INCH-POUND

MIL-PRF-32228
25 October 2006

PERFORMANCE SPECIFICATION

ALARM PANEL, ADVANCED FIRE AND SMOKE SENSOR SYSTEM (AFSSS)

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for alarm panels (see 6.8.3), which are components of an overall Advanced Fire and Smoke Sensor System (AFSSS) for use on naval ships. These alarm panels may be of commercial-off-the-shelf (COTS) design, but must be rugged (see 6.8.17) enough to meet all of the requirements of this performance specification and the rigors of Navy shipboard service. Performance requirements for the other associated AFSSS components (e.g., ionization (see 6.8.11) and photoelectric (see 6.8.13) smoke sensors (see 6.8.20), heat sensors (see 6.8.10), flame detectors (see 6.8.8), Flame Detector Zone Modules (FDZM) (see 6.8.9), Switch Closure Zone Modules (SCZM) (see 6.8.21), and isolators (see 6.8.12) are contained in their respective AFSSS specifications.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-S-901	-	Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for
MIL-E-2036	-	Enclosures for Electric and Electronic Equipment, Naval Shipboard
MIL-DTL-24643	-	Cables and Cords, Electric, Low Smoke, for Shipboard Use General Specification for

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05Q, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil, with the subject line “Document Comment”. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-167-1	-	Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II – Internally Excited)
MIL-STD-461	-	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or http://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

UNDERWRITERS LABORATORIES INC. (UL)

UL 268	-	Standard for Smoke Detectors for Fire Alarm Signaling Systems
UL 864	-	Standard for Control Units and Accessories for Fire Alarm Systems (DoD adopted)

(Copies of these documents are available from Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096 or online at www.ul.com.)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 72	-	National Fire Alarm Code

(Copies of this document are available from National Fire Protection Association, 11 Tracy Drive, Avon, MA 02322 or online at www.nfpa.org.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2 and 6.3), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Design requirements.

3.2.1 Design, materials, and manufacturing processes. The contractor shall select the materials, but the materials shall meet all of the interface, operational, and performance requirements specified herein.

3.2.2 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.2.3 Restricted materials. The use of lithium and mercury batteries is restricted and shall not be used in equipment unless specifically required and approved by the procuring activity.

3.3 Configuration.

3.3.1 Alarm panel. The alarm panel shall contain the microprocessor, printed circuit boards, network cards, power supplies, back-up batteries, alphanumeric display, alphanumeric keypad (for operation and programming) and all associated hardware and software necessary to operate as a fire detection system. The alarm panel shall provide power to and monitor/communicate with various addressable AFSSS analog initiating devices (6.8.5), including ionization smoke sensors, photoelectric smoke sensors, heat sensor, flame detectors, FDZMs (if required), SCZMs, and/or isolators. The total quantity of these devices will vary depending on the particular installation. The alarm panel shall have an alphanumeric display of at least 60 characters, readable in all levels of light (including total darkness), which shall display all alarm and trouble information, sensor data, and system information, and shall provide user-friendly menus to assist in alarm panel programming and selection of sensor alarm thresholds. The alarm panel shall also have the capability to interface and operate with other AFSSS alarm panels, AFSSS color graphic displays (see 6.8.2), and third party color graphic displays (see 6.8.22) as one alarm panel/component on a larger distributed fire detection system.

3.3.2 Interchangeability. The AFSSS alarm panel shall have a unique model number assigned to it. All mechanical and electrical AFSSS alarm panel components shall be physically identical and interchangeable with other AFSSS alarm panel components to ease troubleshooting and parts replacement.

3.3.3 Individual addressability. The alarm panel shall communicate with, individually identify, and monitor the AFSSS ionization smoke sensors, photoelectric smoke sensors, heat sensors, flame detectors (via their FDZMs, if required), and SCZMs via their adjustable mechanical devices or dipswitches contained in either the sensor's head or universal base or the zone module's enclosure. This individual addressability requirement may also apply to the isolator, but is not specifically required for the isolator.

3.4 Drip-proof. When installed on the bulkhead of a compartment, the alarm panel shall be drip-proof (15 degrees) in accordance with MIL-E-2036 such that water falling from above shall not enter the alarm panel.

3.5 Weight. The total weight of the (largest capacity) alarm panel (consisting of the alarm panel enclosure, batteries, and all the required interior components to support 10 loops of sensors as well as interface cards to support communication with other alarm panel(s) and AFSSS or third party color graphic display(s)) shall not exceed 120 pounds.

3.6 Size.

3.6.1 Physical size. The dimensions of the alarm panel shall be as small as possible but shall not exceed 48 inches in height, 36 inches in width, and 12 inches in depth, regardless of the quantity of sensors, detectors, zone modules, and sensor loops powered and monitored by the alarm panel.

3.6.2 Capacity. The alarm panel shall provide power to and communicate with various addressable devices including ionization smoke sensors, photoelectric smoke sensors, heat sensors, flame detectors (via their FDZMs, if required), SCZMs, and/or isolators. The total quantity of these devices will vary depending on the particular installation. These alarm panels shall also be expandable, with the addition of appropriate sensor Loop printed circuit boards, to handle up to at least 10 sensor loops of devices. Each sensor loop shall be capable of powering and monitoring up to at least 60 addressable devices, along with at least 7 isolators. The inclusion of additional isolators on the loop (above the original seven) shall not decrease the amount of devices capable of being supported on the loop by more than five devices per added isolator.

3.7 Interface requirements.

3.7.1 Electrical and operational interface.

3.7.1.1 Power interface. The alarm panel shall operate satisfactory with either grounded or ungrounded 120 VAC, single-phase, 60 Hz power, but shall also operate (in the event of primary power loss) from an internal back-up battery power source as described in 3.8.9.

3.7.1.2 Sensors, detectors and devices interface. The alarm panel shall provide power to and monitor the status of compatible AFSSS ionization smoke sensors, photoelectric smoke sensors, heat sensors, flame detectors (via their FDZMs, if required), SCZMs, and isolators. The cable used to interface the alarm panel with the ionization smoke sensors, photoelectric smoke sensors, heat sensors, FDZMs (if required), SCZMs, and isolators shall be LS2SWU-1 (see MIL-DTL-24643). The LS2SWU-1 cabling shall be routed from the alarm panel to the various sensors and devices throughout the ship's compartments and then return to the alarm panel in a looped NFPA 72, Style 6, Class A signaling line circuit (see 6.8.19) arrangement (i.e., a sensor loop) so that single opens on the loop shall not result in the loss of any sensors.

3.7.1.3 Flame detector power interface. If not supplied via the Style 6, Class A sensor loop in 3.7.1.2, a separate LS2SWU-1 cable shall be routed from the alarm panel to the various FDZMs (if required) and then returned to the alarm panel in a looped arrangement to provide power to the flame detectors.

3.7.1.4 AFSSS local area network (LAN) interface. The alarm panel shall have the capability to operate as a stand alone alarm panel and display. In addition, the alarm panel shall have the capability, with the addition of appropriate network cards, to interface, communicate, and operate with other AFSSS alarm panels and AFSSS color graphic displays (connected on an AFSSS LAN) as one alarm panel/component on a larger distributed fire detection system. All monitoring and control capabilities and functions at one alarm panel, as documented in this specification, shall also be accessible and executable at all other AFSSS color graphic displays and other alarm panels on the AFSSS LAN. Thus, the capability to monitor the status of AFSSS ionization smoke sensors, photoelectric smoke sensors, heat sensors, flame detectors (via their FDZMs, if required), SCZMs, and isolators powered by one AFSSS alarm panel shall be available to all AFSSS alarm panels and AFSSS color graphic displays on the AFSSS LAN. The alarm panel shall also communicate with the AFSSS color graphic display such that the initial or subsequent programming/building of an alarm panel's complete configuration of sensors, detectors, and devices (see 3.7.1.6) can be accomplished on the AFSSS color graphic display (with the Microsoft Windows™-based software of 3.7.1.6 loaded on the AFSSS color graphic display) and downloaded to the alarm panel via the AFSSS LAN. Appropriate AFSSS LAN cabling (and hardware, if applicable) shall be routed from the alarm panel to other alarm panels and AFSSS color graphic displays located throughout the ship. All LAN (data communication) wiring between the AFSSS alarm panel and the AFSSS color graphic display shall be supervised for opens, shorts, and grounds. The AFSSS LAN shall be survivable so that any single failure on one network interface or cabling shall not affect the ability of all panels to communicate.

3.7.1.5 Third party interface. In addition to the AFSSS LAN interface requirements of 3.7.1.4, the alarm panel shall have the capability, with the addition of appropriate network cards, to interface and operate with a third party color graphic display. Such third party color graphic displays may be used aboard ship to provide an integrated picture of damage control situations. The third party color graphic display shall either directly connect to the AFSSS alarm panel or shall connect to the AFSSS LAN. As specified (see 6.2), the manufacturer shall make available all AFSSS alarm panel communication and data output information, proprietary protocol, and coding to allow a third party color graphic display to receive and display all data normally displayed at the AFSSS alarm panel or AFSSS color graphic display. All monitoring and control capabilities and functions at one AFSSS alarm panel, as documented in this specification, shall also be accessible and executable at the third party color graphic display. Thus, the capability to monitor the status of AFSSS ionization smoke sensors, photoelectric smoke sensors, heat sensors, flame detectors (via their FDZMs, if required), SCZMs, and isolators powered by one AFSSS alarm panel shall be available to the third party color graphic display. All data communication wiring between the AFSSS alarm panel and the third party color graphic display shall be supervised for opens, shorts, and grounds.

3.7.1.6 Computer interface. The AFSSS alarm panel shall have a standard computer port communication connector inside the alarm panel which shall allow for the temporary connection of a computer. The manufacturer shall provide Microsoft Windows™ based software (and instructions for the software) which shall allow the Government to solely accomplish the initial (and any subsequent) programming of the alarm panel via the connector. The software shall be fully open and accessible to the Government, allowing the Government to initially or subsequently program/build an alarm panel's complete configuration of sensors, detectors, and devices, including the ability to set sensor sensitivities/alarm thresholds, input alphanumeric characters that identify the sensors and devices, set alarm panel access level passwords, add or delete sensors and devices, activate alarm verification for individual smoke sensors, and download historical logs. The software shall also allow the Government to initially or subsequently program the alarm panel to communicate with other alarm panels or color graphic displays via the AFSSS LAN and to communicate with other third party color graphic displays.

3.7.2 Ship interface. The alarm panel shall attach to the bulkhead of the ship's compartments using bolts. Bolts shall pass through clearance holes in the back of the alarm panel. The mounting bolts for the alarm panel shall mount to 1-inch long threaded-female metal standoffs welded onto the bulkhead. Alternately, the mounting bolts for the alarm panel shall mount (with nuts) flush with appropriate brackets attached to the bulkhead.

3.8 Operating requirements.

3.8.1 Basic operation. When tested in accordance with 4.5, the alarm panel shall meet the following requirements. (Each lettered paragraph below refers to its corresponding lettered paragraph in 4.5.)

a. An appropriate alarm shall register and latch at the alarm panel, the AFSSS color graphic display, and the third party color graphic display for the heat sensor. Alarm panel operation shall also comply with 3.8.2.

b. An appropriate alarm shall register and latch at the alarm panel, the AFSSS color graphic display, and the third party color graphic display for the ionization smoke sensor. Alarm panel operation shall also comply with 3.8.3.

c. An appropriate alarm shall register and latch at the alarm panel, the AFSSS color graphic display, and the third party color graphic display for the photoelectric smoke sensor. Alarm panel operation shall also comply with 3.8.3.

d. An appropriate alarm shall register and latch at the alarm panel, the AFSSS color graphic display, and the third party color graphic display for the flame detector. Alarm panel operation shall also comply with 3.8.5.

e. An appropriate alarm shall register and latch at the alarm panel, the AFSSS color graphic display, and the third party color graphic display for the SCZM. Alarm panel operation shall also comply with 3.8.6.

f. An appropriate Class A trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display for sensor loop 1. In addition, a second trouble indication stating the loss of the SCZM shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display. Alarm panel operation shall also comply with 3.8.7.

g. An appropriate trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display indicating the loss of the heat sensor.

h. An appropriate trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display indicating the loss of the ionization smoke sensor.

i. An appropriate trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display indicating the loss of the photoelectric smoke sensor.

j. Real-time (analog) temperature measurements, in degree Fahrenheit units, shall be capable of being displayed by the alarm panel, the AFSSS color graphic display, and the third party color graphic display commensurate with the actual temperature at the heat sensor. Temperature measurements shall comply with 3.8.4.1.

k. Real-time (analog) smoke measurements, in percent obscuration per foot (gray smoke) units, shall be capable of being displayed by the alarm panel, the AFSSS color graphic display, and the third party color graphic display commensurate with the actual amount (or lack) of smoke at the ionization smoke sensor. Smoke measurements shall comply with 3.8.4.1.

l. Real-time (analog) smoke measurements, in percent obscuration per foot (gray smoke) units, shall be capable of being displayed by the alarm panel, the AFSSS color graphic display, and the third party color graphic display commensurate with the actual amount (or lack) of smoke at the photoelectric smoke sensor. Smoke measurements shall comply with 3.8.4.1.

m. An appropriate trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display indicating the loss of the flame detector.

n. An appropriate trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display indicating the loss of the flame detector.

o. An appropriate trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display indicating the loss of the SCZM switch.

p. An appropriate trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display indicating a positive ground fault on sensor loop 1. No sensors, detectors or devices on sensor loop 1 shall be lost.

q. An appropriate trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display indicating a neutral ground fault on sensor loop 1. No sensors, detectors or devices on sensor loop 1 shall be lost.

r. An appropriate Class A trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display for sensor loop 1. No sensors, detectors, or devices on sensor loop 1 shall be lost.

s. An appropriate Class A trouble indication shall register at the alarm panel, the AFSSS color graphic display, and the third party color graphic display for sensor loop 1. No sensors, detectors, or devices on sensor loop 1 shall be lost.

t. The alarm panel, AFSSS color graphic display, and third party color graphic display history logs shall store all appropriate time, date, and other specific sensor identification information for all alarms and trouble conditions. History logs shall comply with 3.8.11.

u. The alarm panel, AFSSS color graphic display, and third party color graphic display logs shall store the highest temperature and smoke measurements attained for individual heat, ionization smoke, and photoelectric smoke sensors and retain this information until cleared by using a middle access level password. Peak temperature and smoke measurements stored shall comply with 3.8.4.2.

v. The alarm panel shall sustain no physical damage, such as cracks, loosening, warping, thermal deterioration, or dislodgment of parts.

w. The AFSSS color graphic display, third party color graphic display, and/or other AFSSS alarm panels connected to the alarm panel under test shall accurately display all sensor alarm, trouble, measurement, and history log information that is available at the alarm panel. The alarm panel shall interface with the AFSSS color graphic display and the third party color graphic display in accordance with 3.7.1.4 and 3.7.1.5, respectively.

3.8.2 Fixed temperature and rate of temperature rise heat sensor operation. When the temperature at any heat sensor exceeds the fixed temperature (see 6.8.7) or (if selected for the sensor) the rate of temperature rise (see 6.8.14) alarm threshold chosen for the sensor, an alarm shall be indicated at the AFSSS alarm panel, which shall send the alarm information to the AFSSS color graphic display and the third party color graphic display. With the use of a middle access level password (see 3.8.10), the AFSSS alarm panel shall be capable of easily setting/programming all individual AFSSS heat sensors to any of a minimum of three discrete fixed temperature alarm threshold settings. The nominal fixed temperature alarm threshold (sensitivity) settings shall be 105 °F, 135 °F, and 155 °F. In addition, with the use of the same middle access level password, the AFSSS alarm panel shall be capable of easily setting/programming these same individual AFSSS heat sensors to any of a minimum of three discrete rate of temperature rise alarm threshold settings. The nominal rate of temperature rise alarm threshold (sensitivity) settings shall be 15 °F per minute, 20 °F per minute and “no rate of temperature rise alarm threshold setting selected” (i.e., the heat sensor has only a fixed temperature alarm threshold setting). Initial selection and later changing of all discrete fixed temperature and rate of temperature rise alarm threshold settings shall be easily executable at the AFSSS alarm panel (with the use of a middle access level password) for individual heat sensors, without the need to make changes or adjustments at the individual sensors. For all heat sensors, any of the (at least) three nominal rate of temperature rise alarm thresholds may be chosen in combination with any of the (at least) three nominal fixed temperature alarm thresholds. Heat sensors shall be restorable (see 6.8.16) after alarm, but only after a reset (see 6.8.15) at the alarm panel is manually executed and the temperature at the sensor is below its alarm threshold (i.e., heat sensor alarms shall latch at the alarm panel). The alarm panel shall communicate with the AFSSS color graphic display and the third party color graphic display such that either can also be used, with the use of a middle access level password, to set heat sensor fixed temperature and rate of temperature rise alarm thresholds. The alarm panel shall communicate with the AFSSS color graphic display and third party color graphic display such that both shall latch heat sensor alarms and both can be used to reset heat sensor alarms.

3.8.3 Smoke sensor and alarm verification operation. When the amount of smoke at any ionization or photoelectric smoke sensor exceeds the alarm threshold chosen for the sensor, an alarm shall be indicated at the AFSSS alarm panel, which shall send the alarm information to the AFSSS color graphic display and the third party color graphic display. With the use of a middle access level password (see 3.8.10), the AFSSS alarm panel shall be capable of easily setting/programming all individual AFSSS ionization and photoelectric smoke sensors to any of a minimum of three discrete alarm threshold settings. For both ionization and photoelectric smoke sensors, the most sensitive (lowest) alarm threshold setting shall be greater than or equal to 0.5 percent obscuration per foot (gray smoke), but less than 1.0 percent obscuration per foot (gray smoke). For ionization smoke sensors, the least sensitive (highest) alarm threshold setting shall be greater than 1.5 percent obscuration per foot (gray smoke). For photoelectric smoke sensors, the least sensitive (highest) alarm threshold setting shall be greater than 2.5 percent obscuration per foot (gray smoke). Initial selection and later changing of all discrete smoke sensor alarm threshold settings shall be easily executable at the AFSSS alarm panel (with the use of a middle access level password) for individual smoke sensors, without the need to make changes or adjustments at the individual sensors. In addition, using the same middle access level password, the AFSSS alarm panel shall be capable of easily providing all individual AFSSS ionization and photoelectric smoke sensors with an alarm verification feature, in compliance with UL 268, to help eliminate/minimize nuisance alarms. This alarm verification feature shall be easily enabled and disabled for individual smoke sensors at the alarm panel (not at the sensor locations). Smoke sensors shall be restorable after alarm, but only after a reset at the alarm panel is manually executed and the smoke level at the sensor is below its alarm threshold (i.e., smoke sensor alarms shall latch at the alarm panel). The alarm panel shall communicate with the AFSSS color graphic display and the third party color graphic display such that either can also be used, with the use of a middle access level password, to set smoke sensor alarm thresholds and select alarm verification for smoke sensors. The alarm panel shall communicate with the AFSSS color graphic display and third party color graphic display such that both shall latch smoke sensor alarms and both can be used to reset smoke sensor alarms.

3.8.4 Measurement of temperature and smoke.

3.8.4.1 Real-time measurement of temperatures and smoke. The AFSSS alarm panel shall be capable of displaying real-time measurement values of the actual temperatures surrounding the heat sensors upon demand, whether those temperature measurements are below (thus, the heat sensors are in a normal state) or above (thus, the heat sensors are in an alarm state) the fixed temperature alarm thresholds of the sensors. The alarm panel shall measure and display all heat sensor temperatures from at least as low as 32 °F up to at least 194 °F. The alarm panel shall display individual sensor real-time temperature measurements in degree Fahrenheit units. The AFSSS alarm panel shall also be capable of displaying measurement values of the amount of smoke present at the ionization and photoelectric smoke sensors upon demand, whether those smoke measurements are below (thus, the smoke sensors are in a normal state) or above (thus, the smoke sensors are in an alarm state) the alarm thresholds of the sensors. The alarm panel shall measure and display all smoke levels from 0.0 percent obscuration per foot (clean air) up to at least 4.0 percent obscuration per foot (gray smoke). The alarm panel shall display individual smoke sensor real-time smoke measurements in percent obscuration per foot units. The alarm panel shall communicate with the AFSSS color graphic display and third party color graphic display such that either can be used to display real-time measurement values of sensor temperatures in degree Fahrenheit units or smoke levels in percent obscuration per foot units. The term, “real-time,” refers to measurements being updated at least every 15 seconds.

3.8.4.2 Storage of peak temperature and smoke measurements. The AFSSS alarm panel shall be capable of automatically storing the highest (peak) temperature and smoke level measurements attained at each individual heat and smoke sensor and their corresponding date and time of occurrence. These peak/maximum measurements attained shall be stored until manually cleared at the alarm panel using a middle access level password. Storage of peak measurement information is required for tracking the highest ambient levels of temperature and smoke after the initial AFSSS installation, which will assist in selecting the optimum alarm thresholds for individual sensors. The alarm panel shall communicate with the AFSSS color graphic display and third party color graphic display such that either can be used to view the peak temperature and smoke level measurements, and corresponding dates and times of occurrences. In addition, the alarm panel shall communicate with the AFSSS color graphic display and third party color graphic display such that, these peak measurements attained can be cleared at the AFSSS color graphic display or third party color graphic display using a middle access level password (see 3.8.10).

3.8.5 Flame detector operation. When a flame detector is exposed to a flame of appropriate and sufficient radiant energy, an alarm shall be indicated at the AFSSS alarm panel, which shall send the alarm information to the AFSSS color graphic display and the third party color graphic display. If required, flame detectors shall interface with the AFSSS alarm panel via an FDZM, compatible with the AFSSS alarm panel, which provides and identifies the unique address of the flame detector and also channels power from the alarm panel to the flame detector. Flame detectors shall be restorable after alarm, but only after a reset at the alarm panel is manually executed and the flame at the detector has been removed (i.e., flame detector alarms shall latch at the alarm panel). The alarm panel shall communicate with the AFSSS color graphic display and third party color graphic display such that both shall latch flame detector alarms and both can be used to reset flame detector alarms.

3.8.6 Switch closure zone module (SCZM) operation. When any switch closure type device (such as a water flow switch, manual pull station, water switch, and flooding switch) is closed, an appropriate alarm shall be indicated at the AFSSS alarm panel, which shall send the alarm information to the AFSSS color graphic display and the third party color graphic display. Switch closure type devices shall interface with the AFSSS alarm panel via an SCZM, compatible with the AFSSS alarm panel, which provides and identifies the unique address of the switch closure type device. SCZMs shall be restorable after alarm, but only after a reset at the alarm panel is manually executed and the switch closure type device has been restored to its open position (i.e., SCZMs shall latch at the alarm panel). The alarm panel shall communicate with the AFSSS color graphic display and third party color graphic display such that both shall latch SCZM alarms and both can be used to reset SCZM alarms.

3.8.7 Isolator operation. Isolators shall be installed on the sensor loops in series with other heat and smoke sensors, flame detectors and FDZMs (if required), and SCZMs. The quantity and placement of isolators on each sensor loop will vary with different installations, depending on the degree of survivability desired for the sensors, detectors and devices on the sensor loop. The alarm panel shall interface with the isolators such that the isolators shall protect sensors, detectors and devices on sections of sensor loops from short circuits. In the event of a short circuit, two isolators shall open, removing the shorted section of line from the sensor loop. The sensors, detectors, and devices remaining on both non-isolated sections of the sensor loop shall continue to operate and communicate with the AFSSS alarm panel. The sensors, detectors, and devices located between the isolators (within the shorted section of cabling) shall not be powered or operational, and the alarm panel shall report those sensors, detectors, and devices as troubles (missing). The alarm panel shall communicate with the AFSSS color graphic display and third party color graphic display such that both shall also report those sensors, detectors, and devices as troubles (missing).

3.8.8 Self-testing circuitry for heat and smoke sensors. The alarm panel shall perform automatic functional self-tests (see 6.8.18) of the ionization smoke, photoelectric smoke, and heat sensors, and flame detectors without the need to generate high temperatures/smoke or attach meters to the sensors, to verify that the sensors are fully operational.

3.8.9 Back-up battery operation. The AFSSS shall contain an internal, sealed, leakproof, rechargeable lead acid battery to maintain system power and sensor, detector, zone module, and isolator monitoring and alarm/trouble functions in the event of primary 120 VAC power loss. All alarm panel software operations shall be stored in a non-volatile programmable memory within the alarm panel. Loss of primary 120 VAC and secondary back-up battery power shall not erase the alarm panel programming/instructions stored in memory. An “emergency battery kill switch” shall be located on the outside of the alarm panel (either on the right or left side of the alarm panel) which, when thrown, shall disconnect the internal back-up battery and prevent the system from automatically switching from 120 VAC power to battery power upon loss of 120 VAC power. The switch shall be appropriately labeled “emergency battery kill switch” and shall have a hinged protective cover to prevent accidental movement of the switch. If the switch is thrown (with 120 VAC primary power still applied), resulting in the disconnection of the internal battery, an appropriate trouble indication shall register on the alarm panel stating that back-up battery power has been lost/disconnected.

3.8.10 Access levels (passwords). The alarm panel shall have a minimum of three access levels. The lowest access level shall be the default access level for all alarm panel operators and shall not require a password for access. The middle access level shall be for maintenance personnel and shall be accessible only with the use of a middle access level password. The highest access level shall be for AFSSS administrators and shall be accessible only with the use of a highest access level password. The capabilities available to the user at each access level shall include:

a. Lowest (default) access level (for all operators):
   (1) Acknowledge all alarms and troubles (including the silencing of audible alarms at the alarm panel).
   (2) Reset the alarm panel (clear latched alarms) after the sensors, detectors, and zone modules are no longer exposed to fire signatures above their alarm thresholds.
   (3) View temperature and smoke measurements for specific sensors.
   (4) View peak values of temperature and smoke measurements.
   (5) View historical logs of alarms and troubles.
   (6) View the fixed temperature and rate of temperature rise alarm threshold settings for all heat sensors.
   (7) View the alarm threshold settings and selection/non-selection status of alarm verification for all smoke sensors.

b. Middle access level (for maintenance personnel):
   (1) Perform all of the functions allowed at the lowest (default) access level.
   (2) Set/change the fixed temperature and rate of temperature rise alarm threshold settings for all heat sensors.
   (3) Set/change the alarm threshold settings and selection/non-selection status of alarm verification for all smoke sensors.
   (4) Set/change the time and date of the alarm panel.
   (5) Clear stored peak temperature and smoke measurement values.
   (6) Clear/delete and download historical logs of alarms and troubles.

c. Highest access level (for AFSSS administrators):
   (1) Perform all of the functions allowed at the middle access level.
   (2) Program the alarm panel for all sensors, detectors and zone modules for the initial installation/configuration. Add or delete sensors, detectors, and zone modules to the system after the initial installation.

The alarm panel shall communicate with the AFSSS color graphic display such that all of the capabilities associated with the lowest, middle, and highest access levels on the alarm panel are also available to the user on the AFSSS color graphic display, with an appropriate password. The alarm panel shall communicate with the third party color graphic display such that all of the capabilities associated with at least the lowest access level on the alarm panel are also available to the user on the third party color graphic display (without the need for a password).

3.8.11 Historical event logs. The AFSSS alarm panel shall store all alarm panel events in chronological order. These events shall include the time, date, and addressable sensor (see 6.8.1) alphanumeric identifying information for all alarms and trouble conditions and the time, date, and relevant information for all sensor loop, alarm panel, and AFSSS LAN or other system trouble information. The alarm panel history logs shall be non-volatile logs, capable of storing at least 10,000 independent events on a first-in, first-out basis, and capable of being viewed on the alarm panel display. The alarm panel shall provide an indication when the history log is in the range of 70 to 90 percent full. The alarm panel history logs shall be capable of being downloaded from the alarm panel via the interface connection of 3.7.1.6. The alarm panel shall also communicate with the AFSSS color graphic display and the third party color graphic display such that both displays also receive these historical event logs.

3.9 Performance requirements.

3.9.1 Commercial performance requirements. Alarm panels shall be UL listed and be compatible with the UL listed AFSSS sensors and devices and FM approved AFSSS flame detectors. Alarm panels shall comply with UL 864, with the following exceptions/clarifications:

a. An alarm verification feature is required (not optional) for the ionization and photoelectric smoke sensors and shall be integral in the alarm panel. The alarm verification feature shall be easily enabled and disabled for individual smoke sensors.

b. Glass shall not be used for the cover of an alarm panel observation opening.

c. Openings are not permitted in the top of the alarm panel enclosure. The alarm panel shall be drip-proof.

d. All cable penetrations into the enclosure of the alarm panel shall employ appropriate watertight stuffing tubes (see MIL-E-2036), not bushings.

e. The alarm panel shall operate on 120 VAC single-phase 60 Hz power, with alternate back-up battery power. The alarm panel shall not use 220 to 240 volt power.

f. Alarm panels shall withstand jarring as required for UL 864 listing, and shall also comply with the Government performance requirements for shock in 3.9.2.2 of this specification. A momentary trouble signal (see 6.8.23) or alarm, resulting from jarring, is not acceptable. Sensor operation shall not be affected. Dislodgment of internal or external parts is not acceptable, whether or not dislodged parts affect the operation of the unit or expose high-voltage parts.

g. Alarm panels shall withstand transient tests as required for UL 864 listing, and shall also comply with the Government performance requirements for electromagnetic interference (EMI) in 3.9.2.3 of this specification.

3.9.1.1 Operating temperature range. Alarm panels shall operate properly at temperatures ranging from 32 °F to 120 °F.

3.9.2 Government performance requirements. In addition to the UL 864 requirements and listing, the following Government requirements shall be met.

3.9.2.1 Vibration. When tested in accordance with 4.6.2.1, the alarm panel shall meet the requirements of MIL-STD-167-1. The alarm panel shall operate normally without interruption, trouble indications, nor alarm indications (other than those alarms specifically caused by operational tests) throughout the vibration test. The alarm panel shall not show any evidence of physical damage throughout the vibration test. No excessive resonance of any parts shall be present during the test such that alarm panel operation is affected or early failure can be expected. The alarm panel shall comply with the requirements of 3.8.1 and shall not exhibit any of the failures listed in 3.10 during or after the vibration test.

3.9.2.2 Shock. When tested in accordance with 4.6.2.2, the alarm panel shall meet the Grade A, Class I, Type A requirements of the lightweight MIL-S-901 shock test. The alarm panel shall operate normally without interruption, trouble indications, nor alarm indications (other than those alarms specifically caused by operational tests) throughout the shock test. The alarm panel shall not show any evidence of physical damage throughout the shock test. No excessive resonance of any parts shall be present during the test such that alarm panel operation is affected or early failure can be expected. The alarm panel shall comply with the requirements of 3.8.1 and shall not exhibit any of the failures listed in 3.10 during or after the shock test.

3.9.2.3 Electromagnetic interference (EMI). When tested in accordance with 4.6.2.3 (including 4.6.2.3.1 through 4.6.2.3.8), the alarm panel shall meet the requirements of MIL-STD-461. The alarm panel shall operate normally without interruption, trouble indications, nor alarm indications (other than those alarms specifically caused by operational tests) throughout the EMI test. The alarm panel shall not show any evidence of physical damage throughout the EMI test. The alarm panel shall comply with the requirements of 3.8.1 and shall not exhibit any of the failures listed in 3.10 during or after the EMI test.

3.10 Failure criteria. Alarm panels shall be reliable and not exhibit any failures such as:

a. Failure to meet all applicable UL 864 requirements.

b. Failure to be UL listed.

c. Failure to meet any Government requirements in this specification.

d. Inability to receive and display appropriate alarm data or an alarm indication from any sensor, detector or device, including the loss of displayed information.

e. Inability to receive and display appropriate trouble data or a trouble indication from any sensor, detector, device or due to cabling or alarm panel troubles; including the loss of displayed information.

f. Display of alarm data or an alarm indication, whether temporary, intermittent or latched, when no such condition exists at any sensor, detector, or device.

g. Display of trouble data or a trouble indication, whether temporary, intermittent or latched, when no such condition exists at any sensor, detector, device, or within the cabling or alarm panel.

h. Failure to continuously power and monitor the status of all connected sensors, detectors, and devices. Failure to automatically switch to back-up battery power in the event of primary power loss or failure to switch back to primary power, after restoration of primary power.

i. Failure of any alarm panel LED(s) or any incorrect alarm panel LED indications.

j. Erroneous measurements and displays of heat sensor temperatures, anywhere in the range of 32 °F to 194 °F, whether those temperatures are below or above the heat sensor's fixed temperature alarm threshold.

k. Erroneous measurements and displays of ionization or photoelectric smoke sensor smoke levels, anywhere in the range of 0.0 to 4.0 percent obscuration per foot (gray smoke), whether those smoke levels are below or above the smoke sensor's alarm threshold.

l. Loss of any operational capability, such as the loss of alarm or trouble acknowledgements, alarm reset capability, alarm verification, the ability to set/change alarm thresholds, the ability to obtain smoke or temperature measurement information, the ability to store and display historical logs, the ability to store and display peak smoke or temperature measurements attained, or the ability to log on at the different access levels to perform the specific functions required in 3.8.10.

m. Failure to provide information to the AFSSS color graphic display or the third party color graphic display. Failure of the alarm panel to allow the AFSSS color graphic display to remotely access, control, and change the alarm panel's threshold settings or perform other alarm panel functions.

n. Any physical damage, warping, cracking, buckling, deformation, or bending of the alarm panel enclosure or internal components (Internal components include batteries, terminal boards, printed circuit boards, transformers, capacitors, heat sinks, power supplies, lamps, and LEDs). Any dislodgment of any internal or exterior components from the alarm panel, including dislodgment or loosening of batteries. Any breakage, loosening, fraying or disconnection of alarm panel wiring, electrical connectors, wiring harnesses, or soldered terminals. Any partial or full dislodgment of the alarm panel from its installation mounts or any cracks or weakened deformations at the location of the installation mounts. Any physical damage that would render the alarm panel no longer drip-proof. Any covers or hinged doors that become unlatched, unlocked, or opened. Any excessive temporary or permanent deflections of printed circuit boards that would allow electronic parts to touch or short to other alarm panel components resulting in damage to components or alarm, trouble, ground, or fault indications, whether these indications are temporary or latched. Any physical changes to the alarm panel or its components that result in an inability to open, close, rotate, insert, remove, or slide any "previously movable" component, door, or printed circuit board due to component movement or shifting during testing.

3.11 Maintainability. To the maximum extent possible, alarm panels shall require minimum planned maintenance, cleaning, and replacement while maintaining performance.

3.12 Reliability. To the maximum extent possible, alarm panels shall be highly reliable devices that eliminate or significantly minimize the occurrence of false alarms (see 6.8.6) or trouble indications while maintaining an acceptable level of fire detection capability. Numerous false alarms for an installed shipboard system can erode crew confidence in the system. As specified in 3.10, any display of alarm data or any alarm indication at the alarm panel, whether temporary, intermittent or latched, when no such condition exists at any of the sensors, detectors or devices is considered a failure during the conductance of all first article tests.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.3 Conformance inspection. Conformance inspection shall include the examination and tests of Table I.

4.2 First article inspection. First article inspection shall be performed on an alarm panel when a first article sample is required (see 3.1). This inspection shall include the examination and tests of Table I. If only one alarm panel is procured for first article tests, the alarm panel shall be subjected to the Electromagnetic Interference test of 4.6.2.3 prior to the vibration test of 4.6.2.1. Furthermore, the shock test of 4.6.2.2 shall follow the vibration test of 4.6.2.1. Additional AFSSS sensors, detectors, and devices covered by separate AFSSS component specifications, as well as an AFSSS color graphic display and third party color graphic display, are required to conduct the alarm panel first article tests.

4.2.1 Disposition of first article units. Final disposition of first article samples shall be as specified (see 6.2 and 6.3).

4.3 Conformance inspection. Conformance inspection shall include the examination and tests of Table I.

TABLE I. First article and conformance inspections.

Name	Requirement paragraph	Verification paragraph	First article inspection	Conformance inspection
Configuration	3.3	4.4	X	X
Drip-proof	3.4	4.4	X	X
Weight	3.5	4.4	X	X
Size	3.6	4.4	X	X
Interface requirements	3.7	4.4	X	X
Basic operation	3.8.1	4.5	X	X
Fixed and rate of temperature rise sensitivity	3.8.2	4.4	X	X
Smoke sensitivity and alarm verification	3.8.3	4.4	X	X
Real time measurement of temperature and smoke	3.8.4.1	4.5	X	X
Storage of peak measurements	3.8.4.2	4.5	X	X
Flame detector operation	3.8.5	4.4, 4.5	X	X
SCZM operation	3.8.6	4.4, 4.5	X	X
Isolator operation	3.8.7	4.5	X	X
Self-testing circuitry	3.8.8	4.4	X	X
Back-up battery	3.8.9	4.4	X	X
Access levels	3.8.10	4.4	X	X
Historical logs	3.8.11	4.5	X	X
Commercial performance requirements	3.9.1	4.6.1	X	
Operating temperature range	3.9.1.1	4.6.1	X	
Vibration	3.9.2.1	4.6.2.1	X	
Shock	3.9.2.2	4.6.2.2	X	
Electromagnetic interference	3.9.2.3	4.6.2.3	X	

4.4 General examination. Alarm panels shall be thoroughly examined for compliance with the requirements specified in 3.3 through 3.7 and 3.8.2 through 3.8.11. A visual examination shall be made to ensure the proper overall alarm panel configuration, the inclusion of an (at least) 60 character alphanumeric display, the inclusion of a connector for computer interface (as required in 3.7.1.6), and the drip-proof integrity of the overall alarm panel (as required in 3.4). The capability to monitor up to at least 10 sensor loops with at least 60 addressable devices on each shall be verified in compliance with 3.6.2. The existence of and the ability to easily set the three nominal fixed temperature alarm thresholds at the alarm panel, AFSSS color graphic display or third party color graphic display shall be verified in compliance with 3.8.2. The existence of and the ability to easily set the three nominal rate of temperature rise alarm thresholds at the alarm panel, AFSSS color graphic display or third party color graphic display shall be verified in compliance with 3.8.2. The existence of and the ability to easily set the three nominal ionization and photoelectric smoke sensor alarm thresholds at the alarm panel, AFSSS color graphic display or third party color graphic display shall be verified in compliance with 3.8.3. The existence of and the ability to easily enable and disable an alarm verification feature at the alarm panel, AFSSS color graphic display or third party color graphic display for individual smoke sensors shall be verified in compliance with 3.8.3. The restorability of all sensors, detectors and devices after alarm (through a reset at the alarm panel, AFSSS color graphic display or third party color graphic display) shall be verified in compliance with 3.8.2, 3.8.3, 3.8.5, and 3.8.6. The alarm panel shall also be weighed and measured for compliance with 3.5 and 3.6, respectively. The inclusion of self-testing circuitry, as specified in 3.8.8, shall be verified. Back-up battery operation shall be verified in compliance with 3.8.9. All three access level capabilities shall be verified in compliance with 3.8.10. The alarm panel shall comply with the requirements of 3.3 through 3.7 and 3.8.2 through 3.8.11.

4.5 Basic operational tests. Figure 1 shows the basic operational test configuration for the alarm panel. One ionization smoke sensor, one heat sensor, one SCZM, and at least one isolator shall be connected to and powered and monitored by the AFSSS alarm panel in loop fashion as shown in Figure 1. The ionization smoke sensor and heat sensor shall each consist of the appropriate sensor head and the universal sensor base and junction box. The SCZM and isolator(s) shall be housed in their appropriate waterproof enclosures. LS2SWU-1 cables and appropriate stuffing tubes shall be used to connect all of the devices to the alarm panel. The LS2SWU-1 cabling shall be routed from the alarm panel to the devices and then returned to the alarm panel in a looped NFPA 72, Style 6, Class A signaling line circuit arrangement. An on/off switch shall be connected to the SCZM with LS2SWU-1 or appropriate shielded, watertight, low-smoke cable and an appropriate stuffing tube. For testing purposes, another enclosure shall be located on the sensor loop. An LS2SWU-1 cable shall penetrate this enclosure with an appropriate stuffing tube and shall be directly connected across the two sensor loop 1 LS2SWU-1 conductors. On the other end of this cable, a test (on/off) switch shall be connected that will be used to intentionally cause a short across the two conductors on sensor loop 1. If the alarm panel itself does not have the capability to isolate shorts on the two LS2SWU-1 cables entering it at the ends of sensor loop 1, then two additional isolators (housed in appropriate enclosures) shall be installed on sensor loop 1 at the beginning and end of sensor loop 1 as shown in Figure 1. The ionization smoke sensor shall have its alarm threshold set to its most sensitive (lowest) alarm threshold (sensitivity) setting. The heat sensor shall have its fixed temperature alarm threshold set to 105 °F and its rate of temperature rise alarm threshold set to 15 °F per minute. The alarm panel shall be programmed to provide an appropriate alarm signal (see 6.8.4) when the on/off switch is closed, and that alarm shall latch at the alarm panel until the switch is opened and a manual reset is accomplished at the alarm panel, AFSSS color graphic display, or third party color graphic display. In addition, one photoelectric smoke sensor, one FDZM (if required), and at least one isolator shall be connected to and powered and monitored by the AFSSS alarm panel in loop fashion as shown in Figure 1. The photoelectric smoke sensor shall consist of the photoelectric smoke sensor head, the universal sensor base, and the junction box. The FDZM and isolator(s) shall be housed in their appropriate waterproof enclosures. LS2SWU-1 cables and appropriate stuffing tubes shall be used to connect all of the devices to the alarm panel. The LS2SWU-1 cabling shall be routed from the alarm panel to the devices and then returned to the alarm panel in a looped NFPA 72, Style 6, Class A signaling line circuit arrangement. A flame detector shall be connected to the FDZM (if required) with appropriate shielded, watertight, low-smoke cable and appropriate stuffing tubes. If required, an LS2SWU-1 cable, providing flame detector power, shall be routed from the alarm panel, either directly to the flame detector or indirectly to the flame detector via the FDZM, and then returned to the alarm panel, so that a single open on this cable shall not cause power to be lost at the flame detector. The flame detector shall provide an appropriate alarm signal that shall latch at the alarm panel until manually reset at the alarm panel, AFSSS color graphic display or third party color graphic display (once the flame is no longer present). If the alarm panel itself does not have the capability to isolate shorts on the two LS2SWU-1 cables entering it at the ends of sensor loop 2, then two additional isolators shall be installed on sensor loop 2 at the beginning and end of sensor loop 2 as shown in Figure 1. The photoelectric smoke sensor shall have its alarm threshold set to its most sensitive (lowest) alarm threshold (sensitivity) setting. Appropriate cabling shall be used to connect the alarm panel to an AFSSS color graphic display or other AFSSS alarm panels via the AFSSS sensor LAN. In addition, appropriate cabling shall be used to connect the alarm panel to a third party color graphic display (If the third party color graphic display can connect to the AFSSS alarm panel via the AFSSS LAN, then only the AFSSS LAN connection to the alarm panel is required for both the AFSSS color graphic display and the third party color graphic display). Operational tests shall be conducted on all devices. The operational tests shall consist of:

a. Subjecting the heat sensor to sufficient heat to cause an alarm at the alarm panel, AFSSS color graphic display, and third party color graphic display.

b. Subjecting the ionization smoke sensor to sufficient smoke to cause an alarm at the alarm panel, AFSSS color graphic display, and third party color graphic display.

c. Subjecting the photoelectric smoke sensor to sufficient smoke to cause an alarm at the alarm panel, AFSSS color graphic display, and third party color graphic display.

d. Subjecting the flame detector to a flame of appropriate and sufficient radiant energy to cause an alarm at the alarm panel, AFSSS color graphic display, and third party color graphic display.

e. Closing, then opening, the switch attached to the SCZM to ensure proper operation of the SCZM and to cause an appropriate alarm at the alarm panel, AFSSS color graphic display, and third party color graphic display.

f. Closing the test switch, which will short the two LS2SWU-1 loop 1 conductors inside the enclosure, to ensure proper operation of the isolators and appropriate trouble indications at the alarm panel, AFSSS color graphic display, and third party color graphic display.

g. Removing the heat sensor head to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

h. Removing the ionization smoke sensor head to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

i. Removing the photoelectric smoke sensor head to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

j. Reading real-time (analog) temperature measurements for the heat sensor at the alarm panel, AFSSS color graphic display, and third party color graphic display.

k. Reading real-time (analog) values (measurements) of the amount (or lack) of smoke for the ionization smoke sensor at the alarm panel, AFSSS color graphic display, and third party color graphic display.

l. Reading real-time (analog) values (measurements) of the amount (or lack) of smoke for the photoelectric smoke sensor at the alarm panel, AFSSS color graphic display, and third party color graphic display.

m. Disconnecting the flame detector from the alarm panel's looped flame detector power supply to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

n. Disconnecting a conductor on the sense-line cable that connects the flame detector to the FDZM (if required) to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

o. Removing the SCZM switch or opening a switch lead to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

p. Shorting the positive conductor of sensor loop 1 to ground (ship's hull), to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

q. Shorting the neutral conductor of sensor loop 1 to ground (ship's hull), to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

r. Opening the positive conductor of sensor loop 1 to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

s. Opening the neutral conductor of sensor loop 1 to ensure an appropriate trouble indication occurs at the alarm panel, AFSSS color graphic display, and third party color graphic display.

t. Inspecting the alarm panel, AFSSS color graphic display, and third party color graphic display history logs to verify that the time, date, and other specific sensor identification information for all alarms and troubles have been stored appropriately.

u. Inspecting the alarm panel, AFSSS color graphic display, and third party color graphic display logs to verify that the highest temperature and smoke measurements attained for individual heat, ionization smoke, and photoelectric smoke sensors have been stored and remain stored until cleared by using a middle access level password.

v. Visually inspecting the alarm panel for physical damage, cracks, loosening, warping, thermal deterioration, or dislodgment of parts.

w. Inspecting the AFSSS color graphic display, third party color graphic display, and/or other AFSSS alarm panels connected to the alarm panel (either through the AFSSS LAN or directly) to verify accuracy of duplicative sensor alarm, trouble, measurement, and history log information.

The alarm panel shall comply with the requirements of 3.8.1 and shall not exhibit any of the failures listed in 3.10.

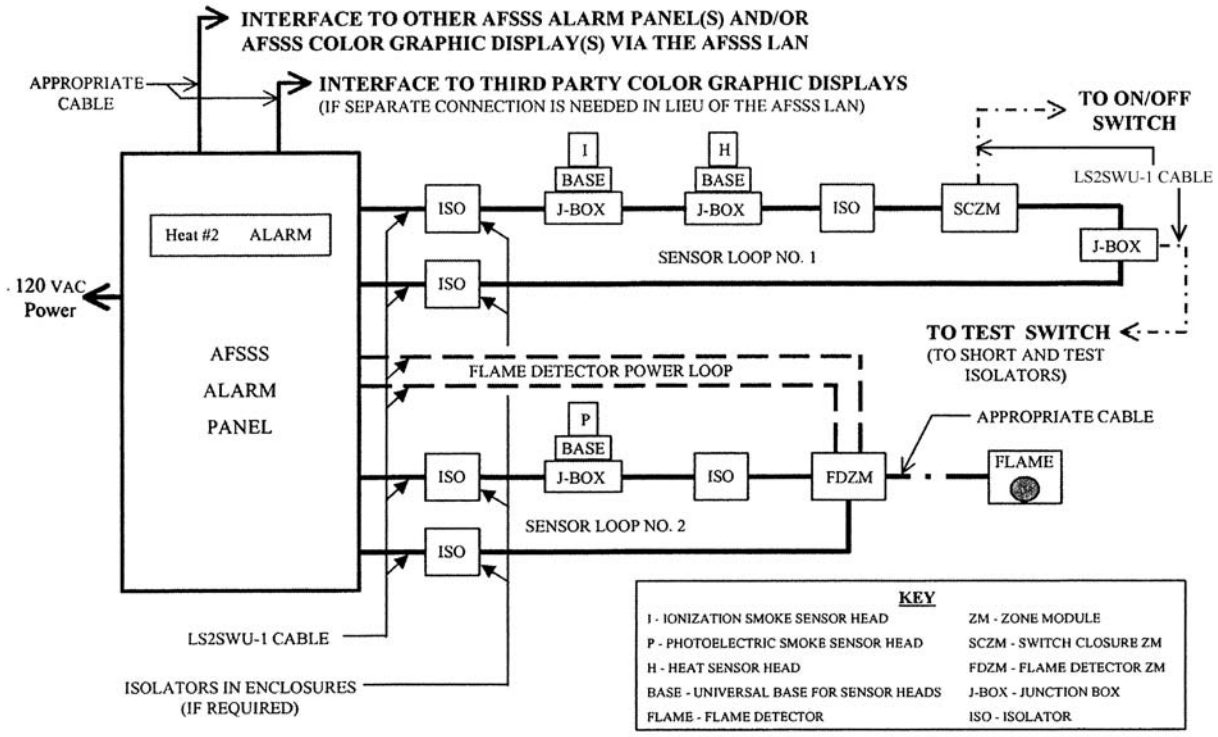

FIGURE 1. Test configuration for AFSSS alarm panel for basic operational, vibration, shock, and EMI tests[1/].

NOTE:

1/ For EMI testing, the AFSSS Color Graphic Display, Third Party Color Graphic Display, ON/OFF switch and test switch shall be located outside the EMI environment.

4.6 Performance tests.

4.6.1 Commercial performance tests. Alarm panels shall be inspected for UL listing, compliance with UL 864, and compatibility with AFSSS ionization smoke sensors, photoelectric smoke sensors, heat sensors, flame detectors, FDZMs (if required), SCZMs, and isolators. Alarm panels shall also be inspected to ensure that the UL 864 exceptions and clarifications of 3.9.1 are met as specified (see 6.2). The UL 864 variable temperature test shall be conducted to verify compliance with the operating temperature range of 32 °F to 120 °F as required in 3.9.1.1.

4.6.2 Government performance tests.

4.6.2.1 Vibration. One alarm panel shall be subjected to MIL-STD-167-1 vibration testing. The alarm panel shall have been subjected to all of the basic operational tests of 4.5 prior to this vibration test. In addition, this alarm panel vibration test shall be conducted after the electromagnetic interference test and before the shock test. The alarm panel shall be mounted (bolted) on the vertical bracket of the vibration platform and shall duplicate actual shipboard mounting conditions. AFSSS sensors, detectors, and devices shall be connected to and powered and monitored by the alarm panel, as described in 4.5 and shown in Figure 1, but shall not be mounted on the vibration platform nor subjected to vibration. An AFSSS color graphic display and third party color graphic display shall also be connected to the alarm panel, but shall not be mounted on the vibration platform or subjected to vibration. The heat sensor shall have its fixed temperature alarm threshold set to 105 °F and its rate of temperature rise alarm threshold set to 15 °F per minute. Both smoke sensors shall have their alarm thresholds set to their most sensitive (lowest) alarm threshold (sensitivity) settings. Alarm verification for the smoke sensors shall not be used. The exploratory, variable frequency, and endurance vibration tests shall be conducted on the alarm panel for each of the three rectilinear orientation axes. The full frequency range (4 through 50 Hz) shall be tested with vibration amplitudes as specified in MIL-STD-167-1. For each of the three orientations, the operational tests of 4.5 (a through l only) shall be conducted (while the alarm panel is mounted on the vibration platform but is not vibrating) once after the exploratory test and once after the variable frequency test. Also, for each of the three orientations, the operational tests of 4.5 (a through i only) shall be conducted (while the alarm panel is mounted on the vibration platform and is vibrating) once midway during the endurance test (or midway at each resonant frequency, if tested at more than one frequency during the endurance test). After the vibration test, the alarm panel shall also be subjected to all of the basic operational tests of 4.5. The alarm panel shall meet the requirements of 3.9.2.1.

4.6.2.2 Shock. One alarm panel shall be shall be subjected to lightweight, Grade A, Class I, Type A, MIL-S-901 shock testing. The alarm panel shall have been subjected to all of the basic operational tests of 4.5 prior to this shock test. In addition, this alarm panel shock test shall be conducted after the vibration test. The alarm panel shall be mounted (bolted) on the (vertical) Fixture 4A of the shock machine and shall duplicate actual shipboard mounting conditions. AFSSS sensors, detectors, and devices shall be connected to and powered and monitored by the alarm panel, as described in 4.5 and shown in Figure 1, but shall not be mounted on the shock machine nor subjected to shock. An AFSSS color graphic display and third party color graphic display shall also be connected to the alarm panel, but shall not be mounted on the shock machine nor subjected to shock. The heat sensor shall have its fixed temperature alarm threshold set to 105 °F and its rate of temperature rise alarm threshold set to 15 °F per minute. Both smoke sensors shall have their alarm thresholds set to their most sensitive (lowest) alarm threshold (sensitivity) settings. Alarm verification for the smoke sensors shall not be used. After each of the nine shock blows, the operational tests of 4.5 (a through l only) shall be conducted (while the alarm panel is mounted on the shock machine). After the shock test, the alarm panel shall be subjected to all of the basic operational tests of 4.5. The alarm panel shall meet the requirements of 3.9.2.2.

4.6.2.3 Electromagnetic interference (EMI). One alarm panel shall be subjected to EMI testing in accordance with MIL-STD-461. The alarm panel shall have been subjected to all of the basic operational tests of 4.5 prior to this EMI test. In addition, this alarm panel EMI test shall be conducted prior to the vibration test. The alarm panel shall be mounted (bolted) to the EMI ground plane and shall duplicate actual shipboard mounting conditions. The shields of the LS2SWU-1 sensor loop cables and other cables at the alarm panel shall connect to the chassis of the alarm panel, which shall be attached and grounded to the EMI ground plane. The AFSSS shall be EMI tested as a system; thus, AFSSS sensors, detectors, and devices shall be included in the EMI test. AFSSS sensors, detectors, and devices shall be connected to and powered and monitored by the alarm panel, as described in 4.5 and shown in Figure 1. An AFSSS color graphic display and third party color graphic display shall also be connected to the alarm panel, but shall not be exposed to the EMI environment nor subjected to EMI testing. The Test Switch and switch connected to the SCZM shall not be subjected to the EMI test and shall be located outside of the EMI environment during testing. The junction boxes and enclosures of all these sensors, detectors, and devices shall be bolted to the EMI ground plane using 1-inch long threaded-female standoffs to duplicate actual shipboard mounting conditions. (The bottoms of the junction boxes shall not rest flush against the ground plane. The bottoms of the junction boxes shall rest flush against the faces of the 1-inch standoffs.) In addition, at each sensor, detector and device location, the shields of the LS2SWU-1 cables shall connect to the EMI ground plane to provide shield termination (electrical conductivity). The heat sensor shall have its fixed temperature alarm threshold set to 105 °F and its rate of temperature rise alarm threshold set to 15 °F per minute. Both smoke sensors shall have their alarm thresholds set to their most sensitive (lowest) alarm threshold (sensitivity) settings. Alarm verification for the smoke sensors shall not be used. The EMI tests of 4.6.2.3.1 through 4.6.2.3.8 shall be conducted in accordance with MIL-STD-461 on the alarm panel and all sensors, detectors, and devices. The operational tests of 4.5 (a through l only) shall be conducted on the alarm panel during the EMI tests as specified in 4.6.2.3.1 through 4.6.2.3.8. After all of the 4.6.2.3.1 through 4.6.2.3.8 EMI tests are conducted, the alarm panel shall be subjected to all of the basic operational tests of 4.5. The alarm panel shall meet the requirements of 3.9.2.3. EMI requirements for the AFSSS sensors, detectors, and devices are contained in separate AFSSS component specifications.

4.6.2.3.1 Conducted emissions (CE 102) (10 kHz to 10 MHz). Conducted emissions on all power leads shall be measured over the range of 10 kHz to 10 MHz. The operational tests of 4.5 shall not be conducted during or after this portion of the EMI test.

4.6.2.3.2 Radiated emissions (RE 101) (30 Hz to 100 kHz). Radiated magnetic field emissions from all power and interconnecting leads, sensors, detectors, devices, and the alarm panel shall be measured over the range of 30 Hz to 100 kHz. The operational tests of 4.5 shall not be conducted during or after this portion of the EMI test.

4.6.2.3.3 Radiated emissions (RE 102) (10 kHz to 18 GHz). Radiated electric field emissions from all power and interconnecting leads, sensors, detectors, devices, and the alarm panel shall be measured over the range of 10 kHz to 18 GHz. The operational tests of 4.5 shall not be conducted during or after this portion of the EMI test.

4.6.2.3.4 Conducted susceptibility (CS 101) (30 Hz to 150 kHz). All power leads shall be subjected to CS 101 test signals as specified in MIL-STD-461 over the range of 30 Hz to 150 kHz. The AFSSS color graphic display, the third party color graphic display, the test switch, and the switch connected to the SCZM shall not be subjected to this EMI test and shall be located outside of the EMI environment during testing. The operational tests of 4.5 (a through l only) shall be conducted after this portion of the EMI test.

4.6.2.3.5 Conducted susceptibility (CS 114) (10 kHz to 200 MHz). All interconnecting cables shall be subjected to CS 114 test signals as specified in MIL-STD-461 over the range of 10 kHz to 200 MHz. The AFSSS color graphic display, the third party color graphic display, the Test Switch, and the switch connected to the SCZM shall not be subjected to this EMI test and shall be located outside of the EMI environment during testing. The operational tests of 4.5 (a through l only) shall be conducted after this portion of the EMI test.

4.6.2.3.6 Conducted susceptibility (CS 116) (10 kHz to 100 MHz). All interconnecting cables shall be subjected to CS 116 test signals as specified in MIL-STD-461 over the range of 10 kHz to 100 MHz. The operational tests of 4.5 shall be conducted after this portion of the EMI test.

4.6.2.3.7 Radiated susceptibility (RS 101) (30 Hz to 100 kHz). All power and interconnecting leads, sensors, detectors, devices, and the alarm panel shall be subjected to radiated magnetic fields over the range of 30 Hz to 100 kHz as specified in RS 101 of MIL-STD-461. The AFSSS color graphic display, the third party color graphic display, the test switch, and the switch connected to the SCZM shall not be subjected to this EMI test and shall be located outside of the EMI environment during testing. The operational tests of 4.5 (a through l only) shall be conducted after this portion of the EMI test.

4.6.2.3.8 Radiated susceptibility (RS 103) (2 MHz to 40 GHz). All power and interconnecting leads and sensors, detectors, and devices shall be subjected to radiated electric fields over the range of 2 MHz to 40 GHz at 25 volts per meter as specified in RS 103 of MIL-STD-461. The alarm panel shall be shielded from the effects of the 25 volts per meter field. The alarm panel shall be subjected to radiated electric fields over the range of 2 MHz to 40 GHz at 10 volts per meter as specified in RS 103 of MIL-STD-461. The AFSSS color graphic display, the third party color graphic display, the test switch, and the switch connected to the SCZM shall not be subjected to this EMI test and shall be located outside of the EMI environment during testing. The operational tests of 4.5 (a through l only) shall be conducted after this portion of the EMI test.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of material is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. AFSSS alarm panels are intended to power and monitor the status of AFSSS smoke and heat sensors and flame detectors that provide fire detection capability on U.S. Navy ships. Isolators, SCZMs, and FDZMs (if required) are associated devices employed by the AFSSS alarm panel. Alarm panels also convey their alarm and trouble status and information to other alarm panels or (AFSSS or third party) color graphic displays connected in the overall fire detection system Local Area Network or directly to the alarm panel.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. When first article is required. (see 3.1 and 6.3)

c. AFSSS alarm panel communication and data output information, proprietary protocol and coding documents required for the integration of the AFSSS alarm panel with a third party color graphic display. (see 3.7.1.5)

d. Quantity of first article alarm panels (including associated software) and associated sensors, detectors, devices, AFSSS color graphic displays, and third party color graphic displays required. (see 4.1)

e. Final disposition of first article test samples, which are considered consumed and nondeliverable. (see 4.2.1 and 6.3)

f. Proof of UL compliance including a full copy of the UL listing report for the alarm panels (with UL 864 testing data and results). The UL listing report will verify that the requirements of the variable temperature test (operating temperature range 32 °F to 120 °F) have been met. (see 4.6.1)

g. Packaging requirements. (see 5.1)

h. Technical manual requirements. (see 6.4)

i. Provisioning requirements. (see 6.5)

j. Warranty requirements. (see 6.7)

6.3 First article. When requiring a first article inspection, contracting documents should provide specific guidance to offerors. This guidance should cover the number of test items. These documents should also include specific instructions regarding arrangements for examination, approval of first article test results, and disposition of first articles. (see 3.1 and 6.2)

6.4 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, a technical manual contract (TMCR) should be obtained and cited in the contract. (see 6.2)

6.5 Provisioning. Provisioning Technical Documentation (PTD), spare parts, and repair parts should be furnished as specified (see 6.2). When ordering spare parts or repair parts for the equipment covered by this specification, the spare parts and repair parts should meet the same requirements as the parts used in the manufacture of the equipment. Packaging for such parts should also be specified.

6.6 Compatibility. If the alarm panel is being procured for use with a previously procured or existing system, ensure that the alarm panel is compatible and UL listed with the specific sensors, detectors, devices, AFSSS color graphic displays, and third party color graphic displays in that system. Individually addressable heat and smoke sensors, detectors, devices, and AFSSS and third party color graphic displays from one manufacturer are generally not compatible nor UL listed with an alarm panel from another manufacturer.

6.7 Warranty. Warranty requirements should be as specified (see 6.2).

6.8 Definitions.

6.8.1 Addressable sensor. A sensor with discrete identification that can have its status individually identified by the alarm panel.

6.8.2 AFSSS color graphic display. Software, residing on a CPU or workstation connected to the AFSSS LAN, that duplicates the AFSSS alarm panel's information display and control functions, but provides user-friendly screen displays of information (instead of the alarm panel's alphanumeric display). The AFSSS color graphic display is assumed to be provided by the AFSSS alarm panel manufacturer, as opposed to the Third Party color graphic display, which is supplied by a third party.

6.8.3 Alarm panel. A system component that provides power to various fire sensors and monitors and visually and audibly displays their status. The alarm panel might also provide transfer of this information to a graphic display system.

6.8.4 Alarm signal. A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.

6.8.5 Analog initiating device (sensor). An initiating device (sensor) that transmits a signal indicating varying degrees of condition as contrasted with a conventional initiating device, which can only indicate an alarm/normal condition.

6.8.6 False alarm. Any alarm caused by mechanical or electrical failure, malfunction, or environmental effects other than the actual signature (e.g., smoke, high temperature, high rate of temperature rise, actual flame radiation) appropriate for that type of sensor.

6.8.7 Fixed temperature type heat sensor. A sensor that responds when its operating element becomes heated to a predetermined level.

6.8.8 Flame detector. A fire detector that detects radiant energy (such as ultraviolet, visible, or infrared) that is emitted as a product of combustion reaction and obeys the laws of optics.

6.8.9 Flame detector zone module (FDZM). An individually addressable device that is used to interface flame detectors with the alarm panel for monitoring purposes. FDZMs generally connect appropriate power from the alarm panel to the flame detector for operation as well as provide the individually addressable flame detector alarm signal to the alarm panel.

6.8.10 Heat sensor. A fire sensor that senses heat. Heat sensors could be of the fixed temperature type, the rate of temperature rise type, or both. A fixed temperature type heat sensor could also be rate-compensated.

6.8.11 Ionization smoke sensor. A sensor that uses a small amount of radioactive material to ionize the air between two differentially charged electrodes to sense the presence of smoke particles. Smoke particles entering the ionization volume decrease the conductance of the air by reducing ion mobility. The reduced conductance signal is processed and used to convey an alarm condition when it meets preset criteria.

6.8.12 Isolators. Devices that protect sections of sensor loops from short circuits. Isolators are placed in series on the sensor loops, where they monitor for short circuits. Isolators are installed after groups of heat and smoke sensors, flame detectors and FDZMs (if required), and SCZMs, depending on the degree of overall sensor loop survivability desired. In the event of a short circuit, two isolators open, removing the shorted section of line from the sensor loop. The sensors, detectors, and zone modules remaining on both non-isolated sections of the sensor loop continue to operate and communicate with the AFSSS alarm panel. The sensors, detectors, and zone modules located between the isolators (within the shorted section of cabling) are not powered or operational, and the alarm panel reports those sensors, detectors, and zone modules as troubles (missing), thus assisting in isolating the location of the short circuit.

6.8.13 Photoelectric (light scattering) smoke sensor. A sensor that uses a light source and a photosensitive sensor arranged in a manner so that the rays from the light source do not normally fall onto the photosensitive sensor. When smoke particles enter the light path, some of the light is scattered by reflection onto the sensor. The light signal is processed and used to convey an alarm condition when it meets preset criteria.

6.8.14 Rate of temperature rise type heat sensor. A sensor that responds when the temperature rises at a rate exceeding a predetermined amount.

6.8.15 Reset. A control function performed by as system operator, that attempts to return a system or device to its normal, non-alarm state.

6.8.16 Restorable initiating device. A device (sensor) whose sensing element is not ordinarily destroyed in the process of operation.

6.8.17 Ruggedized. Physical and operational characteristics that allow equipment to withstand rough handling and extreme or hostile environments.

6.8.18 Self-test. A test or series of tests, performed by a device upon itself, that shows whether or not the device is operating within designed limits.

6.8.19 Signaling line circuit. A circuit or path between any combination of circuit interfaces, control units, or transmitters over which multiple system input signals or output signals, or both, are carried.

6.8.20 Smoke detector (sensor). A device that detects visible or invisible particles of combustion.

6.8.21 Switch closure zone module (SCZM). An individually addressable device that is used to interface switch closure devices (such as water flow switches, manual pull stations, water switches, and flooding switches) with the alarm panel for monitoring purposes.

6.8.22 Third party color graphic display. Software, residing on a CPU or workstation connected to either the AFSSS LAN or the alarm panel directly, that duplicates the AFSSS alarm panel's information display and control functions, but provides user-friendly screen displays of information (instead of the alarm panel's alphanumeric display). The third party color graphic display is assumed to be provided by a third party and not the AFSSS alarm panel or AFSSS color graphic display manufacturer.

6.8.23 Trouble signal. A signal initiated by the fire alarm system or sensor indicative of a fault in a monitored circuit or component.

6.9 Subject term (key word) listing.

Alarm signal
Color graphic display
Flame detector
Isolator
Trouble signal

Custodians:
Army – CR4
Navy – SH
Air Force – 99

Preparing Activity:
Navy – SH
(Project 6320-2005-007)

Review Activities:
DLA – GS, GS2

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.