1.0 Description

This manual provides information on installing and operating your Terra Universal UV Germicidal Cabinet.

This polypropylene cabinet features a variable-speed ceiling fan/filter module that removes submicron particles, including bacteria, aerosols and other biohazards. Select 99.99% HEPA filters (rated at 0.3 µm-diameter particles) or 99.999% efficient ULPA filters (rated at 0.12 µm-diameter particles). Perforated shelves optimize the vertical flow of clean air through the cabinet; air exits through exhaust slots on the amber acrylic doors.

Each of the four chambers features a 254nm UV germicidal lamp with optional timer. A safety “kill” switch automatically halts lamp operation the instant either of the amber acrylic access doors is opened. Refer to “Specification” for additional lamp information. A stand raises the cabinet off the floor for easy cleaning (optional casters available).
2.0 Operation and Maintenance

Pre-Installation Inspection: Unpack the system and check for damaged or missing components. The cabinet is generally shipped with the filter-blower module pre-assembled, ready for operation. Any damage should be reported to the shipping company immediately.

2.1 System Operation

The fan/filter module and the UV germicidal lamps operate on two separate circuits.

To turn ON the fan/filter module, depress the green ON/OFF toggle switch, which energizes the fan circuit. Rotate the variable-speed power switch on the front of the unit in the clockwise to adjust the fan speed.

To turn ON the four UV germicidal fixtures, rotate the timer in the clockwise direction. In the fully clockwise position, the timer allows approximately 6 hours of lamp operation; the lamps will operate until time expires or either of the access doors is opened. The UV light can be turned off by rotating the timer fully counter clockwise. See information on the UV safety switches below.

Although the amber door material is an effective UV shield, care should be taken to ensure that hands, face and especially eyes are not exposed to direct UV radiation.

WARNING!

• Wear goggles or face shield and hand and arm protection (shirt sleeves and gloves) when operating the UV germicidal lamps.

• Never attempt to operate UV lamps if the doors are not closed and/or the safety “kill” switch is not operational.

UV Safety Switches

The magnet at the top of each door activates a door safety switch that halts UV lamp operation if the door is open. Always ensure that the magnet is properly aligned with the opposing switch connector before attempting to operate the system.

UV exposure of 60 seconds provides a “kill” dosage for most bacteria and viruses located within 12” of the UV source, making this cabinet an effective sanitizing chamber for use with most pathogens. Refer to appendix for additional information on UV disinfection.

Operation Status Indicator

The Operation Status Indicator lights (blue TUI logo seen on right) glow to indicate that fan is operational. When unit is powered off, the Operation Status Indicator lights flash intermittently to call attention to the fact that the unit is not operational.
2.2 System Maintenance

Cleaning

These units should be cleaned periodically with warm water and a mild detergent. Frequent cleaning is especially important if the interior is often exposed to chemicals that could drip onto the inner surface of the cabinet.

To maximize cleaning uniformity, wipe in one direction, from top to bottom or left to right. Use only slight overlapping strokes, and fold the wiper before between strokes. Do NOT use circular motion, which moves but does not remove surface particles and produces non-uniform results. Begin cleaning from the top of each panel, working to the very bottom, and then wipe down the vertical and horizontal frame members when all panels are clean.

CAUTION: Do not use alcohol or other cleaning agents on the acrylic doors.

Filter Replacement

Depending on operating conditions, the system will require a periodic HEPA/ULPA filter replacement. Replacement intervals depend on frequency of use and particle load in the ambient environment. As the filter loads, fan operation will become noisier and the air speed will diminish. A recommended filter monitoring protocol is to measure the air speed approximately 6” below the filter face using a hand-held anemometer. When the air speed drops to below 90 feet/minute, a filter change is recommended.

Replacement HEPA Filter (12” x 12” x 3”, rated 99.99% efficient at 0.3 micron particles): Terra # 2100-30

WARNING!: Turn the unit OFF and disconnect it from system power before attempting to replace the filter.

To replace the system filter (requires two technicians),

1. Remove the cross-head screws along the perimeter of fan/filter module cover that hold it in position.
2. Carefully lift the cover away from the unit, being careful not to stress the wire harness that connects the fan (attached to the inside of the cover) to the electrical board.
3. Detach the wire fan wire harness by turning the twist connector. Set the cover aside.
4. The filter is held in place by a retaining clamp. Remove the screws that hold this clamp in position. Replace the filter and re-attach the retaining clamp.

CAUTION: Do not touch the filter, or you may damage the delicate filter pleats. Handle the filter only by the frame.

5. Reattach the fan wire harness and position the fan/filter module cover carefully in place.
6. Re-attach the perimeter cross-head screws to secure the cover in position.
7. Re-connect the unit to system power (120 or 220VAC).

Replacing Gasketing

The gasketing that lines the access doors helps to ensure a tight seal when doors are closed. This gasketing is selected on the basis of its durability, but it may in time need to be replaced. Replacement gasketing (Cat. No. 1100-
Replacing UV Lamp

**Model:** 25 watt Preheat Strip Fixture

**Lamp:** 05-1107

Call Terra 714-578-6000

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### 3.0 Specifications

**Materials:** Stress-relieved white polypropylene (cabinet); amber acrylic (doors); stainless steel (fan/filter housing)

**Dimensions:** 25.75”W x 13.5”D x 56”H (654mm x 343 mm x 1422 mm), excluding stand.

**Fan:**

- **Motor:** 250 mm Backward Curved Motorized Impeller
- **CFM:** 991.8
- **Power:** 115 VAC/ 60 Hz, 105 W

**UV Germicidal Lamps**

- **Manufacturer:** Atlantic Ultraviolet Corporation
- **Model:** 25 watt Preheat Strip Fixture
- **Lamp:** 05-1107
- **Total UV output:** 5.0 Watts
- **Length:** 19-1/2”
- **Dimensions Width:** 2-5/8”
- **Height:** 3-1/2”
- **Rated Average Lamp Life:** 6 Hours

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26) is easy to install. Simply peel off the old stripping (you may need to scrape portions off with a razor blade), clean the old adhesive with a solvent, and replace it. The self-adhesive backing guarantees a secure bond.
4.0 Warranty

Products Manufactured by Terra: Terra Universal, Inc., warrants products that it manufactures to be free from defects for a period of 12 months for parts and 90 days for labor, commencing from the date of shipment. Terra's sole responsibility is to repair or replace, at its option, any part of the product that proves defective or malfunctioning during this time limit. In some cases, components incorporated in Terra Universal products are covered by additional warranties from component manufacturers; obtain specific information from Terra sales representatives. This warranty is void if the equipment is abused or modified by the customer, is operated outside Terra's operating instructions or specifications, or is used in any application other than that for which it is specified. This warranty does not include routine maintenance or service procedures, breakage of quartz baths after 60 days, shipping damage, nor damage from misuse, intentional or unintentional abuse, neglect, natural disasters, or acts of God.

Products Manufactured by Others: Terra Universal, Inc., warrants that, to the best of its ability, Terra's representations of products that are manufactured by others reflect the manufacturer's representations, subject to change without notice. Sole warranty for these products is the original manufacturer's warranty that is passed forward to the purchaser and constitutes the customer's sole remedy for these products. Detailed warranties for distributed products are available through Terra sales representatives.

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Generally, customers can improve the chance of collecting on a freight claim by following these procedures: 1) formally requesting that the carrier inspect the shipment immediately upon suspecting damage or shortage to verify condition; 2) notifying the carrier upon discovery of concealed damage and requesting an inspection within 15 days of receipt, both in person or phone and following up via mail; 3) keeping the shipment as intact as possible, including retaining original packaging materials and keeping the product as close to the original receiving location as possible; 4) holding salvage for disposition by the carrier.

All Claims: Terra Universal expressly disclaims all other warranties, expressed or implied or implied by statute, including the warranties of merchantability or fitness for intended use. Terra Universal is not responsible for consequential or incidental damages arising out of the purchase or use of the products supplied by Terra Universal. Terra Universal is not liable for damage to facilities, other equipment, products, property or personnel of others, or of their agents, suppliers, or affiliated parties, which is caused or alleged to have been caused by products supplied by Terra Universal. In any event or series of events, Terra Universal's total liability for any and all damages whatsoever is limited to the lesser of the actual damages or the original invoice cost of the items alleged to have caused the damage. The customer's sole and exclusive remedy for any cause of action whatsoever is repair or replacement of the non-conforming products or refund of the actual purchase price, at the sole option of Terra Universal. All claims must be made in writing within 90 days of the date the product was shipped. Any claims not made within this time limit shall be deemed waived by the customer. Terra Universal is not responsible for any additional costs of repair caused by poor packaging or in-shipment damage during return.

Warranty Returns: All warranty returns must be authorized in advance by Terra Universal and approved under an RMA. Unless approved in advance for good reason, all returns must be in original condition, including all manuals, and must be packaged in original packaging materials. All returned goods are to be shipped to Terra Universal, freight prepaid at customer's expense. See Terra's "Policy and Procedure for Returned Goods."

Thank you for ordering from Terra Universal!
Ultraviolet Disinfection: Crucial Link in the Sterilization Chain

Many manufacturers face the challenge of maintaining sterile products and processes. In most cases, there’s no one-size-fits-all solution. Highly effective sterilization technologies like ethylene oxide gas (EtO) or hydrogen peroxide vapor carry substantial risk and often come at a high cost. Frequent manual wipe-down with IPA or other cleaning agents is much less expensive but introduces difficulties related to operator training and process documentation and consistency. In many cases, the challenge amounts to managing multiple technologies that provide microbial control throughout widely differing processes—while minimizing costly disruptions for bioburden testing or decontamination routines.

Fortunately, ultraviolet sanitizing technology provides a range of safe, cost-effective disinfection measures that simplify this task, whether employed as a stand-alone measure or as part of a broader sterilization program.

Sanitizing vs. Sterilization: What UVC Does and Doesn’t Do

Ultraviolet C (UVC) radiation is the germicidal range of the ultraviolet spectrum. UVC energy, with wavelengths in the 280 - 100nm range, is removed from sunlight by the earth's atmosphere, so earth-bound microorganisms have not developed a natural defense against it and are highly susceptible to cellular damage—particularly, disruption of DNA sequencing—as a result of relatively low levels of UVC exposure.

UV Germicidal Irradiation (UVGI) has been studied for over a century, and UVGI effects on common bacteria, viruses and mold spores are well known. Manufacturers of UVC equipment often provide D99 dosages (the duration and intensity of UVGI necessary to a 2-log reduction of all microbes present) for specific pathogens and exposure conditions, making it relatively simple for a manufacturer to select a system for a particular situation. Although UVC lamps may not produce an entirely sterile surface, they can maintain consistently low microbial loads throughout a wide range of operations and eliminate bioburden spikes that could necessitate extensive testing and decontamination measures.

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>D99% (1) Direct Dosage in Minutes (2)</th>
<th>Dose Req’d Microwatts - sec/cm²</th>
<th>Time to reach D99 Dosage in Minutes (2)</th>
<th>Direct Distance to Wall in feet (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virus and Bacteria</td>
<td>2-log reduction</td>
<td>5 ft</td>
<td>6 ft</td>
<td>11 ft</td>
</tr>
<tr>
<td>Influenza A</td>
<td>2,000</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Bacillus</td>
<td>3,004</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Coxsackievirus</td>
<td>4,156</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Staphylococcus A</td>
<td>1,324</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>2,168</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Legionella</td>
<td>2,250</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Average Virus and Bacteria from above</td>
<td>2,797</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Fungal - Spores</td>
<td>2-log reduction</td>
<td>5 ft</td>
<td>6 ft</td>
<td>11 ft</td>
</tr>
<tr>
<td>Aspergillus niger spores</td>
<td>270,542</td>
<td>29</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Penicillium italicum spores</td>
<td>65,960</td>
<td>11</td>
<td>10</td>
<td>9</td>
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<tr>
<td>Cladosporium spores</td>
<td>121,188</td>
<td>11</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Average airborne Fungal spores from above</td>
<td>152,913</td>
<td>23</td>
<td>22</td>
<td>21</td>
</tr>
</tbody>
</table>

Notes:
1. Dosage required to disinfect 99.9% at lowest intensity point
2. Horizontal distance from Sanitizer to point on a wall. Distance to the furthest corner of the room should be used.
3. Assumes a ceiling height of 9' and uses intensity at ceiling as lowest point of intensity.
4. Time required to reach theoretical 99.9% disinfection plus an allowance of 1.5 minutes for lamp to reach temperature.

Figure 1: Characteristic UVC “Kill Rates”
Table courtesy of UVDI
In many situations, a D99 dosage is adequate guarantee of germicidal control (D99.9 and D99.99 levels are also obtainable in many cases). As shown in Figure 1, the D99 “kill rate” is reached in as little as two minutes of exposure for common pathogens like influenza A, tuberculosis and legionella. Even when absolute product sterilization requires additional equipment, use of UVC sanitizers often minimizes the frequency of more disruptive sterilization and testing.

**Safe, Simple Implementation**

UVC is relatively easy to implement safely in a wide range of situations. Such applications typically fall into two categories: surface disinfection and airflow disinfection.

Surface disinfections entails UVC exposure to wall or chamber surfaces, as well as to surfaces of manufactured samples. As long as surfaces to be disinfected are within the line of sight of the lamp, it is fairly simple to select a system with the proper intensity to provide D99+ dosing with a few minutes of UVC exposure.

Whole room sanitizers provide this germicidal control for walls, ceiling and floor of a lab, cleanroom or other production space. These units include cycle timers that let a user set the unit for operation and then safely leave the room. Because they require only a few minutes to provide a D99 dosage, they can be operated before and after processing shifts to provide a first line of defense against bioburden accumulation.

A range of UVC lamps is available for standard process enclosures, such as gloveboxes, isolators and hoods. Small enclosure sizes allow effective irradiation with lower-wattage fixtures and shorter cycle times. Because standard glass and many plastics, including acrylic, PVC, and polycarbonate, are effective UVC shields, UVC lamps can be safely incorporated into the systems without risk to the personnel who use them. Laminar flow and exhaust fume hoods, which allow limited exposure of UVC light to the operator’s hands and face, can be fairly simply modified with a pull-down sash and interlock device to preclude exposure during UVC lamp operation. Protective gloves and face shields minimize risk when physical barriers may not be possible.

Airflow sanitizing contributes further to bioburden control in a cleanroom or other air conditioned facility. Because viral particles typically fall in the sub-micron particle size, often below the 0.12-micron diameter pore size used to rate Ultra-Low Particulate Air (ULPA) filters, their transmission is difficult to control even in classified cleanrooms. In most cases, however, special UVC ductwork fixtures can be installed to minimize the bioburden in a cleanroom or other controlled production environment. Even with air moving as fast as 100 feet/minute, a fixture optimized to increase the exposure time will attain D99 dosage for most bacteria and viruses.

**UVC Limitations**

The principal limitation of UVC germicidal irradiation is the need for direct exposure. Place a sample too far from the UVC source, or move it out of the direct line of sight, or cut the exposure time too short, and you lose germicidal efficacy.

Extended UVC exposure also degrades some materials over time. Although it has no effect on most construction materials inside a lab or cleanroom, including metals, painted surfaces, and most plastics, UVC prematurely ages many elastomers and paper-based products. Fortunately, these effects can typically be minimized through controlled exposure cycles.

In most cases UVC solutions can vastly reduce the bioburden with negligible effects on materials and processes and minimal risk to samples or personnel. By maintaining consistently low microbial loads, such UVC technology drives down the need for more expensive sterilization and testing, and with it the overall cost of production.

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**Figure 2: UVC Lamp Fixture Installed Inside Cleanroom Air Return (shown with cover removed)**

Photo Courtesy of Terra Universal, Inc.