EMS-3000 Series User Guide

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Serial Number

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Preface

This User Guide contains basic information for the correct and safe use, operation, and application of the EMS-3000 Series System (Environment Management System-3000 Series System). Please READ this User Guide and its guidelines CAREFULLY and in detail before any attempt is made to operate or utilize this equipment.

Before operation this equipment, all precautions and safety recommendations contained in this document must be strictly followed. Failure to comply with these guidelines may be dangerous or illegal. The installation, activation, and scheduled maintenance of the equipment must be performed only by Ingersoll Rand EMS Certified Technicians. At the same time, the operation of the equipment must be the responsibility of properly trained and duly authorized personnel. Said training and authorization provided by Ingersoll Rand at the time of installation.

No alterations or modifications to the equipment can be made without the prior written consent of Ingersoll Rand. This can seriously jeopardize the safety of both personnel as well as the equipment itself. Ingersoll Rand will not be responsible for damages that may occur as a result of the improper handling or operation of the equipment.

Guidelines for user safety and equipment protection

Symbols are used to highlight information relating to the user’s personal safety and protection of the equipment throughout this guide.

When any of the following symbols appear, the associated information must be read carefully and understood fully.

**WARNING**

The identified danger can cause physical and property damage.

**DANGER**

The identified danger can cause severe physical and property damage.
**Warnings**

Under no circumstances will Ingersoll Rand be liable or responsible for any consequential damage that may arise as a result of installation or use of this equipment.

All examples and diagrams shown in the guide are intended to aid understanding. They do not guarantee operation.

Ingersoll Rand accepts no responsibility for actual use of this equipment based on these examples.

Due to the great variety of possible applications for this equipment, the user must assess the suitability of this product for specific applications.

Equipment described herein is recommended based on the room temperature, the products being stored, the air circulation of the room, and the overall size of the room. Buyer further acknowledges that in order for the equipment to achieve optimal results, there must be sufficient air circulation, sufficient closure of the treated area and proper ventilation in the packaging of stored/palletized product(s).

Make sure to have safety procedures in place to stop any connected equipment in a safe manner if the sensor should malfunction or become damaged for any reason.

Make sure the technician is safely secured when using a lift to install, troubleshoot, or service purifiers. If using ladders, make sure they are sturdy. Do not use forklifts to raise field service personnel.

Secure the EMS-3000 Series ROS Purifier to the lifting device while raising it to the installation point. Be aware of any site hazards that may be present.

Do not replace electrical parts or try to repair this product in any way.

Only Ingersoll Rand EMS Certified Technicians should open the EMS-3000 Series ROS Purifier housing or carry out repairs.

Ingersoll Rand is not responsible for problems resulting from improper or irresponsible use of this device.

The entire EMS-3000 Series ROS Purifier is to be treated as a high voltage device.

Use a mirror when looking into the reaction chamber while the EMS-3000 Series ROS Purifier is running.
1 Technology Overview

Ingersoll Rand manufactures and sells air and surface sanitation equipment using an exclusively licensed technology. ROS (Reactive Oxygen Species) are used to prolong the life of food and other perishable products, increase food safety, remove odors from the air, and create a clean environment. This is the Environment Management System (EMS) air and surface sanitation technology.

By destroying pathogens and contaminants, EMS air and surface sanitation technology significantly improves air quality and product life. This technology creates a safer and cleaner environment and therefore has great benefit when installed in any facility (warehouses, food processing centers, cold storage units, etc.) where food and temperature sensitive products are processed or stored, or where irritating and noxious odors exist.

EMS air and surface sanitation equipment has been shown to remove up to 99% of airborne and surface contaminants under laboratory conditions. EMS also enhances product quality and life, and meets FDA and USDA requirements.

Figure 1. EMS-3000 Series System Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>3100A</th>
<th>3100B</th>
<th>3100C</th>
<th>3300</th>
<th>Control Box</th>
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<tbody>
<tr>
<td></td>
<td>Physical Specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cabinet Material</td>
<td>Stainless Steel</td>
<td>Stainless Steel</td>
<td>Stainless Steel</td>
<td>Powder Coated Steel</td>
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<td>105 lbs</td>
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<td>235 lbs</td>
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<td>Depth (in)</td>
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<td>15 in</td>
<td>15 in</td>
<td>21 in</td>
<td>6 in</td>
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<tr>
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<td>29.5 in</td>
<td>50 in</td>
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<tr>
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<td>26.5 in</td>
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<td>10 in</td>
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<td>Electrical Specifications</td>
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<td></td>
</tr>
<tr>
<td>Frequency (Hz)</td>
<td>60 Hz</td>
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<td>60 Hz</td>
<td>60 Hz</td>
<td>50/60 Hz</td>
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<td>Voltage Requirements</td>
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<td>120VAC</td>
<td>120VAC</td>
<td>120VAC</td>
<td>100-240VAC</td>
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<tr>
<td>Power Consumption (W)</td>
<td>383W</td>
<td>368W</td>
<td>353W</td>
<td>958W</td>
<td>31W</td>
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<td>Minimum Circuit Amps</td>
<td>4.1A</td>
<td>4.1A</td>
<td>4.1A</td>
<td>10.8A</td>
<td>0.3A</td>
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<td></td>
<td>Ambient Operating Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient Temperature (°F)</td>
<td>32° to 102°</td>
<td>32° to 102°</td>
<td>32° to 102°</td>
<td>32° to 102°</td>
<td>32° to 102°</td>
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<tr>
<td>Ambient Humidity</td>
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<td>&lt; 90%</td>
<td>&lt; 90%</td>
<td>&lt; 90%</td>
<td>&lt; 90%</td>
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<td>IP Protection</td>
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<td>IP-40</td>
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<td>Noise Level 1 M, (DB)</td>
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<td>&lt; 60 DB</td>
<td>&lt; 60 DB</td>
<td>&lt; 60 DB</td>
<td>&lt; 60 DB</td>
</tr>
</tbody>
</table>
Introducing EMS-3000 Series System
Current Technology

The EMS-3000 Series System draws in air from the environment. ROS (Reactive Oxygen Species) are created in the reaction chamber of the EMS-3000 Series System from some of the oxygen in the air. These ROS significantly reduce carbon-based compounds including molds, bacteria, viruses, ethylene, odor molecules, and other hydrocarbons.

- The ROS include: Atomic Oxygen (O$_1$), Superoxide (O$_2^-$), Singlet Oxygen (1O$_2$), Peroxynitrite (ONOO$^-$), Hydrogen Peroxide (H$_2$O$_2$), Ozone (O$_3$), and others.

- Most ROS lasts for under 1 second and decays to common oxygen in the air. Hydrogen peroxide (H$_2$O$_2$) and ozone (O$_3$) last for minutes to hours and move out of the reaction chamber to accomplish surface sanitation as well as further air sanitation.

- Approximately 90% of all purification takes place in the air in the purification chamber.

- 10% of the purification takes place on surface and in the air in the treated environment.

Since the room air (enclosed or partially enclosed space) is circulated through the EMS-3000 Series System, the short-lived ROS within the purification chamber are able to carry on their oxidizing benefits. This is a unique quality of the patented EMS systems in that no other technology is capable of producing these species within a purification chamber while creating the ROS from the very air it is cleaning.

As the air is drawn through the purification chamber, the ROS oxidize mold, bacteria, ethylene and other contaminants. Longer-lived ROS work in the treated space to continue to clean the air and to clean facility and produce surfaces. The purifier works continuously and quietly to circulate ROS through the treated space.

Since many food borne pathogens are airborne and cross-contamination occurs through air circulation, this system greatly reduces cross-contamination in the treated environment. It is also effective in reducing the ethylene levels in the air by oxidizing the carbon double bond structure of ethylene thereby creating water (H$_2$O) and carbon dioxide (CO$_2$).
Technology Acceptance and Regulatory Standards

OSHA

Natural ground-level concentrations of ozone (O₃) are typically 0.030ppm to 0.070ppm and may be higher than 0.100ppm in urban areas.

OSHA 24 hour average exposure limit 0.050ppm

OSHA 8 hour average exposure limit 0.100ppm

OSHA Short-term exposure limit 0.300ppm

EMS is effective as a disinfectant and sterilizing agent at levels of 50% or below of that specified by OSHA for 24-hour exposure levels.

The EMS-3000 Series System, as activated by an Ingersoll Rand EMS Certified Technician, operates at controlled ozone levels well below the thresholds dictated by OSHA.

FDA

FDA issued (June 26, 2001) a GRAS (Generally Regarded As Safe) statement as to the use and application of ozone in food processing.

EPA

EPA has standards for assuring that any equipment being sold as an ozone generator for use in the food processing arena have an EPA Establishment Number and that the entity files an annual report disclosing manufacturing and marketing of products in the U.S. and elsewhere.

Each piece of equipment bears the applicable EPA Establishment Number based on the physical site where the purifier was manufactured.

USDA

USDA followed the FDA publication in December 2001 with its own regulation allowing for uses in meats and poultry.

Organically Approved

The EMS-3000 Series System meets all organically approved regulations.
2 EMS-3000 Series System Operation

The EMS-3000 Series System uses the airflow within the room to maximize the distribution of the ROS (Reactive Oxygen Species). This unique feature is a major advantage of the EMS 3000 Series System especially when it is used to treat the ambient air within a target environment.

The EMS-3000 Series System is installed inside the cold room, while the control equipment should be installed on the exterior, providing reasonable access for the authorized operator and/or service personnel.

The ozone sensor is mounted in a location to control the EMS-3000 Series ROS Purifier for optimum production of ROS.

The diffusion pipes are installed in a manner such that the ROS is distributed effectively in the airflow of the blowers.

Figure 2. Diffusion System Installation
EMS-3000 Series System Components

The system consists of the Ingersoll Rand EMS-3000 Series ROS Purifier(s), diffusion system, control box, and the ozone (O₃) sensor. The EMS 3100 and EMS 3300 ROS Purifiers have different specifications.

EMS-3100 ROS Purifier

1. EMS-3100 ROS Purifier Indicators
   Each EMS-3100 ROS Purifier has four (4) indicators located on the front face of the enclosure door to provide visual feedback to the user. It is important to visually inspect the operation of the EMS-3100 ROS Purifier on a regular basis to ensure proper operation. Figure 3 shows the indicators.
   
   **HIGH**
   When lit indicates that the EMS-3100 ROS Purifier is producing ROS at full capacity.

   **MEDIUM**
   When lit indicates that the EMS-3100 ROS Purifier is producing ROS at partial capacity.

   **SYSTEM POWER**
   When lit indicates that the EMS-3100 ROS Purifier is connected to 120VAC.

   **CHECK SYSTEM**
   When lit the customer should contact an Ingersoll Rand EMS Certified Technician for service.

Figure 3. Front View of EMS-3100 ROS Purifier
Figure 4. Right Side View of EMS-3100 ROS Purifier

Figure 5. Left Side View of EMS-3100 ROS Purifier
2. **Cable Entry Glands**
   The cable entry glands provide sealable entry points to connect to the electrical supply, and to connect the 12AWG or 14AWG wires to the control box.

3. **Disconnect Switch**
   The disconnect switch turns the EMS-3100 ROS Purifier ON and OFF. The disconnect switch must be set to OFF and the cabinet locks must be unlocked to open the purifier.

4. **Enclosure Filter**
   The enclosure filter provides ventilation filtration for the EMS-3100 ROS Purifier.

5. **Exhaust Outlet**
   The exhaust outlet is the point at which the ROS is vented into the environment.

6. **Turbine Filter**
   The turbine filter protects the turbine and reactor from physical pollutants.

7. **Cabinet Lock**
   The cabinet locks keep the EMS-3300 ROS Purifier locked and protected against unauthorized intrusion. They must be opened and the disconnect switch must be set to OFF to open the purifier.

**EMS-3300 ROS Purifier**

8. **EMS-3300 ROS Purifier Indicators**
   Each EMS-3300 ROS Purifier has six (6) indicators located on the front face of the enclosure door to provide visual feedback to the user. It is important to visually inspect the operation of the EMS-3300 ROS Purifier on a regular basis to ensure proper operation. Figure 6 shows the indicators.

   **HIGH**
   When lit indicates that the EMS-3300 Series ROS Purifier is producing ROS at full capacity.

   **MEDIUM**
   When lit indicates that the EMS-3300 ROS Purifier is producing ROS at partial capacity.

   **SYSTEM POWER**
   When lit indicates that the EMS-3300 ROS Purifier is connected to 120VAC.

   **CHECK SYSTEM**
   When lit the customer should contact an Ingersoll Rand EMS Certified Technician for service.

   **OTHER INDICATOR LIGHTS**
   There are two (2) additional indicators between the Medium and the High indicators. During the activation process the Ingersoll Rand EMS Certified Technician will adjust the system to provide higher or lower ROS capacity for the Medium setting. This will determine how many more lights are illuminated.
Figure 6. Front View of EMS-3300 ROS Purifier

Figure 7. Right Side View of EMS-3300 ROS Purifier
9. **Cable Entry Gland**
The cable entry glands provide sealable entry points to connect to the electrical supply, and to connect the 12AWG or 14AWG wires to the control box.

10. **Disconnect Switch**
The disconnect switch turns the EMS-3300 ROS Purifier ON and OFF. The disconnect switch must be set to OFF and the cabinet locks must be unlocked to open the purifier.

11. **Enclosure Filter**
The enclosure filter provides ventilation filtration for the EMS-3300 ROS Purifier.

12. **Exhaust Outlet**
The exhaust outlet is the point at which the ROS is vented into the environment.

13. **Turbine Filter**
The turbine filter protects the turbine and purification chambers from physical pollutants.

14. **Cabinet Lock**
The cabinet locks keep the EMS-3300 ROS Purifier locked and protected against unauthorized intrusion. They must be opened and the disconnect switch must be set to OFF to open the purifier.

Figure 8 shows the factory-set configuration for the purification chambers corresponding to Medium and High purifier output. Purification chambers 1 and 2 operate for Medium, and purification chambers 1, 2, 3 and 4 operate for High (in the original factory settings). Modifications to this configuration may be made by the Ingersoll Rand EMS Certified Technician when the system is activated. Make note of the new configuration in this manual.
Figure 9. Factory Default Setting Within EMS-3300 ROS Purifier
The control box should only be opened by an authorized Ingersoll Rand EMS Certified Technician. The control box requires power in order to control the EMS-3000 Series System. The control box provides power to both the PLC and ozone sensor.

1. Indicator Lights
   The control box has twelve (12) indicators located on the front face to provide visual feedback to the user. The twelve (12) indicators support a maximum of six (6) purifiers, with two (2) indicators assigned to each purifier. The indicators provide a more convenient view of the system status outside of the controlled space, depending on where the control box is mounted.
   
   **SYSTEM POWER**
   When lit indicates that a particular purifier is connected to 120VAC. Each purifier has one System Power light.

   **CHECK SYSTEM**
   When lit the customer should contact an Ingersoll Rand EMS Certified Technician for service on that particular purifier. Each purifier has one Check System light.

2. Control Box Disconnect Switch
In the event that the room needs to be shut down temporarily (as in the case of pre-cooler rooms, and ripening rooms.), the control box disconnect switch is set to OFF. This disables all the purifiers connected to the control box and keeps them from producing ROS. Setting the control box disconnect switch to OFF will also disconnect the incoming electrical power to the control box, allowing the front cover to be opened.

3. Programmable Logic Controller (PLC)
   The PLC is programmed to control the operation of the purifiers that are connected to the control box. It displays information about the operation of the purifiers and their environment(s).

**Ozone Sensor**

The sensor is mounted near the intake of the airflow in the room in order to measure the amount of ozone (O₃) present. The ozone (O₃) is used as a marker to measure the level of ROS. The sensor is vital to control the production level of the purifier according to the requirements of the application. This ensures an effective and stable treatment.

**Figure 11. Sensor**
PLC Operation

The PLC (programmable logic controller) display has been designed to display information, providing a true snapshot of the environment and the EMS-3000 Series Purifier in real time.

At system startup the PLC will display the Version of EMS-3000 Series Software installed as shown in Figure 12.

Figure 12. PLC Startup Screen

The second screen that appears is the Main Menu as shown in Figure 13.

Figure 13. PLC Main Menu Screen

The authorized operator can then make a choice from the sub-menus listed.

1 - Setup Mode: For use by trained Ingersoll Rand EMS Certified Technicians.
2 - Run Mode: Standard Mode used to monitor the environment being purified.

3 - View Logged Data: requires password to view history of readings in the treatment room.

Run Mode (see Figure 14) is the screen primarily used for daily monitoring of the EMS-3000 Series System. The PLC will display SENSOR: OK if the ozone sensor is operating correctly, SENSOR: SF if the ozone sensor head has a failure, or SENSOR: NC if the EMS-3000 Series sensor cannot be detected due to damage or a failure in the environmental sensor base. The PLC also displays whether Stage 1 and Stage 2 are ON or OFF. These stages correspond to the High and Medium indicators on the EMS-3000 Series ROS Purifier. This screen also displays the ozone (O_3) level in the room and updates it approximately every 95 seconds, as well as the temperature and relative humidity, which are updated every 15 seconds.

The main reading displays the Room ID, Sensor Status, Main O_3 reading, Stage status, Relative Humidity, and Temperature at the environmental sensor.

**Figure 14. Run Mode Screen**

The readings of ozone (O_3) will vary depending on the requirements of the application, commodity, and temperature. The Ingersoll Rand EMS Certified Technician will have programmed the PLC accordingly and can explain what the range should be per room. Generally speaking the ozone readings can range as low as 0.000ppm for a short period of high activity and could read at a high of 0.100ppm for short periods or in closed rooms. The nominal reading is in the range of 0.020ppm to 0.050ppm.

The View Logged Data screen is used to look at historical data that was recorded for the room. This data includes the date, time, ozone (O_3), temperature, and relative humidity.

The logged data can prove valuable in determining the status of the room based on activity, sensor issues, or potential intermittent events.

In order to access this screen, the authorized operator needs to press <ESC> to return to the main menu. Then press <3> and the operator will be prompted for a password. Type in 0000 unless the Ingersoll Rand EMS Certified Technician has provided another password. The View Logged Data screen will appear as shown in Figure 15.
In order to scroll through the data, which is set to a default of recording every 60 minutes, the operator can press:

Moves to the next logged event.

Moves to the previous logged event.

When finished viewing the logged data, the operator can then press <ESC> to return Run Mode.

**Ozone Sensor Operation**

The ozone sensor must be operational for the system to work. If it is damaged, or a failure occurs, the PLC will shut down the purification chamber.

The sensor is sensitive to water and depends upon good airflow. The sensor was installed by the Ingersoll Rand EMS Certified Technician to provide the best measurement results and where airflow will not be blocked. Once installed, the sensor should not be moved.

For best results, ensure there is nothing placed in the vicinity of the sensor that would block airflow to the sensor or create excessive air turbulence around the sensor. This would cause the speed of the internal fan to fluctuate and could cause sensor failure.

The Ingersoll Rand EMS Certified Technician will install the proper sensor for the room type (controlled atmosphere/low oxygen head vs. standard head). If the room application changes please contact the Ingersoll Rand EMS Certified Technician, as a different sensor head may be required.
Applications

There are two main atmospheres: RA – Regular atmosphere (21% O₂), and CA - Controlled Atmosphere (1.5% - 5%).

There are six main room types: Pre-Cooler (RA), Cold Storage (RA), Processing Rooms (RA), Food Preparation or Kitchen Facility (RA), Odor Control (RA), and Cold Storage (CA).

There are five main categories of commodity or applications: Fruits & Vegetables, Meats, Seafood, Flowers, and Odor Abatement.

Depending on the atmosphere, commodity, and temperature, the EMS-3000 Series System has been configured to meet the application. Some important information to note:

- Flowers: The ozone (O₃) levels should average 0.030ppm and not exceed 0.040ppm.
- Processing Rooms, Food Preparation and Kitchens: The ozone (O₃) levels should average 0.050ppm.
- Odor Control: Depending on the application the ozone (O₃) levels can be stronger if needed, especially with limited exposure to workers/customers.
- CA (Controlled Atmosphere): The EMS-3000 Series Purifier should not be ON until the oxygen (O₂) level has reached 10% or lower.

System Operation Example

The EMS-3000 Series System constantly balances output in response to the monitored ozone conditions to stay within the programmed limits. Three control points are defined during the installation, which are used to calculate the activation of high or medium output when the 3000 Series System is in operation.

To illustrate the typical operation of the EMS-3000 Series System, an example setup is listed below using the following ozone level settings:

- Low Control Point: 0.020ppm
- Med Control Point: 0.030ppm
- High Control Point: 0.040ppm

To show the possible balancing operation that would result using the above example control points, Figure 16 lists the ozone level as well as the Medium and High activation status indicators in a chronological order:

**Figure 16. Ozone Level vs. Activation Status Indicators**

<table>
<thead>
<tr>
<th>Time</th>
<th>ROS Level</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00:00</td>
<td>0.000ppm</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>12:01:30</td>
<td>0.021ppm</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>12:03:00</td>
<td>0.024ppm</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>12:04:30</td>
<td>0.032ppm</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>12:06:00</td>
<td>0.037ppm</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>12:07:30</td>
<td>0.048ppm</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>12:09:00</td>
<td>0.054ppm</td>
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<td>OFF</td>
</tr>
<tr>
<td>12:10:30</td>
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<td>OFF</td>
</tr>
<tr>
<td>12:12:00</td>
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<td>OFF</td>
</tr>
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<td>OFF</td>
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<td>12:15:00</td>
<td>0.018ppm</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>12:16:30</td>
<td>0.025ppm</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>12:18:00</td>
<td>0.036ppm</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>12:19:30</td>
<td>0.051ppm</td>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>
Figure 16 illustrates the following points regarding the EMS-3000 Series System operation:

- The PLC will activate both Medium and High outputs at the same time when the ozone level is under the set low control point (0.020ppm).
- The PLC will deactivate the High output when the ozone level reaches the medium control point (0.030ppm).
- The PLC will deactivate both the Medium and High outputs at the same time when the ozone level is equal to or exceeds the high control point (0.040ppm).
- Once the ozone level reaches the high control point, the PLC will wait until the ozone level returns to equal or below the low control point before repeating the process over again. Since the PLC will wait for ozone level to fall below the low control point (0.020ppm) before restarting the whole process over again, it is possible for the ozone level to read 0.034ppm with both outputs deactivated.
- Ozone is a gas, and as such, the movement of ozone in the environment is dependent upon the existing airflow within the environment.
- To prevent shifts in temperature and to avoid decreases in the concentration levels of ozone, it is important to keep the doors of the treated environment closed as much as possible.
3 Maintenance

Maintenance Overview

The Ingersoll Rand EMS-3000 Series System product line is manufactured to the highest standards using the highest quality parts, components, and technology. Due to the industrial nature of the environments in which the EMS-Series 3000 Systems are often installed, a well-defined maintenance schedule will ensure many years of continuous operation. While most maintenance tasks must be performed only by an Ingersoll Rand EMS Certified Technician, filter replacements are to be handled by the customer. The equipment is designed for continuous operation. Listed below are some precautions, notes and recommendations regarding the maintenance of EMS-3000 Series Systems:

- Wear appropriate Personal Protection Equipment (PPE) at all times.
- Maintenance and replacement of parts and components must be performed promptly and in a timely manner as described in the Maintenance Schedule listed in this chapter.
- The scheduled maintenance and/or replacement of parts must be performed by Ingersoll Rand EMS Certified Technicians. The appropriate parts must be used in the replacement process and the scheduled recommended equipment maintenance schedules must be followed.
- It is recommended that all personnel responsible for the operation of the EMS-3000 Series System be trained on the operation and maintenance requirements of the equipment.
- Some of the components of the EMS-3000 Series System operate with **HIGH VOLTAGE**. Therefore the operation of the EMS-3000 Series System by unauthorized personnel will significantly increase the risk of accidents. Please contact the Ingersoll Rand EMS service department should any assistance and or extra training be needed.
- The EMS-3000 Series System must be kept clean at all times. As with all electrical equipment, avoid excessive contact with water and excessive humidity at all times. Short circuits may occur if the equipment comes in direct contact with liquids while it is in operation.
- Filter replacements can be performed by the customer.
- The customer should also periodically wipe the EMS-3000 Series System with a damp cloth and mild detergent like Simple Green. Abrasives or solvents should not be used.
- Please contact an Ingersoll Rand EMS Certified Technician should you need any assistance.
**Filter Replacement**

Reference your Ingersoll Rand parts manual for your EMS-3000 Series System filter part numbers. Ensure you have a sufficient supply of filters to operate your EMS-3000 Series System for the next six months.

In order to keep your system working at its optimal output, we recommend you change your filters every two (2) weeks, as well as inspect the filter media once a week.

Please note, in certain environments the interval of filter media replacement could be more or less, depending on the exposure to contaminants. A weekly visual inspection of the filter media will help you determine the need. **This is a very important step to keep your system working at the level of performance for which the application was designed.**

The quantity and type of filter depends on the model(s) installed. See the chart below to determine the quantity and type needed.

**Figure 17. Filter Requirement Chart**

<table>
<thead>
<tr>
<th>Model</th>
<th>EMS-3100</th>
<th>EMS-3300</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMS-3300 Enclosure Filter</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>EMS-3000 Series Turbine Filter</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EMS-3100 Enclosure Filter</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**EMS-3300 Enclosure Filter Media Replacement**

1. Turn the disconnect switch on the EMS-3000 Series Purifier to the OFF position.
2. Remove the finger guard
3. Pry the finger guard upwards to remove it, and set it aside.
4. Discard the old filter
5. Replace with new EMS-3300 enclosure filter media
6. Snap on the finger guard with even pressure.

**Figure 18. EMS-3300 Enclosure Filter**
EMS-3000 Series Turbine Filter Media Replacement
1. Pry filter retainer from finger guard assembly (on EMS-3100 and EMS-3300 models)
2. Insert the tip of a small standard screwdriver into the chamfered area located on the circumference of the filter retainer and gently pry the filter retainer from the finger guard assembly.
3. Discard old filter
4. Replace filter with new EMS-3000 Series turbine filter media
5. Reinstall filter retainer into finger guard assembly
6. Gently snap together the filter retainer into the finger guard assembly (use the standard screwdriver if necessary)

Figure 19. EMS-3000 Series Turbine Filter

EMS-3100 Enclosure Filter Replacement
1. Remove finger guard retaining screws
2. Discard old filter
3. Replace EMS-3100 enclosure filter media
4. Reinstall finger guard

Figure 20. EMS-3100 Enclosure Filter
System Shutdown for Room Maintenance
During normal operation of the EMS-3000 Series System maintenance will be done on the room as well as on the EMS-3000 Series System.

Be aware that any gases used on products, cleaning chemicals used in sanitation, or dust from room construction or maintenance can damage the EMS system.

It is very important to shut down the system completely when any chemicals are used in the room or to perform room maintenance. The steps for shutting down the EMS-3000 Series System for room maintenance are as follows:

1. Disconnect all the EMS-3000 Series ROS Purifiers from their 120VAC Power source. This step may require access to the circuit breaker panel in the facility.

2. Turn the disconnect switch on the control box to the OFF position.

3. Turn the disconnect switch on the EMS-3000 Series ROS Purifier to the OFF position.

4. Verify the PLC screen is powered down.

5. Verify each EMS-3000 Series ROS Purifier’s indicators are OFF.

The steps for shutting down the EMS-3000 Series System for room maintenance are as follows:

Proper protection from water is required for the EMS-3000 Series ROS Purifier(s) and sensor. Fully cover the purifier(s) and sensor when spraying the room for cleaning purposes.

The diffusion system has holes drilled in front of each of the fans to distribute the purified air. If these holes are sprayed with water, water may migrate back to the EMS-3000 Series ROS Purifier and into the purification chamber. The EMS-3000 Series ROS Purifier is capable of working in high humidity conditions (up to 90% RH), but direct contact with water must be avoided at all times. A list of recommendations to protect the EMS-3000 Series ROS Purifier and sensor is:

1. Cover each of the intake fans with plastic and tape with a non-residue tape.

2. Lift and remove the diffusion pipe at the purifier and place plastic over the exhaust ports.

3. Cover the cable entry points.

4. Cover the entire EMS-3000 Series ROS Purifier with clear plastic sheeting and tape to protect against direct water contact.

5. Loosen the ozone sensor base from the wall by loosening the top mounting screw from the sensor base. Leave the sensor attached to the sensor base. Gently lift up on the sensor base and cover the ozone sensor in a plastic bag and tape.

Perform room maintenance and remove all plastic and remount sensor before restarting the room for the season.
Figure 21. Example of EMS-3100 Filters Covered in Clear Plastic and Tape

Figure 22. Example of Ozone Sensor Bagged and Taped

Figure 23. Example of EMS-3100 ROS Purifier Bagged and Taped
Service Schedule

Maintenance services can be purchased with the initial purchase of each EMS-3000 Series System.

The scheduled maintenance must be performed by authorized Ingersoll Rand EMS Certified Technicians.

The monthly scheduled maintenance to be performed by the customer includes:

- Filters - Replace (every two weeks if required)
- Verify system operation
The 6 month scheduled maintenance performed by the Ingersoll Rand EMS Certified Technician includes:

- Purification Chambers - Replace
- Power Supplies - Operation Verification / Tune
- Turbine - Operation Verification
- Filters – Replace
- PLC - Operation Verification /Logged Data download
- Sensor - Replace Sensor head / Verify Operation

Any malfunctioning of the EMS-3000 Series System must be promptly reported to Ingersoll Rand. Ingersoll Rand will make all effort to repair or replace malfunctioning equipment as quickly as possible.

The revision and maintenance of the equipment must be performed by Ingersoll Rand EMS Certified Technicians, using the appropriate instrumentation and following the timing indicated in the table listed below. Filter replacement is to be performed by the customer.

**Figure 26. EMS-3000 Series Recommended Equipment Maintenance Schedule**

<table>
<thead>
<tr>
<th>Component Identification</th>
<th>Recommended maintenance</th>
<th>Performed By</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure Filter</td>
<td>Replace with new filter every 2 weeks</td>
<td>Customer</td>
</tr>
<tr>
<td>Turbine Filter</td>
<td>Replace with new filter every 2 weeks</td>
<td>Customer</td>
</tr>
<tr>
<td>Purification Chamber</td>
<td>Replace every 6 months</td>
<td>Ingersoll Rand EMS Certified Technician</td>
</tr>
<tr>
<td>PLC</td>
<td>Verify Operation. No replacement necessary.</td>
<td>Ingersoll Rand EMS Certified Technician</td>
</tr>
<tr>
<td>Sensor</td>
<td>Recalibrate sensor head every 6 months. Replace as required.</td>
<td>Ingersoll Rand EMS Certified Technician</td>
</tr>
</tbody>
</table>
4 Troubleshooting

FAQ (Frequently Asked Questions)

Q: Does having the doors open make a difference?
A: Yes. The room environment must be controlled for the EMS-3000 Series System to run effectively.

Q: I see fog in the room, is this normal?
A: Yes. The fog is water vapor. Depending on the environment, a moisture fog can form in the room. Fog is most often noticed in rooms maintained at temperatures below 36°C. Some of these commodities are: citrus, apples, pomegranates, and pears.

Q: What if I choose to change the application of my purified room?
A: Call an Ingersoll Rand EMS Certified Technician or your Application Engineer to see if any further changes are needed for your system.

Q: Can the EMS-3000 Series System be relocated in the room?
A: Yes. Call an Ingersoll Rand EMS Certified Technician or Application Engineer to arrange the necessary changes.

Q: How do I tell if the system is sanitizing?
A: If the System Power indicator is illuminated then the system is sanitizing. If the Medium indicator is also illuminated, then the system is producing ROS. If the Check System indicator is illuminated, call an Ingersoll Rand EMS Certified Technician.

Troubleshooting

If Ozone (O\textsubscript{3}) reading is 0.000ppm as displayed on PLC screen.

Before calling Ingersoll Rand please check the following:

Is the System Power indicator on the Purifier OFF?
- Check power at the facility circuit breaker.
- Check that the disconnect switch on the control box is in the ON position.
- Check that the disconnect switch on the purifier is in the ON position.

Are the Purifier’s Medium and High indicators ON?
- If ON, check the turbine filter for obstruction. Replace filter if necessary.

Is anything obstructing airflow to the sensor?
- Remove obstruction.

Are all cable connections between control box and sensor secure?
- Tighten any loose cable connections.
If Ozone (O₃) reading is greater than 0.100ppm on PLC screen.

Before calling Ingersoll Rand please check the following:

Review the data on the PLC screen every thirty (30) minutes to verify whether this is a temporary condition.

Is room empty?
  - ROS system is calibrated to work with a room that contains product.

If Ozone (O₃) reading is 9.999ppm:

Call Ingersoll Rand. The sensor is failing.
5 Contact Information

Who To Contact

Corporate
Ingersoll Rand Company
Climate Control Technologies
12999 St. Charles Rock Road
Bridgeton, MO 63044

Phone: (888) 883-0383

Technical

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Installation

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Providing equipment and services to manage controlled-temperature environments for food and other perishables, our Climate Control Technologies sector encompasses both transport and stationary refrigeration solutions. Our product brands include Thermo King®, a world leader in transport temperature control systems, and Hussmann®, a manufacturer of refrigeration and food merchandising equipment.

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