**Completion Steps**

- Allow the formalin vapor a minimum contact time of 8 hours inside the cabinet, preferably 16 hours, but not exceeding 24 hours.

- The ammonia evaporator will automatically start after the "CONTACT TIME" is finished, if possible. It’s advisable to evacuate the ammonia by opening the cabinet. If this is not possible, then the ammonia will be automatically evacuated.

- After the ammonia has been evaporated, turn on the blower and allow it to run for a minimum of 5 minutes.

- The concentration of formalin and ammonia should be checked after 5, 7.5, 10, and 15 minutes, respectively.

**Validation Of Decontamination Procedure (Optional)**

- Place some Bacillus subtilis var. niger spore strips inside the cabinet prior to decontamination.
- After the decontamination cycle, prior to resuming work on the cabinet.
- The filter canister, should be worn. The filter must be selected for the appropriate downstream HEPA filter.
- The filter canister should be replaced regularly following the manufacturer’s recommendations.
- The filter canister should be taped off using plastic film or cardboard or some other suitable material. This will minimize the risk of personnel in the event the decontamination procedure has been successfully verified.

- By pressing MENU button after decontamination process, it started, the decontamination / neutralization cycle is interrupted and the following menu options are then displayed:
  - **CANCEL PROCESS**: This option allows the user to cancel the process after the decontamination / neutralization cycle is interrupted.
  - **RESUME STEP**: This option allows the user to resume the decontamination process after the decontamination / neutralization cycle is interrupted.
  - **SKIP STEP**: This option allows the user to skip the next stage in the decontamination process.

- **Evacuation Process**: In case of an emergency, the user can cancel the decontamination process by choosing this option.

**Standards Compliance**

- The unit enables decontamination to be accomplished by the standard protocol as recommended in EN 12469 European standard for microbiological safety cabinets with formaldehyde and ammonia solutions.
- ANSI / NSF49 (American standard for Class II cabinets) recommends decontamination using formaldehyde and ammonia which is a similar protocol but with agents in the solid (in place of liquid) state, and as such this vaporizer can also be said to be in compliance with the ANSI / NSF49 recommended decontamination protocol.

---

**Formalin Vaporizer**

The Premium Solution for Biological Safety Cabinet Decontamination

Since 1978, Esco has emerged as a leader in the development of controlled environment, laboratory and cleanroom equipment. Products and its operations are manufactured, distributed, marketed and supported by our international network. Esco’s unique products, developed and backed by our university-trained engineers, meet the demanding specifications of the clinical, life science, research, and industrial laboratory community. www.escoglobal.com

- **Equipment Products**
  - Biological Safety Cabinets, Class II, III
  - Fume Hoods
  - Clean Benches
  - Cleanroom Fan Filter Units, Modular Rooms, Air Showers, Pass Thrus
  - PCR Thermal Cyclers, Conventional, Real-Time
  - Specialty Workstations: In-Vitro Fertilization, Powder Weighing
  - Hospital Pharmacy Isolators, Cytotoxic Safety Cabinets
  - Animal Containment Workstations
  - Cleanroom Fan Filter Units, Modular Rooms, Air Showers, Pass Thrus

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**World Class. Worldwide.**

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Esco Asia Pte Ltd • 4-27 Changi South Street 2 • Singapore 487 771
Tel +65 6996 8000 • Fax +65 6996 8030 • asia@escoglobal.com

www.escoglobal.com
Completely enclose the cabinet using the air-tight plastic bag and 2 • Internal heat insulation prevents cross contamination.
• Thermostats for the formalin and ammonia chambers prevent overheating.
• Full-sized grip handles on both sides for easy handling.

Control System Features
• Specifically designed for safety cabinets decontamination in an automatic control and no manual intervention required through the entire decontamination cycle.
• In case of power failure the evaporator will recover automatically once the power resumes. Microprocessor unit will self-test in case of any processor failure.
• Pre-delay, contact time, neutralization timers, are adjustable using the easy view touch control panel with large LCD display on the front of the unit.
• Audible and visual alarm warns of overheating during a cycle.
• Password control to prevent decontamination timers from being adjusted by unauthorized personnel.

Decontamination Procedure
• Operator starts process by pressing a button on the touch panel.
• Pre-delay timer allows decontamination operator to seal the cabinet before evaporation of formalin commence. Delay period can be set from 1 to 5 minutes.
• Vaporization of formalin solution commences to release the formaldehyde gas to the cabinet.
• LCD display will show reminder for operator to seal the cabinet fan to ensure even distribution of the gas.
• Water automatically adds when final formalin solution has completely boiled off.
• Contact time timer starts to regulate the period for which the formalin gas is exposed to the cabinet’s internal surfaces for the decontamination to take effect.
• Neutralization process begins automatically, to vaporize the ammonia solution.
• LCD display will show reminder for operator to cycle the cabinet fan to ensure even distribution of the gas.
• Neutralization timer starts to regulate the period for which the neutralization reaction takes place.

Common List of Equipments Used
• Device to measure the formaldehyde concentration.
• Device to measure the ammonia concentration.
• Tubes with a measuring range of 0-100 ppm are recommended.
• Spore strips (optional).

Apparatus
• Bottle
• Measuring cylinder
• Flask (250 ml is recommended)
• Air tight that can enclose the entire cabinet can be obtained from Esco.
• Measuring tap
• Brine tank
• Hand drip scissors, and sodium hydroxide (NaOH and Mg(OH)2)

Decontamination Process
Calculate the amount of formalin, 25% ammonia, and water required, which is 85 ml each, for every 1 cubic meter of decontaminated volume.

Water is poured into the formalin tank to increase the decontamination process humidity to be above 60%. If the room humidity should exceed 70% the formalin to usage needs to be optimised to decontaminating a large space, such as a small room, where the formalin is exposed. In this instance the water shall not be poured into the formalin tank, but instead, the vaporizer shall be kept in the decontamination process. To anticipate a worst case scenario, a relatively large size “laboratory safety cabinet, with the body height of 1.7 m (5.7 feet) and width of 0.9 m (35 inches), mounted on a “full” 60 cm (20 inches) standing height support stand’ will have the volume enclosed by the air tight bag, and the corresponding required solution mixture, approximately as follows:

<table>
<thead>
<tr>
<th>Cabinet Width</th>
<th>ppm</th>
<th>ppm</th>
<th>ppm</th>
</tr>
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<tbody>
<tr>
<td>2 ft / 0.6 m</td>
<td>85</td>
<td>25</td>
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<tr>
<td>6 ft / 1.8 m</td>
<td>34</td>
<td>26</td>
<td>33</td>
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Note to the customer: Insert electrical voltage number into last model number digit _ when ordering.

Decontamination Steps
1. Connect the evaporator to the air inlet of the decontaminator.
2. Start the evaporator, and let it warm up to its operational temperature.
3. Open the secondoston PROTECT button, select constant power, and debit the appropriate amount of formalin to be used.
4. Select the water volume in the matrix of the evaporator.
5. Pour the calculated water amount into the water container.
6. Start the evaporator, press PROTECT button, and evacuate the water.
7. When the evaporator is connected to the decontaminator, to acquire the appropriate solution mixture, make sure the decontaminator is kept under constant supervision, for example, internal and external decontamination. To avoid the risk of opening the door while the process is active, take precautions to prevent the door from being opened.

In case of connecting a flexible hose tube to the evaporator, the decontaminator shall be coordinated with the decontaminator.

Important Notes
• To anticipate a worst case scenario, a relatively large size “laboratory safety cabinet, with the body height of 1.7 m (5.7 feet) and width of 0.9 m (35 inches), mounted on a “full” 60 cm (20 inches) standing height support stand’ will have the volume enclosed by the air tight bag, and the corresponding required solution mixture, approximately as follows:

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As a global leader in premium quality biological safety cabinets, Esco is committed to providing its customers with a full range of one-stop service products to comply with their requirements. The Esco formalin vaporizer is a microprocessor-controlled unit that simplifies and automates the decontamination process for all sizes and makes of biological safety cabinets. It also increases safety for the decontamination operator and laboratory personnel since no manual intervention is required during the entire process.

**Dependable Construction**
- **Durable**, heavy-duty full stainless steel construction.
- Electrical and electronic components are isolated from thehearing chambers to prevent exposure to chemicals and level which can reduce operator life.
- Thermostats for the formaldes and ammonia chambers prevent overheating.
- Backup thermostat ensures the temperature is required during the entire process.
- Internal heat isolation prevents cross heating of chambers and damage to electronic components.
- Manual shut-off switch isolating safety cabinets, Esco is committed to providing its customers with a full range of one-stop service products to comply with their requirements. The Esco formalin vaporizer is a microprocessor-controlled unit that simplifies and automates the decontamination process for all sizes and makes of biological safety cabinets. It also increases safety for the decontamination operator and laboratory personnel since no manual intervention is required during the entire process.

**Control System Features**
- Specifically designed for safety cabinet decontamination in a user-friendly and effortless manner.
- Manual control over the decontamination steps.
- Automatic operation once the decontamination process has started.
- User-friendly touchpad display.
- Pre-set programs for easy operation.
- Easy to use and easy to maintain.
- Error codes for quick troubleshooting.

**Common List of Equipments Used**
- **Formalin Vaporizer**
  - **Password control to prevent decontamination timers from being adjusted by unauthorized personnel.**
  - **Pre-delay timer allows decontamination operator to seal the cabinet before vaporization.**
  - **Backup thermostat automatically resumes the decontamination cycle once the power supply is restored again.**

**Decontamination Cycle**
- **Operator starts process by pressing a button on the touchpad.**
- **Pre-delay timer allows decontamination operator to seal the cabinet before vaporization.**
- **Duration of the decontamination cycle is required during the entire process.**

**Decontamination Process**
- Calculate the amount of formalin to be used on a case-by-case basis. Suitable materials may be ordered from Esco.
- **Water is poured into the formalin tank to increase the decontamination area humidity to be above 60% if the room humidity should prove low and the formalin usage needs to be optimized to decontami- nate a large space, such as a small room, as the decontamination process proceeds.**
- **Note to customer:** Insert electrical voltage number into last model number digit when ordering.

**Decontamination Steps**
- **Prepare the air-tight plastic bag and 2" wide tape that can enclose the entire cabinet (can be ordered from Esco).**
- **Connect the formalin vaporizer to the electrical outlet when present.**
- **Do not open the aerosol sampling cap while the operator is inside the decontamination area.**
- **Surface decontaminate the cap of the aerosol unless otherwise specified by the appropriate authority.**
- **Close the door of the lab to seal off all personnel accessible areas.**

**General Specifications, Formalin Vaporizer**

<table>
<thead>
<tr>
<th>Model</th>
<th>Volume (m³)</th>
<th>Power Consumption (W)</th>
<th>Compressor</th>
<th>Standard Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>300</td>
<td>9.1</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>2</td>
<td>1.5</td>
<td>350</td>
<td>9.1</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>400</td>
<td>9.1</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>4</td>
<td>2.5</td>
<td>450</td>
<td>9.1</td>
<td>Stainless Steel</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>500</td>
<td>9.1</td>
<td>Stainless Steel</td>
</tr>
</tbody>
</table>

**Formalin**

- **Current 2.5 A**
- **For Room with RH >60% 9.4 m³/h**

**Ammonia**

- **Water (ml) - optional**
- **Volume (m³) 1 1.5 2 2.5 3**

**Password Control**
- **Operator starts process by pressing a button on the touchpad.**
- **Pre-delay timer allows decontamination operator to seal the cabinet before vaporization.**
- **Backup thermostat automatically resumes the decontamination cycle once the power supply is restored again.**

**Decontamination Area**
- **Surface decontaminate the cap of the aerosol unless otherwise specified by the appropriate authority.**
- **Close the door of the lab to seal off all personnel accessible areas.**

**Important Notes**
- **Avoid and visual alarms warn of overheating during a cycle.**
- **Password control to prevent decontamination timers from being adjusted by unauthorized personnel.**
- **Specifically designed for safety cabinet decontamination in a user-friendly and effortless manner.**
- **Manual control over the decontamination steps.**
- **Automatic operation once the decontamination process has started.**
- **User-friendly touchpad display.**
- **Pre-set programs for easy operation.**
- **Easy to use and easy to maintain.**
- **Error codes for quick troubleshooting.**

**Optional Accessory – Formalin Vaporizer**

**Decontamination Cycle**
- **Operator starts process by pressing a button on the touchpad.**
- **Pre-delay timer allows decontamination operator to seal the cabinet before vaporization of formalin containers.**
- **Duration of the decontamination cycle is required during the entire process.**

**Decontamination Process**
- **Calculate the amount of formalin to be used on a case-by-case basis. Suitable materials may be ordered from Esco.**
- **Water is poured into the formalin tank to increase the decontamination area humidity to be above 60% if the room humidity should prove low and the formalin usage needs to be optimized to decontami- nate a large space, such as a small room, as the decontamination process proceeds.**
- **Note to customer:** Insert electrical voltage number into last model number digit when ordering.
**Decontamination Cycle**
- Start by filling one of the compartments of the cabinet. The air-tight plastic bag contains formaldehyde vaporizer to release the formaldehyde gas to the cabinet.
- The LCD display will show the remaining time until the completion of the cycle.
- The operator can then return to the lab and seal the cabinet before vaporization begins.

**Common List of Equipment Used**
- To decontaminate the formaldehyde concentration.
- To decontaminate the ammonia concentration.
- To decontaminate the oxygen concentration.
- To decontaminate the carbon dioxide concentration.

---

**Decontamination Process**

1. **Decontamination Cycle**
   - Open both formalin and ammonia tanks using the power supply.
   - Make sure to connect the vaporizer to a power source before proceeding.
   - Ensure the vaporizer is connected to the power source before connecting it to the formalin and ammonia tanks.
   - Ensure the volume of formaldehyde gas has been adjusted according to the surrounding environment.

2. **Decontamination Steps**
   - Start the decontamination cycle.
   - Ensure that the operator has a clear understanding of the process.
   - The operator should take all necessary precautions to keep the surrounding area contamination-free.

---

**General Specifications, Formalin Vaporizer**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>FV-00_</td>
</tr>
<tr>
<td>Voltage</td>
<td>220-240V</td>
</tr>
<tr>
<td>Frequency</td>
<td>50Hz</td>
</tr>
<tr>
<td>Current</td>
<td>1A</td>
</tr>
<tr>
<td>Power Source</td>
<td>240V, 50Hz</td>
</tr>
<tr>
<td>Dimensions</td>
<td>60 x 70 x 110 cm</td>
</tr>
<tr>
<td>Weight</td>
<td>25 kg</td>
</tr>
<tr>
<td>Capacity</td>
<td>60 ml</td>
</tr>
<tr>
<td>Water (ml)</td>
<td>85</td>
</tr>
<tr>
<td>Formalin (ml)</td>
<td>128</td>
</tr>
<tr>
<td>Ammonia (ml)</td>
<td>170</td>
</tr>
<tr>
<td>Volume (m³)</td>
<td>1</td>
</tr>
</tbody>
</table>

---

**Important Notes**
- Remember that the amount of time you have for this procedure is limited.
- Make sure to connect the vaporizer to the power source before proceeding.
- Ensure the vaporizer is connected to the power source before connecting it to the formalin and ammonia tanks.

---

**Decontamination Steps**

1. **Decontamination Cycle**
   - Start the decontamination cycle.
   - Ensure that the operator has a clear understanding of the process.
   - The operator should take all necessary precautions to keep the surrounding area contamination-free.

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Formalin Vaporizer

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Validation Of Decontamination Procedure (Optional)

- Place some Bacillus subtilis var. niger spore strips inside the cabinet prior to decontamination.
- Add absorbable tray.
- Dry past.
- Insertion of N95 filter.
- Place small strips outside the decontamination room for positive control (optional).
- Remove all the spore strips and place in Trypticase-soy broth and incubate for 2 days at 37°C.
- If there is no growth of bacteria inside the broth, both tests remain clear, the decontamination procedure has been successfully verified.

Standards Compliance

- The unit enables decontamination to be accomplished by the standard protocol as recommended in EN 12469 (European standard for microbiological safety cabinets) with formalin and ammonia solutions.
- ANSI/NSF49 (American standard for Class II cabinets) recommends decontamination using formaldehyde and ammonia Whatever is a similar protocol but with agents in the solid instead of liquid state, and as such, this vaporizer can also be said to be in compliance with the ANSI/NSF49 recommended decontamination protocol.

Formalin Vaporizer

Model FV-00_

- formaldehyde
- ammonium

Completion Steps

- 1. Before the filters are removed from the cabinet, their contaminant free should be handled using plastic film or contoured or other outside materials.
- 2. Should filter through a dry filter.
- 3. Small filters should be disposed following local regulations. They may have to be incinerated or remain as medical waste. They should be double bagged and disposed of.
- 4. Spore strips should be disposed of in accordance with the requirements.
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- 3. Small filters should be disposed following local regulations. They may have to be incinerated or remain as medical waste. They should be double bagged and disposed of.
- 4. Spore strips should be disposed of in accordance with the requirements.
- 5. Small strips outside the decontamination room for positive control (optional).

Validation Of Decontamination Procedure (Optional)

- Place some Bacillus subtilis var. niger spore strips inside the cabinet prior to decontamination.
- Add absorbable tray.
- Dry past.
- Insertion of N95 filter.
- Place small strips outside the decontamination room for positive control (optional).
- Remove all the spore strips and place in Trypticase-soy broth and incubate for 2 days at 37°C.
- If there is no growth of bacteria inside the broth, both tests remain clear, the decontamination procedure has been successfully verified.
Steps to Complete Decontamination

1. Before the filters are removed from the cabinet, their contaminated faces should be taped off using plastic film or cardboard or some other suitable material. This will minimize the risk of personnel in the event the decontamination process is interrupted.

2. Remove all the spore strips and place in Trypticase-soy broth and incubate for 2 days at 37°C. If the broth (the broth remains clear), the decontamination process by choosing this option.

3. Validation of Decontamination Procedure (Optional)

   - Place some bacterial strips v/v to formalin filter is required when opening the cabinet.
   - Allow the ammonia vapor to neutralization time of 2 hours inside the cabinet.
   - After the “CONTACT TIME” is finished, the time will inform the user to open the plastic bag. Please be aware that the formalin and/or ammonia concentration inside the plastic bag may be above the Short Term Exposure Level (STEL) and full face mask with formalin filter is required when opening the plastic bag.
   - During this procedure, until the area is determined to be safe, a full face gas mask equipped with a biological filter is necessary. When the formalin concentration in room air.
   - Check the formaldehyde concentration in room air at the end of the decontamination cycle. If the concentration is not equal to 0, the decontamination process is not complete.

4. After approximately 25, 50, 75, and 100% of the formalin being evaporated, turn on the cabinet blower for 1 minute to circulate the formalin throughout the cabinet. Below is the approximate time interval to turn on the blower, corresponding to the formalin and ammonia table for the “worse case scenario” as previously discussed:

   - Blower ON interval 5 min 7.5 min
   - Volume (m^3) 1 1.5 2 2.5 3
   - Duration 10 min 12.5 min 15 min

5. Completion Steps

   - Remove all the spore strips and place in Trypticase-soy broth and incubate for 2 days at 37°C.
   - If there is no growth of bacteria inside the broth the bioburden cleard, the decontamination procedure has been successfully validated.
   - Remove all the spore strips and place in Trypticase-soy broth and incubate for 2 days at 37°C.
   - If there is no growth of bacteria inside the broth the bioburden cleard, the decontamination procedure has been successfully validated.
   - After the “NEUTRAL TIME” is finished, the time will inform the user to open the plastic bag. Please be aware that the formalin and/or ammonia concentration inside the plastic bag may be above the Short Term Exposure Level (STEL) and full face mask with formalin filter is required when opening the plastic bag.
   - After the ammonia vaporizer will automatically start after the “CONTACT TIME” is finished. However, it is not required, and not as important as circulating the formalin.
   - Allow the ammonia vapor to neutralization time of 2 hours inside the cabinet. (NEUTRAL TIME)

6. Standards Compliance

   - The unit enables decontamination to be accomplished by the standard protocol as recommended in EN 12469 (European standard for microbiological safety cabinets) and the American Society for Testing and Materials (ASTM E 2132-94), 1998). This is a standard protocol but with安徽 returned to the standard, as this vaporizer can be said to be in compliance with the ANSI/NSF49 required decontamination protocol.

   - Formalin Vaporizer

   - The Premium Solution for Biological Safety Cabinet Decontamination

   - Formalin Vaporizer

   - Model FV-00_

   - By pressing MENU button after decontamination process is started, the decontamination / neutralization cycle is interrupt- and the following menu options are then displayed.

   - CANCEL PROCESS: In case of emergency, the user can cancel the decontamination process by choosing this option.