SANYO

# Laboratory $CO_2$ Incubators

MCO-20AIC & MCO-18AIC



LABORATORY $CO_2$ INCUBATORS
PROFESSIONAL RESEARCH & CLINICAL APPLICATIONS

| | |
|---|---|
| MCO-20AIC | 7.6 cu. ft. |
| MCO-18AIC | 6.0 cu. ft |

*MCO-20AIC*

safe cell UV

inCu saFe

IR sensor

## Incubation for specific Temperature & $CO_2$ control with Protection against Contamination

SANYO laboratory $CO_2$ incubators are designed for a wide range of applications in biomedical, pharmaceutical and clinical laboratories, and represent years of research, development and laboratory testing. All SANYO $CO_2$ incubators feature exclusive inCu saFe™ copper-enriched stainless steel alloy interior construction with inherent germicidal protection against contamination, and patented Direct Heat and Air Jacket™ temperature control for accurate, uniform in vitro modeling of the in vivo environment.



innovation
performance
reliability
support

incubation

B E N E F I T S

## Background Contamination Control

The SANYO MCO-20AIC & MCO-18AIC are the world's first and only cell culture $CO_2$ incubator to employ continuous *active background* ultraviolet light decontamination 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.

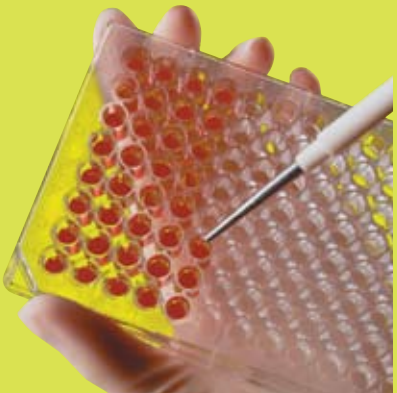
## Eliminates Need for HEPA Filter and Decontamination Heat Cycle

The MCO-20AIC & MCO-18AIC inhibits the growth of mycoplasmas, bacteria, molds, spores, yeast 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 & MCO-18AIC offer 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 $CO_2$ density are achieved through a combination of performance systems supervised by a centralized microprocessor controller complete with alarm, programming, calibration and diagnostic protocols.



- Exclusive SafeCell™ UV System (U.S. Patented) with programmable ultraviolet lamp, isolated from cell cultures, decontaminates 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 (U.S. Patented) & 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 $CO_2$ sensor eliminates conventional filament bulbs and electro-mechanical devices to deliver accurate $CO_2$ 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 7.6 cu.ft. or 6.0 cu. ft. interior chamber field-reversible doors and stackable design assure efficient use of available laboratory space with easy installation and relocation when desired

# Contamination Controlled.

# Downtime None.

**The MCO-20AIC & MCO-18AIC Automatic $CO_2$ Incubators provide a stable cell culture environment where contamination control is a continuous process, not an inconvenience.**

UV
SafeCell™ UV Contamination Prevention

InCuSaFe™ Copper Enriched Stainless Steel Interior

Direct Heat Air, Jacket

CULTURE
24/7/365

$\Delta T \frac{5°C}{AMB}$ ··50°C

0.25°C——0.1°C

$CO_2$ 0-20%—0.1%

RH95%@37°C

170 liters / 6.0 cu.ft.
215 liters / 7.6 cu.ft.
NET INTERIOR VOLUME

SANYO's MCO-20AIC & MCO-18AIC are extraordinary cell culture $CO_2$ incubators, functional in performance, easy to use, and designed specifically for critical applications in laboratory, pharmaceutical, biotechnology and clinical investigation.

Safe for the most demanding cell culture protocols, the SANYO MCO-20AIC & MCO-18AIC offer 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.

*MCO-20AIC with world recognized SANYO Electronics microprocessor control. Shown with five adjustable shelves, included.*

SANYO CONTAMINATION CONTROL TECHNOLOGY

Contamination control in the MCO-20AIC & MCO-18AIC* 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 poished stainless steel interior walls, shelves and plenum components
- A gentle, blower-assist ed 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**

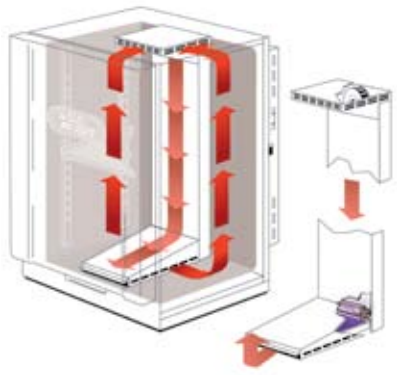
| Mode | Function |
|---|---|
| After Door Opening | UV lamp automatically ON for five minutes after door is closed. Time factory set (5min), user programmable from 0-30 minutes. |
| Cycled OFF | If UV protection is not desired |
| Continuous ON-Demand | Useful for overnight decontamination prior to first use or following total chamber wipe-out after maintenance or service |

*Although the contamination control system is factory set for normal use, operation of the UV lamp can be programmed as desired. Program parameters are input through the microprocessor control panel.*
**Safecell™ UV is optional in the MCO-18AIC and standard in MCO-20AIC.*

*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.*

## 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.



- 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.
- 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).

**Humidifying Water Comparison**

No exposure to UV | Five-minute exposure to SafeCell™ UV

*Test results after three months confirm the efficacy of SANYO SafeCell™ UV protection on humidifying water after three months.*

Other design factors which help mitigate contamination include condensation control, inner door gasket design and triple 0.3 micron filters for vent air and $CO_2$ sensor sampling.

## UV Decontamination vs. Heat Sterilization

*Independent testing confirms that the UV decontamination technique employed by the SANYO incubator is equally effective against contamination as conventional high heat sterilization over a range of +90°C to +140°C. Whenever overnight or event sterilization of the SANYO incubator chamber is desired, all interior components are removed for autoclaving, exposing all interior surfaces to ultraviolet light. During normal operation when cells are being incubated within the chamber, the UV lamp is visibly isolated from the cell culture chamber by a plenum cover over the humidity pan, permitting UV decontamination of circulated, humidified air and humidity pan surface water to remain in process without damaging the cells.*

| METHOD | UV | HIGH HEAT | |
|---|---|---|---|
| | SANYO | (+140°C) | (+90°C) |
| **TEST RESULTS, MAXIMUM LOG REDUCTIONS** | | | |
| Bacteria | > 4.5 | > 4.5 | > 4.5 |
| Yeast | > 2.9 | > 2.9 | > 2.9 |
| Mold | > 2.7 | > 2.7 | > 2.7 |
| **DECONTAMINATION OPTIONS** | | | |
| Overnight | ✓ | ✓ | ✓ |
| Active Background Contamination Control™ | ✓ | ⊘ | ⊘ |

## 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.

*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.*

## Elevated Humidity, Low Water Level Warning

To avoid cell culture desiccation, the MCO-20AIC & MCO-18AIC 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 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 $CO_2$ Control

The SANYO MCO-20AIC & MCO-18AIC uses a unique ceram-based infrared sensor system to maintain precise $CO_2$ 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 ceramic based sensor is maintenance free with no moving parts and eliminates filament bulbs or electro-mechanical "chopping" devices.

- The $CO_2$ sensor automatically calibrates every four hours.
- The system allows $CO_2$ control over a range from 0-20% in 0.1% setpoint increments.
- Actual $CO_2$ is displayed on the main control panel.
- A $CO_2$ sample port mounted on the incubator front permits convenient confirmation of chamber $CO_2$ density.
- An optional automatic $CO_2$ switchover system is avail able. 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.

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.*

## Microprocessor Control System

SANYO expertise in electronic innovations applies to the SANYO MCO-20AIC & MCO-18AIC 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.

- (P.I.D. Proportional, integral and derivative controls super vise temperature, $CO_2$ 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.

## Cabinet Design

The MCO-20AIC & MCO-18AIC 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 & MCO-18AIC cabinet design, with particular emphasis on relational sub-components such as gaskets, hardware and utility management.

## 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.

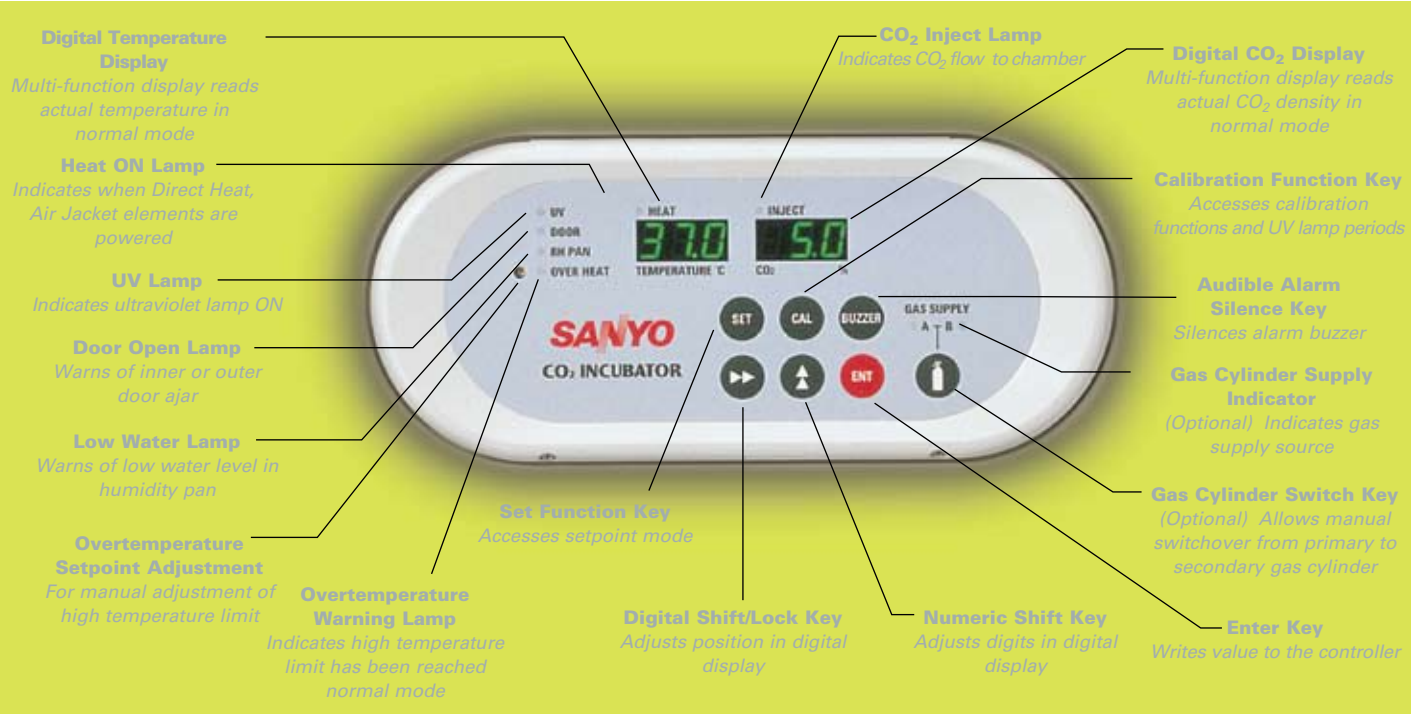
- The entire inner door gasket is removable for cleaning and/or replacement if required.
- The inner door features an adjustable cam-action latch which pulls the glass against the gasket for a gas-tight seal.
- Radiant heat from the outer door, controlled by the DHA heat system, automatically warms the 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 & MCO-18AIC 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.

*The MCO-20AIC & MCO-18AIC 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 at eye level in competitive to conventional dual incubators.*



## InCuSaFe™ Interior Chamber

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 blower wheel are easily removable without tools if required.
- When components are removed, all interior surfaces are exposed for conventional wipe-down.
- Large rounded corners and electropolished surfaces are easy to clean.
- A pass-thru 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.
- Contamination Test results comparing SANYO inCusaFe™ copper-enriched stainless steel with conventional copper construction illustrate the passive resistance of inCusaFe™ interior surfaces against common mycoplasma contamination.

**MYCOPLASMA SURVIVAL RESULTS**

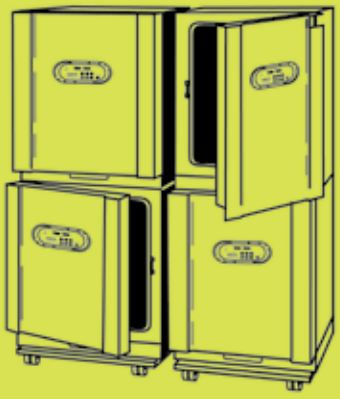
| Mycoplasma Strain | Negative Control | Conventional Type 304 Stainless Steel | SANYO inCu saFe™ | Conventional Copper C1100 |
|---|---|---|---|---|
| Mycoplasma fermentans PG18 | no survival | survival | no survival | no survival |
| Mycoplasma orale CH19299 | | | | |
| Mycoplasma arginini G230 | | | | |
| Mycoplasma hominis PG21 | | | | |


Detailed information is available in the SANYO white paper publication, A Comparative Analysis of Ultraviolet Light Decontamination vs. High Heat Sterilization in the Cell Culture CO2 Incubator, with the Use of Copper-Enriched Stainless Steel Construction to Achieve Active Background Contamination Control™

Contact your SANYO sales representative or visit the SANYO web site at: www.sanyobiomedical.com/library

*The cabinet exterior is constructed of scratch resistant coated steel for easy cleaning. Adjustable leveling feet permit proper installation on uneven surfaces. 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 & MCO-18AIC permits an unlimited combination of installation choices now and in the future. An optional roller base adds mobility where required. See Accessories.*



*Shelves are easily arranged in 1.1"/29mm increments. Five shelves are supplied with the MCO-20AIC. Four shelves are supplied with the MCO-18AIC. Total incubator capacity is fifteen shelves.*

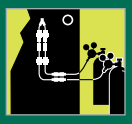
## Shelves and Inventory Management

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.

- Incubator shelves are perforated to permit natural vertical air convection through and around lab ware.
- 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.

# ACCESSORIES

## Automatic $CO_2$ 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.

**Catalog Number MCO-21GC**

## $CO_2$ Cylinder Regulator

Two-stage gas regulator monitor cylinder supply and meters gas to incubator input allows precise adjustment down to 5 psi. CGA Fitting 320.

**Catalog Number MCO-100L**

## Roller Base

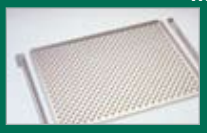
For use in single or stacked installations. Solid steel base includes positioning plates for incubator levelers. High-impact casters permit easy location. Adjustable front mounting pins extend to floor to prevent movement when installation is complete. Pins retract if roller base must be moved.

**Catalog Number MCO-20RB (For MCO-20AIC)**
**MCO-18RB (For MCO-18AIC)**

## Independent Inner Door Kit

High impact, clear plastic doors attach to interior inventory system behind glass inner door. Customer installed; directions included.

**Catalog Number MCO-20ID (MCO-20AIC),**
**MCO-18ID (MCO-18AIC)**



## 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 in-cludes two shelf brackets which insert without tools.

**Catalog Number MCO-58ST (MCO-20AIC),**
**MCO-46ST (MCO-18AIC)**

## Communications Port

Located at rear of chamber, 4 to 20 MA data port acquires information from microprocessor controller including temperature, $CO_2$. Connector, cable and software not supplied.

**Catalog Number MCO-420MA**

# SPECIFICATION SUMMARY

| Model | SafeCell™ UV Series | |
|---|---|---|
| Single Chamber | MCO-20AIC | MCO-18AIC |
| Dual Chamber, Stacked | MCO-40AIC | MCO-36AIC |
| **Heating System** | | |
| Method | Patented Direct Heat and Air Jacket™ | |
| Heating Elements | 395 watts per chamber | 314 watts per chamber |
| Temperature Control | microprocessor controlled P.I.D. | |
| Digital Temperature Display | resolution 0.1°C | |
| Temperature Range | 5°C above ambient to +50°C | |
| Temperature Uniformity | ± .25°C | |
| **$CO_2$ System** | | |
| $CO_2$ Sensor | ceramic-based infrared (I.R.) | |
| $CO_2$ System Electronics | microprocessor | microprocessor P.I.D./R™ |
| $CO_2$ Range and Variation | 0-20%, ± 0.15 | |
| $CO_2$ Setpoint Resolution | resolution to ± 0.1% | |
| $CO_2$ Inlet Connect/Pressure | 5 PSIG, 0.03MpaG | |
| $CO_2$ Switchover System | optional | |
| **Humidification System** | | |
| Method | natural evaporation | |
| Relative Humidity | 95+/-5% (ambient temp. 37C, $CO_2$ 5%) | |
| Water Level Sensor | optical, low water level alarm | |
| **Capacity** | | |
| Gross Interior Volume Per Chamber (Nominal) | 7.6 cu.ft./215 liters | 6.0 cu.ft./170 liters |
| Chamber Interior Dimensions | 24.4"W x 20.6"F-B x 26.2"H | 19.3"W x 20.6"F-B x 26.2"H |
| Exterior Dimensions, Single | 30.3"W x 27.9"F-B x 35.4"H | 24.4"W x 28.0"F-B x 35.4"H |
| Exterior Dimensions, Stacked | 30.3"W x 27.9"F-B x 70.8"H | 24.4"W x 28.0"F-B x 70.8"H |
| Shelf Dimensions | 22.8"W x 17.7"F-B, .05" lip | 17.7"W x 17.7"F-B , 0.5" lip |
| Shelf Capacity Per Chamber | 15, 5 standard | 15, 4 standard |
| **Contamination Control** | | |
| SafeCell™ UV System | standard | optional |
| inCu saFe™ Interior | standard | |
| Decontamination Method | programmable UV sterilization of air and water pan | |
| UV Lamp | 4 watt, 253.7 nanometer narrow bandwidth, ozone-free | |
| Microbiological Filters | 0.3 microns, 99.97% efficient, on air and $CO_2$ inputs | |
| **Control, Alarm, Monitoring and Electrical** | | |
| Microprocessor Control | SANYO-built electronic components | |
| Control Position | door-mounted, eye-level location on dual stacked configuration | |
| Alarm System | overtemp, $CO_2$ and temperature deviation, low water level, door ajar | overtemp, $CO_2$ and temperature deviation, low water level, door ajar, lamp failure alarm |
| Remote Alarm Contacts | 30V DC, 2 amps allowable | |
| Communications (Optional) | MCO-420MA data port available, 4 to 20 MA signal | |
| Electrical Service | 115V, AC, 60Hz, NEMA 5-15 | |
| **Cabinet Construction** | | |
| Interior Surface | inCu saFe™ copper-enriched stainless steel alloy for germicidal protection | |
| Exterior Cabinet | polyester finished, baked-on zinc galvanized steel, reinforced for stacking | |
| Inner Door | tempered glass with positive latch | |
| Outer Door | left hand swing standard, reversible to right hand swing | |
| **Accessories (Catalog #)** | | |
| $CO_2$ Switchover System | MCO-21GC | |
| $CO_2$ Cylinder Regulator | MCO-100L | |
| Roller Base | MCO-20RB | MCO-18RB |
| Independent Door Kit | MCO-20ID | MCO-18ID |
| inCu saFe™ Shelves & Brkts | MCO-58ST | MCO-46ST |
| Communications Port | MCO-420MA | |
| Stacking Brackets | included | |
| SafeCell™ UV System | standard | optional |

SANYO

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