INTRODUCTION

Thank you for your purchase of an Aero-K® aerosol fire suppression system. This manual designed to provide you with a general understanding of the product, as well as, general information on installation, operational, and maintenance parameters. It is not a detailed design, installation, operation, and maintenance manual. A detailed manual may be obtained by contacting the manufacturer:

Sensor Electronics Corporation
5500 Lincoln Drive
Minneapolis, MN 55436
U.S.A.

Aero-K® systems are to be installed and periodically inspected by trained personnel. No modifications are to be made to the installed system without consulting a qualified system designer. The system is made up of units tested within limitations contained in the detailed design, installation, operation, and maintenance manual. The system designer must be consulted whenever changes are planned for the system or the protected area. An authorized installer or system designer must be consulted after the system has discharged.

SYSTEM DESCRIPTION

General

Aero-K® systems combine an environmentally safe fire suppression agent, specially developed components, and highly effective detection devices for rapid agent application. The resulting timely suppression of fire reduces property damage and products of combustion to the lowest possible levels. These systems are electrically activated, are extremely compact, and totally eliminate the expensive pressure vessels, nozzles, and distribution piping associated with other fire suppression systems. The aerosol agent is five - ten times as effective as alternative agents and Aero-K® fire suppression systems. Generators are strategically placed throughout the hazard area offering significant weight and space savings over conventional systems. Aero-K® systems are designed for total flooding applications in accordance with established design criteria. All installations must meet the requirements of the local authority having jurisdiction.

Sensor Electronics Corporation Aero-K® systems are used to suppress fires in specific hazards or equipment located in enclosed areas and confined spaces where an electrically non-conductive agent is required and where low weight/space to extinguishing capacity is a factor. The height of protected area is not to exceed 5 m, and its volume – 10,000 m³. The fire-extinguishing agent is an ultra-fine aerosol, which hangs in suspension for extended periods of time (up to one hour) providing excellent protection against re-flash, as well as, minimizing clean up. Aero-K® systems are suitable for use in unoccupied and normally unoccupied areas. In areas where personnel may be present the system must employ a pre-discharge alarm, 30second time delay, and provision for system isolation and manual only activation whenever personnel are in the protected area. They are intended to protect the following:

- Telecommunications Facilities
- Flammable Liquid Storage Areas
- Process Control Rooms
- Storage Vaults
- Marine Engine Rooms
- Turbine Enclosures
- High Value Mobile Equipment
- Power Plants
- High Value Industrial Equipment Areas
- Data Processing Facilities

Aero-K® systems are not suitable for the following hazards; or, where the following materials may be present:

- Materials, which burn with deep-seated characteristics (wood fiber, cotton, etc.)
- Electrical equipment operating at over 40,000 V
- Metal Hydrides, Pyrophoric substances, and Chemical substances that smolder and burn without air
- Metal powders (magnesium, titanium, etc.)
- Environments rated Hazardous (explosive atmospheres).

Extinguishing Agent

The aerosol produced upon activation of the Sensor Electronics Corporation’s Aero-K® system suppresses fire by a combination of chemical and physical mechanisms similar to the Halons without any negative effect on the environment. Because of the aerosol’s ultra-fine particle size (≤ 2 micron) there is a dramatic increase in the surface area interaction between the agent and the fire. Potassium based aerosol has been shown in numerous tests and scientific studies to be five times as effective as Halon 1301 and more than ten times as effective as any currently available Halon alternatives or Carbon Dioxide.

Unlike gaseous agents the aerosol does not decompose in the presence of fire nor does it extinguish by oxygen deprivation. The aerosol is considered non-toxic to humans when applied in normal design concentrations necessary to extinguish most fires; however, certain safety restrictions should be observed when applying and handling the generators. Exposure to the aerosol should be limited and unnecessary exposure to the particulate should be avoided. Exposure to the aerosol is generally of less concern than is exposure to the decomposition products of a fire.

Toxicity: Tests conducted by the Institute of Biophysics (Department of Public Health and Medicine Russian Federation) as well as others have shown that the aerosol does not present a health hazard due to limited accidental exposure at normal design concentrations. Exposures under ten minutes are normally considered safe. Gas by-products are several times less than that allowable for automobile airbag systems.

While the components of the aerosol are not considered toxic at normal concentration levels, ingestion of the ultra-fine particulate may cause short-term discomfort and unnecessary exposure should be avoided. Tests have shown no long-term negative effects from exposure to the
Aero-K® SYSTEMS SHALL ONLY BE APPLIED IN AREAS WHERE PERSONNEL MAY BE PRESENT IN CONJUNCTION WITH A 30-SECOND TIME DELAY AND SYSTEM ISOLATE SWITCH TO INSURE EGRESS OF PERSONNEL PRIOR TO SYSTEM DISCHARGE.

Corrosivity: Extensive tests have shown that the aerosol is non-corrosive and non-harmful to a wide variety of materials including structural metals, plastics, electrical components, sophisticated materials used in aviation, film, and magnetic tape.

Cleanliness: The ultra-fine aerosol discharge remains in suspension for an extended period of time and can be easily vented by a fan or air handling system. Minor amounts of aerosol, which may have settled on the floor or other horizontal surfaces, can be easily vacuumed or wiped clean. Settled particulate is minor and is much less than the particulate produced by the decomposition products of the fire.

Other Safety Considerations: The aerosol discharged into the hazard area upon activation of the generator is relatively "cool". However, the aerosol stream as it leaves the generator is above 100°C for a very short distance from the outlet of the generator. Maximum temperatures are realized only in the last seconds of discharge. Temperatures 0.6 meter (24 in.) from the discharge ports will reach a momentary (<2sec.) maximum in the range of 32°C - 75°C at the end of discharge (depending on model). Each model has a required installation clearance distance specified as its “C-Zone”. Steps must be taken to insure generator placement so that it complies with this installation requirement. The generator housing is approximately 90°C immediately after discharge and care should be taken if handling the post-discharge generator prior to its cooling to ambient temperature.

Storage: Each Aero-K® aerosol generator is sealed with a non-permeable membrane and is unaffected by fluctuations in temperature and humidity. Accelerated aging tests have shown the generator's charge maintains its viability for more than 10 years under conditions ranging from - 54°C to + 54°C and cycled relative humidity levels up to 98%.

INSTALLATION AND MAINTENANCE

Facility Considerations

Significant Obstructions/Agent Distribution: In cases where there is a large ratio of fixed equipment to total volume, or where the protected equipment is located in such a way as to present a barrier to the free flow and distribution of aerosol throughout the hazard area, the use of a larger number of smaller aerosol generators is preferred. This will allow for strategic placement of the aerosol generators and improved distribution characteristics throughout the area.

INSTALLATION IN AREAS WHERE PERSONNEL MAY BE PRESENT:

NOTE: IN AREAS WHERE PERSONNEL MAY BE PRESENT, A 30-SECOND TIME DELAY SHALL BE INSTALLED TO INSURE EGRESS TIME PRIOR TO SYSTEM DISCHARGE. IN OCCUPIED AND NORMALLY UNOCCUPIED AREAS, A SYSTEM ISOLATE SWITCH SHALL BE INSTALLED OUTSIDE THE HAZARD AREA TO INSURE THAT ACTIVATION OF THE SYSTEM IS “MANUAL ONLY” WHEN PERSONNEL ARE PRESENT.

Mounting: Aero-K® aerosol generators are listed for both sidewall and center locations and may be mounted on walls, beams, constructions, and columns as long as the unit is securely bolted to the support structure and is mounted in a position where its "C-zone" (required clearance zone) will not impact on personnel, equipment, and combustible materials located within the protected area.

Aerosol Stream Characteristics.

<table>
<thead>
<tr>
<th>Model</th>
<th>C-Zone</th>
<th>Height Max.</th>
<th>Area Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G100</td>
<td>0.2 m</td>
<td>2.50 m</td>
<td>2.2m x 2.2m</td>
</tr>
<tr>
<td>G250</td>
<td>0.3 m</td>
<td>4.50 m</td>
<td>2.5m x 2.5m</td>
</tr>
<tr>
<td>G500</td>
<td>0.5 m</td>
<td>4.90 m</td>
<td>4.9m x 4.9m</td>
</tr>
<tr>
<td>G1000</td>
<td>0.8 m</td>
<td>4.88 m</td>
<td>4.9m x 4.9m</td>
</tr>
<tr>
<td>G1500</td>
<td>1.0 m</td>
<td>4.88 m</td>
<td>4.9m x 4.9m</td>
</tr>
<tr>
<td>G2500</td>
<td>1.0 m</td>
<td>4.88 m</td>
<td>4.9m x 4.9m</td>
</tr>
</tbody>
</table>

Mounting Height: In general, the aerosol generators should be mounted at or near ceiling height and angled toward the fire hazard at an angle to insure three-dimensional distribution of aerosol. Normal orientation from vertical is 5° - 20°. In order to insure maximum distribution of aerosol throughout the hazard area, the maximum height of generator placement must be limited as indicated above.

Flow: Placement of the aerosol generators to insure proper aerosol flow and distribution is extremely important. Generators should be spaced as evenly as possible around the hazard area and directionally positioned to promote a circular, three-dimensional flow pattern. Aerosol generators must never be positioned to discharge directly at each other! This will cause agglomeration of the aerosol particulate, reducing the aerosol's extinguishing effectiveness. For the same reason, aerosol generators in total flood applications should also be positioned to insure that the aerosol stream does not impinge directly on walls or the sides of equipment being protected.

Typical Placement

*Spacing S should be even unless prevented by obstruction.

Operating/Temperature Range: Sensor Electronics Corporation: Aero-K® aerosol generators are listed to operate within a temperature range of 65°C - 95°C.
range of - 54 °C to +54 °C. The generators are sealed with a non-permeable membrane and are unaffected by fluctuations in humidity and temperature.

EQUIPMENT INSTALLATION

General. All Sensor Electronics Corporation Aero-K equipment must be installed to facilitate proper operation, inspection, testing, and any other maintenance as may be necessary. Equipment must not be subject to mechanical, chemical, or other damage, which could render the equipment inoperative. Equipment must be installed in accordance with all applicable standards and the contents of this section of the manual.

WARNING

AEROSOL GENERATORS CONTAIN A PYROTECHNIC ELEMENT AND MUST ONLY BE HANDLED, INSTALLED, AND SERVICED BY A TRAINED TECHNICIAN USING THE INSTRUCTIONS CONTAINED IN THIS SECTION. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD CAUSE A PREMATURE DISCHARGE AND POTENTIAL INJURY.

Aerosol Generator Installation. The Aero-K aerosol generators should normally be located within the protected hazard area. The following installation instructions must be followed in the exact sequence outlined below to prevent accidental discharge, bodily injury, or property damage.

WARNING

TO PREVENT PERSONAL INJURY, DE-ENERGIZE ALL ELECTRICAL CONNECTIONS PRIOR TO GENERATOR INSTALLATION.

Single Generator System:

1. Position mounting bracket and securely fasten to wall, ceiling, or other supporting structure in a location and manner, which insures the generator will not be subjected to accidental damage or movement.

2. Remove generator from shipping container and inspect integrity of the non-permeable membrane and generator. Do not install if the membrane is ruptured in any way or if the housing has been damaged in shipment. Check igniter integrity with Ohmmeter. Do not install if reading > 3 ohms.

3. Securely attach generator to the mounting bracket with generator clamp taking care to insure the clamp is free of the initiator mechanism and that all bolts are securely tightened in place.

4. Position generator, via the bracket-mounting swivel, to allow for an unimpeded discharge upon activation. Care must be taken so that the generator does not directly discharge at close range at the wall, ceiling, or vertical surfaces of the equipment within the hazard area.

5. Taking care to insure that power is off, connect electrical lines to the initiator fitting at the top of the generator.

6. Generators should be wired in series to a releasing control panel. Activation current must be supplied to each generator as follows:

   Activation parameters of the initiator are:
   • Resistance: 1.4 – 2.0 Ohms
   • Minimum Parallel Circuit Firing Current: 0.5A for 0.050 Seconds.
   • Minimum Series Circuit Firing Current: 0.8A for 0.050 Seconds.
   • Specified Maximum Test Current: ≤ 0.025A.
   • Specified Maximum Supervisory Current: ≤ 0.005A.

7. Install releasing control panel, detection, and ancillary devices according to the directions contained in the manual supplied. Wiring is to be done to local code requirements.

8. Once the electrical components of the system have been installed and checked out, insure that power is off and then connect electrical lines to the initiator fitting at the top of the generator.

Post Installation Checkout: After the Aero-K generators have been installed and connected to the appropriate detection and/or control system, perform the following inspection and tests.

1. Verify that generators of the correct size are installed per the installation drawings.
<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>2. Verify that generator mounting brackets and clamps are properly installed and that all fittings are tight.</td>
<td>4. Allow no one to enter the hazard area. Call the fire department promptly.</td>
</tr>
<tr>
<td>3. Verify that all electrical connections have been made and test for electrical continuity using an Ohmmeter.</td>
<td><strong>System Isolate Switch:</strong> The automatic operation of the system shall be prevented by means of a system isolate switch (lockout/abort located outside the protected area) when personnel are present in the hazard area. The operation of the system shall be manual only when personnel are present. While the system isolate switch is active the automatic activation of the system is inhibited but the fire detection and alarm system shall continue to function. The system shall return to full automatic control when the switch is reactivated.</td>
</tr>
<tr>
<td>4. Verify that all generators are positioned properly. Check for obstructions in the path of the aerosol discharge stream. Generators must be installed such that they cannot cause personnel injury upon activation. The aerosol discharge stream must not impinge at close range on walls, ceiling, or vertical surfaces of equipment.</td>
<td><strong>NOTE</strong></td>
</tr>
<tr>
<td>5. Manual/Electrical pull stations must be properly installed, readily accessible, and clearly identified.</td>
<td><strong>THE ABOVE INSTRUCTIONS MUST BE POSTED ON DISPLAY IN THE PROTECTED AREA.</strong></td>
</tr>
<tr>
<td>7. Verify Time Delay functionality and integrity.</td>
<td><strong>Post Fire Operation:</strong> After discharge of an Aero-K® fire suppression system, qualified fire suppression system maintenance personnel must perform post fire maintenance and system installation procedures outlined in this manual. Observe all warnings, especially those pertaining to the length of elapsed time before entering the hazard area.</td>
</tr>
<tr>
<td>8. All acceptance testing shall be in accordance with this manual, any applicable standards, and the authority having jurisdiction.</td>
<td><strong>WARNING</strong></td>
</tr>
<tr>
<td></td>
<td><strong>DO NOT ENTER A HAZARD AREA WITH AN OPEN FLAME OR LIGHTED CIGARETTE. THE POSSIBLE PRESENCE OF FLAMMABLE VAPORS MAY CAUSE RE-IGNITION OR EXPLOSION.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>WARNING</strong></td>
</tr>
<tr>
<td></td>
<td><strong>ENSURE FIRE IS COMPLETELY EXTINGUISHED BEFORE VENTILATING AREA. BEFORE PERMITTING ANYONE TO ENTER THE HAZARD AREA, VENTILATE AREA THOROUGHLY OR USE SELF-CONTAINED BREATHING APPARATUS.</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Post Fire Maintenance:</strong> The following procedures must be followed in the exact sequence to maintain and re-commission an Aero-K® suppression system:</td>
</tr>
<tr>
<td>1. After discharge, allow a minimum holding time of 5 minutes for fires involving flammable liquids (Class B) and non-smoldering combustible solids (Class A surface fires). Allow a minimum 10minute hold time for fires involving smoldering solids and PVC electrical cables.</td>
<td>1. After discharge, allow a minimum holding time of 5 minutes for fires involving flammable liquids (Class B) and non-smoldering combustible solids (Class A surface fires). Allow a minimum 10minute hold time for fires involving smoldering solids and PVC electrical cables.</td>
</tr>
<tr>
<td>2. Always be sure to have backup portable extinguishers at hand for use in the unlikely event of re-ignition.</td>
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</tr>
<tr>
<td>3. Vent the area thoroughly by operating the ventilation system, by fan extraction, or by opening doors and windows. To avoid unwanted inhalation of fire by-products and aerosol, a protective breathing apparatus or mask should be worn if it is necessary to enter prior to complete ventilation of the hazard volume.</td>
<td>3. Vent the area thoroughly by operating the ventilation system, by fan extraction, or by opening doors and windows. To avoid unwanted inhalation of fire by-products and aerosol, a protective breathing apparatus or mask should be worn if it is necessary to enter prior to complete ventilation of the hazard volume.</td>
</tr>
<tr>
<td>4. Inspect the area to insure the fire is completely extinguished and that there are no localized hot spots or other sources of re-ignition present.</td>
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</tr>
<tr>
<td>5. Clean any minor amounts of residue, which have not been removed during ventilation, by blowing, brushing, or washing away as appropriate.</td>
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</tr>
<tr>
<td>6. Remove spent generators, being sure to wear gloves or other hand protection. The generators will remain quite warm to the touch for a</td>
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</tr>
</tbody>
</table>
time after actuation.

7. Dispose of spent generators according to applicable federal, state, and local regulations

8. Contact your Aero-K® distributor immediately for replacement generators. Replacement and commissioning should only be undertaken by trained personnel

WARNING
BEFORE PERFORMING POST FIRE MAINTENANCE PROCEDURES REFER TO THE MATERIAL SAFETY DATA SHEET.

MAINTENANCE

General: While Sensor Electronics Corporation’s Aero-K® suppression systems require significantly less maintenance than other fire suppression systems; a regular program of systematic maintenance must be established to insure continuous, proper operation of any fire suppression system. A periodic maintenance schedule must be followed and an inspection log maintained for ready reference. At a minimum, the log must record: (1) inspection interval, (2) inspection procedure performed, (3) maintenance performed, if any, as a result of inspection, and (4) the name of the responsible person performing the operation.

Preventive Maintenance. Perform preventive maintenance per the following schedule at a minimum:

<table>
<thead>
<tr>
<th>Schedule</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly</td>
<td>Check all Electrical Connections</td>
</tr>
<tr>
<td></td>
<td>Visual inspection of Components</td>
</tr>
<tr>
<td>Six Month</td>
<td>Inspect/Test all system components</td>
</tr>
<tr>
<td></td>
<td>Test electrical continuity</td>
</tr>
<tr>
<td></td>
<td>Inspect bracketing &amp; position of</td>
</tr>
<tr>
<td></td>
<td>generators</td>
</tr>
<tr>
<td>Every 10 years</td>
<td>Replace per date code on label.</td>
</tr>
</tbody>
</table>

Inspection Procedures

Weekly

1. Check all electrical connections to insure operation of the Aero-K® suppression system in the event of a fire.

2. Make a general visual inspection of all aerosol generators for damaged or missing parts.

Every Six Months

1. Make a general visual inspection of all aerosol generators for damaged or missing parts.

2. Ensure access to hazard areas, lines of egress, and manual pull stations are unobstructed and that there are no obstacles inhibiting the proper operation of the aerosol generators or distribution of the aerosol in the event of a fire.

3. Inspect Aero-K® aerosol generators for physical damage, such as cracks, dents, distortion, or corrosion. If damage is found, replace generator as instructed in Section 6 of this manual. If minor corrosion is found generator may be cleaned up and appropriate touch-up paint applied.

4. Inspect mounting brackets, straps, and associated hardware for loose, damaged, or broken parts. Replace damaged parts and tighten all loose hardware.

5. Inspect all manual pull stations for cracks, broken or cracked glass plate, dirt or distortion. Inspect station for signs of physical damage, replacing if necessary.

6. Inspect all electrical connections and run electrical continuity tests using an Ohmmeter. Repair and replace as necessary.

7. Replacement from Service. The aerosol generators have an installed service life of 10+ years. They are to be replaced 10 years from the date code in the lower right corner of the product label. Note: (There is a grace period of 1 year as the generators have been certified for a period longer than 10 years to insure a full 10 years in actual service). The Date Code appears as follows, where the alphabetic character represents the year and the numeric the month of shipment from the factory:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
</table>
| A = 2001, B = 2002, C = 2003, etc. A unit marked A 12, for example, would have shipped in December of 2001.

RECYCLING OF AEROSOL GENERATORS AFTER DISCHARGE:

In most cases the discharged generator can be disposed of in any landfill that handles industrial waste. However, local regulations must be researched and observed. Each discharged aerosol generator will contain the following material:

1. Mild steel outer shell, spacer ring – all
2. Mild steel cross members (G100, G250, G500)
3. Stainless steel inner shell, top and bottom plates, screens (all sizes), and cross members (G1000, G1500, G2500)
4. Activated Alumina: CAS 1333-84-2 (Aluminum Oxide non-fibrous)

<table>
<thead>
<tr>
<th>G100</th>
<th>G250</th>
<th>G500</th>
<th>G1000</th>
<th>G1500</th>
<th>G2500</th>
</tr>
</thead>
<tbody>
<tr>
<td>100g</td>
<td>550g</td>
<td>970g</td>
<td>1670g</td>
<td>2350g</td>
<td>3600g</td>
</tr>
</tbody>
</table>

5. Fiberglass rope (ø1cm x 50cm).
6. Ceramic Paper < 15g (G100 only).
7. Wire – 24gauge, PVC coated (< 1g).
8. Trace Chemicals: K$_2$CO$_3$ (water-soluble particulate “trapped” in unit during discharge).

Contact Sensor Electronics if there are any questions relative to the above.
LIMITED WARRANTY STATEMENT

Sensor Electronics Corporation represents that this product is free from defects in material and workmanship, and it will repair or replace any product or part thereof which proves to be defective in workmanship or material for a period of eighteen (18) months from the date of first shipment from our factory. Defective units should be returned shipment prepaid to the factory:

Sensor Electronics Corp.
5500 Lincoln Drive
Suite 170
Minneapolis, MN USA 55436

Sensor Electronics Corporation will repair or replace and return shipping prepaid. Return or repair shall be the purchaser’s sole remedy for defect.

Limitations of Liability

This warranty does not cover equipment damaged during shipment or by misuse, accident, or negligence, or which has been repaired or altered by others. Sensor Electronics Corporation shall not under any circumstances be liable for special or consequential damages such as, but not limited to, damage or loss of property or equipment, loss of profits or revenue, cost of capital, cost of purchased or replacement goods, or claims by customers of the original purchaser. Remedies set forth herein to the original purchaser and all others shall not exceed the price of the equipment supplied.

This warranty is exclusively and expressly in lieu of all other warranties, whether expressed or implied, including warranty of merchantability or fitness.

A DETAILED MANUAL MAY BE OBTAINED BY CONTACTING THE MANUFACTURER:

Sensor Electronics Corporation
5500 Lincoln Drive
Minneapolis, MN 55436
U.S.A.

Questions concerning the information presented in this manual may be addressed to your authorized distributor or:

Sensor Electronics Corporation
5500 Lincoln Drive, Suite 170
Minneapolis, MN 55436
U.S.A.
Tel: 952-938-9486
Fax: 952-938-9617
www.sensorelectronic.com

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