |
| Access ports | 3x30mm Ø (2 in sides, 1 in cabinet top) | | | |
| Locks | 2 x cylinder type | | 1 x cylinder type | |
| Castors | 4 | | | |
| Cooling method | Forced air with double fan | | Forced air with single fan | |
| Compressor | 300W hermetic rotary | | 220W hermetic rotary | |
| Evaporator | Fin tube type | | | |
| Condenser | Fin tube type | | Wire tube type | |
| Refrigerant | R-134A | | | |
| Defrost method | Forced type (cycle defrost system), fully automatic. Hot pipe for automatically evaporation of drain water | | | |
| Defrost heater | 257W | | 153W | |
| Power source | Voltage | 230/240V | | 230/240V |
| | Hz | 50Hz | | 50Hz |
| | Phase | 1Ø | | 1Ø |
| | Amps. | 2,8A | | 1,6A |
| Max. heat release | 1565kJ/hr | | 1440kJ/hr | |
| Temperature control | Microprocessor ON/OFF type. Thermistor sensor temp. control range: 2°C to 14°C (ambient temperature -5°C to 0°C no-load). 2°C to 23°C (ambient temperature 0°C to 35°C no-load) (1°C step) | | | |
| Temperature display | Digital type (1°C step) | | | |
| Safety features | High temp. protection circuit, low temp. protection circuit, temperature lock, self diagnostics, memory backup (non volatile memory) | | | |
| High temp. alarm | When temp. 5°C or more above set level, flashing LED & buzzer after 15-minute delay | | | |
| Low temp. alarm | When interior temp. drops to 0°C or lower, flashing LED & buzzer | | | |
| Door ajar alarm | Flashing lamp, buzzer after 2-minute delay | | | |
| Interior lamp | 40Wx1, fluorescent lamp | | 20Wx1, fluorescent lamp | |
| Net weight | 231kg | 267kg | 167kg | 186kg |

*Appearance and specifications are subject to change without notice

Options:



Automatic temperature recorder MTR-G04

Specifications:
Recording range: -10°C to +40°C,
accuracy ±1degree
Recorder paper: RP-G04



Recorder mounting kit: MPR-S7



**MPR-1013
MPR-1013R
MPR-513
MPR-513R**

PICTOGRAM [SEE PAGE 3]

Stable environment control independent from the outside temperature.

- Superior cooling performance
- Microprocessor temperature control
- Cycle defrost function
- Fan-forced air circulation
- Energy efficient
- Alarm and safety devices

Stable and reliable environment control - the key to high-precision performance for exacting storage or research requirements.

Several factors are important to ensure the quality of pharmaceuticals, samples and reagents. These are storage temperature, expiry date, exposure to ultraviolet light and humidity. Of these the most important is storage temperature. If the temperature is too high, chemical changes can occur which affect the

quality of the materials. If the temperature is too low, there is a risk of structural changes brought about by freezing. Narrow and uniform temperature control without regard to ambient conditions is very important. Don't compromise your results!

- CFC-Free
- Energy
- CPU and Touch Pad
- Remote Alarm
- Quiet, Reliable Compressor
- Automatic Alarm System
- Castors
- Service

MPR-1013
MPR-1013R
MPR-513
MPR-513R



MPR-1013R
1.034 LITER

Equipped with sliding racks.
2°C to 14°C
(Ambient temperature from -5°C to +35°C)

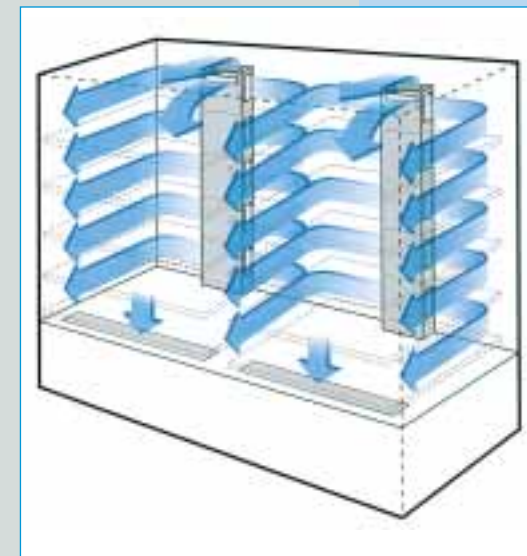


MPR-513
489 LITER

2°C to 14°C
(Ambient temperature from -5°C to +35°C)



Plenums
Sanyo's plenum design features uniform cold air flow distribution throughout the chamber to ensure temperature uniformity-essential for validated storage requirements.

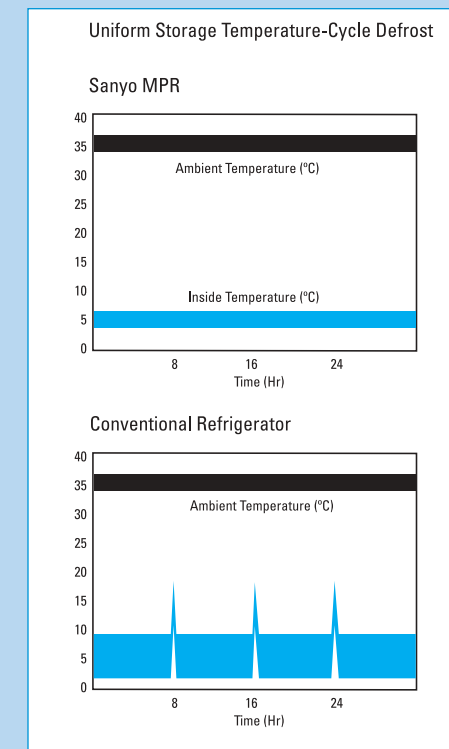
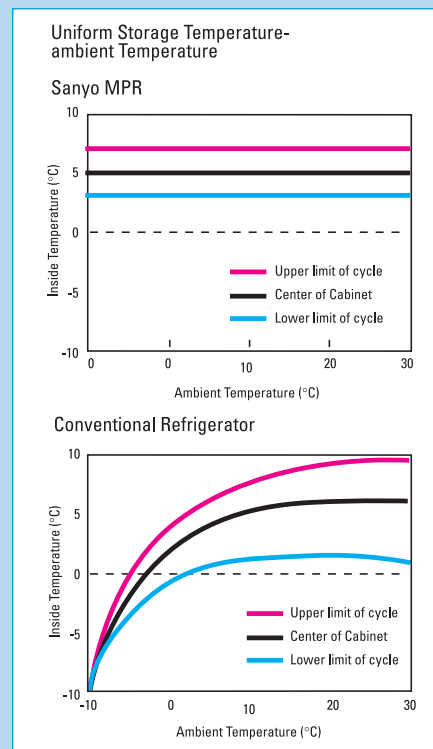


Uniform storage unaffected by ambient temperature
Microprocessor controlled
An electronic sensor accurately monitors chamber temperature and feeds the information to the microprocessor for precise control at preset temperature. Fans ensure gentle air circulation to provide uniform top to bottom temperature control after frequent door openings. Sanyo's easily calibrated, reliable and stable controls make validation easier.

Remarkable cooling efficiency
A highly efficient hermetic compressor, specially designed and developed by Sanyo, is utilized to provide powerful and rapid cooling to maintain proper temperature level.

Worry free cycle defrosting system
With Sanyo's cycle defrost system, defrosting is performed automatically during compressor "off" cycles, and by sensing frost levels. This way defrosting is performed only when required, further protecting the contents against unnecessary temperature rise. The defrosting heater also acts as an emergency heat source to prevent samples from freezing.

HFC refrigerants & CFC-free Insulation
Always a leader in environmentally friendly technology, Sanyo refrigerators feature commonly available HFC refrigerants and CFC-free insulation.



Ergonomic design
The ergonomic design of the MPR series refrigerators provides a clear view of stored items through the large framed windows. The slim profile allows for easy-reach retrieval of your products. Users can choose from two types to suit their needs; one with all wire shelves or one with sliding racks on one side.

Safety is a Sanyo standard
Even the best designed refrigerator must be prepared for the unexpected.

- Cabinet construction
View Window Design with protective film to prevent shattered glass from scattering onto the floor. Key Locked Doors
- Control safety devices
Audible and Flashing LED Visual alarms alert you to the unlikely event of either a High or Low Temperature condition. An over-shooting prevention circuit automatically switches off the fan motor or heater, if the inside temperature rises abnormally.
- Remote alarm contacts
Low/high temperature audible and visual alarms and remote alarm.

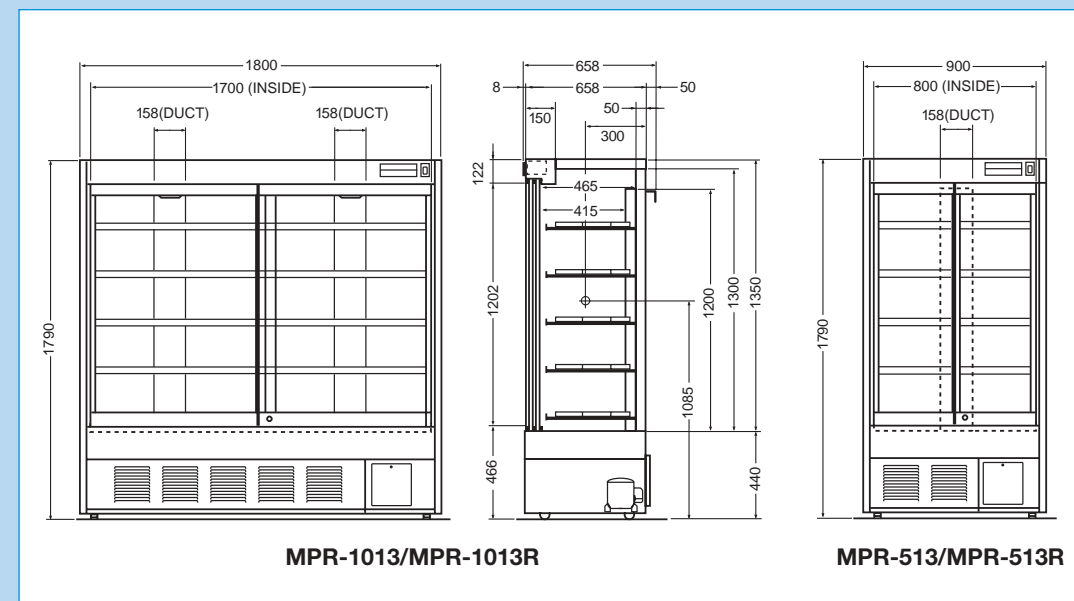


Specifications

| Model no. | MPR-1013, MPR-1013R | MPR-513, MPR-513R |
|--------------------------------|---|---|
| External dimensions (mm) WxDxH | 1800 x 600 x 1790 | 900 x 600 x 1790 |
| Interior dimensions (mm) WxDxH | 1700 x 465 x 1300 | 800 x 465 x 1300 |
| Effective Capacity | 1037 Liters MPR-1013 1034 Liters MPR-1013R | 489 Liters MPR-513 486 Liters MPR-513R |
| Exterior cabinet | Baked-on acrylic finish galvanized steel | |
| Interior cabinet | Stainless steel | |
| Outer door | 2 sliding doors, Double layer glass window | |
| Cabinet insulation | CFC-free rigid polyurethane foamed-in-place | |
| Outer door lock | 1 | |
| Shelves and sliding racks | 10 polyester coated wire shelves Load: 50 kg per shelf (MPR-1013) 5 polyester coated wire shelves Load: 50 kg per shelf 10 polyester coated sliding racks Load: 20 kg per rack (MPR-1013R) | 5 polyester coated wire shelves Load: 50 kg per shelf (MPR-513) 5 polyester coated wire shelves Load: 20 kg per shelf 5 polyester coated sliding racks Load: 20 kg per rack (MPR-513R) |
| Cooling method | Forced cool air circulation | |
| Evaporator | Fin and tube | |
| Condenser | Wire tube, tube on sheet | |
| Compressor | 300W Hermetically sealed | 225W Hermetically sealed |
| Refrigerant | R-134A | |
| Fan motor | for cooling: output 3Wx2 for condensing: output 4W | For cooling: output 3W - |
| Defrosting | Forced type, fully automatic | |
| Internal heater | 175W | 148W |
| Weight | 240kg MPR-1013 252kg MPR-1013R | 136kg MPR-513 142kg MPR-513R |

*appearance and specifications are subject to change without notice.

Dimensions



Options:

Automatic Temperature Recorder MTR-G04 (Circular type)

- Recording paper RP-G04 (circular type)
- Mounting kit for MTR-G04: MPR-S7

MPR-161D MPR-311D



PICTOGRAM [SEE PAGE 3]

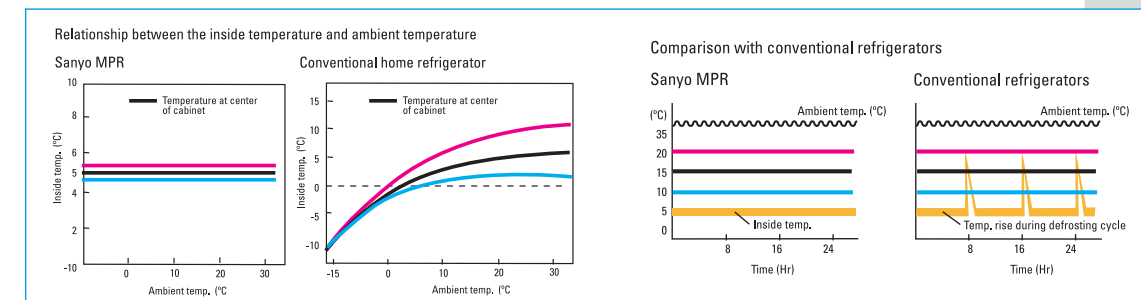


Medical refrigerators for reliable storage of pharmaceutical and medical supplies. For a versatile range of storage applications – compact and large-capacity medical refrigerators.

Sanyo pharmaceutical refrigerators – safe, worry-free cold storage of valuable medical supplies.
To ensure quality, safety and effectiveness of vital medical supplies, Sanyo medical refrigerators feature precisely regulated cooling systems that maintain a delicate temperature balance under a wide range of conditions. For many years, Sanyo has provided equipment for medical supply storage and temperature control to hospitals and pharmacies throughout the world. Now, utilizing this accumulated

experience plus valuable feedback from the medical community, Sanyo has developed the Medi-Cool line of medical refrigerators, each of which is equipped with advanced cooling and electronic technology to provide the ideal temperature for the perfect preservation of a wide range of medical supplies.

Remarkable Cooling Efficiency
Taking into consideration that pharmaceutical refrigerators must be opened frequently, a highly efficient



hermetic compressor, specially designed and developed by Sanyo, is utilized in each model of the Medi-Cool series. The hermetic compressor provides powerful, immediate cooling which is effective in maintaining the inside temperature at a constant level.

Effective Temperature Control

- 1. Electronic Temperature Control System**
A thermistor sensor monitors temperature inside the chamber and microprocessor and electronic temperature control ensure that the set temperature is maintained. Even if the door is opened and closed frequently, the circulation fan ensures rapid temperature adjustment to provide a highly reliable, stable preservation environment that is not affected by ambient temperature. The MPR-161D and 311D have a digital temperature display for easy confirmation.
- 2. Fan-Forced Air Circulation**
The temperature stays even throughout the inside of the refrigerator with the fan-forced air circulation system. No matter how the load is distributed, every corner of the unit is immediately cooled with no noticeable variation in temperature apparent inside the cabinet.
- 3. Cyclical Defrosting System**
During normal operation, the cyclical defrosting system permits defrosting to

take place without increasing the temperature inside the cabinet.

Equipped with Digital Temperature Display

Easy-to-read digital temperature display provides at-a-glance confirmation of the current operating temperature. To simplify temperature control, temperature readings are displayed in graduations of 1°C for temperatures ranging from 0°C to 15°C.

Easy-to-Use, Newly Designed Doors

- 1. Double-Paneled Glass with Heat-Reflective Film**
The refrigerator doors, constructed of double-paneled glass with heat-reflective film, allow easy loading and unloading of medical supplies while preventing ultraviolet rays, which may damage the stored items, from entering the unit. Sanyo's unique heat-reflective film blocks the passage of radiant heat rays through the glass panels and keeps the inside temperature from being adversely affected by excessive amounts of heat.
- 2. Door Open Alarm**
When the door is opened, the Door Open indicator lamp lights automatically. After approx. 30 seconds a buzzer alarm will sound if the door has not been closed. When you want to keep the door open for

more than 30 seconds, you can deactivate the alarm via the buzzer switch provided.

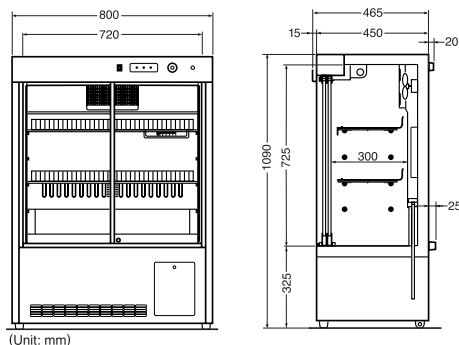
Abnormal Temperature Alarm and Safety Devices

- 1. Abnormal Temperature Alarm**
If the inside temperature suddenly descends to below 0°C or rises to above 15°C, the buzzer sounds an alarm. Simultaneously, the digital temperature display flashes.
- 2. Abnormal Temperature Safety Device**
If the internal temperature reaches below -2°C or above 20°C (approx.), the low- and high-temperature safety devices prevent the contents of the refrigerator from freezing or the temperature from rising abnormally while visible and audible alarms are activated.
 - Rigid polyurethane foam insulation acts to keep cold air inside the unit and effectively protects against the intrusion of warm air.
 - Chemical-resistant interior surface of the cabinet ensures reliable service for many years of use.
 - Less installation area is required with the use of 2 easy-open sliding doors.

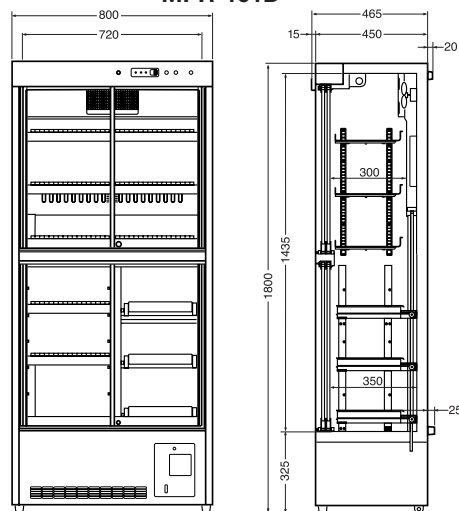


MBR-304D
MBR-304GR
MBR-704GR
MBR-1404G
MBR-1404GR
MBR-107D
MBR-506D

Blood Bank Refrigerator



MPR-161D



MPR-311D

Specifications MPR-161D/MPR-311D

| Model No. | MPR-161D | MPR-311D |
|--------------------------------------|--|---------------------|
| External dimensions | 800 x 450 x 1050 mm | 800 x 450 x 1800 mm |
| Internal dimensions | 720 x 300 x 725 mm | 720 x 350 x 1435 mm |
| Effective capacity | 158 Liter | 340 Liter |
| Cabinet | Metallic brown baked-on acrylic finish on galvanized zinc-plated | |
| Interior | Baked-on acrylic finish on galvanized zinc-plated steel | |
| Insulation | Polyurethane foam | |
| Doors | Sliding glass doors, double-paneled glass with heat-reflective film | |
| Shelves | Rigid wire with polyethylene coating finish | |
| Monitoring hole | 30mm diameter on back wall | |
| Lighting | 20W fluorescent lamp (1) | |
| Castors | 2 | |
| Power source | Voltage | 230/240V |
| | Hz | 50Hz |
| | Phase | 1 |
| | Amps. | 0,9A / 1,3A |
| Compressor | Hermetic type, 90W / Hermetic type, 160W | |
| Refrigerant | R-412A (TP5R) | |
| Evaporator | Fin & tube, forced-air circulation | |
| Condenser | Wire & tube | |
| Defrosting | Cyclical defrosting & evaporator temp. detection system. | |
| Defrosting heaters | 114W | |
| Temperature control | Electronic temp. control (range: 2°C-14°C) | |
| Temperature display | Digital (display range: 0°C-15°C) | |
| High-temperature alarm system | Flashing digital indicator (above 15°C), Buzzer (above 15°C) High temp. indicator lamp (above approx. 20°C) | |
| Low-temperature alarm system | Flashing digital indicator (below 0°C), Buzzer (below 0°C) Defrost indicator lamp (below approx. -2°C) | |
| Door ajar alarm | Buzzer/door ajar alarm | |
| Weight | 59kg | 90kg |

* Specifications subject to change without notice

Sanyo MBR-series provide two styles of storage systems, G-type (coated hard steel wire shelf) and GR-type (stainless steel roll-out drawer with card holder). Designed to conform to AABB criteria, with assured stable and reliable temperature control utilizing SANYO original technology: A special highly efficient compressor designed and developed by SANYO, to provide rapid cooling and quiet performance for each model.

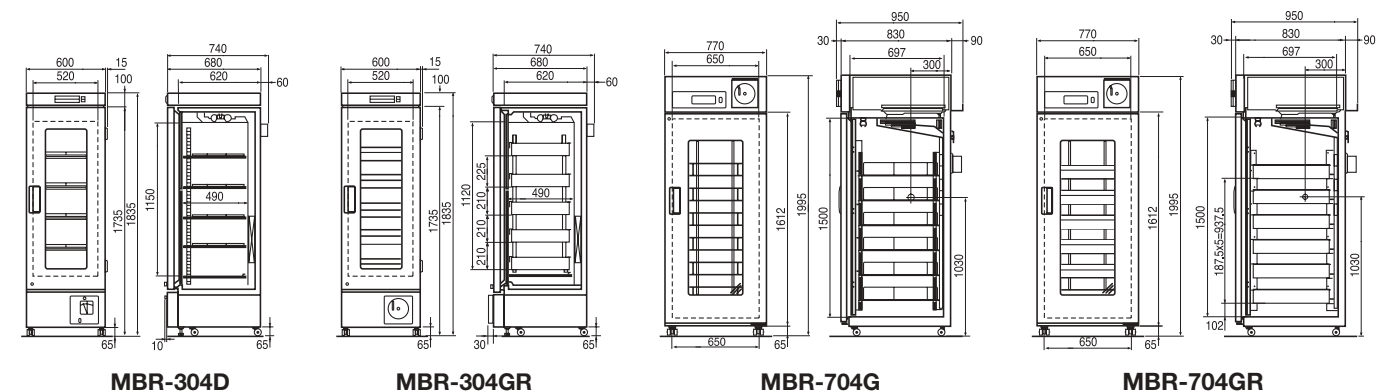
Stable Temperature Control

- Temperature is controlled by two sensors located in the liquid-loaded monitor bottles, which are in the shape of a blood bag.
- Two thermistor sensors for constantly monitoring the temperature in both the upper and the lower part of chamber.
- Microprocessor control ensures the most accurate temperature control available.
- Multi air-flow plenum system ensures excellent temperature uniformity in larger capacity models. (MBR-704G/GR, MBR-1404G/GR).

- Temperature-maintained defrost, designed with thermal sensors and heaters on the evaporator, all under precise microprocessor control.

Temperature Variations Prevented
SANYO MBR series are designed to minimize cold air loss even with frequent door openings.

- Separated transparent inner doors minimize the chamber air leakage during door openings.
- Foamed-in-place insulation in the walls and magnetic sealed outer doors with double-pane glass window prevents





Cooling performance:
4°C ±1,5°C
(Ambient temp. 35°C)

1287 LITER
720 Blood bags 450 ml

MBR-1404G
MBR-1404GR



Cooling performance:
4°C ±1°C
(Ambient temp. 35°C)

79 LITER
32 Blood bags 450 ml

MBR-107D



425 LITER
120 Blood bags 450 ml

MBR-506D

SANYO
Software MTR-2000

* Analog module required

chamber air leakage and promotes complete door closings.

- Large air circulation fan enables rapid temperature recovery after door openings (double fan for MBR-1404G/GR).

User Friendly Design

- Selectable storage system (G-type and GR-type) to suit users needs.
- Fluorescent interior lamp with ON/OFF switch and a large view window in the outer door provide a clear view of stored items.
- Digital display is easy to see, and is calibratable through the control panel.

Alarm and safety functions

To ensure the safety of the precious



easy-to-use display at the front

blood supply, SANYO MBR series provide the following safety functions.

- Audible and flashing LED visual alarms with remote alarm contacts, in the event of power failure, high or low temperature condition, or due to thermal sensor abnormality.
- Door alarm and key lock are standard features.

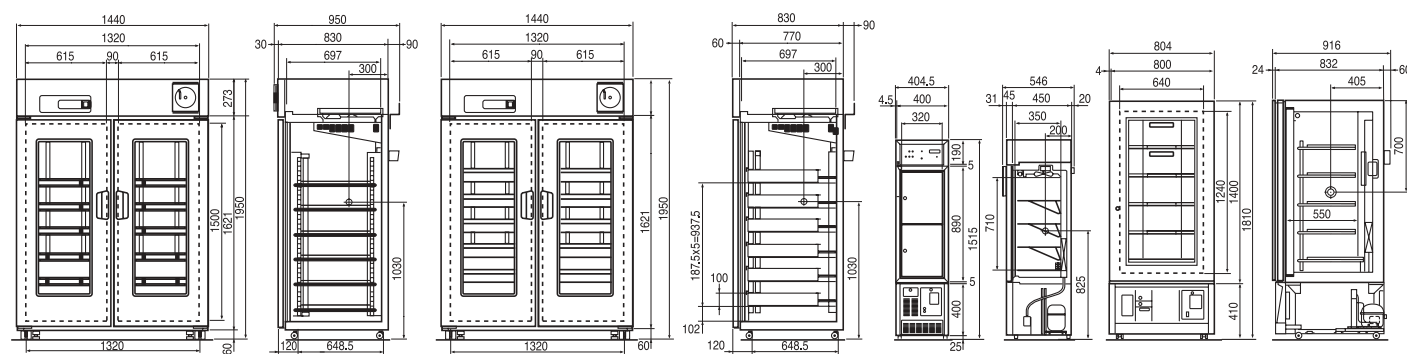
- Re-activating buzzer, lamp and remote alarm-contact. (30 min. After buzzer stops).
- Built-in temperature recorder.

Environment Friendly

SANYO refrigerators feature commercially available CFC-free, HFC refrigerants and CFC-free insulation.

Temperature Monitoring Features

- Unified remote monitoring system for SANYO Biomedical products (optional).



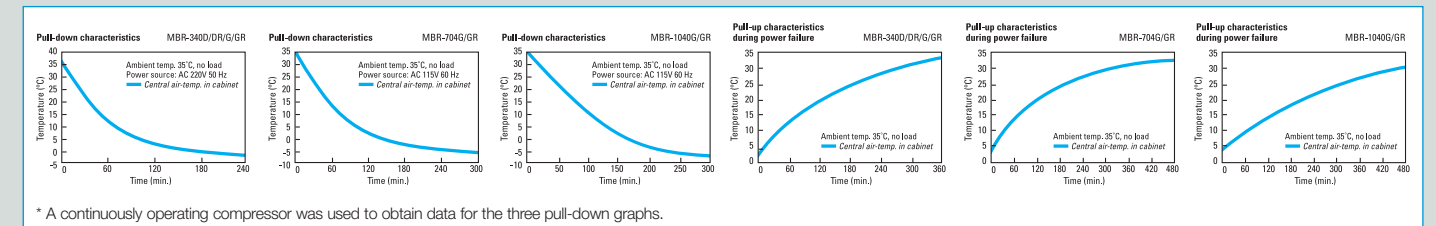
MBR-1404G

MBR-1404GR

MBR-107D

MBR-506D

Performance data (reference data)



* A continuously operating compressor was used to obtain data for the three pull-down graphs.

Specifications

| Model No. | MBR-304D/DR | MBR-304G/GR | MBR-704G/GR | MBR-1404G/GR |
|--|--|---|---|---|
| Exterior dimensions (WxDxH) | 600 x 680 x 1835 | | 770 x 830 x 1955 | 1440 x 830 x 1950 |
| Interior dimension (WxDxH) | 520 x 490 x 1150 | | 650 x 697 x 1500 | 1320 x 697 x 1500 |
| Net weight | 125kg (D/G), 140kg (DR/GR) | | 195kg (G), 210kg (GR) | 245kg (G), 290kg (GR) |
| Effective capacity | 304 Liter(D/G), 302 Liter(DR/GR) | | 625 Liter(G), 617 Liter(GR) | 1287 Liter |
| Storage capacity | 120 bags (450 ml) | | 360 bags (450 ml) | 720 bags (450ml) |
| Exterior cabinet | Baked-on acrylic finish galvanized steel | | | |
| Interior cabinet | Baked-on acrylic finish galvanized steel | | | |
| Cabinet insulation | CFC-free rigid polyurethane, foamed-in place | | | |
| Outer door | Insulated steel frame with double layer glass windows | | | |
| Door lock | 1 | | 1 | 2 |
| Inner door (Acrylic) | 2 | | 3 | 6 |
| Shelves | 4 coated hard steel wire shelves and 1 stainless steel plate(D/G) | | 6 coated hard steel wire shelves (G) | 12 coated hard steel wire shelves (G) |
| Drawers | 5 stainless steel roll-out drawers (DR/GR) | | 6 stainless steel roll-out drawers (GR) | 12 stainless steel roll-out drawers (GR)5 |
| Casters | | | 4 | |
| Compressor | 175 W Hermetically sealed | | 220W hermetically sealed | 300W hermetically sealed4 |
| Refrigerant | R 134a | | | |
| Cooling performance | 4°C - 1°C(ambient temperature 35°C) | | | 4°C-1.5°C) ambient temperature 35°C |
| Air circulation | Forced air circulation | | | |
| Defrost | Fully automatic | | | |
| Temperature control | Microprocessor control | | | |
| Temperature alarm | High (6°C), Low (2°C, Audible and visual alarm | | | |
| Power failure alarm | Audible and visual alarm(24 hours), automatic rechargeable battery (Ni-MH) | | | |
| Door alarm | Audible and visual alarm | | | |
| Remote alarm contact | DC30V,2A, Normal open, , Temperature alarm or power failure alarm | | | |
| Temperature monitor bottle | 250ml x 2 with thermistor sensor | | | |
| Lighting | 15W Fluorescent lamp | | 20W fluorescent lamp | 40W fluorescent lamp |
| Access hole | 1 | | 2 | |
| Accessories | 30days recorder (strip type) Door lock key | 1/7/30 days circular recorder Door lock key | | |
| Options | Recording paper (RP-06) | Recording paper (RP-G04), Recording pen (PG-R) | | |
| SANYO data acquisition software (MTR-2000) * Analog module required. | | | | |

| Model No. | MBR-107D | MBR-506D |
|---|--|--|
| Exterior dimensions (WxDxH) | 400 x 495 x 1515 | 800 x 832 x 1810 |
| Interior dimension (WxDxH) | 320 x 350 x 710 | 540 x 550 x 1240 |
| Net weight | 70 kg | 185 kg |
| Effective capacity | 79 liters (2.8 cu.ft.) | 425 liters (15.0 cu.ft.) |
| Storage capacity | 32 bags (450ml) | 120 bags (450ml) |
| Exterior cabinet | Baked-on acrylic finish galvanized steel | |
| Interior cabinet | Stainless steel | |
| Cabinet insulation | CFC-free rigid polyurethane, foamed-in-place | |
| Outer door | Triple layer glass windows | |
| Door lock | | 1 |
| Inner door (Acrylic) | 2 | 5 |
| Shelves | 3 zinc plated steel wire and 1 stainless steel | 4 coated hard steel wire and 1 stainless steel |
| Casters | - | 4 |
| Compressor | 110W Hermetically sealed | 160W Hermetically sealed |
| Refrigerant | R-134a | R-412A (TP5R) |
| Cooling performance | 4°C ±1°C (ambient temperature 35°C) | |
| Air circulation | Forced air circulation | |
| Defrost | Fully automatic | |
| Temperature control | Microprocessor | |
| Temperature alarm | High (6°C), low (2°C), Audible and visual alarm | |
| Power failure alarm | Audible and visual alarm (9 hours), Automatic rechargeable battery (Ni-Cd) | |
| Door alarm | Visual alarm | |
| Remote alarm contact | DC30V,1a, Normal open Temperature alarm or power failure alarm | DC24V,1A, Normal open |
| Lighting | 6W Fluorecent lamp | 15W Fluorecent lamp |
| Access hole | 1 | |
| Accessories | 30 days recorder, Door lock key 1 set | |
| Options | Recording paper (RP-06) | |
| | Basket (MBR-15B) Max.8pcs/unit 220 ml bags x 7pcs/basket | Basket(MBR-55B)max 20pcs./unit 220ml bags x 10pcs/basket |
| | Basket(MBR-16B) Max.8pcs/unit 450ml bags x 4pcs/basket | Basket(MBR-56B) Max.20pcs/unit 450ml bags x 6pcs/basket |
| SANYO data acquisition software (MTR-2000) *Analog module required. | | |

*Appearance and specifications are subject to change without notice.



A guide through the maze
of CO₂ Incubators.

Since the 1800's, researchers have been searching for the ideal in vitro environment to maintain cell culture stocks. This requires precise temperature, humidity and gas levels for the cells to thrive.

With the introduction of CO₂ incubators in the late 1960's, manufacturers have continued to develop technologies to achieve optimal mammalian cell culture growth: 37°C, 80-95% relative humidity (RH) and 5% CO₂.

The original CO₂ incubator was a bell jar which contained a candle. The cultures were placed in the jar, the candle was lit, and then a lid was placed on the jar to seal it. Finally the jar was placed in a dry heated chamber thus creating the original 'air jacketed' CO₂ incubator.

Not only did the 'Candle Jar' provide an elevated CO₂ environment, it also protected the cultures from the desiccating effects of the dry heat. The water contained in the culture media was sufficient for humidification. The first wide scale use of CO₂ incubators was in the field of Bacteriology, specifically to diagnose meningitis and gonorrhoea. Increased prevalence of these diseases and the growth of tissue culture resulted in the development of larger, more convenient CO₂ incubators. The greatest difficulty to overcome was maintaining elevated humidity without condensation. The incubators of the day were heated internally by gravity convection and used crude thermostatic controls. Under elevated humidity conditions these incubators experienced condensation problems. The technological solution was to utilize water as a heat transfer media and surround the chamber with a jacket.

The resulting "Water Jacketed" incubators had two additional advantages. The mass of water acted as a buffer preventing temperature fluctuations (control hysteresis) and the radiant heat from 5 walls provided superior top to bottom uniformity.

With the advent of today's micro-processor P.I.D. controllers and cabinet designs, progressive incubator manufacturers have air jacket design as the leading technology. The result is an incubator that matches the stability and uniformity performance of water jackets without the inconvenience.



controlled environment

water jacket Incubators.



temperature control

As technology evolved, incubators were developed to allow customers to place product directly on the shelves of the incubator without the use of cumbersome bell jars. To do this, it was important to ensure that the temperature control inside the chamber be very stable allowing for uniform cell growth. Unfortunately, at the time, temperature controller technology was in its infancy. Precise electronic temperature controllers were relatively expensive. To address this problem, a large mass of heated water was used to surround the chamber of the incubator on 5 of the 6 sides. This allowed for the use of inexpensive temperature controllers whose course control characteristics would be buffered by the large water mass surrounding the chamber.

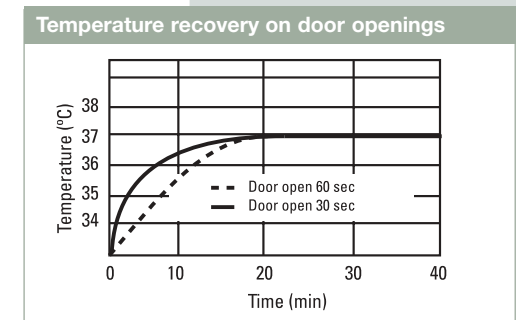
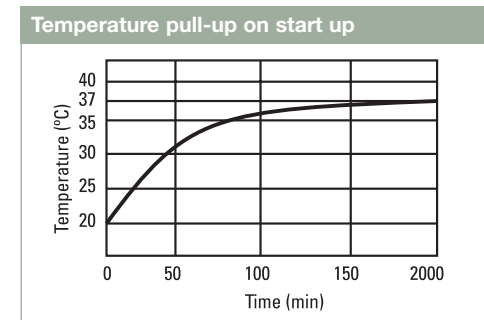
Today, extremely precise microprocessor temperature controls are in widespread use for many applications and are no longer expensive to produce. This advanced technology along with very specific heat distribution along the walls of the incubator chamber and door allows for very tight temperature control without the requirement for a large buffering water mass.

Air Jacketed incubators, quite simply replace the bulk of water with conditioned air surrounding the incubator chamber

Water-jacketed incubators are surrounded by water on five sides -a design that limits their size to no larger than 140~170 litres. Although these incubators take longer to reach the set temperature and stabilize, they have the advantage that in the event of power outages, they will often maintain chamber temperatures for longer. This of course also means the incubator will take longer to get back to the original set point once the power returns. Since most modern CO₂ incubators utilize electronic injection of CO₂, pH concentrations will not be maintained in either air jacket or H₂O jacket units, thus comprimizing the cell growth environment.

The advantage of air jacket design allows for far quicker initial set-up as there is no requirement to heat up large amounts of water. Its lighter operational weight means that it can be easily moved to allow access for cleaning or to change its location. Specific heater placements and continuous sensing of changing ambient temperatures allow air jacket designs to very precisely control temperature distribution and uniformity, while in the process avoiding condensation inside the chamber.

Due to their design, air jacketed incubators can control chamber temperature directly by sensing internal changes - giving them faster recovery times for temperature and humidity -an important consideration if the unit will have frequent door openings.





CO₂ sensors

Once the choice of water versus air jacketing is made, the next decision concerns CO₂ control. CO₂ is needed to control pH. Since cell physiology is highly sensitive to pH variation, accurate control of the CO₂ level is essential.

The two most common CO₂ sensors available in today's generation of incubators are: Thermal Conductivity (TC) and Infrared (IR).

TC sensors control and measure CO₂ levels by sensing changes induced by alterations in temperature. Basically, there are two matching thermistors, mounted in a brass block. One thermistor is sealed and acts as the reference for temperature. The other is the actual sensing element that is exposed to the chamber environment.

This system of CO₂ detection uses the thermal conduction of gases. Given that the thermal conductivity of CO₂ is lower than air, and that dry air is lower than that of humid air, this sensor detects variations in both humidity and CO₂ density, making it impossible to measure the density of CO₂ alone. When the CO₂ and humidity increase, the incubator air becomes more conductive and the thermistor is 'cooled'. The CO₂ controller will then indicate and control the set point because the electronics are calibrated to measure the millivolt change.

Although the TC sensor has been the most prevalent technology used by most CO₂ incubator manufacturers, maintaining accurate CO₂ without drift becomes a challenge since these sensors are affected by variations in humidity and temperature.

IR sensors

IR sensors are affected by temperature variations. To eliminate temperature affects and provide rapid CO₂ recovery after door openings, progressive manufacturers have introduced ways to protect sensors from temperature changes.

Not all IR sensors are created equal.

There have been a number of attempts at designing an IR sensor that is both accurate and reliable. Early designs, while providing improved CO₂ control, consisted of chopper motors and a filament bulb which meant they had limited longevity and reliability.

This problem has been solved by the development of a patented IR sensor that utilizes a ceramic heater instead of the flashing bulbs and the elimination of mechanical or moving parts that were inherently prone to breakdown.

How do they work? IR sensors measure the absorbance of light from an infrared lamp of a specific wavelength over a fixed distance. As only CO₂ absorbs light at the selected wavelength, the sensor functions independently of both temperature and humidity.

The advantages are:

- **Infrared detection through Optical Filter for CO₂ gas.**
There is no influence of humidity, O₂, or N₂ gas. TC sensors can confuse CO₂ gas with humidity, O₂, and N₂ gas. This helps the infrared with quick and accurate CO₂ recovery.
- **Chopper less IR Detector.**
This offers a reliable, simple and compact structure.
- **Long life Ceramic IR/Heat Source.**
A ceramic heater is an effective source of IR rays. A ceramic heat source has an extremely long life and has stable IR emissions. Conventional IR sources such as filament heaters have shorter lives and erratic IR emissions.

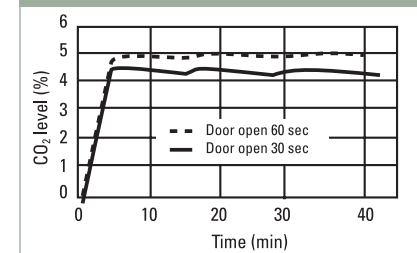
Conclusion- The most reliable IR Sensor features a solid- state, chopper less (no moving parts) and one beam system, which has enabled significant compactness.

When deciding which CO₂ sensor technology will best meet your requirements, a key factor may be the recovery performance of a specific sensor, or its ability to bring the CO₂ level in the incubator back to ideal conditions.

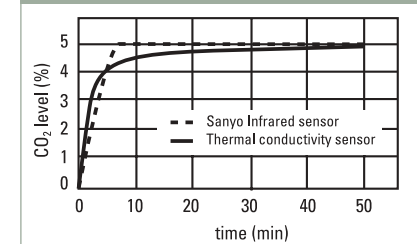
Studies have shown that the recovery time of an IR sensor, after a 30 second door opening, is up to 10 times faster than that with a TC sensor.

When deciding on a CO₂ incubator, consider your application. If your procedures require frequent door openings, an IR sensor will offer greater measurement accuracy and improved CO₂ control.

IR sensor CO₂ level recovery with multiple door openings.



IR vs. TC sensor CO₂ level recovery





In general, mammalian cells achieve optimal growth in culture at a temperature of 37°C and under conditions of 80-95% relative humidity (RH). High humidity levels are required to avoid significant evaporation from culture plates. This desiccation of culture media may cause culture problems since the medium components, especially the salts, may reach concentrations which are harmful to the cells.

There are various methods used by manufacturers of CO₂ incubators to generate the required humidity. They range from complex vapour generators with digital RH displays to the more common and economical method of achieving humidity through water evaporation in a water pan which is placed on the floor of the chamber.

One unique innovation to moderate humidity levels is the incorporation of independent adjustable heaters on the bottom of the incubator chamber, offering a cost effective way to adjust RH levels.

Alternative methods such as flooding the bottom of the incubator chamber is not recommended since it is difficult to change the water and necessitates the use of chemicals (copper sulphate or other bacteria growth inhibitors) which may not be recommended by the manufacturer since they may damage the stainless steel chamber.

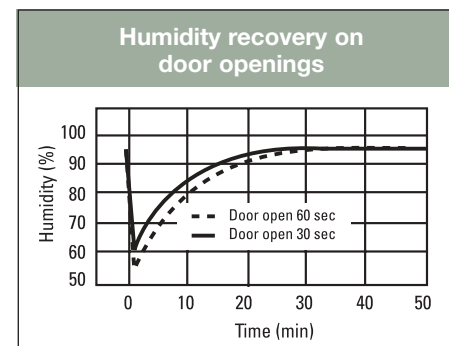
Distilled vs. Deionised H₂O

Most manufacturers of CO₂ incubators recommend using distilled water in the humidifying pan vs. deionised. WHY? DISTILLED H₂O is water that has been purified by passing through an evaporation/condensation cycle and depending on the grade, contains small quantities of dissolved solids. DEIONIZED H₂O on the other hand is water from which both anions and cations have been removed by an ion exchange process. The problem occurs when deionised water comes in contact with the stainless steel humidity pan. The embedded free ions on the surface of the stainless steel will react with the deionised water and the result is "pitting" or rusting of the pan.



| Chamber temperature uniformity | | | | | |
|--------------------------------|-------|-------|-------|-------|-------|
| Sample position | 1 | 2 | 3 | 4 | 5 |
| Shelf | | | | | |
| Upper | +0,03 | +0,14 | 0.00 | -0,15 | +0,05 |
| Middle | | | 0.00 | | |
| Lower | -0,15 | -0,13 | -0,18 | -0,13 | +0,05 |

| Chamber humidity uniformity | |
|-----------------------------|----------|
| Sample position | 3 |
| Shelf | |
| Upper | 96,5% RH |
| Middle | 96,5% RH |
| Lower | 96,0% RH |





protection

CONTAMINATION is a serious and ongoing concern in cell culture.

Given the expansion of cell culture technology into research laboratories and biopharmaceutical production facilities around the world, contamination issues can have a serious impact on both the biology and economics of basic research resulting in the loss of years of valuable work. The most common contaminants; bacteria, fungi, moulds and mycoplasma are present in basically every cell culture laboratory.

Sources of contamination:

Typically, there are several key sources of contamination in a lab:

- Improper sterilization and aseptic techniques.
- Contaminated cell lines, reagents and growth media.
- Laboratory personnel.

For example, MYCOPLASMA constitutes a major contamination threat. It is estimated that between 10% to 35% of cells may be contaminated with mycoplasma. Given that it is one of the smallest organisms, a single cell can be as small as .15 microns in diameter and its unique morphology (devoid of a cell wall), typical sterilization techniques of filtration or the use of common antibiotics may not destroy these organisms.

Contamination control:

The challenge to control contamination is two fold:

- Minimize the risk of introducing contaminants into the laboratory through primary cultures, reagents and media and ensure personnel are trained in proper sterile cell culture techniques.
- Methods to control contamination once it is introduced into the incubator.

Decontamination

Manufacturers of incubators have developed a number of methods to control contaminants once they are introduced into a chamber. Beginning with the interior of the incubator, manufacturers have used a variety of materials from stainless steel, which was originally adopted because of its durability and minimal maintenance, to copper with its known ability to inhibit the growth of common contaminants from bacteria to mycoplasma.

In addition, recently, progressive manufacturers have gone one step further and introduced a new 'Copper Alloy Stainless Steel' that combines the ease of use of stainless steel with the contaminant resistant qualities of copper. The result is a stainless steel alloy that offers a 'first defence' against contamination.

Next, incubator manufacturers have developed a number of ways to 'clean' the air within the chamber. Some work on the principal of theoretically 'trapping' contaminants in the chamber by circulating the air through filters to remove all airborne contaminants. While this is an effective method, the difficulty is in ensuring that all the chamber air is circulated through the filter and that once the contaminants are trapped in the chamber, routine changing of the filter must be done to ensure sterility.

Others have developed systems that decontaminate the chamber walls of the incubator using moist heat. Again, although this method is well known, it requires the incubator to be 'out of service' for an extended period to ensure complete sterilization.

Finally, a new method of decontaminating both the chamber air and the water in the humidity pan has been developed using the well established effectiveness of ozone free Ultraviolet (UV) light for continuous sterilization during culturing.

Although all these methods have some benefits in fighting contamination, the most effective incubator is one that offers a combination of features that work on continually preventing contamination rather than curing it.

| Typical Bacteria killing rate after 24 hours (drop method) | | |
|--|----------------------|---|
| Species | Stainless (type 303) | Sanyo's InCusaFe Copper - alloy stainless |
| Escherichia coli | 0% | 99,928% |
| Staphylococcus aureus | 0% | 99,928% |
| Bacillus subtilis | 0% | 99,927% |



accuracy and control

Calibration

To calibrate or not to calibrate - that is the question?

Why should you calibrate your CO₂ incubator?

CO₂

Most people use CO₂ to control the pH level of the media used to culture their cells. If the CO₂ is not calibrated properly, then the rate of growth of the organisms inside the incubator will most likely be affected. In extreme cases, the organisms will die.

If repeatability, validation and accuracy are an issue, it is recommended that you use a digital CO₂ meter calibrated against a known source or standard reference. These can be obtained from your gas supplier or the suppliers of the digital CO₂ meter.

Special care must be taken when calibrating CO₂ on incubators that utilize thermal conductivity (TC) sensors. These are sensitive to environmental changes inside the chamber, especially humidity. It is therefore recommended that TC CO₂ sensors NOT be calibrated until the humidity has stabilized inside the closed chamber. This could take up to four hours.

Temperature

There are many types of thermometers available on the market to perform the task of calibrating temperature. It is important that no matter which method is chosen, that the thermometer be calibrated to a recognized standard such as N.I.S.T.. If using a digital meter, it is important that this meter be calibrated against a known source at least yearly, and that the same sensing probe be used with the same meter at all times. Most manufacturers recommend that the probe or thermometer be placed in the geometric centre of the chamber, and that the environment in the chamber be allowed to stabilize before making adjustments. Always follow the manufacturer's recommendations. Care should be taken when making adjustments in an area where line voltage electricity is present. If in doubt, call on the services of a qualified service engineer.

N.I.S.T.
National Institute of Standards and Technology.

To ensure safe and accurate culturing, progressive CO₂ incubator manufacturers use microprocessors or PID (proportional, integrated & differential) controls to provide precise and accurate control of environmental parameters. The best of these take into account user conveniences such as:

- Ergonomically placed controls for easy access, especially important with 'stacked' units.
- Auto Setup. Simply enter the temperature and CO₂ set points through the control panel.
- Low CO₂ consumption.
- Automatic CO₂ calibration.
- Fast start up. Less than 2 hours for air jacketed incubators (24 hours for water jacketed).

Safeguards

Once the unit is set up (following manufacturers recommended procedures) ensure the incubator you purchase has a full range of cell culture protection systems for:

- Temperature - to detect deviations from the set point
- Over Temperature - to alarm and shut down if temperature rises above the critical overheat protection set point
- CO₂ levels - to detect if CO₂ level deviates from set point.
- Door ajar - to alarm and shut off fan motor and CO₂ if door is accidentally left open.

CO₂ safety

Though this guide is aimed primarily at CO₂ incubators, some people are not aware of the hazards posed by high concentrations of CO₂ gas. This section is intended as a guide to the hazards and what should be taken into consideration when using CO₂ gas.

A local risk assessment related to the use of CO₂ gas must be made by a person in authority such as your local safety officer. Many people know that CO₂ gas exists in the atmosphere at a level of approximately 0.03%. It is not usually considered as a toxic gas, though the Threshold Limit Value is usually taken to be 0.5%. This is the maximum level that can be tolerated over an 8 hour day. Also remember that CO₂ gas is about 1.5 times heavier than air so it will migrate to floor level and can collect in basement type laboratories where ventilation can be restricted.

Even low concentrations of CO₂ can have an adverse effect on health. 2% CO₂ will cause an increase in breathing rate of about 50%, headaches, some dizziness and muscular weakness. A 5% concentration, in addition to the previous symptoms, will increase the breathing to about 4 times the normal rate. There will also be feelings of intoxication. Above 10% concentration of CO₂ will result in rapid loss of consciousness so CO₂ gas leaks must be taken seriously!

1 kg of liquid (or solid) CO₂ will evaporate (or sublime) to form 0.5m³ of gaseous CO₂. Therefore a 30kg cylinder of liquid CO₂ could produce 15m³ of gaseous CO₂. Though it is unlikely that a cylinder would vent all its contents at once, allowances must be made for adequate ventilation wherever CO₂ is to be used. These are all considerations that will be taken into consideration by the local safety officer. Simple precautions and instructions, if adhered to, can help to prevent an incident related to the escape of CO₂ gas.

1) Make sure that you are using the correct type of gas and make sure that all pipes are connected securely and will not become disconnected. The gas cylinder should be filled with liquefied CO₂ gas, do not use a siphon (dip tube) type cylinder.

2) Ensure that you have the correct regulator attached to the CO₂ cylinder. This must be able to accurately control the gas pressure into the CO₂ incubator according to the manufacturer's specifications.

3) Ensure that the gas pressure is set at the value specified by the manufacturer.

4) Check that no gas is leaking at any point where the pipe connects with the CO₂ regulator or the CO₂ incubator.

5) The gas supply pipe is intended to be a consumable item and it is recommended that the pipe be replaced annually.

Enclosed or confined spaces

As with any equipment that uses CO₂ gas, there is a likelihood of oxygen depletion in the vicinity of the equipment. It is important that the work site be assessed to ensure there is suitable and sufficient ventilation. If restricted ventilation is suspected, then other methods of ensuring a safe environment must be considered. These may include atmosphere monitoring and warning devices.

As long as an appropriate risk assessment is made and adequate precautions are taken then there should be little likelihood of any adverse incidents arising from the use of CO₂ gas in the laboratory situation.





working together

Who is responsible for keeping your CO₂ Incubator running after it is delivered and installed?

The manufacturer

Assumes the costs for parts and labour repairs during the warranty period (as laid out in the warranty agreement) and maintains adequate parts supply for the service groups. The manufacturer should also provide service training on the products it offers.

The sales group

Keeps in touch with the end user ensuring the unit is running in concurrence with performance specifications and keeps abreast of needs for accessories and after-sales requirements.

The service group

Supplies the parts and labour to service the incubator as required. To satisfy the end user's needs both parts and labour should be supplied in acceptable time frames. Ensure they have adequate and timely, manufacturers training to offer optimal service.

The end user

Make sure the unit is installed as per manufacturers instructions in an appropriate location in the laboratory. To ensure the best performance of your incubator, follow manufacturers guidelines for installation and calibration (of both temperature and CO₂). To minimize contamination during installation, follow proper sterile techniques and ensure adequate training in cell culture techniques for all staff. Performing routine maintenance, calibration and cleaning as outlined by the manufacturer will ensure optimum performance of your incubator.

SANYO: tomorrows technology today

SANYO means "THREE OCEANS" and in the industry, SANYO has always ridden high on an ever-evolving wave of innovative technologies. SANYO focuses on customer needs and improves on our latest achievements, while our competition may wait to see what the industry standards are.

SANYO is one of the first manufacturers to bring advanced and new CO₂ Incubator technologies to the industry:

- First to develop and promote effective Direct Heat Air Jacket Incubator technology (US Patent 551911880)

- First to design a reliable, long life Infrared Sensor for CO₂.
- First to introduce contamination resistant Copper-Alloy-Stainless Steel incubator interiors.
- First to develop SafeCell UV continuous contamination control technology.

SANYO's strength comes from its vast resources. We do not have to rely on third party manufacturers to develop our technology. We are here in the forefront as an Innovator and industry leader.

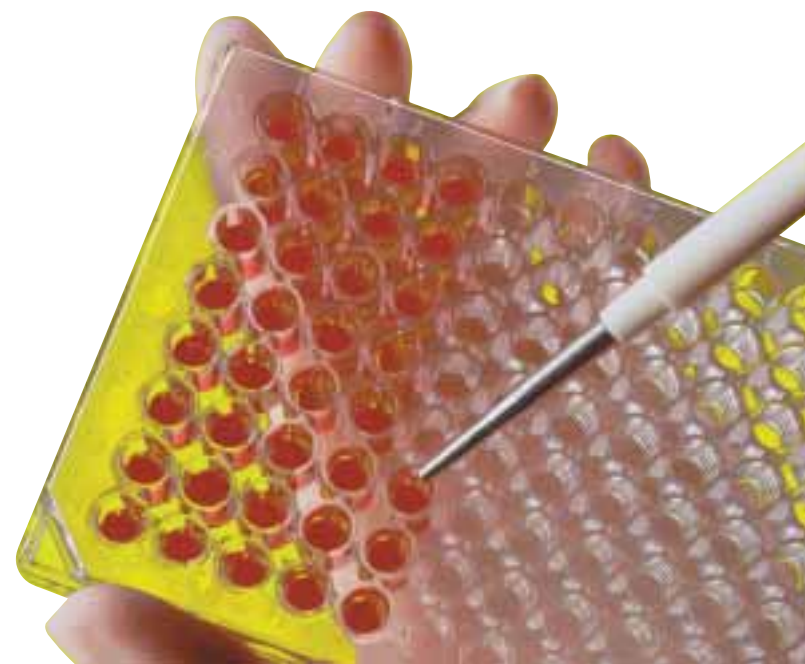
MCO-20AIC



Professional Cell Culture CO₂ incubator with UV sterilisation.

Contamination-Controlled. Downtime-None.

The new MCO-20AIC Automatic CO₂ Incubator provides a stable cell culture environment where contamination control is a continuous process, not an inconvenience.



safe cell UV
Decontamination via UV radiation

inCu safe
Inner cabinet consists of Copper stainless steel alloy

IR sensor
Infrared CO₂ sensor

After years of research, development and laboratory testing, SANYO introduces the Model MCO-20AIC. Here is an extraordinary cell culture CO₂ incubator, functional in performance, easy to use, and designed specifically for critical applications in pharmaceutical, biotechnology and clinical investigation.

Safe for the most demanding cell culture protocols, the SANYO MCO-20AIC offers significant economic benefits by avoiding costly interruptions for decontamination, improving cell culture growth and expression under stable, repeatable conditions, and minimizing the potential for loss due to contamination, drift, overshoot or operator error.

Background Contamination Control
The SANYO MCO-20AIC is the world's first cell culture CO₂ incubator to employ continuous active background ultraviolet light sterilization in combination with the passive resistance of a copper-enriched stainless steel chamber to destroy contaminants in vitro without affecting cell cultures and without downtime.

Eliminates HEPA Filter Scrubber and Decontamination Heat Cycle

The MCO-20AIC inhibits the growth of mycoplasmas, bacteria, molds, spores, yeasts and fungi without costly HEPA filter air scrubbers which accumulate contaminants in the chamber, or disruptive, high temperature decontamination schemes which can actually encourage growth of heat resistant thermophilic and hyperthermophilic microorganisms in vitro. As a result, the MCO-20AIC offers a sensitive yet robust platform for short term, high-throughput drug discovery projects as well as intermediate and long-term cell culture investigations.

High Performance In Vitro Modeling
Stable temperature, humidity and CO₂ density are achieved through a combination of performance systems supervised by a centralized microprocessor controller complete with alarm, programming, calibration and diagnostic protocols exportable to remote databases through optional communications ports for compliance monitoring.

- Exclusive SafeCell™ UV System (Patent Pending) with programmable ultra-violet lamp, isolated from cell cultures, sterilizes conditioned air and humidity water reservoir to prevent contamination
- InCuSaFe™ copper-enriched stainless steel interior chamber and inventory components provide natural germicidal protection without rust or corrosion
- Direct Heat, Air Jacket (DHA) heating system eliminates need for water jacket, and provides accurate temperature control, quick recovery and uniform stability without condensation
- Ceramic-based IR Infrared CO₂ sensor eliminates conventional filament bulbs and electro-mechanical devices to deliver accurate CO₂ control with fast recovery following door openings
- Mounted in the door, SANYO electronic PID microprocessor control assures safe, secure operation with alarm and monitoring for all functions, plus system programming for individual protocol or preference
- A spacious 6.9 cu.ft./195 liter interior chamber (net useable volume), field-reversible doors and stackable design assure efficient use of available laboratory space with easy installation and relocation when desired

MCO-20AIC



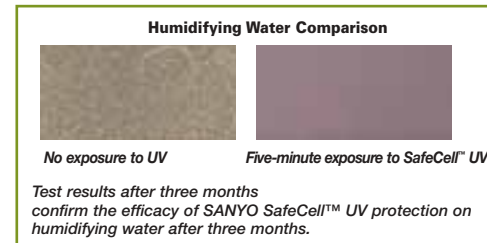
Active Background Contamination Control

At the base of the plenum, an isolated beam of high intensity, ozone-free UV light destroys contaminants in the air and in the water reservoir, away from cell cultures, not simply collected in a HEPA filter.

Contaminants contained within the distilled water in the humidity pan are destroyed by UV.

- Sterile, humidified air is released from the lower plenum for vertical convection through and around the perforated shelves.
- Interior air motion stops when the door is opened, minimizing movement of room air into the chamber.
- Plenum components isolate UV light to protect cell cultures, while the UV process continues in the background as programmed without downtime.

- Following door openings, trace contaminants which attach to walls, shelves and plenum components are destroyed by the germicidal properties of the inCuSaFe™ copper-enriched stainless steel surfaces, and airborne contaminants are eliminated by an automatic 5 minute UV cycle (programmable 0 - 30 minutes).
- Other design factors which help mitigate contamination include condensation control, inner door gasket design and triple 0.3 micron filters for vent air and CO₂ sensor sampling.



SANYO CONTAMINATION CONTROL TECHNOLOGY



Contamination control in the MCO-20AIC is managed by a combination of three basic performance techniques:

- A programmable ultra-violet lamp to sterilize air and humidity pan water without affecting cell cultures
- Copper-enriched polished stainless steel interior walls, shelves and plenum components
- A gentle, fan-assisted air circulation system which stops when the door is opened

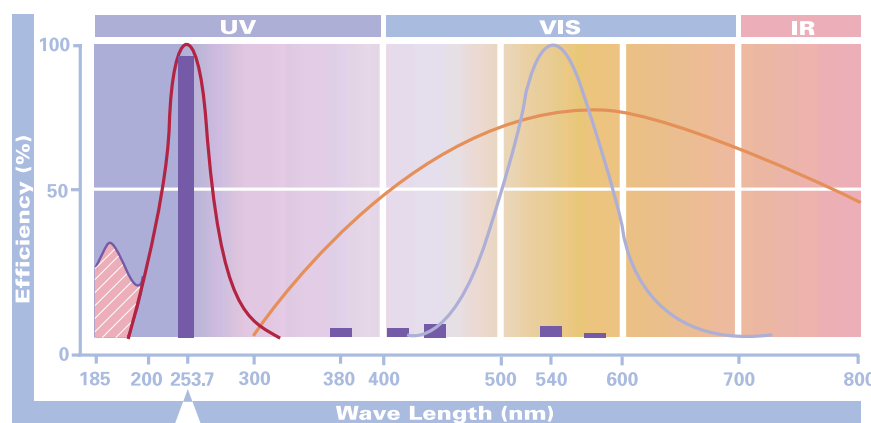


The SafeCell™ UV system gently circulates

incubator air through a plenum for decontamination and humidification.

UV Lamp Program Options

| Modus | Function |
|--------------------|--|
| After Door Opening | UV lamp automatically ON for five minutes after door is closed. Time factory set, user programmable from 0-30 minutes. |
| OFF | If UV protection is not desired |
| Continuous ON | Useful for overnight decontamination prior to first use or following total chamber wipe-out after maintenance or service |



The SANYO MCO-20AIC UV Lamp is a highly effective, ozone-free contamination control technique.

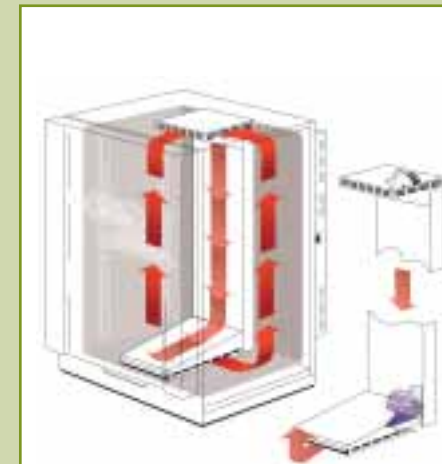
■ SANYO Lamp ■ Ozone Release ■ Germicidal Effect ■ Eye Sensitivity ■ Sunlight

Although the contamination control system is factory set for normal use, operation of the UV lamp can be programmed as desired. Program parameters are set through the micro-processor control panel

Unlike typical germicidal lamps, the long-life SafeCell™ UV lamp is designed to deliver straight-line performance at approximately 257.9 nm for maximum germicidal efficiency and long life.

Direct Heat, Air Jacket (DHA) Heating System

The Direct Heat, Air Jacket (DHA) heating system eliminates the need for a conventional water jacket, while achieving temperature stability, uniformity and fast recovery following door openings.



The SafeCell™ UV air flow plenum promotes temperature uniformity through the chamber, shaped by natural and mechanical convection through and around the perforated shelves with gentle circulation through the plenum for UV sterilization and warm water humidification. Air motion stops when door is opened.

Elevated Humidity, Low Water Level Warning

To avoid cell culture desiccation, the MCO-20AIC maintains 95% RH at 37°C through a combined forced air and natural evaporation method, which is enhanced by the DHA base heater and protected by an optical water level indicator to warn of low water in the removable humidity pan.

- A unique optical water level sensor automatically inserts into the humidity pan when filled and replaced.
- If the water level drops below one liter (nominal), an indicator on the main control panel will flash.
- Because the DHA base heater helps maintain higher RH levels than in conventional incubators without direct RH control, media desiccation is minimized and condensation is eliminated.
- The humidity pan removes easily with one hand; the optical sensor releases automatically and no tools are required.
- When filled with distilled water, the pan slides into place and the optical sensor returns to position automatically.
- Once returned to position, the SafeCell™ UV lamp destroys any contaminants introduced during the process.

IR Infrared CO₂ Control

The SANYO MCO-20AIC uses a unique ceramic-based infrared sensor system to maintain precise CO₂ control regardless of temperature and relative humidity changes within the incubator chamber. Sensor stability is especially useful following door openings while temperature and humidity return to equilibrium.



The sensor is virtually maintenance free with no moving parts and eliminates filament bulbs or electro-mechanical "chopping" devices.

- The CO₂ sensor automatically calibrates every four hours.
- The system allows CO₂ control over a range from 0-20% in 0.1% setpoint increments.
- Actual CO₂ is displayed on the main control panel.
- A CO₂ sample port mounted on the incubator front permits convenient confirmation of chamber CO₂ density.
- An optional automatic CO₂ switchover system is available. See Accessories.
- A two-stage regulator from the supply cylinder to the incubator is required. See Accessories.

The microprocessor controller directs proportional distribution of electrical power to a series of independent heating sources in the incubator.

Arranged in three zones, these sources include the side, top and rear walls, the chamber base and the outer door. Together, the heating sources maintain accurate temperature control over a range from 5°C above ambient to +50°C, with setpoint accuracy to 0.1°C and uniformity better than 0.25°C throughout the chamber.

Each zone is controlled according to the demands of the microprocessor, which manages continuous feedback from the incubator via a PID (proportional, integral and derivative) algorithm.

| Zone | Location | Energy | Microprocessor Control |
|-------|--------------------------|----------|---|
| Main | Side, top and rear walls | Variable | Energizes any, all or a combination of heating elements as required |
| Base | Floor | Variable | |
| Front | Outer door | Variable | |

An air jacket with five independent heating elements arranged in three zones surrounds the interior chamber. The microprocessor control system apportions energy to heaters in response to chamber demand and ambient temperature.

- Side, top and rear walls form the dominant radiant heat source.
- The base heater elevates the humidity reservoir water temperature to achieve 95% RH at 37°C.
- The outer door heater warms the inner glass in response to ambient conditions to eliminate condensation on the glass and around the opening, and to assure interior uniformity.



MCO-20AIC



Microprocessor Control System

SANYO expertise in electronic innovations applies to the SANYO MCO-20AIC microprocessor control system. All incubator functions are managed by a fully integrated controller which acquires and processes information from data entry, setpoints and alarm parameters.

- Proportional, integral and derivative controls supervise temperature, CO₂ and other features for accurate, repeatable performance.
- A range of setpoint, alarm and programmable inputs are established through the use of function keys.
- Standard parameters are factory-set for quick start-up, and all parameters may be changed as required.
- A remote alarm terminal mounted at the rear of the cabinet can be connected to an external alarm system.

Data Communications (Optional)

The MCO-20AIC microprocessor control system automatically exports performance values to the optional RS232 or RS485 data port for transfer to computer or other data logging systems.

- Data points include temperature, CO₂ density, low water level and door ajar signal.
- When installed, ports are located at the rear of the cabinet.

Cabinet Design

The MCO-20AIC represents a continuing evolution in incubator development pioneered by SANYO applications in inCuSaFe™ copper alloy stainless steel, unitized interior radii and flexible door configurations for universal installation.

Integrated contamination control techniques are based on the MCO-20AIC cabinet design, with particular emphasis on relational sub-components such as gaskets, hardware and utility management.

inCuSaFe™ Interior Chamber

When exposed to humidity and CO₂, the copper-enriched, polished stainless steel interior expresses a natural germicidal attribute to inhibit the growth of molds, fungi, mycoplasma and bacteria.

- All interior components, including the air management plenum, shelf supports, humidity pan and fan are easily removable without tools if required.
- When components are removed, all interior surfaces are exposed for conventional wipe-down.
- Large curve corners and electropolished surfaces are easy to clean.
- An access port accommodates probes or instrumentation leads as required for specialized cell culture protocols.



The port is positioned in the interior chamber, rear wall, upper left, with dual rubber stoppers inside and outside the cabinet for added protection.

Inner Door and Gasket

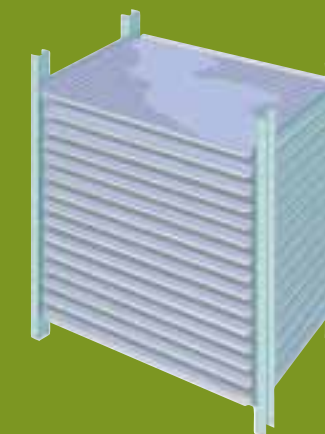
The inner door gasket is comprised of a dual durometer extrusion from closed-cell silicone to inhibit contamination. A feather-edge outside surface allows the inner glass door to close gently against the chamber opening for a tight peripheral seal.

- The inside gasket body forms an effective thermal transition between the ambient air and warm, humidified incubator atmosphere, minimizing condensation and eliminating moisture traps which can harbor contaminants.
- The entire inner door gasket is removable for cleaning and/or replacement if required.
- The inner door features an adjustable cam-action latch which pulls the glass against the gasket for a gas-tight seal.
- Radiant heat from the outer door, controlled by the DHA heat system, automatically warms the glass in proportion to total heat demand and condensation control.

Exterior Cabinet

Universal design offers a distinct advantage in model selection. With reversible inner and outer doors and a cabinet reinforced for stacking, a single SANYO MCO-20AIC offers the industry's most flexible installation option without added cost.

- Stacking hardware is included.
- Low density cabinet insulation promotes energy efficiency and protects the air jacket from ambient temperature fluctuations, while allowing the cabinet to operate at setpoint temperatures as low as 5°C above ambient.
- The outer door latches and door heater cable are easily switched if a reverse opening is required. Cabinet knock-outs are pre-punched to eliminate drilling.
- The outer door closes against the cabinet opening with a soft, easy-to-clean magnetic gasket designed to eliminate ambient air motion across the inner glass door.
- A door ajar alarm provides an audible and visual warning if the outer door is left open.



Shelves are easily arranged in 1.1"/29mm increments. Five shelves are supplied with the MCO-20AIC. Total incubator capacity is fifteen shelves.

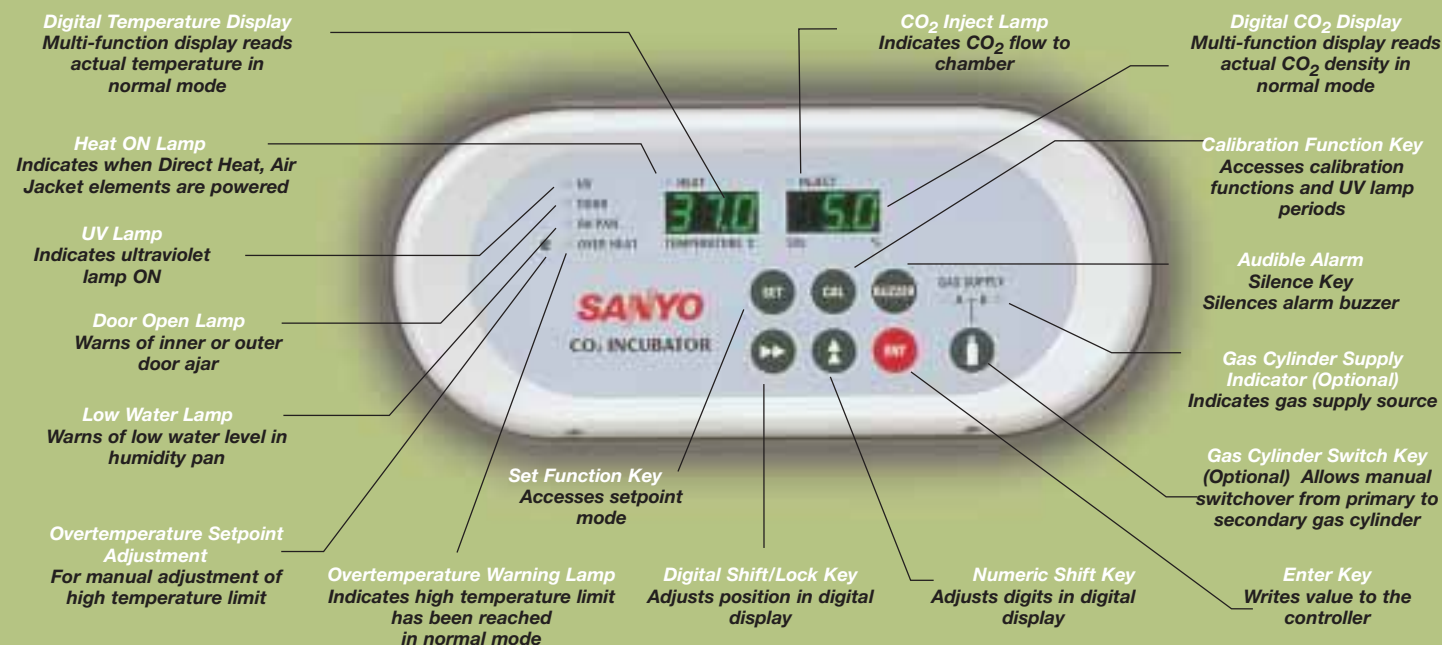
Shelves and Inventory Management



Inventory management components including shelves, brackets and shelf supports are formed from copper-enriched polished stainless steel to inhibit contamination. All components are removable without tools for cleaning or autoclaving if required.

DISPLAY

The MCO-20AIC control panel is center mounted in the outer door for easy access, even when incubators are stacked. Microprocessor based controls manage all incubator functions including setpoints, alarm parameters, UV lamp periods, programming, calibration and diagnostics. Extra-large digital displays are easy to read. Tactile feedback touchpad data shift and entry keys simplify operation. When stacked, door mounted controls remain easily accessible in comparison to conventional dual incubators.



The cabinet exterior is constructed of scratch resistant coated steel for easy cleaning. Adjustable leveling feet permit proper installation on uneven surfaces. Recessed stops on the exterior top are matched to leveling feet to simplify stacking. A lightweight door with universal door handle permits one-hand opening from either side.

With a reversible door and structural stability designed for stacking, the MCO-20AIC permits an unlimited combination of installation choices now and in the future. An optional roller base adds mobility where required. See Accessories.

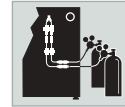


- Incubator shelves are perforated to permit natural vertical air convection through and around samples.
- Shelves are easily accessible and can be removed with one hand for transfer to a bench or biological safety cabinet.
- Shelf brackets slip easily into vertical supports that attach to interior chamber walls with clearance sufficient to permit air circulation against all interior surfaces.
- Additional shelves include two brackets. See Accessories.

MCO-20AIC

Automatic CO₂ Cylinder Switchover System

Automatically changes from primary to secondary gas cylinder when first cylinder is depleted. Audible alarm and flashing indicator on main control panel notifies user when switch has occurred. Field installed by authorized service personnel only. **Number MCO-21GC**



CO₂ Cylinder Regulator

Two-stage gas regulator monitors cylinder supply and meters gas to incubator input. CGA Fitting 320. **Number MCO-100L**

Roller Base

For use in single or stacked installations. Solid steel base includes positioning plates for incubator levelers. High-impact casters permit easy location. Adjustable front mounting pins extend to floor to prevent movement when installation is complete. Pins retract if roller base must be moved. **Number MCO-20RB**



Independent Inner Door Kit

High impact, clear plastic doors attach to interior inventory system behind glass inner door. **Number MCO-2000**



door. Customer installed; directions included. **Number MCO-20ID**

InCuSaFe™ Shelf and Brackets

The MCO-20AIC Incubator holds up to fifteen shelves. Five shelves are included with each incubator. Additional shelves may be ordered. Each shelf includes two shelf brackets which insert without tools. **Number MCO-58ST**

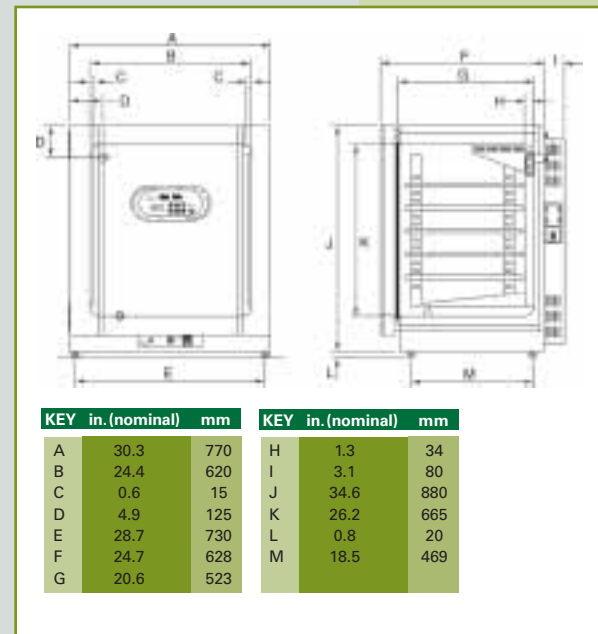
Communications Port

Located at rear of chamber, RS232/RS485 data port acquires information from microprocessor controller including temperature, CO₂, door ajar status and humidity pan water level. Connector, cable and software not supplied. **Number MTR-480**

Data Acquisition Software

Available for monitoring and/or controlling microprocessor system. Windows® based, for installation on PC. LAN compatible, configurable, SMTP server to internet for user PC or mobile phone delivery. **Number MTR-2000**

MCO-18AIC



| SPECIFICATION SUMMARY | |
|--------------------------------------|--|
| Heating System | Direct Heat, Air Jacket (DHA) with positive air flow |
| Combined Heating Elements | 395 W distributed proportionally |
| Temperature Controller | Microprocessor PID |
| Temperature Display | Digital, resolution to 0.1°C |
| Temperature Range | 5°C above ambient to +50°C, ±0.1°C |
| Temperature Uniformity | ±0.25°C top to bottom |
| CO ₂ System | Ceramic based infrared CO ₂ sensor with ON/OFF inject |
| CO ₂ Range | 0 to 20%, ±0.1% |
| CO ₂ Variation | ±0.15% |
| CO ₂ Setpoint and Display | Digital, control panel, resolution to 0.1% |
| CO ₂ Inlet Connection | Requires 4 to 6mm ID tubing |
| CO ₂ Inlet Pressure | 5 PSIG • 0.03MPaG • 0.3kgf/cm ² G • 294millibarG |
| Humidification Method | Gentle air flow through duct, natural evaporation from humidity pan over base heater |
| Relative Humidity | 95%@37°C, ±5% |
| Water Level Sensor | Optical, with visual low water alarm |
| Net Interior Volume | 6.9 cu.ft./195 liters, nominal |
| Gross Interior Volume | 7.6 cu.ft./215 liters, nominal |
| Interior Dimensions | 24.4"W x 20.6"F-B x 26.2"H (620 x 523 x 665mm) |
| Exterior Dimensions | 30.3"W x 27.9"F-B x 35.5"H (770 x 708 x 900mm) |
| Shelf Dimensions | 22.8"W x 17.7"F-B x 0.5" lip (580 x 450 x 12mm) |
| Maximum Load Each Shelf | 11 lbs (5 kg) nominal, 5 shelves standard, 15 shelves maximum |
| Access Port | 1.18" diameter (30mm) with inner and outer rubber stoppers |
| Exterior Finish | Polyester finished, baked-on zinc galvanized steel |
| Inner Door | Tempered glass |
| Outer Door | PMMA/PVC with integrated door heater |
| Cabinet Insulation | Rigid polyurethane, foamed-in-place, CFC-free |
| Decontamination, Programmable | Continuous UV sterilization of air and humidity source |
| UV Lamp | 4 W, 253.7 nanometer, ozone-free emission |
| Microbiological Filters | Three, 0.3 micron, 99.97% efficient |
| Interior Surface | Copper alloy polished stainless steel for germicidal protection |
| Alarm System | Overtemperature, CO ₂ deviation, low water, door ajar |
| Remote Alarm Contacts | 30V, DC, 2 amps allowable |
| Communications | RS232/RS485 data port (optional) |
| Electrical | Switchable, 110-120V, 60Hz, AC or 220-240V, 50Hz, AC |
| Maximum Current | 110-120V, 3.8 amps; 220-240V, 1.9 amps |
| Maximum Heat Emission | 1299 BTU/Hr (1370 kJ/Hr) |
| Noise Emission | 30 dB (A scale) |
| Net Weight | 234 lbs (106 kg) |

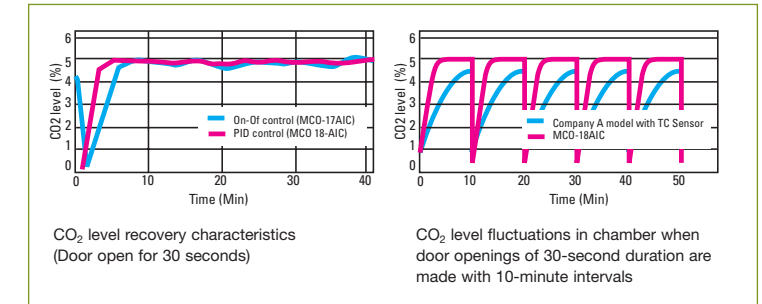


Professional Cell Culture CO₂ incubator

Faster CO₂ level recovery

Fast recovery of the CO₂ level is due to the effective combination of an infrared CO₂ sensor and PID (Proportional, Integrated and Differential) control. This incubator offers a long-awaited performance level with a more stable CO₂ environment ideal for heavy usage situations that require frequent door openings.

Conventional recovery time: approx. 7 minutes → **MCO-18AIC: approx. 3 minutes** *Maintaining uniform CO₂ levels is assured even with frequent incubator door openings*



Decontamination via UV radiation (Option)

Inner cabinet is made from Copper stainless steel alloy

Infrared CO₂ sensor

0-20,0%

5~50°C

170L/6cu

MCO-18AIC

Preventive Contamination Control

InCusaFe interior chamber with fully rounded corners inhibits bacteria growth continuously. An automatic ultraviolet lamp (option) can also eliminate contaminants in the circulating air and water in the humidity pan without affecting cell cultures. The two powerful measures result in complete contamination control.

Water Level Sensor

The humidity pan has an optical water level sensor to warn of a low water level.

Field-reversible Door

The reversible door allows right or left opening depending on the installation space and how other peripheral equipment is positioned. Each corner of the door has a special grip for easier opening.

Improved Temperature Stability with DHA System

Three independently controlled heaters plus SANYO's proprietary air jacket structure provides a high-precision temperature environment.

Automatic CO₂ cylinder Switchover System (option)

This system automatically switches from the primary to secondary gas cylinder when a CO₂ gas level drop in the chamber is detected. The in-use gas cylinder is confirmed on the control panel.

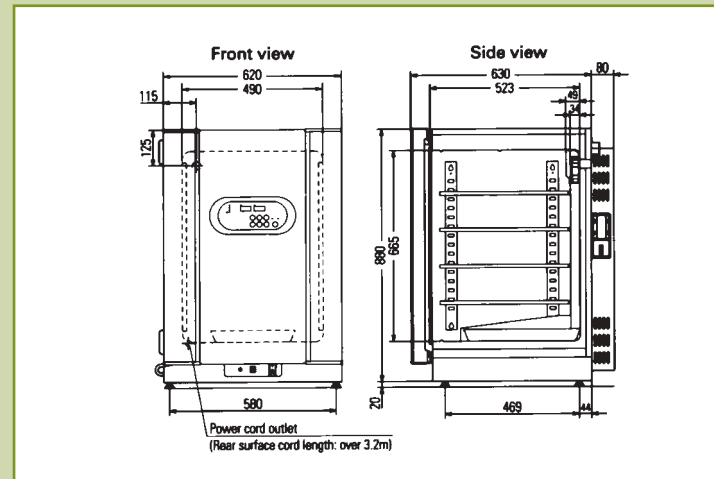
Ergonomic Design

Low profile, stackable design for efficient use of available laboratory space. User-friendly door-mounted control panel is easy to use and access.

MCO-5AC



| Specifications | | |
|-----------------------------|--|---|
| Exterior dimensions (WxDxH) | 620x710x900(mm) | |
| Interior dimensions (WxDxH) | 490x523x665(mm) | |
| Interior volume | 170L | |
| Net Weight | 93kg | |
| Temperature | Heating Method | Direct heat & Air jacket (DHA) |
| | Temp. control system | Microprocessor PID |
| | Temp. range | 5°C above ambient temperature to +50°C (Ambient temp.: +5°C to 35°C) |
| | Temp. uniformity | ±0,25°C*1 |
| CO ₂ | Temp. controllability | ±0,1°C*1 |
| | CO ₂ control system | Microprocessor PID |
| | CO ₂ sensor | Infrared |
| | CO ₂ range | 0 to 20% |
| Humidity | CO ₂ controllability | ±0,15%*1 |
| | Humidifying system | Natural evaporation by water in humidity pan over bottom heater (with water level sensor) |
| | Chamber humidity | 95±5%RH |
| Shelves | Shelves (WxDxH) | 450x450x12(mm) |
| | Shelf material | Copper Alloy stainless steel |
| | Maximum load | 7kg per shelf |
| | Shelves | 4(standard) |
| Contamination control | Interior surface | Copper Alloy stainless steel |
| | UV lamp (ozone-free) | UV system kit (option) |
| Access port | 30mm diameter | |
| Alarm system | High/low temperature, CO ₂ level, door and UV lamp failure, independent overheat protection | |
| Remote alarm contacts | 30V DC, 2A allowable | |
| Options | CO ₂ pressure regulator (MCO-100L) InCusaFe shelf (MCO-46ST) Automatic CO ₂ cylinder switchover system (MCO-21GC) Roller base (MCO-18RB) Stacking plate for 18AIC + 17AC/15AC (MCO-18PS)*2 UV system kit (MCO-18UVS2) | |



Automatic CO₂ cylinder Switchover System
Automatically changes from the primary to secondary gas cylinder when first cylinder is depleted.
number MCO-21GC.

CO₂ cylinder regulator
Two stage gas regulator monitors cylinder supply and meters gas to incubator input.
number MCO-100L.

Roller Base
For single or stacked incubators.
number MCO-18RB.

InCusaFe Shelf and Brackets
Each shelf includes two shelf brackets which insert without tools.
number MCO-46ST.

Data Acquisition Software
Controls or acquires information from microprocessor.
number MTR-2000.

UV Kit for MCO-18AIC
number MCO-18UVS2.

Personal Series Compact CO₂ Incubator



- Space Saving
- Triple Stackable
- Compact Design

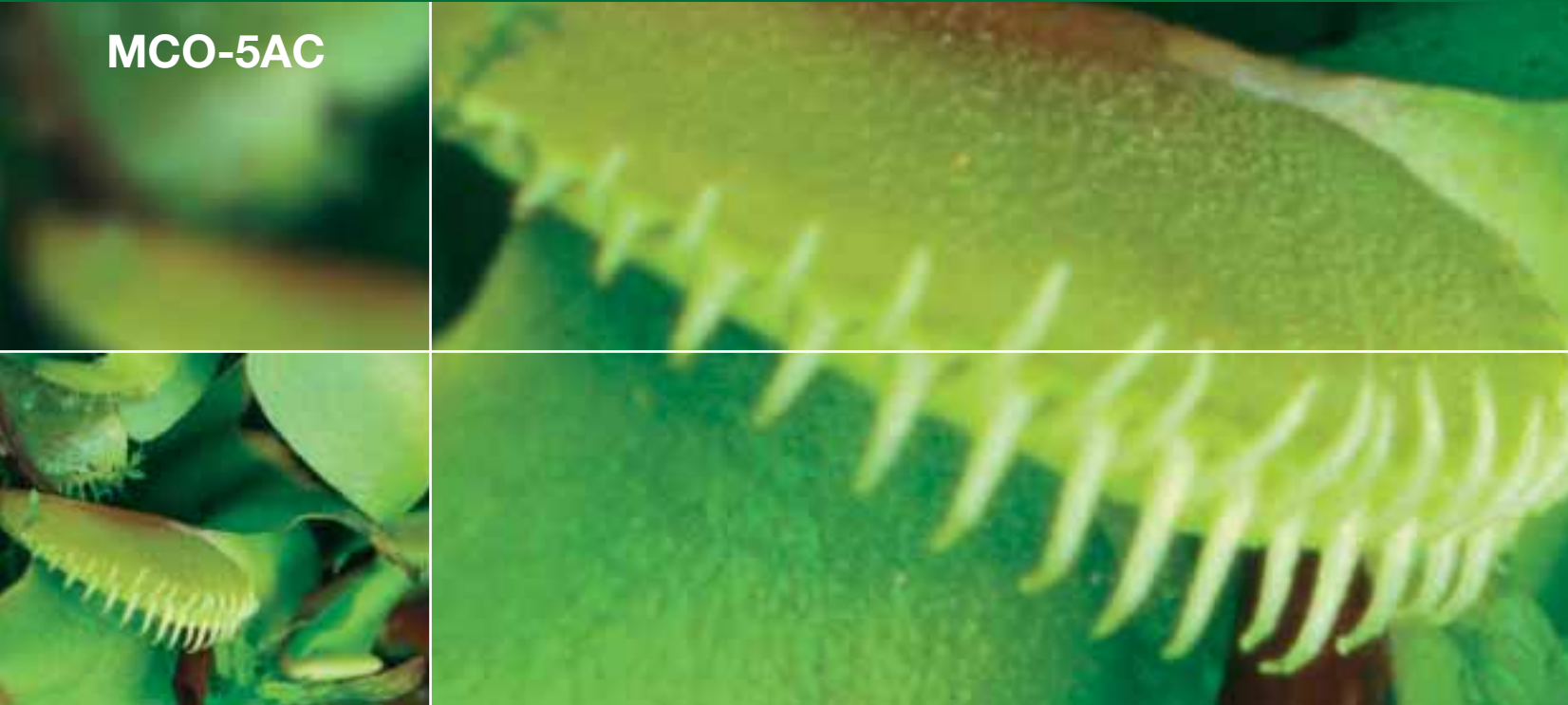
safe cell UV
Decontamination via UV radiation (Option)

inCu safe
Inner cabinet is made from Copper stainless steel alloy

| | |
|--------------------------------|------------|
| CO ₂ -concentration | 0-20,0% |
| Temperature | 5~50°C |
| Interior volume | 49L/1,7 cu |

*1 Conditions: Ambient temperature: 25°C, Temperature setting: 37°C, CO₂ level setting: 5%, no load.
*2 Stacking plate for 18AIC + 18AIC is included in the main body.

MCO-5AC



Patient Specific, Space Saving, Triple Stackable, Compact Design

When arrayed in triple stackable configurations (pictured below), this unit meets GLP (Good Laboratory Practice) requirements by helping to avoid patient-to-patient cross contamination in individualized patient-specific clinical incubation applications, such as in vitro fertilization and regenerative medicine techniques.



Preventive Contamination Control

InCu saFe® copper-enriched stainless steel chamber, shelves, and air plenum inhibit surface contamination growth continuously.

Airborne and water pan contaminants can also be prevented and continuously controlled by use of a patented SafeCell UV™, ultraviolet decontamination method (optional). The ozone-free UV light is shielded away from the cell culture area allowing for UV use while cultures remain in the incubation chamber.

Improved Temperature Stability with DHA System

Three independently controlled heaters plus SANYO's exclusive and patented air jacket construction provide high-precision



The main heater provides precise temperature control. The variable bottom heater warms distilled water in the water pan and allows for adjustment of the chamber's humidity level. The variable outer door heater prevents condensation on the inner glass door and helps facilitate quick temperature recovery after door openings.

temperature control, uniformity, and quick recovery after door openings.

Ergonomic Design

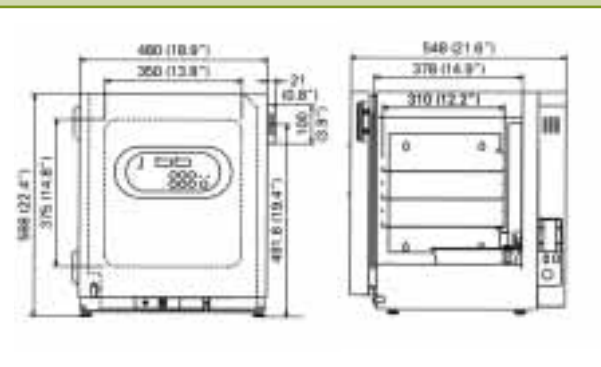
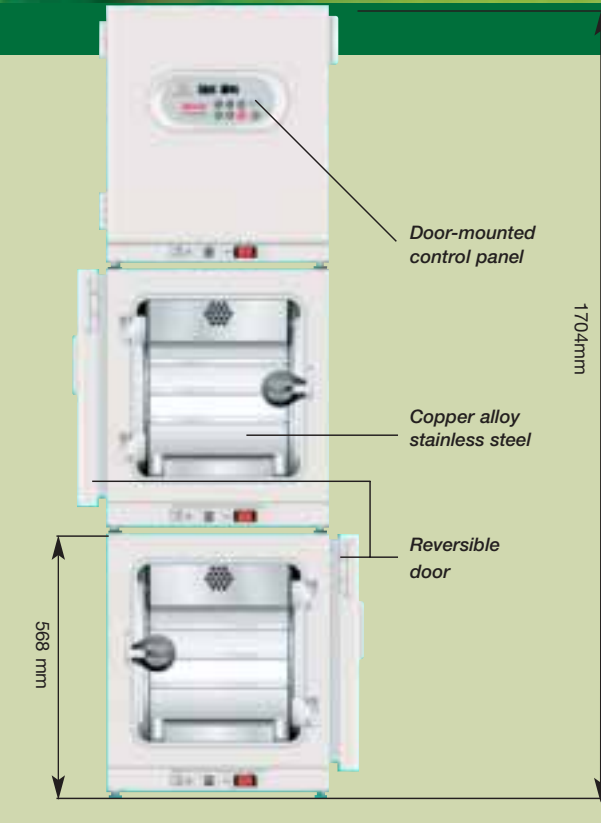
Even in a triple-stack configuration, the units are space-saving and low-profile, allowing for the most efficient use of laboratory space and also user-friendly access to the door-mounted control display panel.

Automatic CO₂ Cylinder Switchover System (option)

This system automatically switches from the primary to secondary gas cylinder when a CO₂ gas level drop in the chamber is detected. The in-use gas cylinder is confirmed on the control panel.

Field-reversible Door

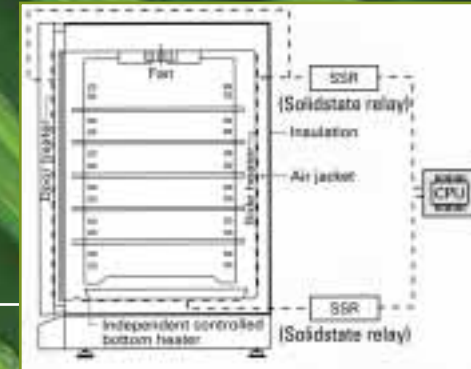
The field-reversible door can be set up for right-hand or left-hand door openings, allowing for multiple configurations during laboratory installation. A special door handle allows for easier door grab and opening in triple-stacked configurations.



| | | |
|-----------------------------|--|---|
| Exterior dimensions (WxDxH) | 480x548x568(mm) | |
| Interior dimensions (WxDxH) | 350x378x375(mm) | |
| Interior volume | 49L | |
| Net Weight | 49kg | |
| Temperature | Heating Method | Direct heat & Air jacket (DHA) |
| | Temp. control system | Microprocessor PID thermistor sensor |
| | Temp. range | 5°C above ambient temperature to +50°C (Ambient temp.: +5°C to 35°C) |
| CO ₂ | Temp. controllability | ±0,1°C*1 |
| | CO ₂ control system | On-off control |
| | CO ₂ sensor | TC sensor (direct chamber detection) |
| Humidity | CO ₂ range | 0 to 20% |
| | CO ₂ controllability | ±0,15%*1 |
| | Humidifying system | Natural evaporation by water in humidity pan over bottom heater (with water level sensor) |
| Shelves | Chamber humidity | 95±5%RH |
| | Shelves (WxDxH) | 310x310x10(mm) |
| | Shelf material | Copper Alloy stainless steel |
| | Maximum load | 4kg per shelf |
| Contamination control | Shelves | 3 (6 max) |
| | Interior surface | Copper Alloy stainless steel |
| | UV lamp (ozone-free) | UV system kit (option) |
| Access port | 30mm diameter | |
| Air filter | 0,3µm, Efficiency: 99,97% (for CO ₂) | |
| Alarm system | High/low temperature, CO ₂ level, door and UV lamp failure, independent overheat protection | |
| Remote alarm contacts | 30V DC, 2A allowable | |
| Options | CO ₂ pressure regulator (MCO-100L) InCu saFe shelf (MCO-30ST) Automatic CO ₂ cylinder switchover system (MCO-5GC) Roller base (MCO-5RB) UV system kit (MCO-18UVS2) | |

*1 Conditions
Ambient temperature: 25°C, Temperature setting: 37°C, CO₂ level setting: 5%, no load

MCO-17AC
MCO-15AC



Precision control & quick recovery. Direct Heat & Air (DHA) jacket system. The incubator has three sources of heat sides, door, and independent bottom heaters, all of which are located outside the chamber.

The sealed air jacket and foam insulation maintain a uniform temperature. The DHA jacket design provides quick recovery for temperature after door openings.

1 Day Drop method with E. Coli (ATCC8739)



Bacteria killing after 24 hours (Drop method)

| Species | Stainless steel (Type 304) | Copper Alloy Stainless steel |
|-----------------------------------|----------------------------|------------------------------|
| Escherichia coli (ATCC8739) | 0% | 99,928% |
| Escherichia coli (IFO3301) | 0% | 99,847% |
| Staphylococcus aureus (ATCC6538P) | 0% | 99,98% |
| Bacillus subtilis (ATCC6633) | 0% | 99,997% |



Inner cabinet is made from Copper stainless steel alloy

Air jacketed CO₂ incubators

SANYO's MCO-17 AC/15AC CO₂ incubators were developed utilizing advanced technology for unprecedented temperature and CO₂ control. Chamber conditions are accurately maintained by the Microprocessor P.I.D. controller. The new DHA Direct Heat & Air jacket was designed to surpass the performance of the traditional water jacket and eliminates the inconveniences of using water. Start-up is simple and easy with the Automatic set-up function.

What's inCusaFe?

InCusaFe is our name for products using copper-alloyed stainless steel.

Why Copper Alloy?

Contamination is the worst enemy of laboratory work. Therefore the production of bacteria in CO₂ incubators is too great a problem to ignore.

Copper Alloyed Stainless Steel - SANYO's New Concept Against Contamination

Contamination is the worst enemy of laboratory work. When designing its new range of incubators, SANYO examined two methods

commonly used to combat contamination: HEPA filters and copper. HEPA filters are efficient at removing bacteria in the air, but maintenance is demanding. Copper is effective against bacteria but corrosion is a problem; even a small spill of culture media is enough to cause oxidation.

SANYO's solution to the problem is copper alloyed stainless steel; a material that combines the bacteria killing properties of copper with the corrosion resistance of stainless steel.

Copper Alloy Stainless Steel Kills Mycoplasma

SANYO is proud to announce that InCusaFe, the new copper/stainless steel alloy used in the interior of its CO₂ incubators, kills mycoplasma. Mycoplasma is one of the most common causes of contamination found in cell culture and the source can often be traced back to contaminated laboratory apparatus. The InCusaFe walls and shelves inside SANYO CO₂ incubators eliminate mycoplasma and significantly reduce the risk of contamination without emptying the incubator.

Independent control bottom heater

The microprocessor controls the bottom heater independent from the sides and door heaters. By adjusting the bottom heater control, you can change the ratio, resulting in humidity control from about 93% to 98% RH.

Automatic setup

By turning on the power and simply entering the temperature and CO₂ set points you can walk away from the unit while the microprocessor takes over. The unit will attain set point and adjust itself to

your required parameters.

Full rounded corners

The interior chamber is constructed of Copper Alloy Stainless steel with full rounded corners. All plenums, shelves, brackets are removable without use of tools. These design features provide an interior that is easily cleaned to reduce chances of contamination. (MCO-15AC Round Corners)

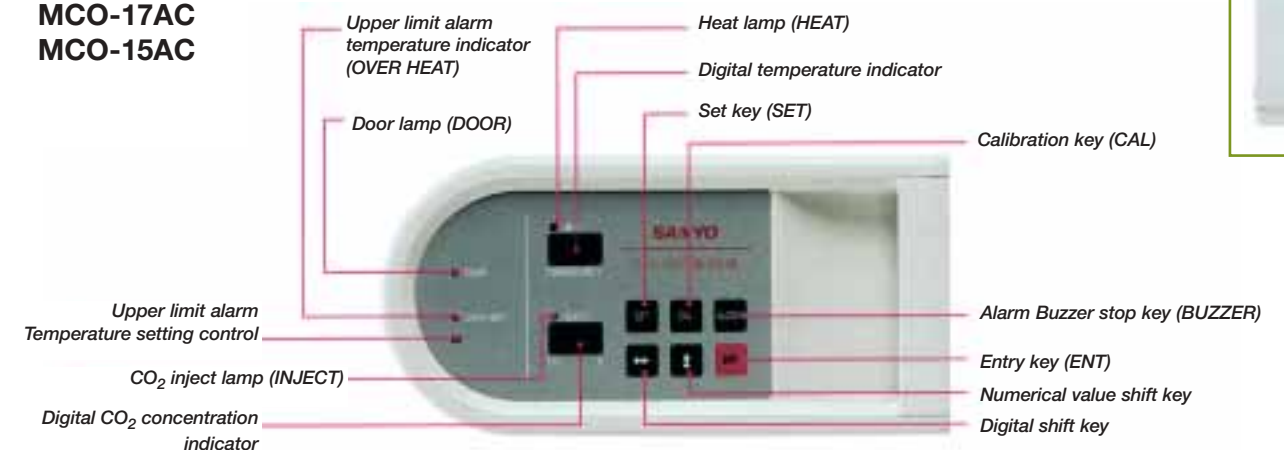


Stackable function

Due to the design and minimal weight one unit can be stacked on top of another using stacking kit MCO-17PS. This provides not only the space saving of a double unit but also the flexibility of



MCO-17AC MCO-15AC



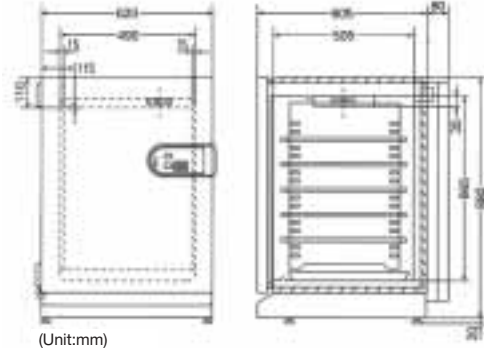
MCO-17AC MCO-15AC



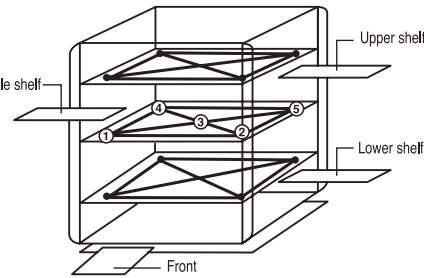
MCO-17AC

- accurate temperature control & recovery characteristics
- Space saving
- Easy installation

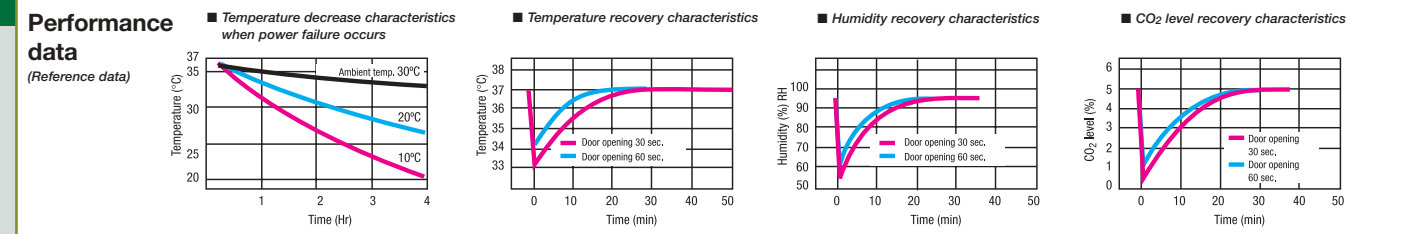
Condition:
Ambient temp. 20°C
Ambient humidity 45%
CO₂ level setting 5,0%
Water humidity pan 2,0 litres



(Unit:mm)



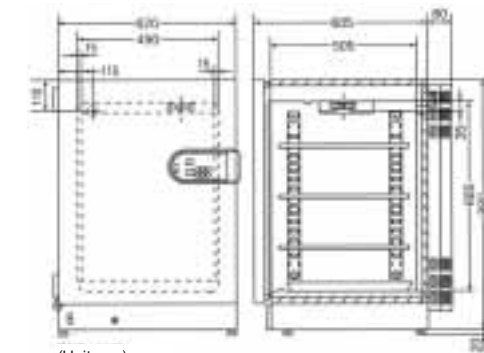
| Measurement position | ① | ② | ③ | ④ | ⑤ |
|----------------------|-------|-------|-------|-------|-------|
| Shelf position | | | | | |
| Upper shelf | +0,03 | +0,14 | 0,00 | -0,15 | +0,05 |
| Middle shelf | | | 0,00 | | |
| Lower shelf | -0,15 | -0,13 | -0,18 | -0,13 | +0,05 |



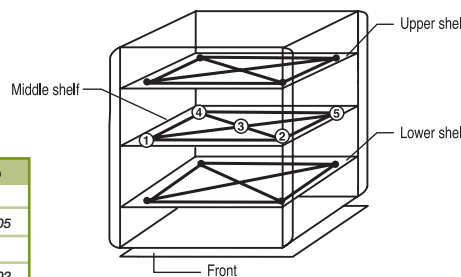
MCO-15AC

- Easy maintenance, easy installation and quick warm up
- Automatic CO₂ control system
- Space utility

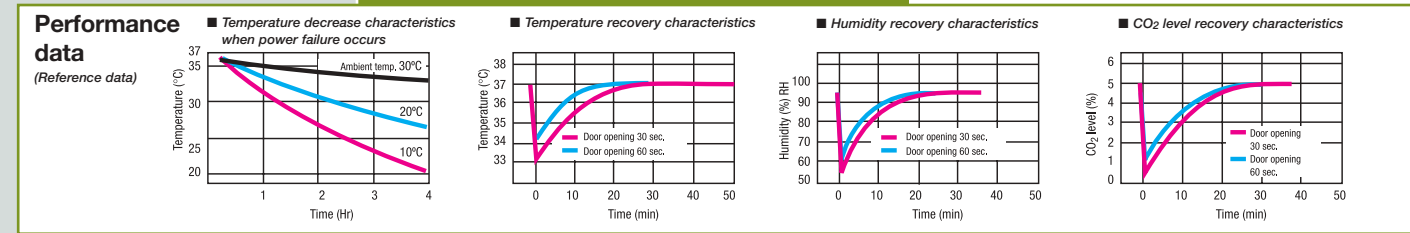
Condition:
Ambient temp. 20°C
Ambient humidity 45%
CO₂ level setting 5,0%
Water humidity pan 2,0 litres



(Unit:mm)



| Measurement position | ① | ② | ③ | ④ | ⑤ |
|----------------------|-------|-------|-------|-------|-------|
| Shelf position | | | | | |
| Upper shelf | +0,03 | +0,07 | 0,00 | -0,15 | +0,05 |
| Middle shelf | | | 0,00 | | |
| Lower shelf | -0,05 | -0,02 | -0,05 | -0,03 | +0,02 |



Specifications

| Specifications* | CO ₂ -Incubators | | |
|------------------------------------|---|---|------------------------------|
| Model | MCO-17AC | MCO-15AC | MCO-17S |
| Exterior dimensions (WxDxH) | 620 x 610 x 900 | 620 x 685 x 900 | 770 x 620 x 900 |
| Interior dimensions (WxDxH) | 490 x 505 x 665 | 490 x 505 x 665 | 490 x 505 x 690 |
| Effective capacity | 164 Liter | 164 Liter | 170 Liter |
| Shelves | Standard 5 max. 17 | Standard 3 | Standard 6 max. 19 |
| Exterior finish | Baked-on acrylic finish on galvanized steel | | |
| Interior finish | Copper Alloy stainless full rounded corner | Copper Alloy stainless round corner | Stainless steel round corner |
| Door | Baked-on acrylic finish on galvanized steel with door heater | | |
| Inner door | Tempered glass | | |
| Insulation | Foamed in place polyurethane (non CFC) | | |
| Heating method | Direct heat & Air (DHA) jacket system | Waterjacketed | |
| Humidifying system | Natural evaporation with water in humidity pan (stainless) | | |
| Temperature control | Microprocessor PID control (sensor: thermistor) | PID-Steuerung (sensor: Pt.100 Ohm) | |
| CO ₂ control | Microprocessor control (sensor : Thermal conductivity) | ON-OFF control system (sensor : Thermister) | |
| Air circulation system | Gentle air circulation | | |
| Temperature range | Ambient temperature +5°C-50°C | | |
| Temperature uniformity | ±0,2°C (setting temperature: 37°C, ambient temperature: 20°C) | | |
| CO ₂ range | 0 - 20% | | |
| CO ₂ variation | ± 0,15% | ± 0,15% | ± 0,15% |
| CO ₂ secondary pressure | 0,03 bar | | |
| Chamber humidity | 95% ± 5% RH (AT: 20°C, 60% RH) | | |
| Power source | Voltage | 230/240 V | 230/240 V |
| | Amps | 1,7 A | 1,6 A |
| | Breaker | 10A | 10A |
| Alarm system | <ul style="list-style-type: none"> ■ Audible and visual Alarm ■ Temperature, CO₂, Door alarm (circulation fan and CO₂ valve OFF) ■ Independent overheat protection circuit and sensor ■ Remote alarm contact (w/o MCO-15AC) | | |
| Power consumption | 405 W | 380 W | 285 W |
| Net weight | 84 Kg | 78 Kg | 108 Kg |

* Specifications subject to change without notice.



Electronic automatic recorder MCO-101TR
With a 6-point data recorder, this automatically records temperature and CO₂ level.

Specifications:
Recording range: temperature 0-100°C, CO₂ level 0-20%.
Recording paper: folding type.
Effective width: 60mm
Overall length: 10m
Approx. 40 days recorded on one roll.
Paper feeding speed: 10mm/Hr.

MCO-17S only



CO₂ pressure regulator MCO-100L
Primary pressure gauge: 0-25 Bar.
Secondary pressure gauge: 0-2 Bar.

With 2-stage pressure adjustment, fluctuation of secondary pressure caused by the change of primary pressure is eliminated. Thus, stable pressure and flow of CO₂ can be maintained.



Water preservative agent MCO-100C (cleanser #1000)
When added to the water in the tank (0.1-1% of total amount of water), algae or stains are not produced, enhances anticorrosion and rust proof qualities.

MCO-17S only



Exclusive tray MCO-45ST
External dimensions 450(W)x450(D)x10(H)mm

MCO-175



MCO-175
 ■ Effective capacity 170 Liter.

Condition:
 Ambient temp. 20°C
 Ambient humidity 45%
 CO₂ level setting 5,0%
 Water humidity pan 2,0 litres



Technical data:

Water-Jacketed CO₂ incubator

PID control plus chamber direct sensing system maintains a high-precision temperature environment.

Through the combination of a PID (Proportional, Integrated and Differential) control system for ultra-precise temperature control and a cabinet-air sensing system which accurately monitors inside temperature, this model exhibits exceptional precision within ±0,1 degree of the preset temperature. For the temperature sensor, a durable, ultra-precise PT sensor (Pt 100) is used.

Complete Decontamination

Automatic stop mechanism for Fan Motor and CO₂ valve. With this mechanism, the fan motor and CO₂ valve are automatically stopped when the door is opened. This prevents air flow from the chamber and prevents air contamination due to the mixing of air.

Automatic control door heater

The outer door incorporates a door heater that is automatically controlled. This prevents temperature differences between the chamber and the inner door, thereby preventing condensation on the inner door.

SUS-304 Stainless steel with rounded corner structure

Stainless steel featuring superior chemical resistance and a rounded corner structure are incorporated within the cabinet interior. The shelves, shelf supports and shelf support tabs are easily removable to allow thorough cleaning and sterilization.

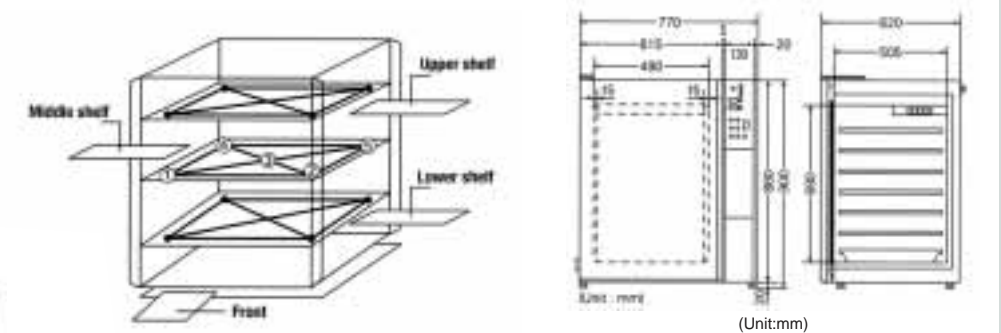
Specific Tube for CO₂ Gas

A specific tube is used for supply and sampling of the CO₂. Featuring superior mold resistance and enabling autoclave sterilization, the tube conforms to the Japanese regulations for Medical and Health and Food Hygiene, eliminating the causes of contamination.

A compact electronic dehumidifier plus a CO₂ sensor produces a high-precision CO₂ environment

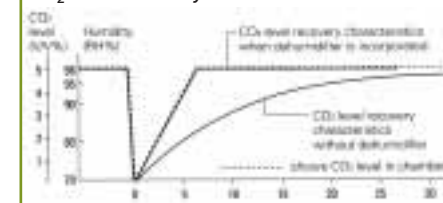
Water Jacketed MCO-175 System

The large size MCO-175 model incorporates a water jacketed system which takes advantage of the heat retention characteristics of water. Because there is no sudden temperature change or loss of temperature during power failure, a stable temperature environment is ensured.



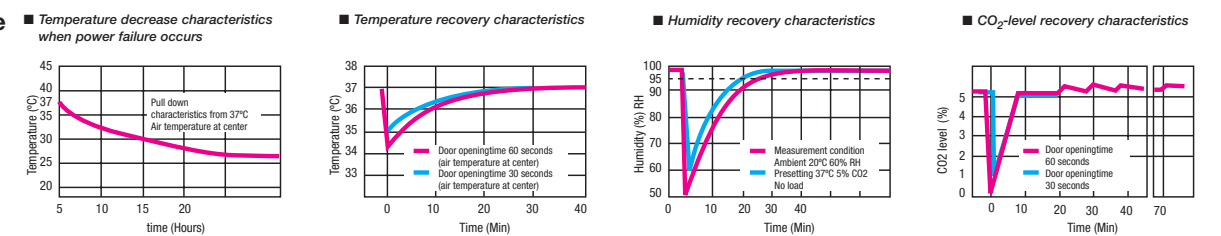
| Measurement position | ① | ② | ③ | ④ | ⑤ |
|----------------------|-------|-------|-------|-------|-------|
| Shelf position | | | | | |
| Upper shelf | +0,05 | +0,07 | 0,00 | -0,15 | +0,05 |
| Middle shelf | | | 0,00 | | |
| Lower shelf | +0,05 | -0,02 | -0,05 | -0,03 | +0,02 |

MCO - 175
 CO₂ - level recovery characteristics



Performance data

(Reference data)



MCO-18M



Professional Cell Culture Multi-gas Incubator

- Continuous contamination control with inCu saFe® interior and safeCell™ UV (option) technologies.
- P.I.D. controls for fast recovery of temperature, CO₂ and O₂ levels
- Speedy humidity level recovery by N₂ gas bubbler



Decontamination via UV radiation (Option)



Inner cabinet is made from Copper stainless steel alloy



Infrared CO₂ sensor

| | |
|---------------------------------|------------------|
| CO ₂ -concentration: | 0-20,0% |
| O ₂ -concentration: | 1-18,0% 22-80,0% |
| Temperature | 5~50°C |
| Effective Capacity | 170L |

The new MCO-18M automatic air jacket multi-gas incubator provides precise CO₂ and O₂ level controls to realise a stable cell culture environment. It features multiple-patented technologies to safely achieve in vitro performance. Also, the MCO-18M has been cleared by the US FDA for In-Vitro Fertilisation (IVF) use.

- In vitro/micro fertilization
- Gene research
- ES cell research
- Regenerative medicine research
- Cancer research
- Biological research
- Cell test

Fast Recoveries

Rapid CO₂ and O₂ recovery without the risk of overshoot is achieved through the use of IR(CO₂) and Zirconia(O₂) sensors and PID control of gas injection. The Sanyo solid-state IR sensor incorporates no moving parts providing long-term, reliable performance.

To optimise humidity recovery rates after door openings, N₂ gas used to control reduced O₂ levels is injected via the humidity pan. The resulting bubbling effect increases humidity transfer into the incubator.

Easy-to-Access Double Inner Door System

A double inner door system keeps gas consumption low and prevents outside air

influx. An optional half tray adds greater flexibility.

Water Level Sensor

The humidity pan has an optical water level sensor to warn of low water level.

Automatic Gas Cylinder Switchover System

This system automatically switches from the primary to secondary gas cylinder when the O₂ gas level does not change while an injection valve is open. An optional gas switchover for CO₂ gas is also available. The in-use gas cylinder is confirmed on the control panel.

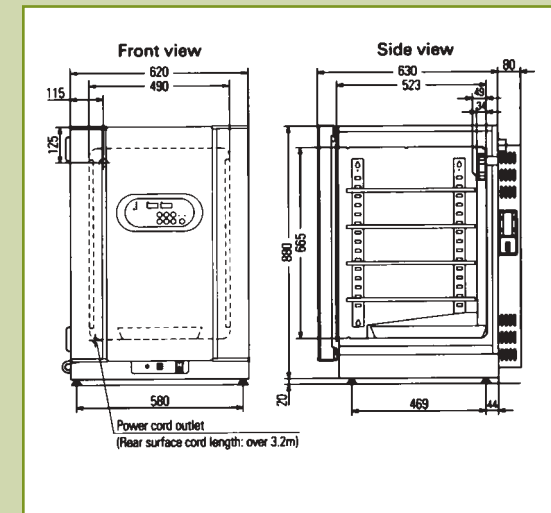
Preventive Contamination Control

InCu saFe interior chamber with fully rounded corners inhibits bacteria growth continuously. An automatic ultraviolet lamp

(option) can also eliminate contaminants in the circulating air and water in the humidity pan without affecting cell cultures. The two powerful measures result in complete contamination control.

Improved Temperature Stability with D.H.A. System

P.I.D. controlled 3-way heaters plus SANYO's proprietary D.H.A. (Direct Heat and Air jacket) provides a high-precision temperature environment, and minimises the risk of condensation and subsequent contamination.





inCu saFe shelf and Brackets
MCO-46ST



CO₂ gas pressure regulator
MCO-100L



Half tray
MCO-25ST



Roller base
MCO-18RB

SANYO DAQ (Data Acquisition) system
MTR-480 & 2000
Automatic CO₂ gas cylinder switchover system
MCO-21GC
UV system kit
MCO-18UVS 2

| | | |
|-----------------------------|---------------------------------|--|
| Exterior dimensions (WxDxH) | 620 x 710 x 900 mm | |
| Interior dimensions (WxDxH) | 490 x 523 x 665 mm | |
| Interior volume | 170 L | |
| Net Weight | 97 kg | |
| Heating Method | Direct heat & Air jacket (DHA) | |
| Temperature | Temp. control system | Microprocessor PID |
| | Temp. range | 5°C above ambient temperature to +50°C (Ambient temp.: +5°C to 35°C) |
| | Temp. uniformity | ± 0,25°C |
| CO ₂ | Temp. controllability | ± 0,1°C *1 |
| | CO ₂ control system | Microprocessor PID |
| | CO ₂ sensor | Infrared |
| O ₂ | CO ₂ range | 0 to 20 % |
| | CO ₂ controllability | ± 0,15% |
| | O ₂ control system | Microprocessor PID |
| Humidity | O ₂ sensor | Zirconia |
| | O ₂ range | 1 to 18 % / 22 to 80% |
| | O ₂ controllability | ± 0,2% |
| Shelves | Humidifying system | Natural evaporation by water in humidity pan over bottom heater (with water level sensor) |
| | Chamber humidity | 95 ± 5% RH |
| | Shelf (WxDxH) | 450 x 450 x 12 mm |
| Contamination control | Shelf material | Copper Alloy stainless steel |
| | Maximum load | 7kg per shelf |
| | Shelves | 4(standard) |
| Access port | Interior surface | Copper Alloy stainless steel |
| | UV lamp (ozone-free) | UV system kit (option) |
| | Access port | 30mm diameter |
| Alarm system | Alarm system | High/low temperature, CO ₂ level, door and UV lamp failure, independent overheat protection |
| | Remote alarm contacts | 30V DC, 2A allowable |

*1 Conditions
Ambient temperature: 25°C, Temperature setting: 37°C, CO₂ level setting: 5%, O₂ level setting 5%, no load.
*2 Stacking plate for 18M + 18M is included in the main body

MLR-350



Versatile Environmental Test chamber

The wide variety of temperatures and lighting patterns that are essential in various research and testing can now be accurately reproduced and controlled. And humidity control too!

Microprocessor PID control of temperature and humidity (0 to +50°C, 0 to 20,000lux and 55 to 90%RH resp.) create the optimum environments for various applications.

Applications

- Plant growth
- Culture of plant cells, tissue and organs
- Acclimatization and rearing of plants
- Incubation and rearing of insects
- Electronic testing
- Food testing

1. Microprocessor PID (Proportional, Integral and Differential) and Refrigeration Capacity control minimise temperature fluctuations and thereby improve temperature control, allowing superior precision experiments plus energy and electricity savings.
2. Forced air circulation system enhances precision of temperature distribution for ideal testing.
3. Programmable temperature function is perfect for temperature cycle and vernalization treatment research. Other than pre-set operation, there are nine user-programmable steps available (Temperature, Time) that simulate day, night, climate as well as various other repeatable cycles.

Programmable lighting function is ideal for optical formation and optical synthesis. Fifteen fluorescent lamps (40W each) are incorporated into the left, right and front doors. Up to nine-step programmed operation with automatic control of a maximum of six light levels allows operation over a wide lighting range.

Space-saving, large capacity, slim and octagonal design is appropriate anywhere, from the experimentation room to the laboratory.

User-friendly design ensures easy maintenance and simple data control. A hybrid recorder is standard equipment on Model MLR-350T/350HT. The unit's communication ability with an external computer permits automatic data collection and operation monitoring.

Convenient security and alarm system. The following security and alarm system are standard equipment for protection of the chamber contents (see table below).

The realization of precise humidity control High-Molecular Membrane- Type Humidity sensor. Small and lightweight, this sensor also boasts a high degree of accuracy and reproducibility. Of the newest high- molecular membrane type, the humidity sensor accurately measures chamber humidity.



| Security and alarm system | The mode of operation | Alarm notification method and security operation |
|----------------------------------|---|--|
| Automatic set temperature | Chamber temperature deviation exceeds 2,5°C | Alarm lamp and digital display flashing. Buzzer sounds. (high temperature: heater OFF; low temperature: compressor OFF) |
| High limit temperature | Chamber temperature exceeds the high limit temperature | Alarm lamp and buzzer activate. Heater and fluorescent lamp OFF |
| Low limit temperature | Chamber temperature falls below low limit temperature | Alarm lamp and buzzer activate. Compressor OFF |
| Program memory back-up | Power failure, accidental power loss | Memory contents are stored for approx. 5 hours. When power is restored, operation resumes according to predetermined program |
| Key lock switch | Key lock switch is turned OFF | New input parameters are refused |
| Automatic set humidity | Chamber humidity deviates by more than 10% from the set level | Alarm lamp and %RH flashing (high humidity: humidification output OFF; Low humidity: minimum defrosting) |
| Trouble checking monitor | During trouble checking | Check by PTN STEP from E1 to EA |

MLR-350



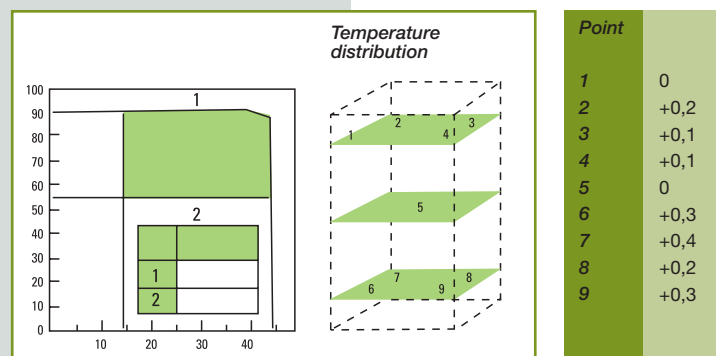
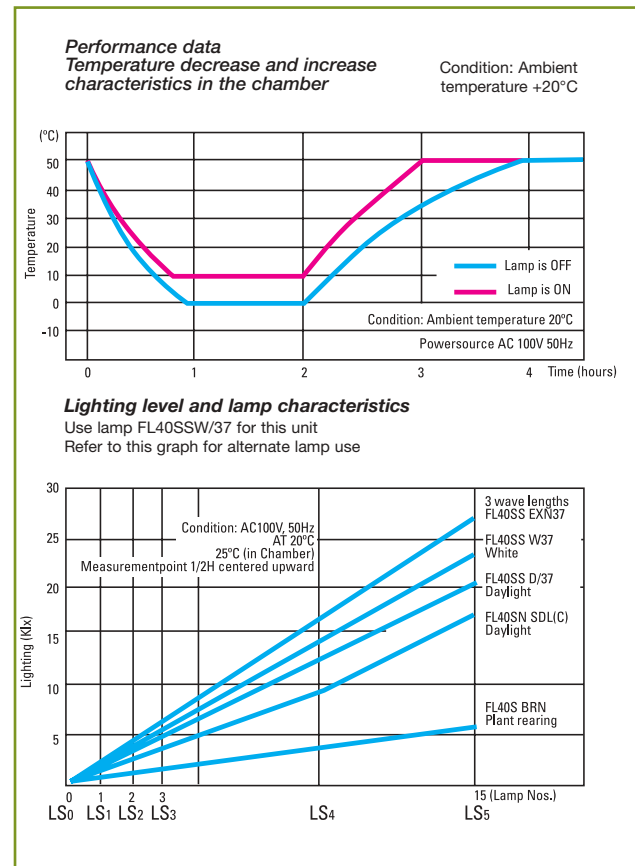
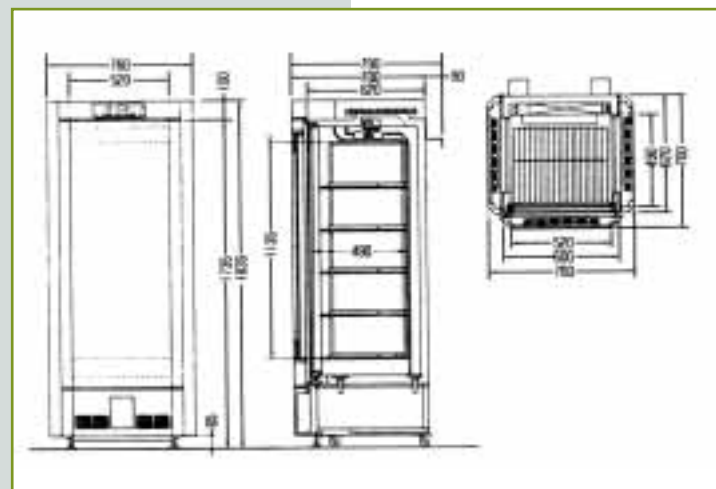
- Switch box
Data input/output port
- Control panel
- Door switch
- Air intake
- Side door fluorescent lamps
- Shelves
- Inner door
- Main door
- Items shown in the unit are for display purposes only.
- Air outlet
- Power switch
- Hybrid recorder (T type only)
- Casters and adjustable legs
Evaporation tray

| Specifications MLR-350/350T/350H/350HT | | Temperature | |
|--|---|--------------------------------------|---|
| Exterior dimensions: (WxDxH) | 760x700x1.835mm | Temperature range: | 0-50°C (lamp OFF) +10-50°C (lamp ON) |
| Interior dimensions: (WxDxH) | 520x490x1.135mm | Temperature distribution: | ±1.0°C (lamp OFF) ±2.5°C (lamp ON) |
| Effective capacity: | 294L | Temperature accuracy: | ±0.3°C |
| Exterior: | Baked-on acrylic finish on galvanized steel Left/right wall: paired glass window (370x1.110mm). | Temperature control: | PID microprocessor control + refrigeration capacity control |
| Interior: | Stainless steel (SUS-304) | Temperature programmable operations: | Max.: 9steps (3 patterns) 99hours 59min. 1-99 cycles repeat or unlimited |
| Door: | Baked-on acrylic finish on galvanized steel with fluorescent lamps | Lighting | |
| Inner door: | Paired glass door | Lighting range: | 0-20.000lux Max. 6 increments adjustable (manual adjustment is possible) Fluorescent lamp 40W x 15pcs. |
| Shelves: | 5pcs. PE coated steel wire (bottom shelf with stainless steel cover), adjustable | Lighting programmable operations: | Lighting levels: 6 (0,1,2,3,4,5) Max. 9 steps (1 pattern) 1-99 cycles repeat or unlimited |
| Access hole: | 40mm dia. 1x (chamber top position) | Humidity | (MLR-350H/350HT only) |
| Casters: | 4pcs. | Control system: | Ultrasonic PID control |
| Air circulation | Forced air circulation | Control range: | 55-90% RH |
| Compressor: | Fully hermetic, 325W output | Alarm and security | |
| Evaporator: | Fin and tube type, forced circulation | Automatic temp. alarm: | Automatically set when temperature deviates approx. ±2.5°C Heater or compressor OFF |
| Refrigerant: | R509 | High and low temp. limit: | Optional setting of 0 to +55°C: receptacle, heater, fan motor in chamber, fluorescent lamp OFF, optional setting -15 to +40°C: compressor OFF |
| Heater: | Cord heater 280W | Thermal fuse: | Fused receptacle: heater, fan motor in chamber OFF |
| Defrosting system: | Automatic finish, (manual start), natural evaporation of drain water | Automatic humidity alarm: | Operates if chamber humidity deviates by more than 10% from the set level |
| Power source: Voltage | 230/240V | Weight: | 220/220/230/230kg |
| Hz | 50Hz | | |
| Phase | 1Ø | | |
| Amps 350/350T: | 9,2A | | |
| Amps 350H/350HT: | 9,5A | | |
| Breaker: | 15A | | |



MIR-153
MIR-253
MIR-553
MIR-162/262

*note: • When unit is continuously below +10°C the evaporator may become frosted and the unit efficiency will decline resulting in a chamber temperature increase. Regular inspection is recommended
• Optional accessory MTR-D60 (Hybrid recorder)



The temperature distribution (°C) is determined using 1/2H and centre point (5) as the zero reference.

SANYO's MIR cooled series incubators have been recognized as exceptional units suitable for a wide range of applications by providing a temperature range of -10°C to 50°C. In pursuit of temperature precision and enhanced operability, the MIR-153/253/553 series makes its debut. Incorporating an 8-bit microcomputer, these incubators control the heater and compressor within a precise ±0.2°C and ±1°C range, respectively. In addition, they can be applied to a wide variety of experimentation patterns with the aid of a 3-step microcomputer program. These cooled incubators are designed to meet a variety of advanced experimental needs ranging from micro organism cultures and plant germination tests to various constant temperature experiments.

Programmable 3-step operation with microcomputer control

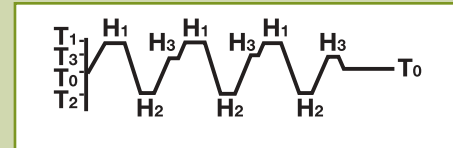
Combining flexible Temperature (T) and Time (H) control, a maximum 3-step plus constant operation or max. 3-step repeating operation can be programmed according to the experimentation requirements. The one-step setting time ranges from 0.0 to 99.5 hours in increments of a half hour. A program can be set to repeat for a minimum of once up to a

maximum of 99 times. Program input is simple and the steps during each operation are indicated by a lamp. This incubator accommodates a range of diversified experimentation requirements, and is ideal for experimentation during night time or holidays, experimentation that requires settings to be changed, and micro organism culture and preservation. Constant operation mode without step operation is also available.

3-Step Repeat Operation

Temperature (T1, T2, T3) and Time (H1, H2, H3) are set. Then, limited repeating operations (from 1 to 99 times) or continuously repeated operations are conducted.

After a limited repeating operation has been completed, constant operating temperature T0 is retained. Application: Optimum for repeated experiments in which 3 different temperatures and times are combined.



Cooled incubators MIR-153/253/553

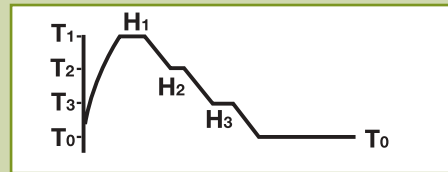
High-precision Temperature Environment

Microprocessor Control with Feed forward Function

SANYO Cooled Incubators incorporate a high precision microprocessor temperature control combined with a heater PID and compressor ON-OFF system. This system has a feed forward function that monitors the operating conditions of the compressor, ensuring accurate temperature control of the chamber. In a wide temperature range of -10°C to 50°C, the heater PID exhibits temperature fluctuation of only $\pm 0.2^\circ\text{C}$, and the Compressor ON-OFF controls only $\pm 1^\circ\text{C}$. In addition, temperature uniformity in the chamber is within $\pm 1^\circ\text{C}$, allowing a full range of precise experimentation from micro

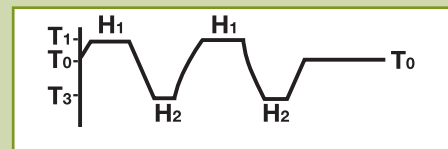
3-Step to constant Operation

With a temperature of T1, T2, and T3, operation is conducted using time H1, H2, H3 respectively. Then, constant operation temperature T0 is retained. Application: Optimum for experiments that require consistent 4-step temperature increases and decreases.



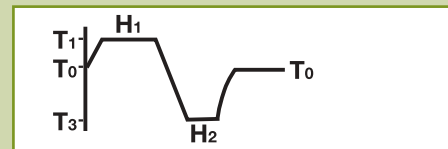
2-Step Repeat Operation

Using a temperature of T1 and T2, operation is repeatedly conducted (using time H1 and H2). Application: Optimum for day and night cycle operations of plant material or quality testing for chemicals, foods and samples.



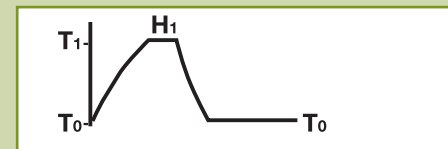
2-Step to constant Operation

With a temperature of T1 and T2, operation is conducted using time H1 and H2. Then, constant operating temperature T0 is retained.



1-Step to constant Operation

With a temperature of T1, operation is conducted using time H1. Then, constant operating temperature T0 is retained. Application: Optimum for automation and labour savings while performing bacteria inspection from culture to preservation, and from preservation to culture.



organism cultures to various types of incubation.

Energy Savings

Because heater output and compressor on/off are microprocessor controlled, optimum automatic operation according to ambient temperature and fluctuation of chamber load is possible, resulting in high-energy savings.

CFC-free Foamed-in-place Rigid Polyurethane Insulation

CFC-free Foamed-in-place polyurethane is used for the chamber because of its high thermal retention and energy saving properties.

Triple-pane Glass Observation Window plus 15W Fluorescent Lamp

An easy-to-observe triple-pane glass window and 15W fluorescent lamp are provided for sample observation during experimentation. When observation is not required, a light shielding plate (MIR-153/253) can be easily attached.

Alarm and Security System to Protect Sample Safety

Automatic Setting Temperature Alarm

When the chamber temperature deviates more than $\pm 2.5^\circ\text{C}$, all the digits on the digital indicator flash and after 10 minutes a buzzer sounds to notify you. This system also automatically allows for programmed operation or setting value changes.

Independent Over-temperature Protection Device

This incubator incorporates an excessive temperature prevention circuit that protects experimentation materials in the rare event that a temperature abnormality does occur. Isolated from the main circuit, this exclusive circuit and sensor operate even if the temperature sensor or micro-processor malfunction, activating an exclusive lamp and buzzer for notification. This system turns off the heater and chamber fan motor when over high temperature is detected (setting

temperature range: 15°C - 55°C), and turns off the compressor when over low temperature is detected (setting temperature range -15 to 20°C). A remote alarm contact is provided for monitoring alarm from a remote location.

Programmed Memory Backup Mechanism

Should the power source be interrupted due to power failure or other event, programmed data remains stored in memory for approx. 5 hours. When the power source is restored, operation can be continued according to the predetermined program.

Automatic Return Buzzer Switch

After an abnormality occurs, the alarm buzzer automatically switches to the ON mode, even if the operator forgets to return the alarm buzzer to the ON mode, thus ensuring safe and secure operation.

Key Lock Switch

A key lock switch is provided so that settings may not be changed unintentionally. This prevents the control key from operating unless the lock switch in the switch box is turned to the "OFF" position.

Auto Return Mechanism

This mechanism automatically returns the chamber temperature indicator to its normal indication when the control key is not operated for approx. 90 seconds at each setting mode. Thus, normal operation is ensured even if the operator forgets an operational procedure during setting.

Trouble Monitor (Self Diagnostic Function)

Should a malfunction occur, the location of the malfunction can be digitally indicated, allowing quick operator response.

MIR-153
MIR-253
MIR-553
MIR-162/262

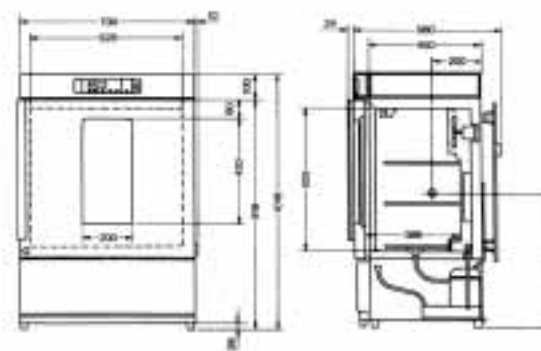
Cooled incubators



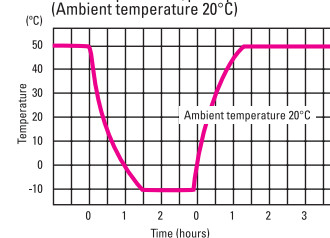
126 Liter

MIR-153

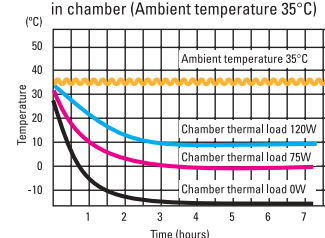
Performance
Temperature pull-down speed: 50°C to 0°C Approx. 60 minutes. (ambient temperature 20°C , no load)
Temperature pull-up speed: 0°C to 50°C Approx. 70 minutes. (ambient temperature 20°C , no load)



Performance data
Chamber pull-down/pull-up characteristics
(Ambient temperature 20°C)



Pull-down characteristics for thermal load in chamber (Ambient temperature 35°C)



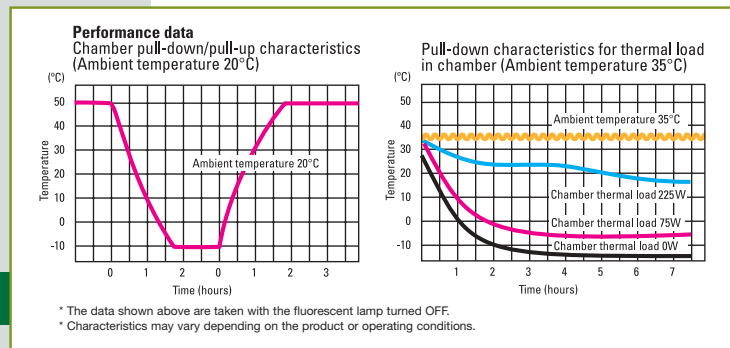
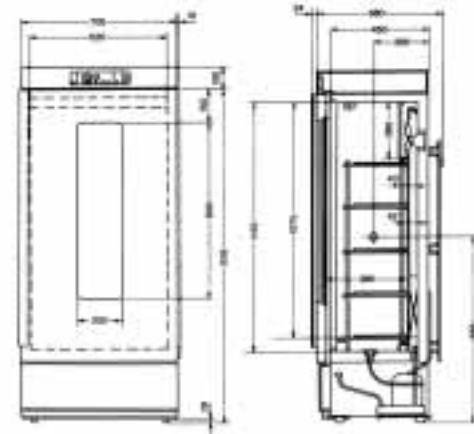
* The data shown above are taken with the fluorescent lamp turned OFF.
* Characteristics may vary depending on the product or operating conditions.

MIR-253

254 Liter



Performance
 Temperature pull-down speed: 50°C to 0°C Approx. 86 minutes.
 (ambient temperature 20°C, no load)
 Temperature pull-up speed: 0°C to 50°C Approx. 105 minutes.
 (ambient temperature 20°C, no load)



Cooled incubators

Heated incubator MIR-162/262

Microcomputer PID Control+ Air Jacketed System

Microcomputer PID control and air jacketed system gives precise temperature control within the chamber. Temperature accuracy is within $\pm 0.2^\circ\text{C}$ (at 37°C) and temperature uniformity is within $\pm 1^\circ\text{C}$ (at 37°C).

Microcomputer Timer Function

An accurate microcomputer timer is fitted to allow experiments up to 99 hours and 59 minutes. Desired start time is set by an automatic start (delay function). The program activates a buzzer when a set time is over and keeps a set temperature after an operation finishes. Various operation patterns can be set by utilizing these functions.

Temperature Control Range- Ambient Temperature +5°C~80°C (at 20°C)

SANYO heated incubators allow incubation at normal temperature to high temperature.

Advanced Design

Control panel uses a touch keyboard and an easy-to-read green LED display. Temperature and time are shown respectively by digital displays. Durable stainless steel (SUS-304) for interior cabinet.



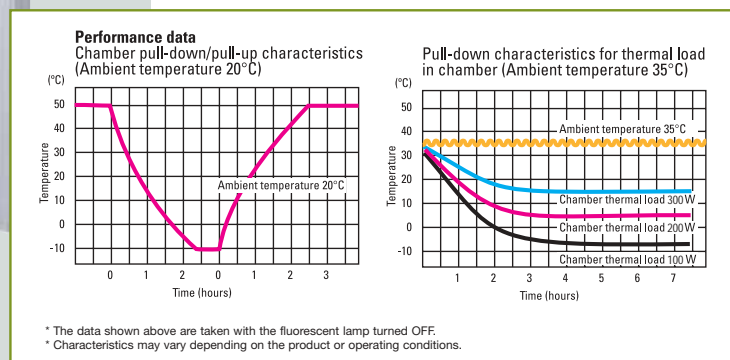
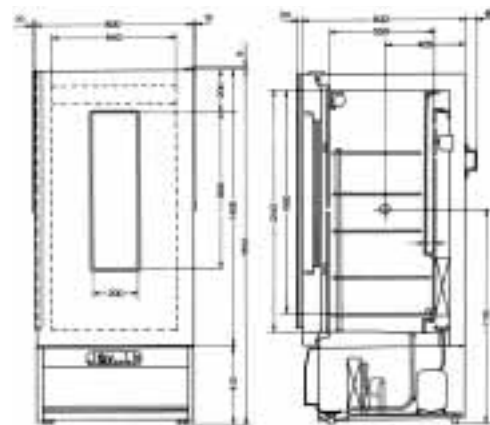
MIR-153
 MIR-253
 MIR-553
 MIR-162/262

MIR-553

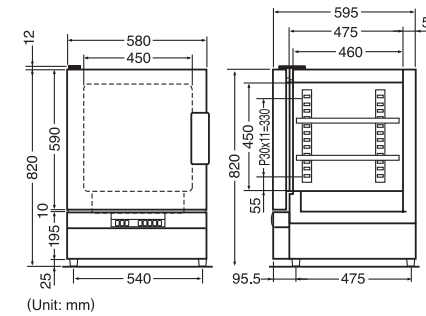
406 Liter



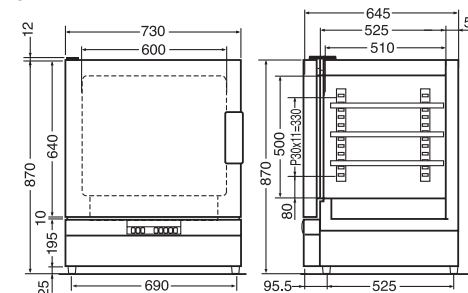
Performance
 Temperature pull-down speed: 50°C to 0°C Approx. 100 minutes.
 (ambient temperature 20°C, no load)
 Temperature pull-up speed: 0°C to 50°C Approx. 140 minutes.
 (ambient temperature 20°C, no load)



MIR-162



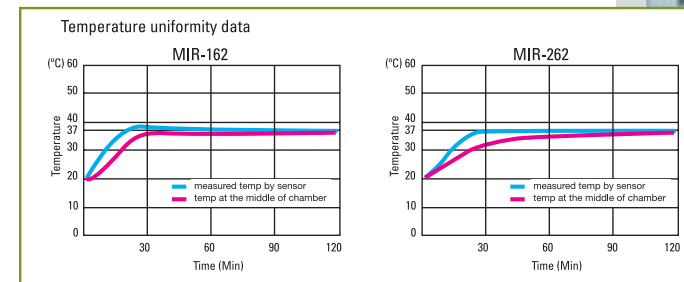
MIR-262



93 Liter / 153 liter

MIR-162 / 262

Temperature pull-up speed; 20°C to 60°C
 Approx. 70 minutes (MIR-162)
 Approx. 60 minutes (MIR-262)
 (Ambient temperature 20°C, no load).





Exclusive stand
 MKD-300T
 (for MIR-153)
 External dimensions
 820(W)x750(D)x750(H)mm



| Specifications | Cooled incubators | | | Heated incubators | |
|------------------------------|--|-------------------------------------|---|---|-------------------|
| Model | MIR-153 | MIR-253 | MIR-553 | MIR-162 | MIR-262 |
| Exterior dimensions: (WxDxH) | 700 x 580 x 1018 | 700 x 580 x 1618 | 800 x 832 x 1800 | 580 x 595 x 820 | 730 x 645 x 870 |
| Interior dimensions: (WxDxH) | 620 x *386 x 555 | 620 x *386 x 1075 | 640 x 550 x 1160 | 450 x 460 x 450 | 600 x 510 x 500 |
| Effective capacity: | 126 Liter | 254 Liter | 406 Liter | 93 Liter | 153 Liter |
| Exterior finish: | Baked acrylic finish on galvanized steel | | | | |
| Interior finish: | Stainless steel | | | | |
| Door: | Baked acrylic finish on galvanized steel, triple pane glass with key | | triple pane glass with observation window and key | Baked acrylic finish on galvanized steel | |
| Shelves: | PE coated steel wire, adjustable | | | Stainless steel, stainless wire | |
| | 3 | 5 | 5 | 2 | 3 |
| Insulation: | Foamed-in-place rigid polyurethane | | | Glass wool | |
| Circulation system: | Forced air circulation | | | Natural convection | |
| Compressor: | Hermetic type | | | | |
| | Single phase, output 180W | | Single phase, output 300W | - | |
| Evaporator: | Fin and tube type, forced circulation | | | | |
| Condenser: | Wire and tube type natural air cooling system | | | | |
| Defrosting system: | Manual start, automatic finish, natural vaporisation of drain water | | | | |
| Heater: | Cord heater | Cord heater | Cord heater | Sheathed heater | Sheathed heater |
| | 141 W | 218 W | 332 W | 200 W | 300 W |
| Temp. setting indication | Digital setting with key lock digital display | | | | |
| Temperature control | Microprocessor PID system (when compressor operates, ON/OFF control) | | | Microprocessor PID system | |
| Temperature sensor | Thermistor | | | | |
| Autom. setting temp. alarm | When temperature deviates approx. ±2.5°C, visual and audible alarm | | | | |
| Over temp. protection device | Visual and audible alarm | | | | |
| Programmed operation | 3-step repeat from 1-99 times. Continuous repeat 1 step 0.5-99.5Hr (program memory back up function approx. 5 hours) | | | - | |
| Temperature range | -10°C ~ +50°C | | | + 5°C ~ +80°C (UT 20°C) | |
| Timer | - | | | Automatic timer with delay function 00:00 ~ 99:59 | |
| Temperature controllability | ±0.2°C at heater PID control (Temp. setting 50°C, ambient temp. 20°C, no load) ±1°C at compressor ON/OFF control (Temp. setting 5°C, ambient temp. 20°C, no load) | | | ± 0.2°C (-60°C) ± 0.5°C (60-80°C) at 37°C | |
| Temperature uniformity | ±0.5°C (Temp. setting 37°C, ambient temp. 20°C, no load) | | | ± 1°C | |
| Power source: Voltage | 230/240 V / 50 Hz | 230/240 V / 50Hz | 230/240 V / 50 Hz | 230/240 V / 50 Hz | 230/240 V / 50 Hz |
| Amps | 1.4 A | 1.2 A | 2.1 A | 0.9 A | 1.4 A |
| Breaker | 15 A | 15 A | 15 A | 15 A | 15 A |
| Power consumption | 224/232 W | 292/290 W | 384/415 W | 200 W | 300 W |
| Interior lamp | 15 W x 1, fluorescent lamp | | | | |
| Net weight | 69 Kg | 104 Kg | 205 Kg | 44 Kg | 61 Kg |
| Accessories | Key 1set Light shielding plate 1 | Key 1set Light shielding plate 1 | Key 1set | - | - |

* Specifications subject to change without notice.
 * MIR-153/253 minimum depth 370mm.



A guide for autoclaves and ovens

safety first



Autoclaves and ovens designed for easy operation and operator safety.

Researchers waste valuable time and energy when limited to using a centralized building autoclave. Installation and maintenance of central autoclaves are not only costly but time consuming. SANYO offers two solutions. The MLS series and MAC portable autoclaves are designed for individual lab use and can be conveniently moved from one lab to another. Model MLS-3750 has a low enough profile to be stored under a lab bench when not in use.

Accurate, High-Temperature Equipment for Scientific Research.

Sanyo has always aimed to provide research support equipment that offers complete satisfaction to its users. Inspired by the search for even higher precision and greater flexibility of control, Sanyo presents the new MOV Series ovens and sterilizers.



MLS-3750
MLS-3780



Insulated door and control panel



Lock lever



Drainage hose simply clips on and off



Low-Profile Design for ease of use

The top of the autoclave chamber is only 641 millimetres from the floor. This low profile design makes it very easy to load and unload the sterilizing baskets (MLS-3750).

High-pressure autoclaves are the most popular method of sterilization used in today's laboratories. Such autoclaves serve a wide variety of purposes from preparation of culture media and sterilisation of glass and metal instruments to processing of laboratory waste. With this in mind, we have made our latest autoclaves very easy to use. They are very simple to load and unload, and designed to save space.

Swing-Top Door

The door opens upwards, so no slide open space is required. This makes the 37-centimeter wide chamber easy to access, and a low-profile design is also made possible. The MLS-3780 offers 75-liter capacity with the same footprint as the MLS-3750.

37cm-Diameter Chamber

The 37cm-diameter wide chamber offers ample capacity. For example, four 1000ml flasks will fit easily into one sterilizing basket. Also, two racks holding 50 test

tubes can fit into one basket. The MLS-3750 can accommodate two sterilizing baskets, while the large-capacity MLS-3780 can hold up to three baskets at one time.



Microprocessor Temperature Control

Sterilizing temperature is controlled by the microprocessor to within +2°C/-0°C of the set temperature in the range of 105°C to 135°C.

Double Interlocking Structure

To ensure the safe operation of this high-temperature, high-pressure autoclave, the chamber and the open/close lever are controlled by a double interlock system dependent on temperature and pressure sensors. In this way, it is impossible to open the autoclave until temperature and pressure levels are safe.

Air Vent Control

The exhaust valve release temperature can be set to allow automatic release after the sterilizing cycle has been completed. The setting range is from +0°C to 25°C above boiling point to suit the items being sterilized (patent pending).

Human-oriented design

SANYO has included a host of features to make this autoclave user friendly. There is a heat-insulating resin housing and the corners are gently rounded. The control panel is mounted on top so it is easier to see and use. There is a clip-on drainage hose and an exhaust tank that's easy to fill and empty. And for safety, there's a lever locking system.

Simple-to-set temperature programs for sterilizing, preparing and maintaining culture media.

Four programs with three variations for a total of 12 programs

Sterilisation program:

This program is intended for fluids, including water, culture media and reagents. After sterilization is completed and the contents have cooled down naturally to the selected temperature air is expelled from the chamber automatically through the exhaust valve. This program is suitable for BGLB culture media and for Durham tubes*.

Sterilization temperature: 105°C to 135°C
Sterilization timer: 1 to 250 minutes
Exhaust temperature: +0°C to 25°C

*For E. coli tests

Melting/Keep Warm program

Used to dissolve culture media or keep media at a fixed temperature. Keeping dissolved media hot prevents it from solidifying. (This is not a sterilizing program.)

Melting Temperature: 60°C to 100°C
Timer: 0 to 250 minutes, 72 hours
Incubation temperature: 45°C to 60°C

Sterilizing/Keep Warm program

To sterilize culture media, reagents and other liquid substances, then keep them at a high temperature. After sterilization is completed and the contents have

cooled down naturally to the selected temperature, air is expelled from the chamber automatically through the exhaust valve. Sterilized media are maintained at a high temperature to prevent them from solidifying. Suitable for BGLB culture media and for Durham tubes.

Sterilization temperature: 105°C to 135°C
Sterilization timer: 1 to 250 minutes
Exhaust temperature: +0°C to 25°C
Incubation temperature: 45°C to 60°C

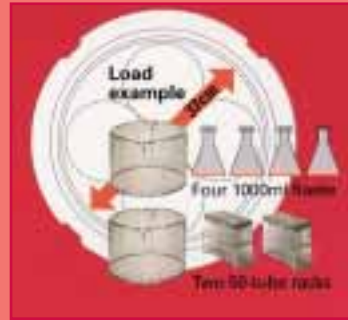
Instrument Sterilization program

For sterilizing flasks, beakers, test tubes and other laboratory instruments and equipment.

After sterilization is completed, the exhaust valve opens and the temperature drops to 100°C. Suitable for appliances that can withstand sharp drops in pressure and also for sterilizing waste products.

Sterilization temperature: 105°C to 135°C
Sterilization timer: 1 to 250 minutes, 72 hours

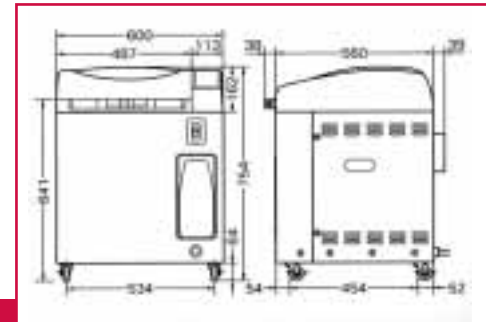
MLS-3750



Load example

50 Liter
Effective capacity

High-pressure autoclaves are the most popular method of sterilization used in today's laboratories. Such autoclaves serve a wide variety of purposes from preparation of culture media and sterilisation of glass and metal instruments to processing of laboratory waste. With this in mind, we have made our latest autoclaves very easy to use. They are very simple to load and unload, and designed to save space.



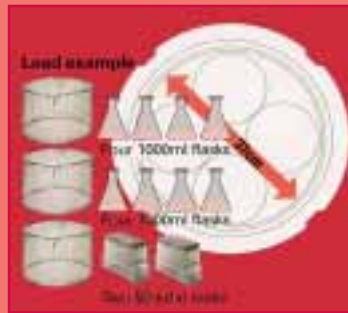
Dimensions (mm)

Specifications

| Model | MLS-3750 | MLS-3780 |
|---------------------------------------|---|--|
| Power supply | 230V single phase, 50Hz (20A) | 230V single phase, 50Hz (20A) |
| Power consumption | 2kW | 4kW |
| External dimensions (WxHxD) | 600x754x560mm | 600x979x560mm |
| Weight | 63kg | 74kg |
| Chamber dimensions (diameter x depth) | Ø370x415mm (480mm effective incl. door) | Ø370x640mm (705mm effective incl. door) |
| Effective capacity | 50 Liters | 75 Liters |
| Chamber material | SUS404 (stainless steel) | |
| Maximum pressure | 0,235MPa | |
| Sterilization temperature | 105 to 135°C | |
| Culture media melting temperature | 60 to 100°C | |
| Keep warm temperature | 45 to 60°C | |
| Sterilisation timer | 1 to 250 minutes, instrument sterilization program up to 72 hours | |
| Melting timer | 0 to 250 minutes, 72 hours possible | |
| Keep warm timer | 72 hours delayed, auto off | |
| Program timer | 1 to 99 hours | |
| Exhaust control | Exhaust valve open temperature setting | |
| Safety devices | Pressure safety valve, over temperature limiter, anti dry scorch limiter, door interlock, over pressure limiter, current fuse | |
| Pressure vessel type | Small-scale pressure vessel | |
| Accessories | 2x stainless steel baskets, heater cover | 3x stainless steel baskets, heater cover |

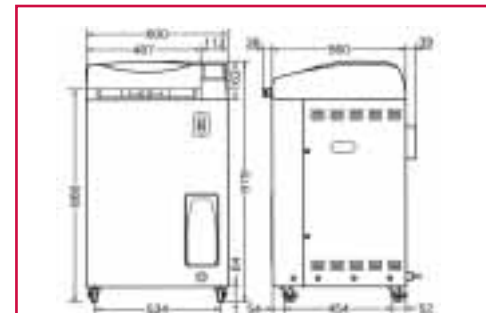
**Appearance and specifications are subject to change without notice*

MLS-3780



Load example

75 Liter
Effective capacity



Dimensions (mm)

Surprisingly large capacity in a compact body

Object temperature sensor (MLS-SA)

Measures temperature of items in the autoclave chamber and sets the sterilization timer accordingly. Suitable for materials that heat up more slowly than the chamber, such as resins. After installation, the autoclave control system can be switched between this sensor and the main sensors.



Cooling fan (MLS-F23)

Forces down chamber temperature after sterilization is completed, thereby shortening the operating cycle. Saves time compared with natural convection.



Round basket (MLS-RBC)

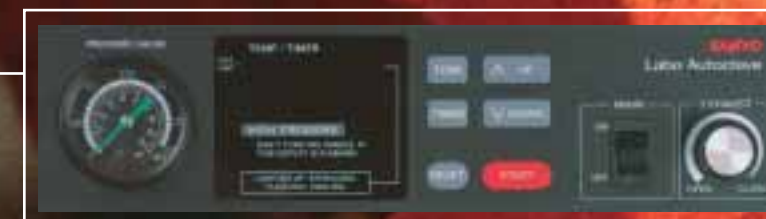


Ambient sensors (MLS-SVT)

A kit containing three independent sensors to measure temperature inside the chamber, and tubing to connect to a pressure gauge. The temperature sensors can provide printed results for validation purposes, but the recorder and pressure gauge are not included in the kit (if a sample temperature sensor is used (see above), only two other sensors can be used).



MLS-2420
MLS-3020
MLS-2420U
MLS-3020U



Accurate sterilization temperature control - easy to use

The importance of sterilization is growing in the field of good laboratory practice in areas such as biotechnology and medicine. Of all sterilization methods, the use of high pressure steam (autoclave) is the most widely used because of its efficacy, speed and reliability. This method is suitable for a wide range of applications including culture media, glass and metal implements, and waste products. SANYO laboratory autoclaves provide a safe, reliable high pressure steam sterilizing environment within a unit that is particularly easy to use. Microprocessor control ensures that the correct temperature is accurately maintained and easily operated with one-touch operation. Fail-safe functions ensure user safety and the compact design maximises use of valuable laboratory space. These reliable, energy saving autoclaves are ideal for a wide range of applications.

Microprocessor control maintains accurate sterilization temperature.
A microprocessor monitors and controls the steam temperature within the chamber, ensuring that it is maintained within the range 105°C - 121°C (MLS-2420 / 3020), 105°C - 126°C (MLS-2420U / 3020U).



Easy to operate ergonomic design
The interior of the chamber is free of protrusions such as sensors or piping joints that could interfere with the insertion or removal of items. The single rectangular handle turns easily and

securely seals the chamber. The control panel is mounted at the top of the unit, making it easier to see and operate. A water outlet valve allows easy changeover of the sterilization water.

Digital controls and display eliminate setting errors
The digital control panel allows temperature and time settings to be entered accurately in 1°C and 1-minute intervals. The display panel is easy to read helping to prevent errors when setting parameters. Pressing the (TEMP) and (TIMER) keys simultaneously displays the remaining sterilization time.

Safety assured with fail-safe functions

1. Dry scorch protection function
Should the water level drop too low, an overheating protection circuit is triggered, a buzzer sounds and an error message appears on the display. Buzzer alert: pairs of short beeps repeated in succession.

2. Door switch
A safety mechanism prevents the autoclave from operating if the door is not completely closed. A door closed lamp lets you check whether the door is closed.

3. Pressure safety valve
A reliable pressure safety valve is used to prevent the pressure inside the chamber from rising above acceptable levels. A spring type safety valve is incorporated for MLS-3020U and MLS-2420.



4. Thermistor error detector function
If the thermistor temperature sensor goes open circuit (connection broken), the heater turns off to prevent overheating. Buzzer alert: pairs of short beeps repeated in succession.

5. Overheating protection function
The digital display starts to flash if the temperature in the chamber rises more than 2°C above the temperature setting. If it rises 3°C or more above the setting, the relay shuts off and cuts off power to the heater.

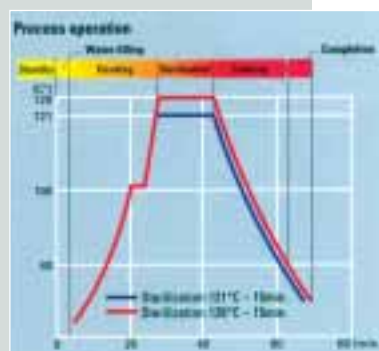
Door protection function
If the magnet-holder is not connected to the switch button, the high pressure lamp will flash when the temperature inside the chamber is over 99°C (210°F) (MLS-3020U and MLS-2420U only).

Audible and visual alarms alert the user to end of cycle and error conditions.
The unit sounds a buzzer to alert the user to any error conditions requiring attention and to the end of the sterilization cycle so that items can be removed from the autoclave.

1. Sterilization finished alert function
A buzzer sounds to tell you when sterilization is finished.

2. Safe to open door alert function
The unit continues to monitor the temperature inside the chamber after sterilization is finished. Once the autoclave has cooled to the point where it is safe to open the door, a buzzer sounds.

3. Safe to remove contents alert function (cycle fully complete)
When the items being sterilized have cooled down to the point where it is safe to remove them, a buzzer sounds.



MLS-2420
MLS-3020
MLS-2420U
MLS-3020U

One touch operation with memory pattern settings.

Thanks to the autoclave's microprocessor control, frequently used sterilization pattern parameters are stored in the memory for easy use. Operating is as easy as pressing the START key.

The following memory patterns are available for selection:

| Sterilization temperature | Sterilization time |
|---------------------------|--------------------|
| 121°C | 15 minutes |
| 121°C | 20 minutes |
| 115°C | 15 minutes |
| 110°C | 15 minutes |

Compact design ideal where space is limited

The body of the unit, with its built in exhaust bottle, measures a mere 380 x 490 mm (MLS-2420) and 440 x 550 mm (MLS-3020) so it will fit in the tightest spaces.

Features of MLS-3020U/2420U

- Wide variety of items can be autoclaved using 126°C sterilization.
- The pressure vessel is designed to meet the ASME safety code. In accordance with the code, these units have a lid interlock function.
- 120V and 208V versions comply with CSA-NTRL(UL)/CSA standards
- 230V versions comply with European Directives and are CE marked accordingly.



Medical autoclave

MAC-235EX



Autoclave options



| Model | MLS-2420U | MLS-2420 |
|-------------------------------|---|--|
| Power supply | 120V units: 120V AC (50/60Hz), 12,5 A 208V units: 208V AC (50/60Hz), 7,2 A 230V units: 230V AC (50/60Hz), 6,5 A | AC local voltage (110V, 120V, 220V, 240V) |
| Power consumption | 1,5 kW | |
| External dimensions | 380 x 490 x 84 mm | |
| Chamber dimensions | 240 x 450 mm | |
| Chamber material | Stainless Steel (SUS304) | |
| Sterilization temperature | 105°C - 126°C | 105°C - 121°C |
| Temperature gauge range | Digital display 80° - 141°C | |
| Safety valve release pressure | 177kPa (25psig) | 200kPa |
| Pressure gauge range | 0 - 0.3 MPa / 0 - 45psi | 0 - 0.3 MPa |
| Timer setting range | 1 - 180 minutes | |
| Exhaust tank | 3L polyethylene | |
| Safety devices | Pressure safety valve Anti dry scorch thermo limiter Door switch Handle switch Current fuse | Pressure safety valve Anti dry scorch thermo limiter Door switch |
| Accessories | Vinyl cover Stainless steel baskets | |
| Applicable standards | Pressure vessel: Japanese standard/CE | General standard |

| Model | MLS-3020U | MLS-3020 |
|-------------------------------|---|--|
| Power supply | 120V units: 120V AC (50/60Hz), 16,7 A 208V units: 208V AC (50/60Hz), 9,6 A 230V units: 230V AC (50/60Hz), 8,7 A | AC local voltage (110V, 120V, 220V, 240V) |
| Power consumption | 2kW | |
| External dimensions | 440 x 550 x 1050 mm | |
| Chamber dimensions | 300 x 670 mm | |
| Chamber material | Stainless Steel (SA-240 type 304) | Stainless Steel (SUS304) |
| Sterilization temperature | 105°C - 126°C | 105°C - 121°C |
| Temperature gauge range | Digital display 80° - 141°C | |
| Safety valve release pressure | 177kPa (25psig) | 200kPa |
| Pressure gauge range | 0 - 0.3 MPa / 0 - 45psi | 0 - 0.3 MPa |
| Timer setting range | 1 - 180 minutes | |
| Exhaust tank | 3L polyethylene | |
| Safety devices | Pressure safety valve Anti dry scorch thermo limiter Door switch Handle switch Current fuse | Pressure safety valve Anti dry scorch thermo limiter Door switch |
| Accessories | Vinyl cover Stainless steel baskets | |
| Applicable standards | ASME Code/CSA/CSA-NTRL (UL)/CE | General standard |

- Automatic control system with microprocessor
- 7-parameter selection system
- Built-in safety system

Sterilization temperature for Non-liquids:

- 121°C
- 126°C
- 132°C

For Liquids:

- 105°C
- 110°C
- 115°C
- 121°C

Features

Automatic control system with microprocessor

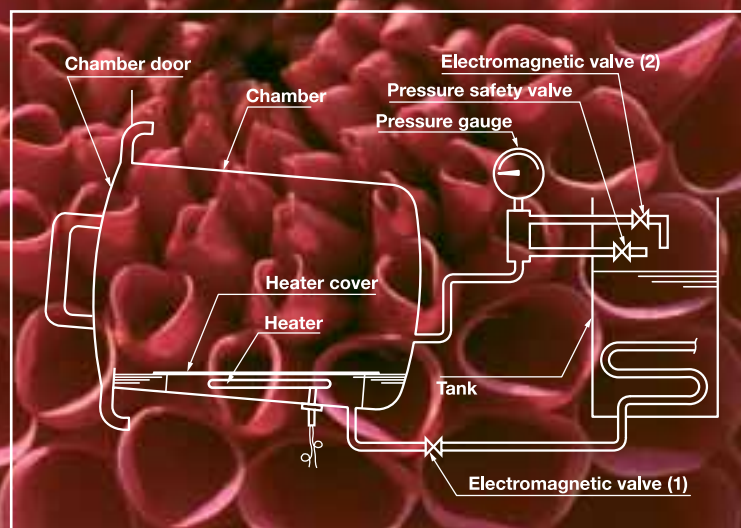
A microprocessor senses the steam temperature within the chamber, and controls the sterilizing temperature.

7-parameter selection system

MAC-235EX allows the user to select from 7 programs according to the category of items to be sterilized.

| No. | Category of items | Sterilisation | | Drying |
|-----|-------------------|---------------|----------|---------|
| | | Temperature | Time | |
| 1 | Non-liquid | 132°C | 10-90min | 0-90min |
| 2 | | 126°C | 15-90min | |
| 3 | | 121°C | 20-90min | |
| 4 | Liquid | 121°C | 15-90min | 0min |
| 5 | | 115°C | | |
| 6 | | 110°C | | |
| 7 | | 105°C | | |

MAC-235EX



- 1 Chamber fills with water to appropriate level from the tank through electromagnetic valve (1).
- 2 The heater heats the water and steam is created
- 3 Air is expelled from the chamber via electromagnetic valve (2). The chamber fills with steam.
- 4 Electromagnetic valve (2) opens and the chamber temperature rises to sterilization level. Pressure also increases.
- 5 When sterilization has been completed, electromagnetic valve (1) opens and the water returns to the tank. In this way the same water can be used several dozen times.
- 6 Electromagnetic valve (1) closes, electromagnetic valve (2) opens and the chamber returns to normal atmospheric pressure. The sterilisation process has been completed.

| | |
|--|--|
| Model | MAC-235EX |
| Control method | Microprocessor control method |
| Power source | AC local voltage, 50Hz |
| Power consumption | Sterilisation: 1,0kW Drying 0,5kW |
| Chamber | SUS444 (stainless steel) |
| Capacity of chamber | 14 liter, Ø228x338mm |
| Sterilizing Temp. control range | Liquid: 105°C, 110°C, 115°C, 121°C Non-liquid: 121°C, 126°C, 132°C |
| Timer | Sterilization: 20-90min (121°C) 15-90min (126°C) 10-90min (132°C) 15-90min (liquid) Drying: 0-90min (Non-liquid only) |
| Timer display method | Digital |
| Operation method | Automatic |
| Pressure gauge range | 0-4Bar |
| Sterilizing pressure gauge | 1,02-2,04Bar |
| Safety pressure regulation | 2,55Bar |
| Water tank | 4liter (stainless steel) |
| Water drain function | Flexible hose type (lower part of body) |
| Water filter | Double filter |
| Exhaust valve | Solenoid valve |
| Safety devices | Pressure safety valve, Thermal fuse, Anti-dry scorch electrical thermo limiter, Current fuse |
| Overall dimensions (WxDxH) | 452x400x365mm |
| Weight | 20kg |

Built-in safety systems

Built-in safety systems are pressure safety valve, thermal fuse, anti-dry scorch electrical limiter and current fuse.

Easy operation

MAC-235EX operates automatically from water supply to completion of sterilization by touching the start button. And it starts drying by touching the start button again with half opened door.

Easy-to-read digital display

The digital display provides accurate temperature and time indication.

Process- monitor

The sterilisation process is indicated on the process monitor panel. Alarm and bar-sign indicate completion of sterilisation.

Options:

Special rectangular case

Overall dimensions (WxDxH): 160x310x127mm Casing: stainless steel.

Special tray (set of 3):

Overall dimensions (WxDxH): 160x300x20mm Casing: stainless steel.

Ovens / Sterilizers



MOV-112 /212
MOV-112F /212F
MOV-112S /212S
MOV-112P /212P
MOV-313P

Accurate, High-Temperature Equipment for Scientific Research.

Sanyo has always aimed to provide research support equipment that offers complete satisfaction to its users. Inspired by the search for even higher precision and greater flexibility of control, Sanyo presents the new MOV Series.

Microprocessor PID temperature control system guarantees accurate temperature environment

The microprocessor PID (Proportional, Integrated and Differential) temperature control system ensures accurate inside temperature. With less offset or overshoot, precise control is possible. And flexible programming allows up to 3-step temperature patterns. This system provides the high-temperature environment that exactly meets experimentation requirements.

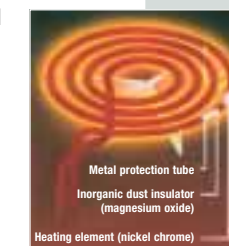
Forced air circulation system ensures stable temperatures accurate to within ±2.5°C

Fan circulation ensures that deviations in cabinet temperature are kept within

±2.5°C (at 200°C). The MOV Series can be widely used for basic to applied experimentation in the areas of scientific, industrial and environmental testing.

Sheathed heater ensures durability and safety

A sheathed heater is incorporated in the heater section. The heating element is wrapped in a magnesium oxide insulating material and covered with a metal protection tube. With conventional wire heating elements, gases or dust can cause corrosion, resulting in loss of heating capacity and electrical leakage. With its durability and high chemical resistance, the sheathed heater ensures safer, more stable operation without the risk of electrical leakage.



High-temperature Ovens



| | | |
|----------|----------|------------|
| MOV-112 | 97 LITER | 40°C~250°C |
| MOV-112F | 90 LITER | 40°C~200°C |
| MOV-112S | 90 LITER | 40°C~200°C |
| MOV-112P | 90 LITER | 40°C~200°C |



| | | |
|----------|-----------|------------|
| MOV-212 | 157 LITER | 40°C~250°C |
| MOV-212F | 150 LITER | 40°C~200°C |
| MOV-212S | 150 LITER | 40°C~200°C |
| MOV-212P | 150 LITER | 40°C~200°C |



| | | |
|----------|-----------|------------|
| MOV-313P | 223 LITER | 40°C~300°C |
|----------|-----------|------------|

MOV-112 /212
MOV-112F /212F
MOV-112S /212S
MOV-112P /212P
MOV-313P

Four models that feature natural convection and forced air circulation systems to create environments for a wide variety of experiments. Designed for ease of use and safety.

Natural convection system (MOV-112/212)

Natural convection is best for drying very small samples and fine particles which would be scattered by a fan. This system can be used for high-temperature applications up to 250°C.

in the cabinet but also keeps the motor cool, improving the reliability and safety of the motor.

Microprocessor timer function

Sanyo has included a microprocessor timer function, so operated times can be set up to a maximum of 99 hours and 59 minutes. The combination of auto start and auto stop provides operating patterns suited to a wide variety of applications. The auto stop operates the timer when the heater is on, or when the set temperature has been reached. A buzzer indicates the end of timer operation.

Forced air circulation system (MOV-112F/212F)

Sirocco fan circulation keeps variations in inner cabinet temperature within ±4°C at 200°C. Compared with natural convection, quicker drying is possible. And Sanyo's unique fan motor not only circulates hot air

Attractive new design

Sanyo believes that laboratory equipment should be attractive as well as functional. The MOV Series features a future-oriented design, with rounded corners, door handles that blend with the main body, and a flat control panel.

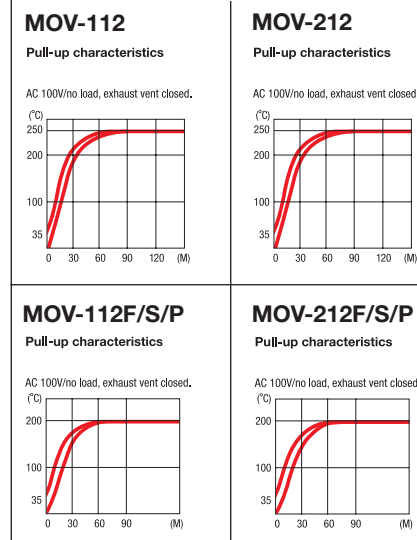
User-oriented design for easy operation

The control panel has soft-touch keys and bright, green digital LED display that allows easy confirmation of temperature and remaining operation time. Other

advantages of the design include a soft-latched door handle integrated with the door, an observation window for checking conditions inside the cabinet, two exhaust vents (shared with an access vent) on the top of the unit, and a stainless-steel (SUS-304) interior to guarantee durability and superior resistance to chemicals.



Performance data



Alarm and safety functions

A comprehensive range of alarm and safety devices is included as standard in the MOV Series including a remote alarm terminal.

Malfunction Monitor (Self diagnosis function)

Should a malfunction occur, it is diagnosed and indications are given on the digital display.

Sanyo has added high-temperature ovens to the popular MOV Series. These models are new-generation programmable ovens for a wide range of applications.

Flexible programming to fulfill experimentation and research needs

In response to trends in advanced research, Sanyo has included a flexible programming function for setting 3-step temperature patterns. Programs can be set for a maximum of 99 hours and 59 minutes. And the combination of automatic start, automatic stop and slope control makes programming easier.

Temperature slope control allows complex programming

To meet the requirements of thermal denaturation tests of ceramics or plastics, these ovens incorporate a slope control. With this function, the heating-up time can be freely set, so the necessary temperature slope can be programmed in accordance with the experiment.

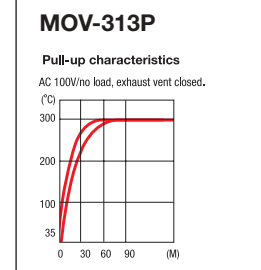
MOV-313P: For higher temperatures and greater capacity.

Temperatures up to 300°C can be precisely controlled for many different applications, including industrial tests, ageing tests, high-temperature tests and thermal denaturation tests during materials development.

Space-saving, large-capacity, economical upright type

The upright model is only 615mm deep, allowing more effective use of space. With a maximum power consumption of 2.6kW, this model saves energy too.

Performance data



Dry Heat Sterilizers

Constant Temperature Environments for Dry Heat Sterilizing and Efficient Laboratory Work (MOV-112S/212S).

MOV Series models provide many advantages:

- PID precision temperature control is adjustable to within ±1°C
- The built-in sheathed heater offers superior durability and safety
- Forced air circulation keeps cabinet temperatures even to within ±4°C
- The new microprocessor timer provides correct sterilizing time

Ovens / Sterilizers

Specifications

| High temperature Ovens | | | |
|---------------------------------|---|-------------------|--|
| Model No. | MOV-112P | MOV-212P | MOV-313P |
| External dimensions (W x D x H) | 580 x 595 x 820mm | 730 x 645 x 870mm | 890 x 615 x 1025mm |
| Internal dimensions (W x D x H) | 450 x 450 x 450mm | 600 x 500 x 500mm | 570 x 465 x 840mm |
| Effective capacity | 90 L | 150 L | 223 L |
| Exterior finish | Baked acrylic finish on galvanized steel | | |
| Interior finish | Stainless-steel plate (SUS-304) | | |
| Insulation | Glass wool | | Rock wool |
| See-through window | Reinforced triple glass window (t = 5mm) | | |
| Shelves | Stainless-steel plate, stainless-steel wire (adjustable) | | |
| | 2 | 3 | 4 |
| Air exhaust vent | Two on top plate (32mm inside dia.) | | One on top plate (32mm inside dia.) |
| Heating system | Forced air circulated system | | |
| Temperature control system | Microprocessor PID control | | |
| Sensor | Thermo couple | | |
| Temperature setting | Digital setting (adjustable range: ± 1° C) | | |
| Timer | Auto start, Auto stop, Slope control, 3-step program 00:00 ~ 99:59/one step. Max. 99 repetition | | |
| Temperature/Timer display | Digital LED display | | |
| Heater (Sheathed heater) | 1.1kW | 1.2kW | 2.5kW |
| Interior fan | Sirocco fan dia. 149mm | | Turbo fan dia. 180mm |
| Exterior fan | Propeller fan 107mm | | |
| Power source | 50/60Hz, cord approx. 2m | | |
| Max. power consumption | Approx. 1.1kW | Approx. 1.2kW | Approx. 2.6kW |
| Temperature range | 40° C ~ 200° C | | 40° C ~ 300° C |
| Temperature controllability | ±0.5 deg. | | |
| Temperature uniformity | ±2.5 deg. (at 200° C) | | ±3.0 deg. (at 200° C) |
| Weight | 50kg | 66kg | 97kg |
| Alarm and safety function | Overcurrent breaker, alarm for automatic set temperature (set point +10° C), independent overheating protection circuit, overtemperature safety system for control section (triggered at 65° C), self diagnosis, memory backup, jack for remote control alarm, serial communications. | | Overcurrent breaker, self diagnosis, alarm buzzer, protective thermistor at control section, jack for remote control alarm, double independent heat protector (electronic system), memory backup, serial communications. |

| Electric Ovens | | | | Dry Heat Sterilizers | | |
|---------------------------------|--|-------------------|---------------------------|----------------------|------------------------------|-------------------|
| Model No. | MOV-112F | MOV-212F | MOV-112 | MOV-212 | MOV-112S | MOV-212S |
| External dimensions (W x D x H) | 580 x 595 x 820mm | 730 x 645 x 870mm | 580 x 595 x 820mm | 730 x 645 x 870mm | 580 x 595 x 820mm | 730 x 645 x 870mm |
| Internal dimensions (W x D x H) | 450 x 450 x 450mm | 600 x 500 x 500mm | 450 x 450 x 450mm | 600 x 500 x 500mm | 450 x 450 x 450mm | 600 x 500 x 500mm |
| Effective capacity | 90 L | 150 L | 97 L | 157 L | 90 L | 150 L |
| Exterior finish | Baked acrylic finish on galvanized steel | | | | | |
| Interior finish | Stainless-steel plate (SUS-304) | | | | | |
| Insulation | Glass wool | | | | | |
| See-through window | Reinforced triple glass window (t = 5mm) | | | | | |
| Shelves | Stainless-steel plate, stainless-steel wire (adjustable) | | | | | |
| | 2 | 3 | 2 | 3 | 2 | 3 |
| Air exhaust vent | Two on top plate (32mm inside dia.) | | | | | |
| Heating system | Forced air circulated system | | Natural convection system | | Forced air circulated system | |
| Temperature control system | Microprocessor PID control | | | | | |
| Sensor | Thermo couple | | | | | |
| Temperature setting | Digital setting (adjustable range: ± 1° C) | | | | | |
| Timer | Auto start, Auto stop 00:00 ~ 99:59/one step. Max. 99 repetition | | | | | |
| Temperature/Timer display | Digital LED display | | | | | |
| Heater (Sheathed heater) | 1.1kW | 1.2kW | 1.1kW | 1.3kW | 1.1kW | 1.2kW |
| Interior fan | Sirocco fan dia. 149mm | | - | | Sirocco fan dia. 149mm | |
| Exterior fan | Propeller fan 107mm | | - | | Propeller fan 107mm | |
| Power source | 50/60Hz, cord approx. 2m | | | | | |
| Max. power consumption | Approx. 1.1kW | Approx. 1.2kW | Approx. 1.1kW | Approx. 1.3kW | Approx. 1.1kW | Approx. 1.2kW |
| Temperature range | 40° C ~ 200° C | | 40° C ~ 250° C | | 40° C ~ 200° C | |
| Temperature controllability | ±1 deg. | | - | | - | |
| Temperature uniformity | ±4° C (at 200° C) | | ±10° C (at 200° C) | | ±4° C (at 200° C) | |
| Weight | 50kg | 66kg | 47kg | 63kg | 50kg | 66kg |
| Alarm and safety function | Overcurrent breaker, alarm for automatic set temperature (set point +10° C), independent overheating protection circuit, overtemperature safety system for control section (triggered at 65° C), self diagnosis. | | | | | |

