

| Model Number                                    |        | MCO-170AIC-PK<br>MCO-170AICUV-PK                                                                                                                          | MCO-170AICL-PE<br>MCO-170AICUVL-PE<br>MCO-170AICUVL-PA | MCO-170AICUVHL-PE<br>MCO-170AICUVHL-PA | MCO-230AIC-PK<br>MCO-230AICUV-PK        | MCO-230AICL-PE<br>MCO-230AICUVL-PE<br>MCO-230AICUVL-PA |
|-------------------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------|-----------------------------------------|--------------------------------------------------------|
| External dimensions (W x D x H)*1               | mm     | 620 x 730 x 905                                                                                                                                           |                                                        |                                        | 770 x 730 x 905                         |                                                        |
| Internal dimensions ( W x D x H )               | mm     | 490 x 523 x 665                                                                                                                                           |                                                        |                                        | 643 x 523 x 700                         |                                                        |
| Volume                                          | litres | 165                                                                                                                                                       |                                                        |                                        | 230                                     |                                                        |
| Net weight                                      | kg     | 80                                                                                                                                                        |                                                        |                                        | 90                                      |                                                        |
| Performance                                     |        |                                                                                                                                                           |                                                        |                                        |                                         |                                                        |
| Temperature control range                       | °C     | ambient temperature +5 to 50*2 [AT 5°C to 35°C]                                                                                                           |                                                        |                                        |                                         |                                                        |
| Temperature control uniformity*3                | °C     | ±0.25*4                                                                                                                                                   |                                                        |                                        |                                         |                                                        |
| CO <sub>2</sub> control range and fluctuation*3 | %      | 0 to 20 / ±0.15                                                                                                                                           |                                                        |                                        |                                         |                                                        |
| CO <sub>2</sub> sensor platform                 |        | Ceramic based, single beam infrared sensor, with dual wavelength measurement for continuous auto-zero calibration                                         |                                                        |                                        |                                         |                                                        |
| CO <sub>2</sub> sampling, patent pending        |        | No moving parts; airflow passes over in/out ports to sustain continuous sampling                                                                          |                                                        |                                        |                                         |                                                        |
| CO <sub>2</sub> calibration                     |        | Automatic, continuous zero reference calibration.                                                                                                         |                                                        |                                        |                                         |                                                        |
| Airflow                                         |        | Gentle vertical airflow, continuous with inner door closed                                                                                                |                                                        |                                        |                                         |                                                        |
| Interior humidity                               | % RH   | 95 ±5 at 37°C by natural evaporation with humidifying pan                                                                                                 |                                                        |                                        |                                         |                                                        |
| Control, monitoring, alarm                      |        |                                                                                                                                                           |                                                        |                                        |                                         |                                                        |
| Temperature and CO <sub>2</sub> control         |        | P.I.D. control system setpoint resolution 0.1°C, 0.1 %                                                                                                    |                                                        |                                        |                                         |                                                        |
| Data acquisition                                |        | Automatic log function of temperature, CO <sub>2</sub> , Door opening/closing, Alarm and CSV file output                                                  |                                                        |                                        |                                         |                                                        |
| Communication                                   |        | Remote alarm contacts standard. Optional 4-20mA connection. Optional with RS-232C/ RS-485/LAN data ports*5                                                |                                                        |                                        |                                         |                                                        |
| Construction                                    |        |                                                                                                                                                           |                                                        |                                        |                                         |                                                        |
| Display                                         |        | Touch Panel (WVGA full color LCD)                                                                                                                         |                                                        |                                        |                                         |                                                        |
| USB data logging                                |        | Standard                                                                                                                                                  |                                                        |                                        |                                         |                                                        |
| Exterior cabinet and door                       |        | Galvanized steel with baked-on finish                                                                                                                     |                                                        |                                        |                                         |                                                        |
| Interior and shelves                            |        | Copper-enriched stainless steel                                                                                                                           |                                                        |                                        |                                         |                                                        |
| Inner door                                      |        | Tempered glass                                                                                                                                            |                                                        |                                        |                                         |                                                        |
| Outer door                                      |        | Field-reversible, Heated                                                                                                                                  |                                                        |                                        |                                         |                                                        |
| Shelves                                         | qty    | 4 x standard (Maximum 10)                                                                                                                                 |                                                        |                                        | 4 x standard (Maximum 10)               |                                                        |
| Shelf dimensions (W x D x H)                    | mm     | 470 x 450 x 12, maximum load 7 kg/shelf                                                                                                                   |                                                        |                                        | 628 x 450 x 12, maximum load 7 kg/shelf |                                                        |
| Insulation                                      |        | Styrene AcryloNitrile Copolymer                                                                                                                           |                                                        |                                        |                                         |                                                        |
| Access port                                     |        | Diameter 30mm port with non-VOC silicone stoppers (1 on back side)                                                                                        |                                                        |                                        |                                         |                                                        |
| Leveling feet                                   |        | 4, Adjustable                                                                                                                                             |                                                        |                                        |                                         |                                                        |
| Energy and CO <sub>2</sub> utilities            |        |                                                                                                                                                           |                                                        |                                        |                                         |                                                        |
| Maximum power consumption                       | W      | 380                                                                                                                                                       |                                                        |                                        | 430                                     |                                                        |
| Maximum heat dissipation                        | kJ/h   | 1,070                                                                                                                                                     |                                                        |                                        | 1,250                                   |                                                        |
| CO <sub>2</sub> gas connection                  | mm     | ID 4, OD 6 tubing                                                                                                                                         |                                                        |                                        |                                         |                                                        |
| CO <sub>2</sub> gas pressure                    |        | 0.03 MPa [G] — 0.1 MPa [G] [0.3 kgf/cm <sup>2</sup> [G] — 1 kgf/cm <sup>2</sup> [G], 4.4 psi [G] — 14.5 psi [G]] from two stage CO <sub>2</sub> regulator |                                                        |                                        |                                         |                                                        |
| Electrical                                      |        | MCO-170AIC-PK<br>MCO-170AICUV-PK                                                                                                                          | MCO-170AICL-PE<br>MCO-170AICUVL-PE<br>MCO-170AICUVL-PA | MCO-170AICUVHL-PE<br>MCO-170AICUVHL-PA | MCO-230AIC-PK<br>MCO-230AICUV-PK        | MCO-230AICL-PE<br>MCO-230AICUVL-PE<br>MCO-230AICUVL-PA |
| Power supply                                    | V      | 220                                                                                                                                                       | 220 – 240 (PEI/110 – 120 [PA])                         |                                        | 220                                     | 220 – 240 (PEI/110 – 120 [PA])                         |
| Frequency                                       | Hz     | 60                                                                                                                                                        | 50/60                                                  |                                        | 60                                      | 50/60                                                  |
| Quality Management System**6                    |        |                                                                                                                                                           |                                                        |                                        |                                         |                                                        |
| Certification                                   |        | ISO13485                                                                                                                                                  | ISO9001                                                |                                        | ISO13485                                | ISO9001                                                |

\*1 External dimensions of main cabinet only. See dimension drawings showing handles and other external projections. \*2 When set temperature is 37°C, ambient temperature must be 32°C or less. Regardless of ambient temperature, the maximum of temperature control range is always 50°C. \*3 Ambient temperature 23 °C, SV 37°C, CO<sub>2</sub>: 5 %, no load. \*4 The measurement condition complies with PHC Corporation specified measuring method. \*5 For the data acquisition system MTR-5000 user only. \*6 MCO-170AICL, MCO-170AICUVL, MCO-170AICUVHL, MCO-230AICL and MCO-230AICUVL are for laboratory use. • The optimum performance may not be obtained if the ambient temperature is not above 15°C.

Optional Accessories

| Model Number                                                | MCO-170AIC<br>MCO-170AICL      | MCO-170AICUV<br>MCO-170AICUVL | MCO-170AICUVHL | MCO-230AIC<br>MCO-230AICL        | MCO-230AICUV*7<br>MCO-230AICUVL |
|-------------------------------------------------------------|--------------------------------|-------------------------------|----------------|----------------------------------|---------------------------------|
| UV System Set                                               | MCO-170UVS-PE<br>MCO-170UVS-PA | Standard                      |                | MCO-170UVS-PE<br>MCO-170UVS-PA   | Standard                        |
| H <sub>2</sub> O <sub>2</sub> Decontamination Control Board | MCO-170HB-PE/-PA               |                               |                | MCO-170HB-PE/-PA<br>MCO-170EL-PW |                                 |
| Electric Lock                                               | MCO-170EL-PW                   |                               |                |                                  |                                 |
| H <sub>2</sub> O <sub>2</sub> Generator                     | MCO-HP-PW                      |                               |                |                                  |                                 |
| H <sub>2</sub> O <sub>2</sub> Reagent                       | MCO-H202-PV                    |                               |                |                                  |                                 |
| Gas Regulator                                               | MCO-010R-PW                    |                               |                |                                  |                                 |
| CO <sub>2</sub> Gas Auto Changer                            | MCO-21GCP-PW                   |                               |                |                                  |                                 |
| Tray (same as that of standard accessory)                   | MCO-170ST-PW                   |                               |                | MCO-230ST-PW                     |                                 |
| Half Tray                                                   | MCO-25ST-PW                    |                               |                | MCO-35ST-PW                      |                                 |
| Reinforced Additional Tray (inCu-saFe®)                     | MCO-170RT-PW                   |                               |                | MCO-230RT-PW                     |                                 |
| Double-stacking Bracket                                     | MCO-170PS-PW                   |                               |                | MCO-170PS-PW                     |                                 |
| Stacking Plate                                              | MCO-230SB-PW                   |                               |                | MCO-230SB-PW                     |                                 |
| Roller Base                                                 | MCO-170RB-PW                   |                               |                | MCO-230RB-PW                     |                                 |
| Small Door                                                  | MCO-170ID-PW                   |                               |                | —                                |                                 |
| Optional Communication Systems                              |                                |                               |                |                                  |                                 |
| Interface Board*8; for LAN                                  | MTR-L03-PW                     |                               |                |                                  |                                 |
| Interface Board*8; for RS-232C/RS-485                       | MTR-480-PW                     |                               |                |                                  |                                 |
| Interface Board (4-20mA)                                    | MCO-420MA-PW                   |                               |                |                                  |                                 |

\*7 Attaching the optional MCO-170HB and MCO-170EL to MCO-230AICUV will add the H<sub>2</sub>O<sub>2</sub> decontamination function.  
\*8 For the data acquisition system MTR-5000 user only.

Double-stacking matching table

| Accessories needed for stacking 2 units |                | Upper unit   |                               |
|-----------------------------------------|----------------|--------------|-------------------------------|
|                                         |                | MCO-230AIC   | MCO-170AIC (M)<br>MCO-170AICD |
| Lower unit                              | MCO-230AIC     | MCO-170PS-PW | MCO-230SB-PW                  |
|                                         | MCO-170AIC (M) | —            | MCO-170PS-PW                  |
|                                         | MCO-170AICD    | —            | MCO-170PS-PW                  |
|                                         | MCO-20AIC      | MCO-230SB-PW | MCO-230SB-PW                  |
|                                         | MCO-5AC (M)    | —            | —                             |
|                                         | MCO-50AIC (M)  | —            | —                             |

Field-reversible Door (select left/right opening)

• Appearance and specifications are subject to change without notice.  
**Caution:** PHC Corporation guarantees this product under certain warranty conditions. However, please note that PHC Corporation shall not be responsible for any loss or damage to the contents of the product.



CO<sub>2</sub> Incubators



Enhance your cell growth with an intelligent CO<sub>2</sub> incubator designed for precise temperature and CO<sub>2</sub> control, efficient cleaning and rapid decontamination.



\*1 Standard for Model No. including UV. \*2 Standard for MCO-170AICUVHL



Preservation Equipment, Experimental Environment Equipment, Dispensary Equipment, Culturing Equipment and Drying & Sterilising Equipment for General Laboratory use

The management of the design, development, production and servicing of the above.

Freezers, Refrigerators, Incubators, and Drying and Sterilising Equipment for Medical use

The management of the design, development, production and distribution of the above.

PHC Corporation Biomedical Division is certified for:

**Environmental management system: ISO14001**

PHC Corporation, Biomedical Division 1-1-1 Sakada, Oizumi-machi, Ora-gun, Gunma 370-0596, Japan

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PHC Corporation, Biomedical Division

Life Science  
Innovator  
Since 1966

# Next Generation Incubators for Optimum Cell Culture

PHCbi's CO<sub>2</sub> incubators with touchscreen control panels deliver superior usability, rapid cleaning, and effortless maintenance while keeping the tradition of outstanding environmental stability and precise performance.

## Grow results, not bacteria!

### MCO-170AIC/MCO-230AIC Incubators

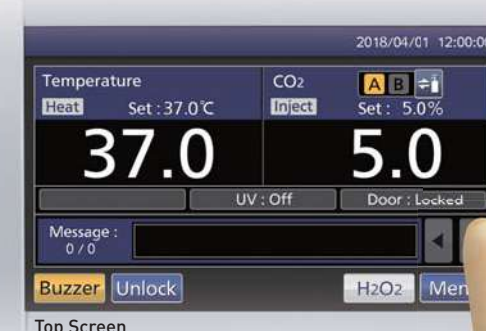
Optimized for high-value samples including hard-to-grow and contamination-sensitive media/reagents.

#### Applications:

- Stem cell research
- Autologous tissue regeneration
- Genomic and proteomic expression
- Esoteric plant and amphibian cell cultures
- Hyper-sensitive and transgenic cell cultures
- Low volume media microplate work

## Easy Use & Easy Maintenance

## Integrated Tray Catches minimize cleaning time while LCD Panel enhances operation



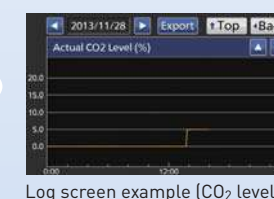
Responds to gloved finger action.

### LCD Touch Panel Controller

A WVGA color LCD touch panel delivers full control over different protocols. Control can be performed with gloved fingers as the controller is equipped with a resistive touch-screen.

### USB Memory Data Transfer

Standard USB port provides convenient log data transfer to a USB memory stick and to a PC. Data log period is 1.5 months using 2-minute intervals.



**Note:** It is impossible to use a USB memory device which is password-protected.

### Door Lock

Automatic door lock (Electric Lock) can be set on the MCO-170AICUVHL (standard equipped) and other models equipped with the optional Electric Lock (MCO-170EL).



The Auto-Lock set up screen



User-ID setting screen



### Integrated Tray Catches

Tray catches are integral parts of the chamber, opening up more space for trays, allowing the incubator to accommodate more culture containers. (Comparison with MCO-20AIC/MCO-19AIC)



MCO-170AIC's/MCO-230AIC's interior components



MCO-170AIC's/MCO-230AIC's tray catches (integral part of the chamber)

MCO-170AIC's Tray  
Internal dimensions  
470(W) x 450(D)mm



Up to 24 ø100 mm dishes (92 mm) can be arrayed (5 wide x 4 deep)  
\*In-house comparison

16 dishes (MCO-19AIC)  
→ 20 dishes (MCO-170AIC)

MCO-230AIC's Tray  
Internal dimensions  
620(W) x 450(D)mm



Up to 24 ø100 mm dishes (92 mm) can be arrayed (6 wide x 4 deep)  
\*In-house comparison

20 dishes (MCO-20AIC)  
→ 24 dishes (MCO-230AIC)

### Optimal Humidity Control

Stable humidity control not influenced by environmental conditions and frequent incubator door openings.



- Control Panel with single-user Key Lock (All models include as standard equipment.)
- Addition of user ID function for better traceability (able to register up to 99 user-IDs and passwords) (MCO-170AICUVHL includes it as standard. Or optional MCO-170EL to be installed for other models.)



- Multiple detailed activity logs exported to individual CSV files.

(\*User Access log downloaded for MCO-170AICUVHL as standard. Or optional MCO-170EL to be installed for other models.)

| MCO-230AIC NO.1 |          |      |     |              |             |
|-----------------|----------|------|-----|--------------|-------------|
| Date            | Time     | Temp | CO2 | Door         | Unlock User |
| 2015/3/16       | 11:13:38 | 37   |     | 0 Door Open  |             |
| 2015/3/16       | 11:13:42 | 37   |     | 0 Door Close |             |
| 2015/3/16       | 11:32:10 | 37   |     | 0 Door Open  | Aa001       |
| 2015/3/16       | 11:32:25 | 37   |     | 0 Door Close |             |
| 2015/3/16       | 13:40:58 | 37   |     | 0 Door Open  | Bb002       |
| 2015/3/16       | 13:41:09 | 36.9 |     | 0 Door Close |             |
| 2015/3/16       | 13:50:01 | 36.9 |     | 0 Door Open  | Cc003       |
| 2015/3/16       | 13:51:19 | 35.6 |     | 0 Door Close |             |
| 2015/3/16       | 15:27:40 | 37   |     | 0 Door Open  | Aa001       |
| 2015/3/16       | 15:27:40 | 36.9 |     | 0 Door Close |             |

User Access log\*



inCu-saFe® Construction for Germicidal Protection

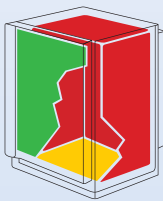
- PHCbi offers the exclusive use of inCu-saFe® copper- enriched stainless steel alloy interior surfaces within a technical design created to eliminate contamination sources and to mitigate the effect of airborne contaminants introduced through normal use.
- Chart summarizes test results with four strains of mycoplasma. Results demonstrate how PHCbi inCu-saFe® copper- enriched stainless steel alloy offers germicidal properties of conventional C1100 copper while maintaining both corrosion-proof and discoloration-resistant properties of conventional stainless steel 304.

| Mycoplasma Stain           | Positive Control | Conventional Stainless Steel 304 | PHCbi inCu-saFe® | Conventional Copper C1100 |
|----------------------------|------------------|----------------------------------|------------------|---------------------------|
| Mycoplasma fermentans PG18 | YES              | YES                              | NO               | NO                        |
| Mycoplasma orale CH19299   |                  |                                  |                  |                           |
| Mycoplasma arginini G230   |                  |                                  |                  |                           |
| Mycoplasma hominis PG21    |                  |                                  |                  |                           |

"YES" mycoplasma strains grew on the material.  
"NO" no mycoplasma strain grew on the material.

Accurate Temperature Control

- The patented Direct Heat and Air Jacket conditioning system precisely regulates temperature through three independent heating zones under microprocessor PID\* control. Uniform temperatures are further enhanced by gentle fan circulation.



\*Proportional Integral Derivative

- The main heater provides precise temperature control.
- The bottom heater warms the distilled water and controls chamber humidity.
- The outer door heater prevents condensation on the inner door and facilitates quick temperature recovery after door openings.

Direct Heat and Air Jacket Conditioning System

- To avoid cell culture desiccation, the MCO-170AIC/MCO-230AIC maintains up to 90 % RH at 37°C.
- Humidification is achieved by reliable natural evaporation and forced-air circulation.



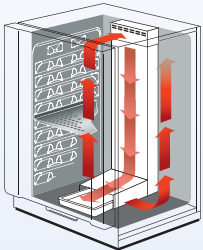
Precise CO<sub>2</sub> Control

- PHCbi proprietary single beam dual detector infrared CO<sub>2</sub> system offers unprecedented control accuracy and stability by simultaneously measuring two wavelengths for continuous zero calibration.
- Benefits include ultra-fast recovery without overshoot and accurate CO<sub>2</sub> averages during periods of frequent incubator access with multiple door openings.

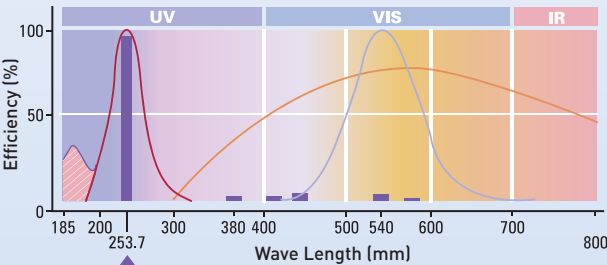


SafeCell UV Decontamination

- SafeCell UV includes a programmable ultraviolet lamp, isolated from cell cultures, that decontaminates conditioned air and humidity reservoir water to prevent contamination without affecting cell cultures in vitro.
- Contaminants trapped within the humidifying pan at the base of the plenum are destroyed by high intensity, ozone-free ultraviolet light.
- Decontaminated, humidified air is released from the lower plenum for vertical convection through and around the perforated shelves. Interior air motion is suspended when the door is opened, minimizing movement of room air contaminants into the chamber. The unique air duct system also improves temperature recovery characteristics.



Airflow and water pan decontamination using a UV system



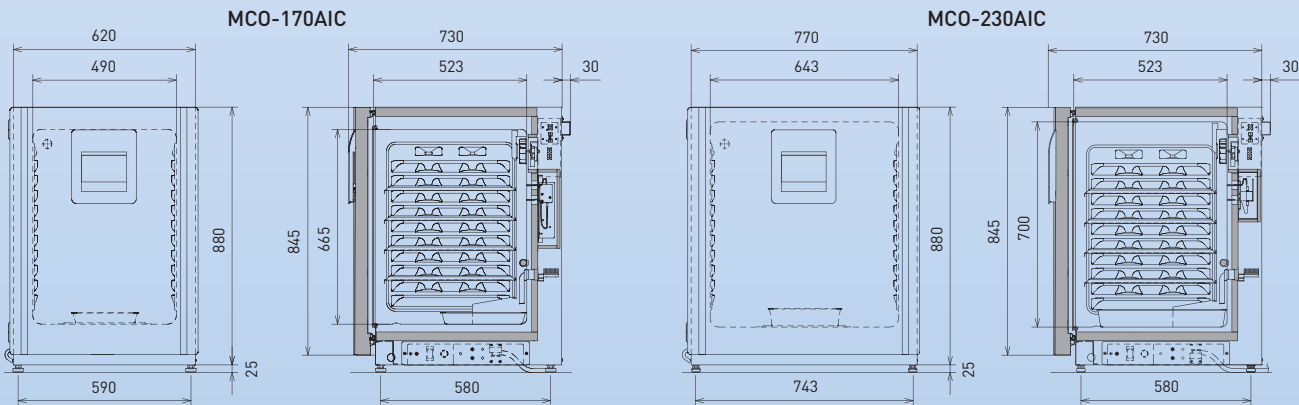
Use of the MCO-170AICUVHL/MCO-170AICUV/MCO-170AICUVL/MCO-230AICUV/MCO-230AICUVL ultraviolet lamp is a highly effective ozone-free contamination control technique.

■ PHCbi Lamp ■ Ozone Release ■ Germicidal Effect ■ Sunlight

The SafeCell UV lamp cycle is factory set for normal use, and can be re-programmed as desired by entering parameters through the central microprocessor control panel. Program parameters for the H<sub>2</sub>O<sub>2</sub> decontamination cycle are non-adjustable for operator safety.

Dimensions

Unit: mm



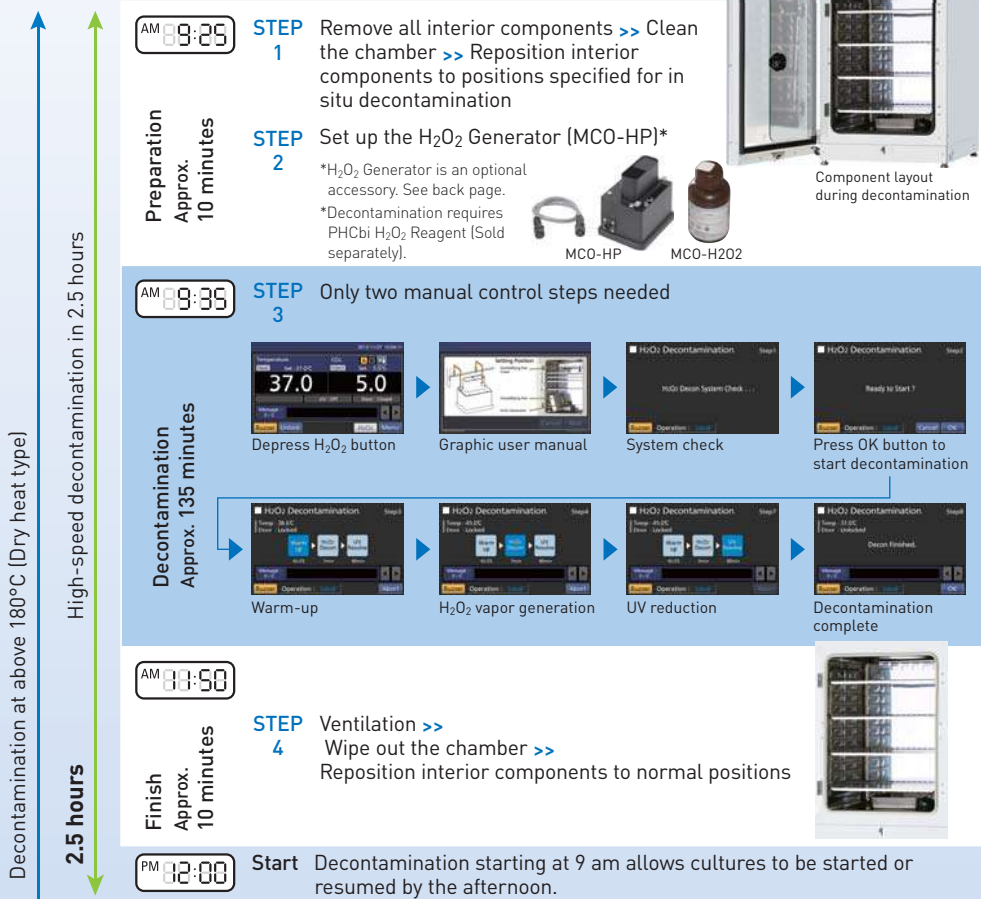
Rapid, Effective and Safe H<sub>2</sub>O<sub>2</sub> Decontamination Cycle

Industry-first PHCbi unique high-speed decontamination system utilizing vaporized H<sub>2</sub>O<sub>2</sub> offers time-saving and documented chamber decontamination with complete safety.

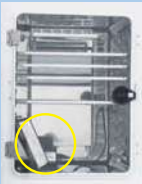
- Full decontamination process takes less than three hours, saving valuable time. For example, if the decontamination cycle is started at 9 am, the unit will be ready for use in the afternoon.
- All interior components are decontaminated in situ. No need for time-consuming removal and autoclaving.
- No high heat emission. No sensor removal necessary.

- After decontamination H<sub>2</sub>O<sub>2</sub> vapor is decomposed to harmless water and oxygen by UV light.
- Outer door is locked automatically by the electric interlock system during the decontamination cycle to ensure operator safety.
- Unlike high-heat decontamination incubators, PHCbi's unique H<sub>2</sub>O<sub>2</sub> decontamination cycle does not emit high heat. Therefore, when two MCO-170AIC/MCO-230AIC units are stacked, one incubator can be decontaminated without affecting the temperature of the other.

H<sub>2</sub>O<sub>2</sub> decontamination process (example)



Chamber conditions during decontamination



**Start of H<sub>2</sub>O<sub>2</sub> solution vaporization**  
H<sub>2</sub>O<sub>2</sub> solution in the H<sub>2</sub>O<sub>2</sub> Generator (MCO-HP) is sprayed into the chamber by the ultrasonic transducer.



**H<sub>2</sub>O<sub>2</sub> fills up chamber**  
H<sub>2</sub>O<sub>2</sub> mist is quickly gasified to thoroughly fill up the chamber.



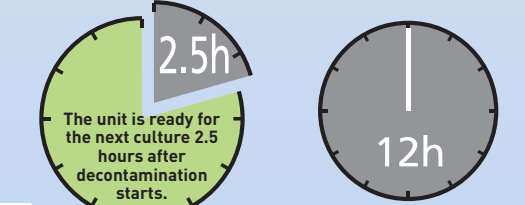
**UV radiation for H<sub>2</sub>O<sub>2</sub> reduction**  
• UV lamp turns on.  
• H<sub>2</sub>O<sub>2</sub> gas is reduced to water and oxygen.

\*Above H<sub>2</sub>O<sub>2</sub> vaporization photos are concept images only.

\* Above decontamination process is performed with standard interior items. Additional shelves and dishes may reduce decontamination effectiveness.

\* Decontamination times shown above are for indication only. Actual process time may differ depending on chamber cleaning time and set-up time.

Time comparison between the H<sub>2</sub>O<sub>2</sub> decontamination process and sterilization at above 180°C



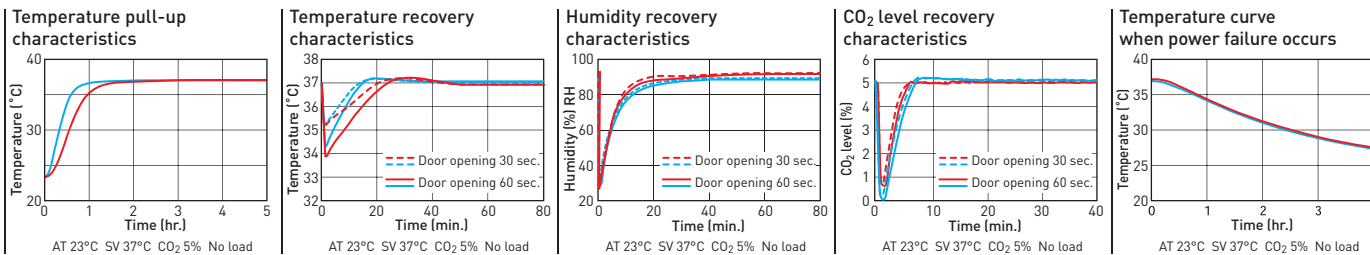
One-day cultures are not possible with dry heat type incubators.

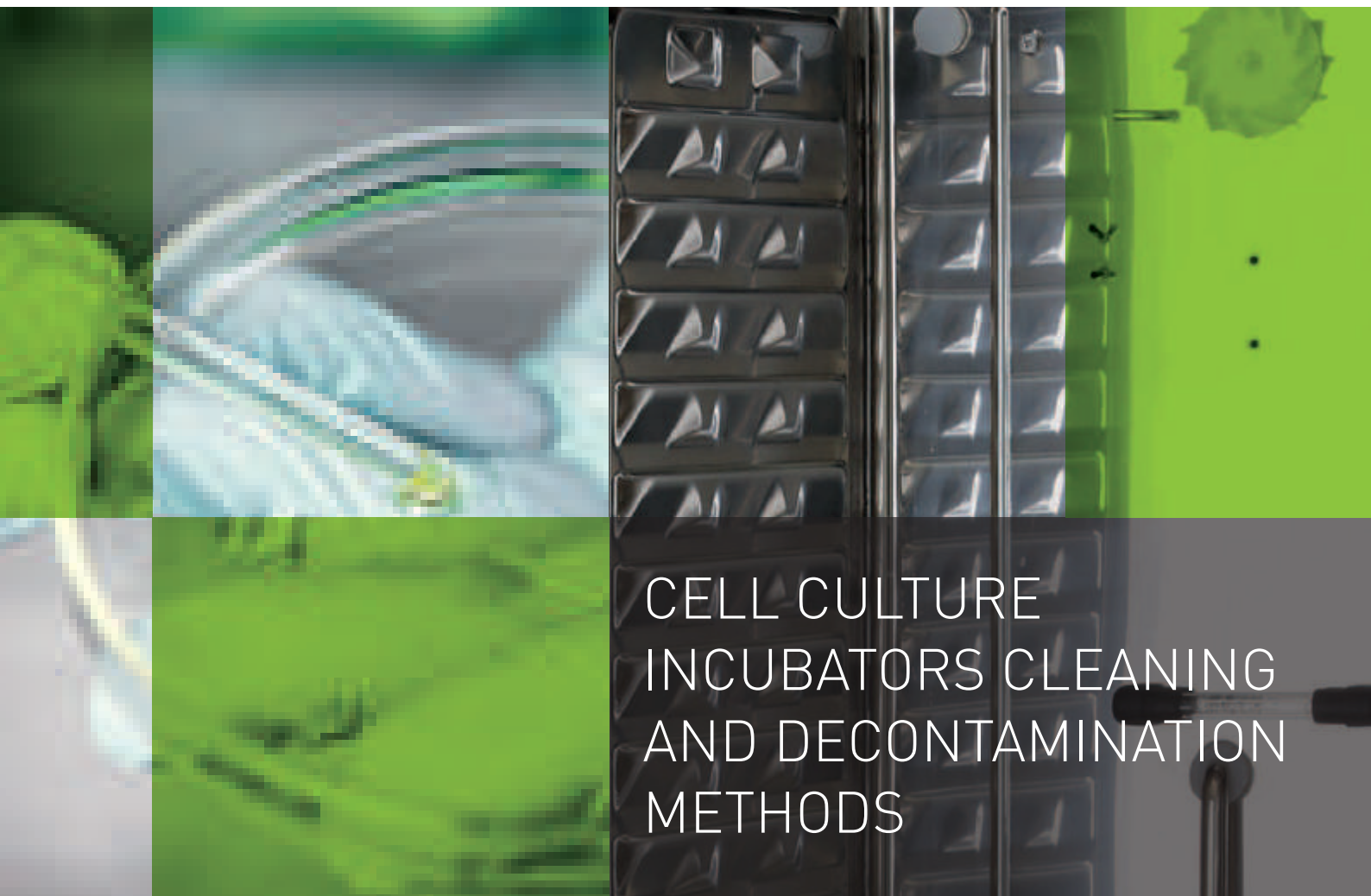
12 hours

Performance Data

MCO-170AIC / MCO-230AIC

\*Internal research as of November 2013





## CELL CULTURE INCUBATORS CLEANING AND DECONTAMINATION METHODS

### Models:

MCO-170AC-series  
MCO-170AIC-series  
MCO-170AICD-series  
MCO-230AIC-series  
MCO-170M-series  
MCO-50AIC-series  
MCO-50M-series

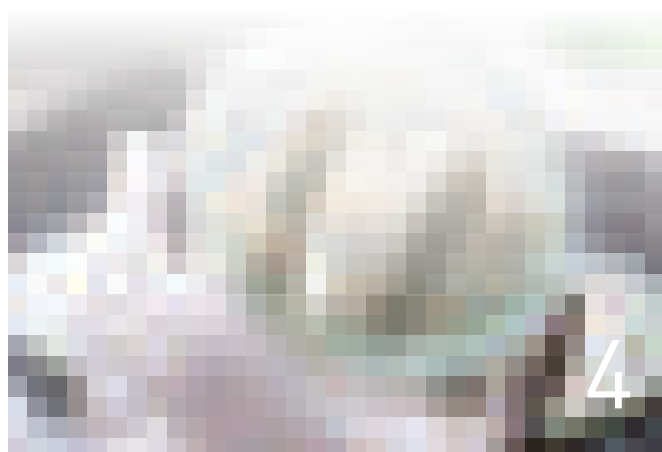
Basic care for optimum  
performance and care in the  
event of contamination



# Cell culture incubators Cleaning and Decontamination Methods

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### Cleaning and Decontamination Methods



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# Introduction to cell culture incubators

A cell culture incubator is designed to artificially replicate in vitro conditions essential to in vivo physiology typical of human and animal models. Cell growth outside of a natural environment presents a multitude of challenges associated with exposure to microorganisms that are not present in the in vivo state. Depending on the type of cell cultures being managed, several operating parameters must be carefully controlled with accuracy, repeatability and flexibility in setpoint choices. These include temperature and gas control.

- Cell culture incubators are designed to establish and maintain a controlled, stable environment by regulating temperature at a typical setpoint of 37°C or over a range from ambient to points above 37°C.
- Incubator gases typically include CO<sub>2</sub> and/or O<sub>2</sub>.

CO<sub>2</sub> is controlled at a precise setpoint to maintain desired pH in the cell culture media, whether liquid or gel. The CO<sub>2</sub> concentration in the incubator functions as a critical pH buffer.

Some biological materials may require different pH levels.

Desired CO<sub>2</sub> setpoint concentrations may differ. Most media contain an indicator which helps detect the change in pH.

- Optimal cell culture environments must include humidification to prevent desiccation of cell culture media.

While some incubators have internal humidification systems with heated water reservoirs, most incubators include simplified, removable humidifying trays designed to hold sterile distilled water which evaporates to naturally increase the relative humidity within the chamber.

- The use of deionized water should be avoided in the humidifying tray. Due to the lack of ions, deionized water will leach ions out of stainless steel causing pitting which can harbor contamination. Deionized water will react with the high concentration of CO<sub>2</sub> and form carbonic acid, causing further corrosion.

## TYPES OF CELL CULTURE CONTAMINATION

Contamination of a cell culture in vitro is usually caused by the inadvertent introduction of one or more organisms that can damage or destroy the cell culture in progress.

These organisms include:

- Bacteria (including Thermophilic Bacteria) and Mycoplasma
- Molds and Yeasts
- Viruses

Other contaminants include dust, volatile organic compounds (VOC's) from adjacent instrumentation or processes, cross contaminants from other cultures in a shared incubator environment and particulates found in the natural environment. Regardless of the contaminant or its source, prudent laboratory techniques can help avoid the recurrence of contamination.



## THE INCUBATOR BUBBLE

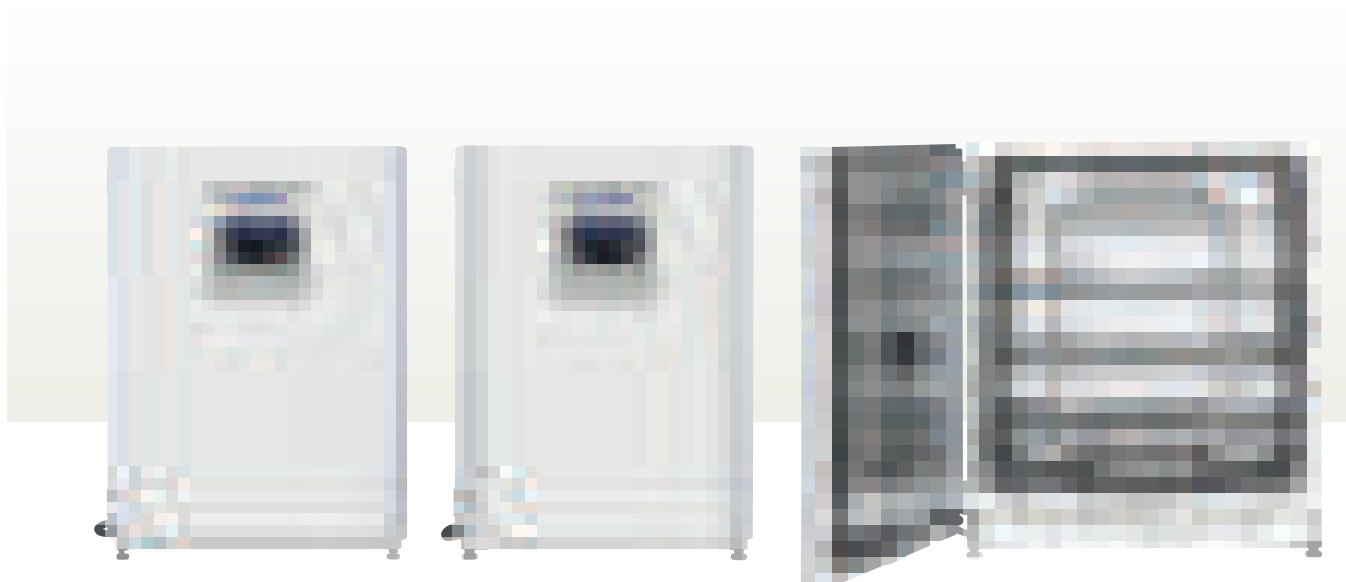
Unlike closed systems, such as hollow-fiber substrates, stirred tank or airlift bioreactors, the typical cell culture incubator is a conditioned chamber with a door that closes against a soft gasket. When the door is closed, the incubator creates an ideal environment for the cell culture process based on user defined setpoint parameters for temperature, CO<sub>2</sub> and O<sub>2</sub>. Humidification is naturally evaporative from the humidifying tray, and an elevated relative humidity is sufficient to eliminate desiccation, especially in microplates with small media volumes. Some larger cell culture incubators use immersion heaters to supplement the natural humidification process.

When the incubator door is opened, however, the conditioned bubble is lost. Accessing cell culture labware for transport to a biological safety cabinet (BSC) or other processes is a normal part of laboratory workflow. Opening the door exposes the incubator interior walls, shelves, humidifying water tray and culture vessels to ambient conditions that carry the potential for contamination from molds, yeasts, fungi or other microorganisms such as mycoplasma and viruses. In a practical sense, unless the incubator is installed in a clean room, this exposure cannot be avoided. Proper technique can reduce the potential. The first consideration is to understand basic incubator systems and how they can harbor contamination.

## INCUBATOR DESIGN PREREQUISITES

The first step in managing cell culture contamination is to consider the incubator design, specifically, the interior. All interior components exposed to the high humidity atmosphere should be constructed on high quality stainless steel and should be easily removable (preferably without tools) for manual cleaning or autoclaving. These include: shelves, shelf brackets, plenums, floors, humidifying trays, blower wheels, sensor housings, inner door gaskets and anything present in the chamber during cell culture. Control probes are often protected by stainless steel sheath housings. These must be cleaned according to the manufacturers' instructions.

Components manufactured from copper enriched or copper supplemented stainless steel contain an inherent germicidal property that resists airborne organisms introduced to the chamber during door openings. Such materials are considered "passive" contamination control insofar as the inability of organisms to sustain growth on these surfaces.



# Important points for installation

There are many factors to consider when determining the permanent location of the cell culture incubator. It is desirable to locate the unit where there is minimal foot traffic and where air disturbance is of little consequence. This reduces the volatility of outside air entering the incubator during a door opening. Avoid installing the incubator near windows, air conditioners, ceiling or floor HVAC air diffusers and return air intakes, all of which are sources of airborne contamination.

## INSTALLATION, LOCATION AND CLEARANCES

It is important to consider the function of the biological safety cabinet when planning for incubator contamination mitigation.

If feasible, locate the incubator as close to the biological safety cabinet (BSC) as possible. This limits the exposure when removing or replacing cell cultures for processing.

Improper use of the BSC, wrong sash window height, blockage of downflow slots and use of instrumentation or equipment on the BSC work surface can create pathways for contaminants to attach to the cell culture labware when working in the hood. These contaminants are then returned to the incubator where they can migrate to other cultures via cross contamination or to interior surfaces exposed to a conditioned atmosphere ideal for cell growth. While BSCs are usually equipped with HEPA filters designed to trap particulates of 0.3 microns (0.12 microns for ULPA filters), smaller viruses can easily pass through these barriers. Although the cell culture lab may normally be under positive pressure, this can change to neutral or even negative pressure when a BSC is operating, especially when the BSC has an exhaust transition connected to or over the exhaust filter.

Other laboratory equipment such as centrifuges, stirrers, shakers and robotic plate readers can aggravate an otherwise calm air environment to create aerosols that are easily airborne.

It is important to establish clearances adjacent to and behind the incubator because this space is required to provide easy access to gas supply tubing, tubing filters, gas input ports, pass-thru ports and blanking plugs and any interior components such as blower motors, fans or sensors that must be removed for maintenance.

Most CO<sub>2</sub> cylinders, for example, contain an industrial grade CO<sub>2</sub> supply in liquid form wherein the CO<sub>2</sub> gas evaporates and moves through the two-stage pressure regulator as a gas. It exits the regulator at a pressure of approximately 20 PSIG, sufficient to prevent the introduction of contaminants into the gas system. The CO<sub>2</sub> itself, however, often contains microscopic particles that may provide surfaces for contaminants. Thus, it is recommended that the final CO<sub>2</sub> supply tubing be fitted with a 0.3-micron HEPA filter prior to passage into the incubator.



**Locations where there is a lot of foot traffic are not suitable for the unit.**

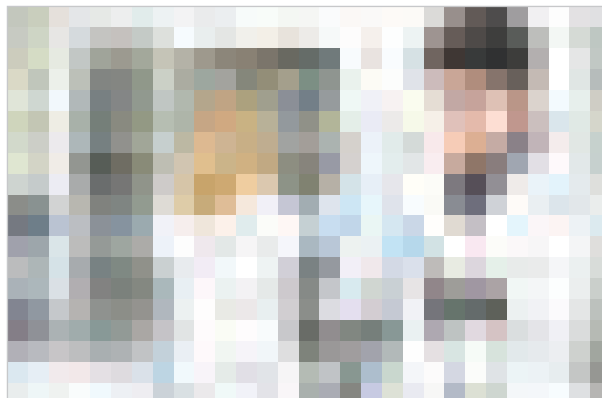
- Locate the incubator in a clean room or location where few people enter
- Choose a clean room that is safe or a place where there are as few people as possible.

**Set up the unit as high off the floor as possible**

- Since there are fewer airborne bacteria in the upper part of a room, the incubator should be placed on a laboratory table or a special stand.
- If stacking two or three units on top of each other, use a special roller base for that purpose.

**Place in a location that is not directly affected by outside air**

- Avoid putting the unit in a location that will be directly affected by air from a window, door, or air conditioning/ heating vent.



# Cleaning and decontamination methods

Most incubator manufacturers recommend a solution of 70% ethanol and manual cleaning prior to initial start-up and regularly thereafter. The 70% ethanol solution is intentionally diluted to give the ethanol time to kill the contaminant before the ethanol evaporates.

Why is 70% ethanol better than 100% ethanol in bacterial inhibition? 100% ethanol coagulates and dehydrates proteins so quickly that a layer of relatively impermeable denatured protein forms in the exterior parts of the bacterial cell (in and under the cell wall), and this prevents further diffusion of the alcohol into the cell. This protects the core of the cell from denaturation.

With 70% ethanol, the process is slower and the alcohol manages to diffuse throughout the cell denature proteins. In addition to conventional manual wipe down using 70% ethanol, the incubator may be equipped with a sterilisation cycle such as a high heat (180°C) system or a hydrogen peroxide vapor H<sub>2</sub>O<sub>2</sub> system. The cycle should be performed prior to first use.

If commissioning and Current Good Manufacturing Practices (cGMP) criteria are in place, all contamination control efforts must be in compliance with previously approved best practices and facility protocol.

## INSTRUMENTATION AND EQUIPMENT INTERFACE

Shakers, cell bottle rollers, magnetic stirrers and other devices are commonly used in the cell culture incubators. These must be free of contaminants before they are placed in the incubator.

Cell culture vessels usually include flasks with and without vent caps, petri dishes, roller bottles and multi-well plates. These are usually prepackaged and sterilized by gamma radiation prior to shipment. They should be opened only in a biosafety cabinet to preserve the integrity of the sterilisation.

Other labware returned from a central sterilisation room must be considered a source of contamination if exposed to ambient air during cart transit and shelf storage.

## SUMMARY CONTAMINATION SOURCES

The following contamination points must be included in a regular schedule for cleaning in situ or removal and cleaning manually or by autoclaving.

### INSIDE THE INCUBATOR

- Walls
- Ceiling
- Floor
- Chamber corners
- Ductwork and plenums
- Humidifying tray
- UV light housing if so equipped
- Temperature control probe and probe housing
- Probe wire to control panel

### INCUBATOR CABINET

- Inner door gasket and feather surfaces
- Inner door latch
- Inner door glass
- Inner door hinges and fasteners
- Cool spots where condensation may accumulatedue to insufficient cabinet insulation

### GAS SYSTEM

- CO<sub>2</sub> or O<sub>2</sub> sensor
- Sensor housing and connectors
- Injection tubing from control solenoid(s)
- Air pump
- Filters and housings
- Fan, shaft and seal

# Basic care of cell culture incubators

## Always puts on gloves before cleaning the unit.

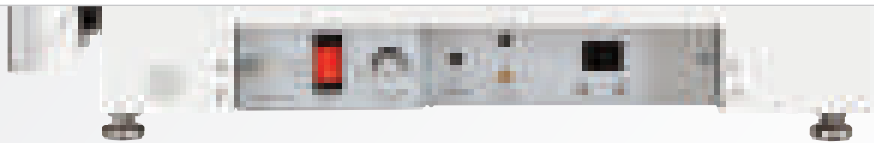
As a basic rule, do not clean the incubator with bare hands.  
Be sure to use rubber gloves.

## Necessary materials

- Rubber gloves
- 70% ethanol
- Sterile non-woven cloth/paper

### STEP 1

Turn off the power



### STEP 2

#### Remove the interior components.

Remove the components in the correct order.

- 1 Remove the shelves
- 2 Remove the humidifying tray cover, and take out the tray
- 3 Remove the back duct
- 4 Remove the fan
- 5 Remove the stopper for the access port



### STEP 3

#### Clean the interior components

Use the correct cleaning procedure.

- 1 Wash with a neutral detergent (soap)
- 2 Rinse well with distilled water
- 3 Wipe with sterile non-woven cloth/paper

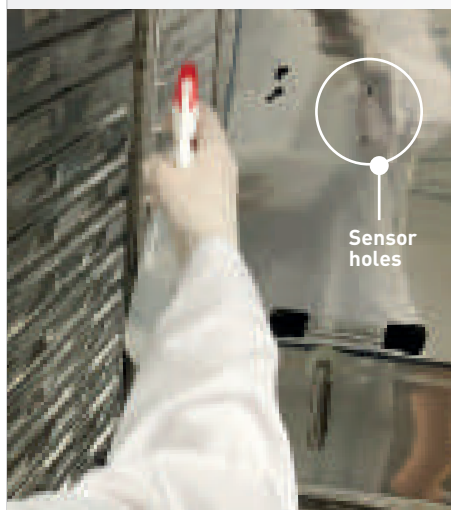


# Basic care of cell culture incubators

## STEP 4

**Spray disinfecting alcohol inside the unit and wipe (70% ethanol).**

Do not spray 70% ethanol into the sensor holes directly! Just wipe off with non-woven cloth/paper which is sprayed with 70% ethanol.



## STEP 5

**Disinfect all interior surfaces, internal components, shelves and water tray with 70% ethanol.**

## STEP 6

**Please make sure to spread the ethanol for disinfection to all corners of the inner door gasket and sufficiently remove stains while wiping it clean.**

If it is operated with the inner door gasket not in place, the humidified air will leak and will cause condensation between the unit and outer door. After wiping, confirm that the inner door gasket is securely in place and doesn't have any creases.

### **Adjust shape of inner door gasket after wiping**

Adjust the shape of inner door gasket by sliding fingers from each corner in direction of arrows. Specifically, insert fingers behind fin of inner door gasket and slide.

The inner door gasket has an important role to maintain the chamber humidity. If it is operated with the inner door gasket not in place, the humidified air will leak and will cause condensation between the unit and outer door. After wiping, confirm that the inner door gasket is securely in place and doesn't have any creases. If the inner door gasket is not in place, please refer to the back side and adjust the shape of the inner door gasket.

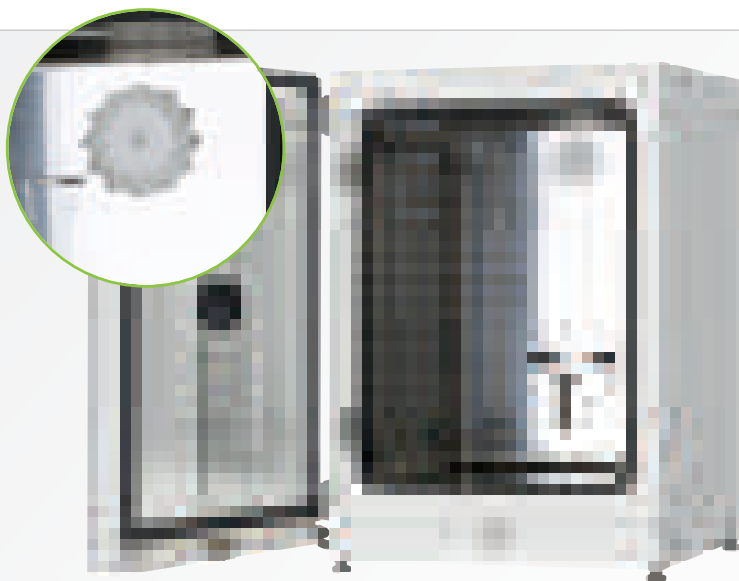


## STEP 7

### Replace the interior components.

Replace the components in the reverse order of [STEP 2], and put sterilized distilled water in the humidifying tray.

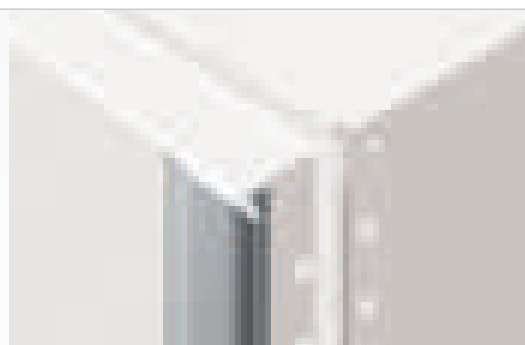
- 1 Replace the stopper for the access port
- 2 Replace the fan, check to see if the fan spins smoothly by turning it with your hand.
- 3 Replace the back duct
- 4 Replace the humidifying tray cover, and put in the tray
- 5 Replace the shelves



## STEP 8

### Let it dry with the door ajar.

Before turning the power back on (restarting) let the inside dry out, check that there is no alcohol smell remaining. If you turn the power on while it is still damp inside, the  $O_2$  and  $CO_2$  sensors may be damaged.



## STEP 9

If using a unit that is equipped with dual heat sterilisation function or  $H_2O_2$  (hydrogen peroxide) decontamination function, performing sterilisation/decontamination before use will make prevention of contamination (bacterial contamination) more effective.



**IncuSafe  $CO_2$  Incubator with dual heat sterilisation:**  
MCO-170AICD-series

**IncuSafe  $CO_2$  Incubator with  $H_2O_2$  decontamination:**  
MCO-170AICUVH, MCO-230AICUVH  
MCO-50AICUVH, MCO-50MUVH  
MCO-170MUVH



# Basic care of cell culture incubators

## CLEANING PRECAUTION

### Get into the habit of wiping carefully

- Be sure to wear gloves to avoid cutting your hands on the interior component
- Do not use acid, alkali, or chlorine-based cleansers, disinfectants, or sanitizers

### IMPORTANT POINT

**Do not wipe with the same portion of the sterile non-woven cloth more than once.**

If you wipe another area with same portion of the cloth, you will be spreading bacteria around. Don't forget to wipe the gasket and the inside of the door.



## CLEANING THE HUMIDIFYING WATER

**When replacing the water, also clean the tray.  
Do this at least once every two weeks.**

- Remove the tray from the unit
- Wash it in neutral detergent before wiping it
- Spray it with 70% ethanol, and then wipe
- Fill the humidifying tray with sterile distilled water (preferably pre-heated to 37°C)

### IMPORTANT POINT

**Do not use ultrapure water, tap water, deionized water or reverse osmosis water as these are not suitable for incubators.**

**Please avoid adding any chemicals to the humidifying tray.**



# Tips for the incubator which is prone to be contaminated easily

## TIPS TO MINIMIZE CONTAMINATION

- Increase the frequency of cleaning and humidifying water replacement.
- Spray Biocidal ZF to the inside of chamber once every week.

### Replacement of humidifying water

Recommended frequency: Once in two weeks (depending on frequency/ environment of use)

- 1 Remove the humidifying tray from an incubator
- 2 Wash the humidifying tray with neutral detergent, rinse it thoroughly with distilled water and wipe it off with sterile non-woven cloth/paper.
- 3 Spray ethanol to the humidifying tray and wipe off thoroughly.
- 4 Place the tray under the tray cover and pour sterile distilled water (preferably pre-heated to 37°C) into it.

### IMPORTANT POINT

**Do not replenish the humidifying water.**  
**The humidifying tray area is a major air way which is prone to collect dust and/or dirt that UV sterilisation can't remove.**

*The use of biodegradable Biocidal ZF spray-disinfectant in incubators will help protect cultures against bacteria, fungi and enveloped viruses.*

*Non-volatile:*

*The active microbiocidal ingredients of Biocidal ZF are non-volatile. These protect cell cultures from microbial contamination and do not invade cell cultures via air. Thus cell cultures are protected against contamination and the disinfectant itself.*



## TIPS TO MINIMIZE THE RISK OF CONTAMINATION

- Locate the incubator in a clean room or a site where there are few people.
- Install the incubator some distance above floor level (The higher you go, the less floating bacteria are found). Use a roller base to facilitate cleaning around and under the incubators.
- Install the incubator in an area away from draughts and easy air intrusion when opening and closing the incubator doors. Beware of air dust and the air flow direction of any air conditioning.
- Ensure that there is no condensation inside chamber.
- Always keep the interior of an incubator clean and free from culture medium and/or water and fingerprints. They must be wiped off immediately if ever spilled or smeared (When there is a film or foreign matter foamed or placed on the surface of the copper alloy, sterilisation effect will be lost).
- Always maintain and handle culture vessels under the maximum aseptic conditions possible. It is recommended to wipe off the bottom and periphery of the culture vessels with ethanol for sterilisation when taking them into or out of an incubator.
- Minimize the door opening and closing frequency.

# Care in the event of contamination

## Get into the habit of wiping carefully

- Be sure to wear gloves to avoid cutting your hands on the interior component
- Do not use acid, alkali, or chlorine-based cleansers, disinfectants, or sanitizers

## Necessary materials

- Rubber gloves
- 70% ethanol
- Sterile non-woven cloth/paper

## 24 HOUR UV DECONTAMINATION

### STEP 1

**Turn off the power**

### STEP 4

**Spray 70% ethanol inside the unit and wipe**

### STEP 2

**Remove the interior components.**

Remove the components in the correct order.

- 1 Remove the shelves
- 2 Remove the humidifying tray cover, and take out the tray
- 3 Remove the back duct
- 4 Remove the fan
- 5 Remove the stopper for the access port

### STEP 5

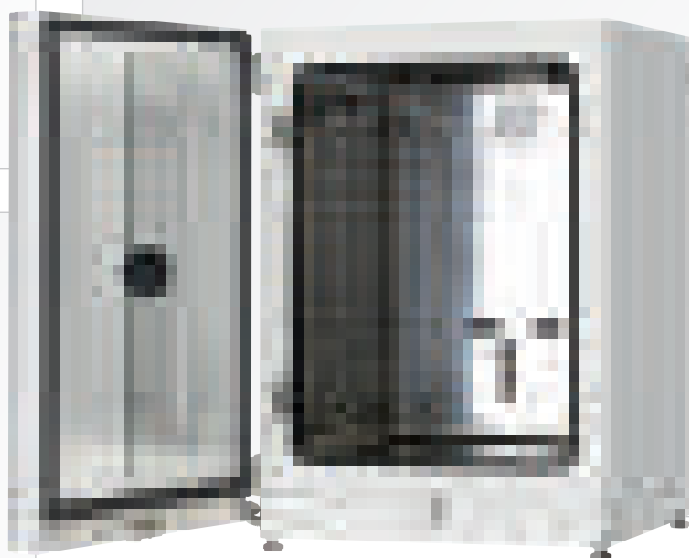
Disinfect all interior surfaces, internal components, shelves and water tray with 70% ethanol

### STEP 3

**Clean the interior components**

Use the correct cleaning procedure.

- 1 Wash with a neutral detergent (soap)
- 2 Rinse well with distilled water
- 3 Wipe with a sterile non-woven cloth/paper



SEE PAGE 9/10 FOR MORE DETAILS  
ABOUT STEP 1 TO 5

## STEP 6

### Turn on the power and (activate the UV lamp for 24 hours)

Once the interior components and UV lamp cover have been removed, carry out UV sterilisation for 24 hours. It is not necessary to wipe the interior with alcohol afterwards.

## STEP 7

### Replace the interior components.

Replace the components in the reverse order of [STEP 2], and put sterilized distilled water in the humidifying tray. Before replacing all the components, check to see if the fan spins smoothly by turning it with your hand.

## STEP 8

### Let it dry with the door ajar.

Before turning the power back on (restarting) let the inside dry out, check that there is no alcohol smell remaining.

If you turn the power on while it is still damp inside, the  $O_2$  and  $CO_2$  sensors may be damaged.

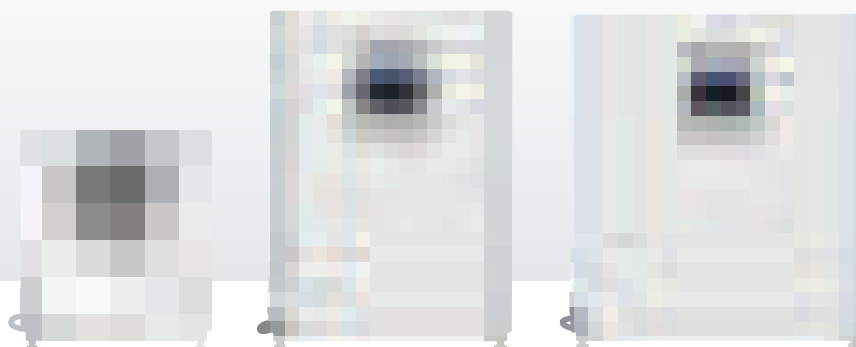


### PHCbi IncuSafe CO<sub>2</sub> Incubators with Safecell UV Lamp:

MCO-50AICUV, MCO-50AICUVH,  
MCO-170AICUV, MCO-170AICUVH,  
MCO-170ACUV, MCO-230AICUV,  
MCO-230AICUVH

### PHCbi Multigas Incubator with Safecell UV Lamp:

MCO-50MUV, MCO-50MUVH,  
MCO-170MUV, MCO-170MUVH



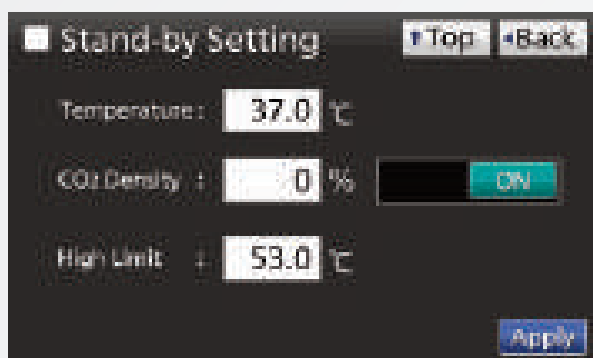
# Care in the event of contamination

## ACTIVATION UV LAMP 24H FOR MCO-170AIC AND MCO-230AIC SERIES

### Lighting the UV lamp for 24 hours

If the chamber has been contaminated by dirt or by spilling the medium, use the following procedure to decontaminate it by lighting the UV lamp for 24 hours.

1. Remove all attachments from the chamber, including the trays, the fan cover, the duct, the fan, the humidifying tray, and the humidifying tray cover. Disinfect all the attachments in an autoclave or with alcohol.
2. Clean and wipe down the inside of the chamber with alcohol.
3. Set the CO<sub>2</sub> density to 0 %.  
Go to the Stand-by-Setting screen (Menu > Set). enter 0 % at CO<sub>2</sub> density . Press "Apply" to save the entered values.



4. Go to the Tools #1 screen (Menu > Tools#1). Press "UV Setting" to display the UV Setting screen.



5. Turn the UV 24h Mode to ON and press "Apply".

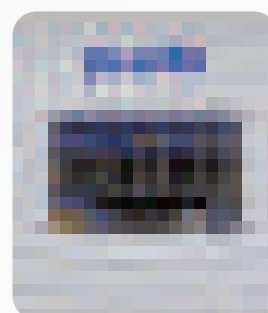


6. The UV lamp will now light continuously for 24 hours. "UV 24h Mode ON" is displayed on the UV lamp condition display.

#### Notes:

- The UV 24-hour mode may activate the automatic set temperature alarm because of rising chamber temperature.
- If the outer door is opened when the UV lamp is lit, the UV lamp is turned OFF and UV 24-hour mode is cancelled. Repeat procedures 4 to 6 to restart the UV 24-hour mode.

7. After 24 hours, the UV lamp turns OFF automatically. Reinstall all the attachments removed in procedure 1.



## ACTIVATION UV LAMP 24H FOR MCO-170AC AND MCO-50AIC SERIES

### Lighting the UV lamp for 24 hours

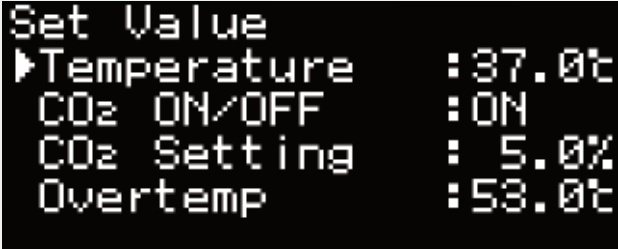
If the chamber has been contaminated by dirt or by spilling the medium, use the following procedure to decontaminate it by lighting the UV lamp for 24 hours.

1. Remove all internal items from the chamber (racks, fan cover, duct, fan, humidifying tray and humidifying tray cover).

Disinfect all the attachments in an autoclave or with alcohol.

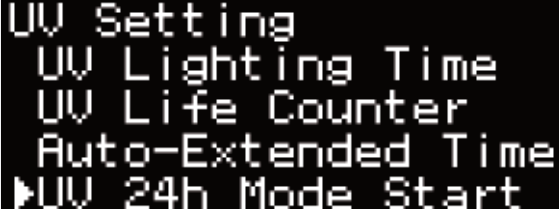
2. Clean and wipe down the inside of the chamber with alcohol.

3. Set the CO<sub>2</sub> density to 0 %.



```
Set Value
▶Temperature      :37.0°C
CO2 ON/OFF       :ON
CO2 Setting      : 5.0%
Overtemp         :53.0°C
```

4. On the home screen press MENU. The left side of the display will change to Menu screen.
  - Move the cursor to Alarms & Controls by using the up/down keys and press ENTER.
  - Move the cursor to UV Setting by using the up/ down keys and press ENTER.



```
UV Setting
UV Lighting Time
UV Life Counter
Auto-Extended Time
▶UV 24h Mode Start
```

5. Move the cursor to UV 24h Mode Start by using the up/down keys and press ENTER.  
The right side of the display will change to the UV

24h Mode Start setting screen, the current setting (OFF) will be displayed.

6. Use the up/down keys to change the UV 24h lighting mode setting to ON and press ENTER.



```
UV 24h Mode Start
  ON
ON / OFF
```

7. Press the MENU key to display the home screen.  
The UV lamp will now light continuously for 24 hours.

#### Notes:

- The UV 24-hour mode may activate the automatic set temperature alarm because of rising chamber temperature.
- If the outer door is opened when the UV lamp is lit, the UV lamp is turned OFF and UV 24-hour mode is cancelled. Redo procedures from 4 to restart the UV 24-hour mode.

8. After 24 hours, the lamp UV turns OFF automatically.  
Reinstall all the attachments removed in procedure 1.



# Care in the event of contamination



## H<sub>2</sub>O<sub>2</sub> DECONTAMINATION MCO-170 AND MCO-230 SERIES

No need to remove UV lamp and inner parts  
No heat transfer when stacked  
It doesn't use a heater, so it conserves energy

### STEP 1

**Preparation Time: 10 - 15 minutes**



1. Remove all interior components
2. Wipe down the inside of the incubator
3. Reposition interior components to specified locations for in situ decontamination
4. Set up the H<sub>2</sub>O<sub>2</sub> generator (MCO-HP)\*  
\*Optional Accessory. H<sub>2</sub>O<sub>2</sub> reagent is required for this process.



Placement H<sub>2</sub>O<sub>2</sub> generator

### STEP 2

**Decontamination Time:  
Approx. 135 minutes**



Decontamination of the chamber can be completed by pushing just 2 buttons on the control panel

1. Press the H<sub>2</sub>O<sub>2</sub> button.
2. The chamber will warm up to 45°C for optimum results
3. H<sub>2</sub>O<sub>2</sub> vapour generation starts
4. Interior fan circulates vapour
5. UV lamp reduces H<sub>2</sub>O<sub>2</sub> to water and oxygen



### STEP 3

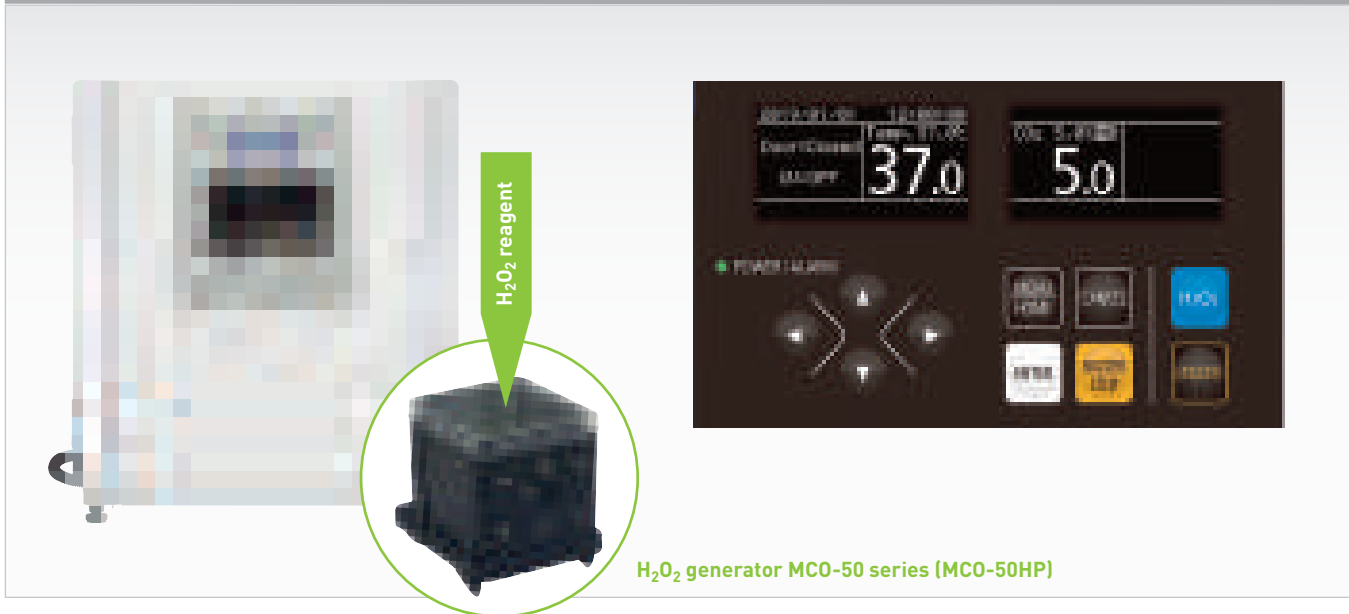
**Finish Time: Approx. 10 minutes**



1. Open chamber door
2. Wipe off remaining liquid with sterile cloth
3. Reposition interior components to normal positions

## H<sub>2</sub>O<sub>2</sub> DECONTAMINATION MCO-50 SERIES

FOLLOW STEPS 1 TO 3 FROM PAGE 18

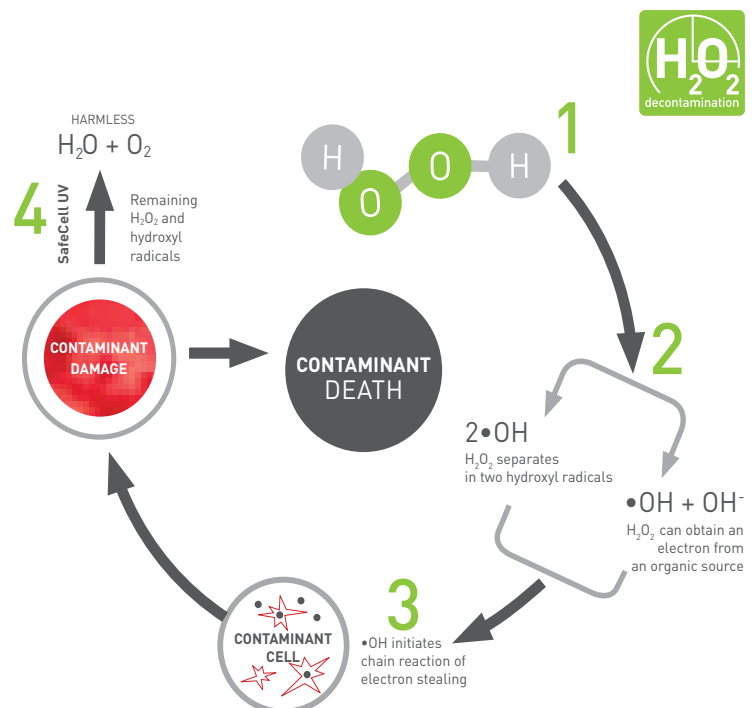


H<sub>2</sub>O<sub>2</sub> generator MCO-50 series (MCO-50HP)

## HOW DOES IT WORK?

1. Hydrogen peroxide (aqueous) is converted to vapour using high frequency ultrasonics. During this process, the fan motor remains active, ensuring H<sub>2</sub>O<sub>2</sub> vapour accesses every point of the chamber and the tubing to and from, and the inside of the CO<sub>2</sub> sensor.
2. The H<sub>2</sub>O<sub>2</sub> vapour breaks down into hydroxyl radicals naturally.
3. The hydroxyl radicals initiate a chain reaction of electron stealing.
4. This unstable internal environment leads to death of contaminants. Remaining hydroxyl radicals and H<sub>2</sub>O<sub>2</sub> are resolved to H<sub>2</sub>O (aqueous) & O<sub>2</sub> (gas).

PHCbi's H<sub>2</sub>O<sub>2</sub> decontamination achieves at least a 6 log reduction of major contaminants. The full decontamination process takes less than three hours.



DNA is very susceptible to oxidative damage. Since most bacteria have a single chromosome controlling all their life functions, this kind of effect can be detrimental to their normal function. Prokaryotic organisms often lack repair mechanisms to limit such damage, making them more prone to change.

# Care in the event of contamination



## DUAL HEAT STERILISATION

Resolved the issues of using dual heat sterilisation which had to be restricted in spite of customer needs.

Convenient approx. 11 hrs. / 180 °C dual heat sterilisation

### STEP 1

**Preparation time: 10 - 15 minutes**



1. Press the Sterilisation button to see instructions on the display
2. Remove all interior components
3. Wipe down the inside of the incubator and the interior components with alcohol
4. Reposition interior components to specific locations for in situ sterilisation

### STEP 2

**Sterilisation time: approx. 11 hours**



1. Close the inner and outer door and press OK. The outer door is now electronically locked and the chamber will warm up.
2. Sterilisation process will start after the entire inside of the chamber exceeds 180°C and runs for 60 minutes.
3. The cooling process starts to cool down the chamber to 40°C

### STEP 3

**Finish time: Approx. 10 minutes**

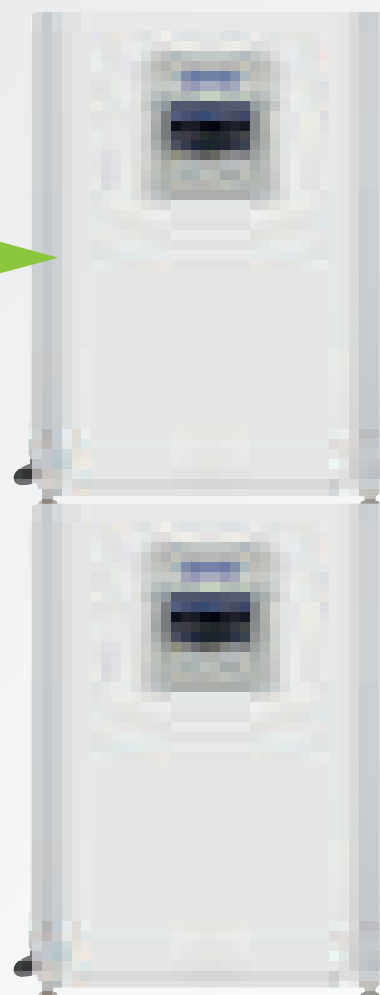


1. Outer door is unlocked upon completion.
2. Open chamber door
3. Reposition interior components to normal positions

**no heat leakage**

*Both chambers can be in use at the same time even when double stacked.*

*One unit in dual heat sterilisation mode the other in incubation mode.*



To prevent burning during the heat sterilisation cycle, the outer door is electronically locked. The top surface temperature of the MCO-170AICD during heat sterilisation is approximately 60°C. 60°C is within the tolerance described in the International Safety Standard IEC61010 10.1 Surface temperature limits for the burn prevention. Safety limit for outer metal is 65°C.

# Care in the event of rust

## **Always put on gloves before cleaning the unit.**

As a basic rule, do not clean the incubator with bare hands.

Be sure to use gloves.

Be careful as hands may get cut on the interior components.

## **Necessary materials**

- Gloves
- 70% ethanol
- Sterile non-woven cloth/paper

FIRST FOLLOW STEPS 1 TO 5 FROM PAGE 9/10

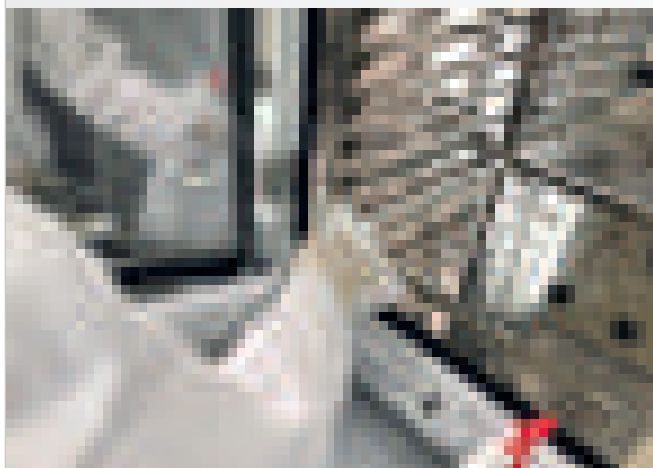
## **STEP 6**

### **Remove the rust with a cream cleanser.**

Use a suitable amount of fine-grained cream cleanser, and carefully remove the rust.

## **STEP 7**

### **Wipe with 70% ethanol.**



## **STEP 8**

### **Activate the UV lamp for 24 hours.**

\*If it is a UV-lamp models

Once the interior component and UV lamp cover have been removed, carry out UV sterilisation for 24 hours. It is not necessary to wipe the interior with alcohol afterwards.

## **STEP 9**

### **Replace the interior components.**

Replace the components in the reverse order of [STEP 2], and put sterile distilled water in the humidifying tray.

Before replacing all the components, check to see if the fan spins smoothly by turning it with your hand.

## **KEEP IN MIND**

### **These are the conditions that promote rust**

- Insufficient wiping after the use of acid, alkali, or chlorine-based cleansers, disinfectants, or sanitizers
- Scratches on the surface of the unit interior or interior components
- The incubator is used with foreign matter left stuck to the inside of the unit or interior components
- Sodium dodecyl sulfate (SDS) is added to the humidifying water
- Using ultrapure water, deionized water or reverse osmosis water in the humidifying tray
- Adding chemicals to the humidifying water
- If an autoclave is used  
If articles are stored wet in an enclosed place after coming out of an autoclave, rust can easily occur.
- If a dual heat sterilizer is used  
After coming out of a dual heat sterilizer, once oxide scale appears on the surface that turns yellow or black, rust can easily occur.

# Best practice and good laboratory technique

The most obvious approach to contamination-free incubator operation is to keep the incubator clean. A combination of manual cleaning and automatic (if equipped) decontamination processes managed on a regular schedule help protect cultures in situ and minimize loss of work due to contamination and downtime. Predictive maintenance is analogous to preventive maintenance, whereby cleaning processes can be documented for standardization and compliance, scheduled in advance and assigned to laboratory staff as required. There is no substitute for aseptic technique when handling cell cultures. Both personal and laboratory hygiene are essential to a holistic contamination management program.

## ACTIVE VS. PASSIVE DECONTAMINATION

Active decontamination, whether by manual wipe down, high heat sterilisation,  $H_2O_2$  vapor or other method, must be initiated by the user. Design attributes inherent to a properly engineered cell culture incubator offer an additional layer of protection by working in the background to inhibit and destroy contaminants as they occur.

### Active Decontamination



**High Heat.** A high heat process utilizes time and temperature, typically 160°C to 170°C for a two-hour period, for a proven method of decontamination. The PHCbi brand, new

thermal decontamination system operates at a higher temperature. It is the fastest and most effective active method of decontamination in a cell culture incubator reaching 180°C for a two-hour dwell before returning to ambient temperature. To minimize downtime, total cycle time is less than 12 hours. This energy-efficient process does not require the removal of the  $CO_2$  sensor and UV light in the PHCbi brand incubator.



**Hydrogen Peroxide ( $H_2O_2$ ) Vapor.** PHCbi brand incubators permit the use of active hydrogen peroxide ( $H_2O_2$ ) vapor decontamination with complete safety and

zero impact on the surrounding environment. Hydrogen peroxide starts in aqueous form and is converted to vapor using a nebulizer; this exposes all interior surfaces to the  $H_2O_2$  vapor which ultimately resolves to water and oxygen at less than 1 ppm when catalyzed by a UV lamp.

### Passive Decontamination



**Copper Enriched Stainless Steel (marketed as inCu-saFe® under the PHCbi brand)** is a stainless steel and copper composite alloy that forms a germicidal barrier to prevent

growth of organisms on surfaces. All interior surfaces, shelves and brackets are comprised of the inCu-saFe composite. This material is a hybrid of Type 304 stainless steel. It is 100% corrosion-proof and will not corrode or discolor like conventional C100 copper surfaces.



**Ultraviolet Light (marketed as SafeCell™ UV under the PHCbi brand)** consists of a concealed UV lamp that creates a serial exposure of 257.3 nm wavelength to destroy

DNA of any organism passing through the airflow system as well as surface water contaminants in the removable humidity tray. The UV lamp initiates automatically upon a door opening/closing event. SafeCell UV inhibits the growth of mycoplasma, bacteria, molds, spores, viruses, yeasts and fungi without costly HEPA filter air scrubbers which accumulate contaminants in the filter media. Additionally, the UV lamp can be programmed for a timed 100% ON cycle for a supplemental chamber decontamination





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