INCH-POUND

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PERFORMANCE SPECIFICATION

HEAT SENSOR, 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 spot-type heat sensors (see 6.8.9 and 6.8.10) and their universal bases and junction boxes, which are components of an overall Advanced Fire and Smoke Sensor System (AFSSS) for use on naval ships. These heat sensors, universal bases, and junction boxes may be of commercial-off-the-shelf (COTS) design, but must be rugged (see 6.8.19) 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 6.8.14) smoke sensors (see 6.8.23), flame detectors (see 6.8.7), Flame Detector Zone Modules (FDZM) (see 6.8.8), Switch Closure Zone Modules (SCZM) (see 6.8.25), isolators (see 6.8.12), and alarm panel (see 6.8.2) 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
MIL-DTL-24643	-	Cables and Cords, Electric, Low Smoke, for Shipboard Use General Specifications 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.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 72	-	National Fire Alarm Code

(Copies of this document are available from National Fire Protection Association, One Batterymarch Park, Quincy, MA 02269 or online at http://www.nfpa.org/.)

UNDERWRITERS LABORATORIES INC. (UL)

UL 521	-	Heat Detectors for Fire Protective Signaling Systems

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

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. Mercury shall not be used in heat sensors.

3.3 Configuration. The overall heat sensor shall consist of a heat sensor head, a universal sensor base, and a junction box. Alternately, the universal sensor base and junction box may be combined into one unit, provided this one unit meets all of the combined requirements of both the universal sensor base and the junction box. The term, “heat sensor,” as used in this specification, refers to the overall heat sensor consisting of the heat sensor head, the universal sensor base, and the junction box or, alternately, the heat sensor head and a combined universal sensor base and junction box.

3.3.1 Sensor head. The heat sensor head shall contain the actual heat-sensing element of the heat sensor. When the temperature at the sensor exceeds the fixed temperature (see 6.8.6) alarm threshold chosen for the sensor, an alarm shall be indicated at the AFSSS alarm panel. In addition, when the rate of temperature rise (see 6.8.16) at the sensor exceeds the rate of temperature rise alarm threshold (if selected for the sensor), an alarm shall be indicated at the AFSSS alarm panel. The heat sensor head shall be compatible with the universal sensor base and shall securely attach to it but be easily attached and removed without the need for special tools. The sensor head, including the actual heat-sensing element (if exposed to the environment), shall be rugged enough to withstand gentle cleaning with water, water with mild detergent, or the manufacturer's recommended cleaner or cleaning method in the event of dust and dirt build-up. Sensor heads shall operate properly in both overhead (vertical) and bulkhead (horizontal) mounted positions. Heat sensors shall be restorable after alarm, but only after a reset (see 6.8.17) 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).

3.3.1.1 Interchangeability. The AFSSS heat sensor head shall have a unique model number assigned to it and shall be physically identical and interchangeable with all other AFSSS heat sensor heads from the same manufacturer.

3.3.1.2 Fixed temperature alarm threshold function of heat sensor head. In addition to the requirements of 3.3.1.3, heat sensors shall be able to be easily set/programmed by the AFSSS alarm panel 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. Initial selection and later changing of all discrete fixed temperature alarm threshold settings shall be easily executable at the AFSSS alarm panel (using at least a middle security access level) for individual sensors, without the need to make changes or adjustments at the individual sensors. For all heat sensor heads, any of the (at least) three nominal fixed temperature alarm thresholds may be chosen in combination with any of the (at least) three nominal rate of temperature rise alarm thresholds of 3.3.1.3.

3.3.1.3 Rate of temperature rise alarm threshold function of heat sensor head. In addition to the requirements of 3.3.1.2, heat sensors shall be able to be easily set/programmed by the AFSSS alarm panel to any of a minimum of three discrete rates 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 rate of temperature rise alarm threshold settings shall be easily executable at the AFSSS alarm panel (using at least a middle security access level) for individual heat sensors, without the need to make changes or adjustments at the individual sensors. For all heat sensor heads, 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 of 3.3.1.2.

3.3.2 Universal sensor base. The universal sensor base shall securely accept attachment of heat sensor heads and AFSSS ionization and photoelectric smoke sensor heads. The base shall be universal, permitting direct interchange between and compatibility with the heat sensor head and the AFSSS ionization and photoelectric smoke sensor heads from the same manufacturer. Universal sensor bases shall operate properly in both overhead (vertical) and bulkhead (horizontal) mounted positions. The universal sensor base and junction box may be combined into one unit, provided this one unit meets all of the combined requirements of both the universal sensor base and the junction box.

3.3.2.1 Interchangeability. The AFSSS universal sensor base from the same manufacturer shall have a unique model number assigned to it and shall be physically identical and interchangeable with all other AFSSS universal sensor bases from the same manufacturer.

3.3.3 Individual addressability and LED. Either the sensor head or the universal sensor base shall have an adjustable mechanical device or dipswitch that can be easily set to allow each sensor to be individually identifiable and addressable (see 6.8.1) by the alarm panel once installed in a specific location in a shipboard compartment. Once set, this device or dipswitch shall be easily capable of later being set to a different address, without the use of special tools or equipment, to support sensor head or base interchangeability. Either the sensor head or the universal sensor base shall also contain one or more LEDs. Failure of any LED shall not interfere with the operation of the head or base or the transmission of sensor information or alarm or trouble signals (see 6.8.26) to the alarm panel. The LED(s) shall be capable of visually showing the condition of the sensor head and universal base. The LED(s) shall distinctly identify the three possible sensor states:

State 1: Power is not being supplied to the sensor or the sensor is not properly operating (darkened LED).

State 2: Power is being supplied to the sensor and the sensor is operating but is not in an alarm state.

State 3: Power is being supplied to the sensor and the sensor is in an alarm state.

3.3.4 Junction box. A junction box shall securely accept attachment of the universal sensor base. The junction box and universal sensor base may be combined into one unit, provided this one unit meets all of the combined requirements of both the universal sensor base and the junction box. All junction boxes from the same manufacturer used for heat sensors shall be identical and shall also be identical to those used for AFSSS ionization and photoelectric smoke sensors. The junction box shall possess two flat areas to allow two separate LS2SWU-1 cables (See MIL-DTL-24643) with appropriate watertight stuffing tubes (See MIL-E-2036) to penetrate the junction box. The conductors of the LS2SWU-1 cables shall provide sensor power and supervision from the alarm panel and shall be wired to the universal sensor base. The junction box shall provide a conductive path for the shields of the LS2SWU-1 cables to connect to the ship's hull to provide shield termination. The junction box shall possess mounting tabs or brackets with clearance holes for bolts that will secure the junction box to 1-inch long threaded-female metal standoffs welded to the overhead or bulkhead of the compartment. When installed on the overhead of a compartment, the junction box shall be drip-proof such that water falling from above shall not enter the junction box. Therefore, standard 4-inch electrical boxes with holes or knockout plugs (which are commonly used for mounting commercial grade heat sensors and bases, but are not drip-proof) are not permitted as junction boxes.

3.4 Drip-proof. When installed on the overhead of a compartment, the overall heat sensor shall be drip-proof (15 degrees) in accordance with MIL-E-2036 such that water falling from above shall not enter the junction box, universal sensor base, or sensor head.

3.5 Weight. The total weight of the heat sensor (consisting of the sensor head, the universal sensor base, and the junction box) shall not exceed 3 pounds.

3.6 Size. Heat sensors (consisting of the sensor head, the universal sensor base, and the junction box) shall have a low profile. The maximum height of the overall heat sensor, assembled with sensor head mounted on the universal base and the junction box, shall not exceed 7 inches. The maximum diameter of the overall heat sensor shall not exceed 8 inches.

3.7 Interface requirements.

3.7.1 Electrical interface. Heat sensor heads and their universal sensor bases shall obtain power from and be compatible with the UL listed AFSSS alarm panel. The universal bases of the heat sensors shall be two-conductor devices, whose power supply terminals are the same as their signaling terminals. The cable used to interface the alarm panel with the heat sensors (via their universal bases and junction boxes) shall be LS2SWU-1. The LS2SWU-1 cabling shall be routed from the alarm panel to the various sensors 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 6.8.22) arrangement so that single opens on the loop will not result in the loss of any sensors.

3.7.2 Ship interface. The heat sensors shall attach to their universal bases, which, in turn, shall attach to their junction boxes. These junction boxes shall be mounted with bolts to 1-inch long threaded-female metal standoffs welded onto the overheads and bulkheads of the ship's compartments. Alternately, the universal sensor base and junction box may be combined into one unit, provided this one unit meets all of the combined requirements of both the universal sensor base and the junction box.

3.8 Operating requirements.

3.8.1 Basic operation. When tested in accordance with 4.5.1, heat sensors shall alarm when subjected to sufficient heat, and shall send appropriate alarm data or an alarm signal (see 6.8.3) to the alarm panel. Heat sensors shall provide actual temperature measurement information to the alarm panel, commensurate with the actual temperature at the sensor, which will allow the panel to display individual sensor real-time temperature measurements in degree Fahrenheit units.

3.8.2 Fixed temperature sensitivity. When tested in accordance with 4.5.2, heat sensors shall comply with the UL 521 operating temperature test requirements. Appropriate alarm data or an alarm signal shall be sent to the alarm panel when the temperature at the heat sensor reaches or exceeds the fixed temperature alarm threshold (sensitivity setting) of 105 °F for sensors H1, H3, and H5, 135 °F for sensors H2 and H6, and 155 °F for sensors H4 and H7.

3.8.3 Fixed temperature sensitivity tolerance. When tested in accordance with 4.5.2, heat sensors shall be uniform in operation with repeatable sensitivities (fixed temperature alarm threshold settings) and shall comply with the UL 521 operating temperature test requirements. Heat sensors set at 105 °F shall alarm within ±5 °F of their 105 °F alarm threshold. Heat sensors set at 135 °F and 155 °F shall alarm within ±7.5 °F of their 135 °F and 155 °F alarm thresholds, respectively.

3.8.4 Real time measurement of temperature. Heat sensors shall be analog initiating devices (see 6.8.4), which provide measurement values of the actual temperature surrounding the sensor, whether that temperature measurement is below (thus, in a normal state) or above (thus, in an alarm state) the fixed temperature alarm threshold of the sensor. When tested in accordance with 4.5.1, 4.5.2, 4.5.3, the UL 521 low temperature exposure test (see 4.6.1 and 3.9.1.e), and the UL 521 (high) temperature test (on polymeric materials) (see 4.6.1 and 3.9.1.k), heat sensors shall measure all temperatures from at least as low as 32 °F up to at least 194 °F, and convey this measurement information to the alarm panel for viewing. The alarm panel shall display individual sensor real-time temperature measurements in degree Fahrenheit units.

3.8.5 Rate of temperature rise sensitivity. When tested in accordance with 4.5.3, heat sensors shall comply with the UL 521 rate-of-rise operation test requirements. None of the seven sensors shall send alarm data or an alarm signal to the alarm panel when the rate of temperature rise at the heat sensors is between 8 °F and 10 °F per minute. Only heat sensors H1, H3, and H5 shall send alarm data or an alarm signal to the alarm panel when the rate of temperature rise at the heat sensors is between 15 °F and 18 °F per minute. Only heat sensors H1, H2, H3, H5, and H7 shall send alarm data or an alarm signal to the alarm panel when the rate of temperature rise at the heat sensors is between 20 °F and 25 °F per minute.

3.8.6 Self-testing circuitry. The heat sensors and their universal bases shall perform an automatic functional self-test (see 6.8.21) from the alarm panel, without the need to generate high temperatures at or attach meters to the sensors, to verify that the sensors are fully operational.

3.8.7 Spacing. Heat sensors shall be sufficiently sensitive to qualify for at least a 15-foot spacing (see 6.8.24) limitation, as determined by UL 521 oven or fire tests. Manufacturers shall clearly state/identify the UL 521 spacing obtained.

3.9 Performance requirements.

3.9.1 Commercial performance requirements. Heat sensors, universal bases, and junction boxes shall be UL listed and be compatible with a UL listed AFSSS alarm panel. Heat sensors, universal bases, and junction boxes shall comply with UL 521, with the following exceptions/clarifications:

a. Heat sensors shall employ both the fixed-temperature type of heat detection and the rate-of-temperature rise type of heat detection in the same unit.

b. Non-restorable heat detectors (see 6.8.13) (i.e., those that are destroyed after detecting high temperature) are not permitted. Restorable heat detectors (see 6.8.18) (i.e., those that are not destroyed after detecting high temperature) are required. Self-restoring heat detectors (see 6.8.20) (i.e., those that are restorable and that automatically reset the alarm indication at the alarm panel without a manual operator reset), are not permitted.

c. The use of a sealing compound shall not be permitted.

d. A fusible alloy is not permitted as the operating member of a heat detector.

e. Three heat sensors shall be energized/operating during the entire UL 521 low temperature exposure test when tested at -22 °F for 24 hours. All three heat sensors shall operate normally without interruption or trouble indications throughout this low temperature exposure test. Heat sensors shall provide actual temperature measurement information to the alarm panel, commensurate with the actual temperature at the sensor, down to at least 32 °F. The panel will display the appropriate individual sensor real-time temperature measurements in degree Fahrenheit units. Following the low temperature exposure test, the sensors shall comply with the requirements of the UL 521 oven test, the UL 521 operating temperature test, and the UL 521 rate-of-rise operation test.

f. The corrosion tests for outdoor use heat detectors (including salt spray) are required.

g. Heat sensors shall withstand transient tests as required for UL 521 listing, and shall also comply with the Government performance requirements for electromagnetic interference (EMI) in 3.9.2.3 of this specification.

h. Heat sensors shall withstand vibration as required for UL 521 listing, and shall also comply with the Government performance requirements for vibration in 3.9.2.1 of this specification.

i. The rain test for heat detectors intended for outdoor use is required.

j. Heat sensors shall withstand jarring as required for UL 521 listing, and shall also comply with the Government performance requirements for shock in 3.9.2.2 of this specification. In addition, a momentary trouble signal or alarm, resulting from jarring is not acceptable. Sensor operation shall not be affected. Dislodgment of parts is not acceptable, whether or not dislodged parts affect the operation of the unit or expose high-voltage parts.

k. Three heat sensors shall be energized/operating during the entire UL 521 (high) temperature test (on polymeric materials) and tested at 194 °F for 7 days (as opposed to 158 °F for 28 days). This temperature test (at a temperature above the alarm threshold settings of the heat sensors) is required, whether polymeric materials are used or not. All three heat sensors shall operate normally without interruption or trouble indications throughout this temperature test. Heat sensors shall alarm when subjected to temperatures above their alarm threshold settings and shall send appropriate alarm data or an alarm signal to the alarm panel. Heat sensors shall provide actual temperature measurement information to the alarm panel, commensurate with the actual temperature (194 °F) at the sensor. The panel will display the appropriate individual sensor real-time temperature measurements in degree Fahrenheit units. Following this temperature test, the sensors shall comply with the requirements of the UL 521 oven test, the UL 521 operating temperature test, and the UL 521 rate-of-rise operation test.

3.9.1.1 Operating temperature range. Heat sensors, consisting of heat sensor heads, universal bases, and junction boxes, shall operate properly at temperatures ranging from -22 °F to 194 °F. Proper operation includes the generation of an alarm indication if the operating temperature is above the alarm threshold set for the sensor and the lack of an alarm indication if the operating temperature is below the alarm threshold set for the sensor.

3.9.2 Government performance requirements. In addition to the UL 521 requirements and listing, the following Government requirements shall be met.

3.9.2.1 Vibration. When tested in accordance with 4.6.2.1, heat sensors (consisting of sensor heads, universal bases, and junction boxes) shall meet the requirements of MIL-STD-167-1. Heat sensors shall operate normally without interruption, trouble indications, nor alarm indications (other than those alarms specifically caused by operational tests) throughout the vibration test. Heat sensors shall not show any evidence of physical damage throughout the vibration test. No excessive resonances of any parts shall be present during the test such that sensor operation is affected or early failure can be expected. Heat sensors 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. Both heat sensors shall also comply with the requirements of 3.8.2, 3.8.3, and UL 521 after the vibration test when tested in accordance with 4.5.2 with their alarm thresholds set at 105 °F and 15 °F per minute for heat sensor H1 and 135 °F and 20 °F per minute for heat sensor H2. Both heat sensors shall also comply with the requirements of 3.8.5 and UL 521 after the vibration test when tested in accordance with 4.5.3 with their alarm thresholds set at 105 °F and 15 °F per minute for heat sensor H1 and 135 °F and 20 °F per minute for heat sensor H2.

3.9.2.2 Shock. When tested in accordance with 4.6.2.2, heat sensors (consisting of the sensor heads, universal bases, and junction boxes) shall meet the Grade A, Class I, Type A requirements of the lightweight MIL-S-901 shock test. Heat sensors shall operate normally without interruption, trouble indications, nor alarm indications (other than those alarms specifically caused by operational tests) throughout the shock test. Heat sensors shall not show any evidence of physical damage throughout the shock test. No excessive resonances of any parts shall be present during the test such that sensor operation is affected or early failure can be expected. Heat sensors 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. Both heat sensors shall also comply with the requirements of 4.5.2, 3.8.3, and UL 521 after the shock test when tested in accordance with 4.5.2 with their alarm thresholds set at 105 °F and 15 °F per minute for heat sensor H3 and 155 °F and “no rate of temperature rise alarm threshold chosen” for heat sensor H4. Both heat sensors shall also comply with the requirements of 3.8.5 and UL 521 after the shock test when tested in accordance with 4.5.3 with their alarm thresholds set at 105 °F and 15 °F per minute for heat sensor H3 and 155 °F and “no rate of temperature rise alarm threshold chosen” for heat sensor H4.

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), heat sensors (consisting of sensor heads, universal bases, and junction boxes) shall meet the requirements of MIL-STD-461. Heat sensors shall operate normally without interruption, trouble indications, nor alarm indications (other than those alarms specifically caused by operational tests) throughout the EMI test. Heat sensors shall not show any evidence of physical damage throughout the EMI test. Heat sensors 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. All heat sensors shall also comply with the requirements of 3.8.2, 3.8.3, and UL 521 after the EMI test when tested in accordance with 4.5.2 with their alarm thresholds set at 105 °F and 15 °F per minute for heat sensor H5, 135 °F and “no rate of temperature rise alarm threshold chosen” for heat sensor H6, and 155 °F and 20 °F per minute for heat sensor H7. All heat sensors shall also comply with the requirements of 3.8.5 and UL 521 after the EMI test when tested in accordance with 4.5.3 with their alarm thresholds set at 105 °F and 15 °F per minute for heat sensor H5, 135 °F and “no rate of temperature rise alarm threshold chosen” for heat sensor H6, and 155 °F and 20 °F per minute for heat sensor H7.

3.10 Failure criteria. Heat sensors (consisting of heat sensor heads, universal bases, and junction boxes) shall be reliable and not exhibit any failures such as:

a. Failure to meet all applicable UL 521 requirements.

b. Failure to be UL listed.

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

d. Inability to transmit appropriate alarm data or an alarm signal to the alarm panel when an actual alarm condition is present at the sensor (i.e., the lack of an alarm when the temperature at the sensor is above the fixed temperature alarm threshold selected or the lack of an alarm when the rate of temperature rise at the sensor is above the rate of temperature rise alarm threshold selected, if chosen).

e. Inability to transmit appropriate trouble data or a trouble indication to the alarm panel when an actual trouble condition is present at the sensor.

f. Transmission of alarm data or an alarm indication, whether temporary, intermittent or latched, when no such condition exists at the sensor (i.e., the occurrence of an alarm when the temperature at the sensor is below the fixed temperature alarm threshold selected or the occurrence of an alarm when the rate of temperature rise at the sensor is below the rate of temperature rise alarm threshold selected, if chosen).

g. Transmission of trouble data or a trouble indication, whether temporary, intermittent or latched, when no such condition exists at the sensor.

h. Failure of the sensor LED(s) or any incorrect LED indication for any of the three sensor states.

i. Erroneous measurements of temperature (once displayed in degrees Fahrenheit at the AFSSS alarm panel), anywhere in the range of 32 °F to 194 °F, whether at temperatures below the sensor's fixed temperature alarm threshold, or at temperatures above the sensor's fixed temperature alarm threshold.

j. The shifting of fixed temperature alarm thresholds beyond the limits of 3.8.3 or beyond the operating temperature range limits specified in UL 521.

k. Any physical damage, warping, or cracking of the sensor head, universal base, or junction box. Any physical damage, warping, cracking, or dislodging of any components from the sensor head, universal base, or junction box. Any dislodging of the entire sensor head from its universal base, the entire base from its junction box, or the entire junction box from its installation mounts (standoffs). Any physical damage that would render the sensor head, universal base, or junction box no longer drip-proof.

l. Any mechanical failure or alteration of the sensor's mechanical device or dipswitch (which sets the sensor's individual address) that results in a trouble signal, renders the sensor inaddressable from the alarm panel, or changes the address of the sensor.

m. Any change in the "manufacturer's stated" and "UL 521 determined" heat sensor's spacing limitation.

3.11 Maintainability. To the maximum extent possible, heat sensors, universal bases, and junction boxes shall require minimum planned maintenance, cleaning, and replacement while maintaining performance.

3.12 Reliability. To the maximum extent possible, heat sensors, universal bases, and junction boxes shall be highly reliable devices that eliminate or significantly minimize the occurrence of false alarms (see 6.8.5) while maintaining an acceptable level of high temperature and rate of temperature rise fire detection capability. Numerous false alarms for an installed shipboard system can erode crew confidence in the system. As specified in 3.10, any transmission of alarm data or an alarm indication, whether temporary, intermittent or latched, when no such condition exists at the sensor 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).

4.2 First article inspection. First article inspection shall be performed on heat sensors when a first article sample is required (see 3.1). This inspection shall include the examination and tests listed in Tables I and II. The total quantity of first article heat sensors required will consist of those required by and supplied to UL for the UL 521 commercial performance tests of 4.6.1 (as clarified in 3.9.1), as well as the seven additional heat sensors required for the Governmental tests of 4.4, 4.5, and 4.6.2. Table II delineates the fixed temperature and rate of temperature rise alarm threshold settings required for the seven first article heat sensors subjected to the Governmental operational and performance tests of 4.5 and 4.6.2.

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

4.3 Conformance inspection. Conformance inspection shall include the examination and tests listed in 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	4.5.1	X	X
Fixed temperature sensitivity	3.8.2	4.5.2	X	X
Fixed temperature sensitivity tolerance	3.8.3	4.5.2	X	X
Real-time measurement of temperature	3.8.4	4.5.1, 4.5.2, 4.5.3, 4.6.1	X	X
Rate of temperature rise sensitivity	3.8.5	4.5.3	X	X
Self-testing circuitry	3.8.6	4.4	X	X
Spacing	3.8.7	4.6.1	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	

TABLE II. Fixed temperature and rate of temperature rise alarm threshold settings required for the seven first article heat sensors subjected to the government operational and performance tests of 4.5 and 4.6.2.

Sensor designation	Basic operation test (4.5.1)	Fixed temperature sensitivity test (4.5.2)	Rate of temperature rise sensitivity test (4.5.3)	Vibration test (4.6.2.1)	Shock test (4.6.2.2)	Electromagnetic interference (EMI) test (4.6.2.3)
H1	105 15	105 15	155 15	105 15		
H2	135 20	135 15	155 20	135 20		
H3	105 15	105 15	155 15		105 15	
H4	155 N/A	155 15	155 N/A		155 N/A	
H5	105 15	105 15	155 15			105 15
H6	135 N/A	135 15	155 N/A			135 N/A
H7	155 20	155 15	155 20			155 20

NOTES:

1. The top number in each table cell is the fixed temperature alarm threshold setting (in degrees Fahrenheit) required for the test.
2. The bottom number in each table cell is the rate of temperature rise alarm threshold setting (in degrees Fahrenheit per minute) required for the test.
3. "N/A" means that no rate of temperature rise alarm threshold setting is required for the test; thus the heat sensor is a fixed temperature alarm threshold sensor only for the test.
4. A blank table cell means that that particular sensor is not used for that particular test.

4.4 General examination. Heat sensors (consisting of heat sensor heads, universal sensor bases and junction boxes) shall be thoroughly examined for compliance with the requirements specified in 3.3 through 3.7, as well as 3.8.6. A visual examination shall be made to ensure the proper overall sensor configuration (sensor head, universal sensor base, and junction box or sensor head and combination sensor base and junction box), the inclusion of an adjustable mechanical device or dipswitch for individually identifiable addressability, the proper assembly/disassembly/interchangeability of the sensor components, and the drip-proof integrity of the overall sensor (as required in 3.4). Heat sensors shall be cleaned with the manufacturer's recommended cleaner or cleaning method to ensure compliance with 3.3.1. The restorability of heat sensors after alarm (through a reset at the alarm panel) shall be verified in compliance with 3.3.1. The existence of and the ability to easily set the three nominal fixed temperature alarm thresholds at the alarm panel (using at least a middle security access level) shall be verified in compliance with 3.3.1.2. The existence of and the ability to easily set the three nominal rate of temperature rise alarm thresholds at the alarm panel (using at least a middle security access level) shall be verified in compliance with 3.3.1.3. The sensors shall also be weighed and measured for compliance with 3.5 and 3.6, respectively. The inspection shall also include operational checks of proper LED operation, as specified in 3.3.3, when the sensors, powered and monitored by the alarm panel in accordance with 3.7, are in their non-powered, powered/normal, and powered/alarm states. The inclusion of self-testing circuitry, as specified in 3.8.6, shall be verified.

4.5 Operational tests.

4.5.1 Basic operational tests. Seven heat sensors shall be powered and monitored by the AFSSS alarm panel. These seven heat sensors shall be designated H1, H2, H3, H4, H5, H6, and H7. LS2SWU-1 cables and appropriate stuffing tubes shall be used to connect the seven sensors to the alarm panel. The LS2SWU-1 cabling shall be routed from the alarm panel to the seven sensors and then returned to the alarm panel in a looped NFPA 72, Style 6, Class A signaling line circuit arrangement. Heat sensors H1, H3, and H5 shall have their fixed temperature alarm thresholds set to 105 °F and their rate of temperature rise alarm thresholds set to 15 °F per minute. Heat sensor H2 shall have its fixed temperature alarm threshold set to 135 °F and its rate of temperature rise alarm threshold set to 20 °F per minute. Heat sensor H4 shall have its fixed temperature alarm threshold set to 155 °F and its rate of temperature rise alarm threshold not set (i.e., heat sensor H4 will be a fixed temperature alarm threshold sensor only). Heat sensor H6 shall have its fixed temperature alarm threshold set to 135 °F and its rate of temperature rise alarm threshold not set (i.e., heat sensor H6 will be a fixed temperature alarm threshold sensor only). Heat sensor H7 shall have its fixed temperature alarm threshold set to 155 °F and its rate of temperature rise alarm threshold set to 20 °F per minute. Operational tests shall be conducted on all seven sensors. The operational tests shall consist of:

a. Subjecting the heat sensor to sufficient heat to cause an alarm.

b. Reading real-time (analog) temperature measurements for the heat sensors.

c. Visually inspecting the sensors, bases, and junction boxes for physical damage, cracks, loosening, warping, or thermal deterioration.

The seven heat sensors shall comply with the requirements of 3.8.1 and 3.8.4 and shall not exhibit any of the failures listed in 3.10.

4.5.2 Fixed temperature sensitivity test. The seven heat sensors previously tested in 4.5.1 (heat sensors H1, H2, H3, H4, H5, H6, and H7) shall be powered and monitored by the AFSSS alarm panel, placed in the overhead of a suitable air oven and subjected to the UL 521 operating temperature test. All seven heat sensors shall have their rate of temperature rise alarm thresholds set to 15 °F per minute. Heat sensors H1, H3, and H5 shall have their fixed temperature alarm thresholds set to 105 °F. Heat sensors H2 and H6 shall have their fixed temperature alarm thresholds set to 135 °F. Heat sensors H4 and H7 shall have their fixed temperature alarm thresholds set to 155 °F. The air temperature in the oven shall be increased at the rate of 1 °F per minute, from ambient room temperature, until all of the sensors alarm. The temperature of the air, measured at the sensors, shall be recorded for each sensor at the moment of each alarm. Sensors shall comply with the requirements of 3.8.2, 3.8.3, and 3.8.4 and UL 521 requirements and shall not exhibit any of the failures listed in 3.10. The primary purpose of this test is to establish a baseline for each sensor's 105 °F, 135 °F, and 155 °F nominal fixed temperature alarm threshold setting. This test shall then be repeated after each of the vibration, shock and EMI tests to ensure that the sensors' fixed temperature alarm thresholds do not change/vary. (Thus, the primary purpose of this test is not to ensure basic compliance with UL 521, which is covered separately by the UL testing and listing requirement in 3.9.1.)

4.5.3 Rate of temperature rise sensitivity test. The seven heat sensors previously tested in 4.5.1 and 4.5.2 (heat sensors H1, H2, H3, H4, H5, H6, and H7) shall be powered and monitored by the AFSSS alarm panel, placed in the overhead of a suitable air oven and subjected to the UL 521 rate-of-rise operation test. All seven heat sensors shall have their fixed temperature alarm thresholds set to 155 °F. Heat sensors H1, H3, and H5 shall have their rate of temperature rise alarm thresholds set to 15 °F per minute. Heat sensors H2 and H7 shall have their rate of temperature rise alarm thresholds set to 20 °F per minute. Heat sensors H4 and H6 shall have their rate of temperature rise alarm thresholds not set (i.e., heat sensors H4 and H6 shall be fixed temperature alarm threshold sensors only). The air temperature in the oven shall be increased at a rate of from 8 °F to 10 °F per minute, from ambient room temperature, until a temperature of 145 °F is reached. The temperature of the air, measured at the sensors, shall be recorded for each sensor at the moment of each alarm (if applicable). The oven shall then be cooled to and maintained at room temperature for at least five minutes prior to the start of the next test. The air temperature in the oven shall then be increased at a rate of from 15 °F to 18 °F per minute, from ambient room temperature, until a temperature of 145 °F is reached. The temperature of the air, measured at the sensors, shall be recorded for each sensor at the moment of each alarm (if applicable). The oven shall then be cooled to and maintained at room temperature for at least five minutes prior to the start of the next test. The air temperature in the oven shall then be increased at a rate of from 20 °F to 25 °F per minute, from ambient room temperature, until a temperature of 145 °F is reached. The temperature of the air, measured at the sensors, shall be recorded for each sensor at the moment of each alarm (if applicable). Sensors shall comply with the requirements of 3.8.4 and 3.8.5 and UL 521 requirements and shall not exhibit any of the failures listed in 3.10. The primary purpose of this test is to establish a baseline for each sensor's 15 °F per minute or 20 °F per minute nominal rate of temperature rise alarm threshold setting. This test will also establish a baseline of "no alarms" for sensors H4 and H6, which do not have any rate of temperature rise thresholds selected. This test will then be repeated after each of the vibration, shock and EMI tests to ensure that the sensors' rate of temperature rise alarm thresholds do not change/vary. (Thus, the primary purpose of this test is not to ensure basic compliance with UL 521, which is covered separately by the UL testing and listing requirement in 3.9.1.)

4.6 Performance tests.

4.6.1 Commercial performance tests. Heat sensors, universal bases, and junction boxes shall be inspected for UL listing, compliance with UL 521, and compatibility with the AFSSS alarm panel. Sensors shall also be inspected to ensure that the UL 521 exceptions and clarifications of 3.9.1 are met as specified (see 6.2). The UL 521 oven or fire tests shall be conducted to determine the UL 521 spacing limitation for the heat sensor and this spacing limitation shall comply with 3.8.7. The UL 521 rain test and corrosion tests (including salt spray) for outdoor use heat sensors shall be conducted and all sensors shall meet the requirements of 3.9.1.f and 3.9.1.i. The UL 521 low temperature exposure test (at –22 °F for 24 hours) shall be conducted with all sensors energized/operating and all sensors shall meet the requirements of 3.9.1.e. The UL 521 (high) temperature test (on polymeric materials) (at 194 °F for 7 days) shall be conducted with all sensors energized/operating and all sensors shall meet the requirements of 3.9.1.k. Thus, sensor operating temperature ranges shall be verified to comply with the requirements of 3.9.1.1.

4.6.2 Government performance tests.

4.6.2.1 Vibration. Two heat sensors (H1 and H2) (each consisting of a heat sensor head, universal base, and junction box) shall be subjected to MIL-STD-167-1 vibration testing. Sensors H1 and H2 shall have been subjected to the operational tests of 4.5.1 and the sensitivity tests of 4.5.2 and 4.5.3 prior to this vibration test. Both heat sensors shall be mounted on the vertical bracket of the vibration platform. The junction boxes of both sensors will be bolted to the vibration platform using one-inch long threaded-female standoffs to duplicate actual shipboard mounting conditions (The bottoms of the junction boxes shall not rest flush against the vibration platform. The bottoms of the junction boxes shall rest flush against the faces of the one-inch standoffs.). Both heat sensors shall be powered and monitored by the AFSSS alarm panel. The AFSSS alarm panel shall not be mounted on the vibration platform. LS2SWU-1 cables and appropriate stuffing tubes shall be used to connect the two heat sensors to the alarm panel. The LS2SWU-1 cabling shall be routed from the alarm panel to the two sensors and then returned to the alarm panel in a looped NFPA 72, Style 6, Class A signaling line circuit arrangement. Additional AFSSS sensors, detectors, and devices (e.g., other heat sensors not being subjected to this vibration testing or other smoke sensors, flame detectors, FDZMs, SCZMs, and isolators also being subjected to this vibration testing) may be included on this sensor loop. Heat sensor H1 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. Heat sensor H2 shall have its fixed temperature alarm threshold set to 135 °F and its rate of temperature rise alarm threshold set to 20 °F per minute. The exploratory, variable frequency and endurance tests shall be conducted 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 4.5.1 shall be conducted on both heat sensors (while mounted on the vibration platform) once after the exploratory test, once after the variable frequency test, and 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 sensors shall also be subjected to the sensitivity tests of 4.5.2 and 4.5.3 at the fixed temperature and rate of temperature rise alarm thresholds stated in 4.5.2 and 4.5.3 for sensors H1 and H2. Both heat sensors shall meet the requirements of 3.9.2.1.

4.6.2.2 Shock. Two heat sensors (H3 and H4) (each consisting of a heat sensor head, universal base, and junction box) shall be subjected to lightweight, Grade A, Class I, Type A, MIL-S-901 shock testing. Sensors H3 and H4 shall have been subjected to the operational tests of 4.5.1 and the sensitivity tests of 4.5.2 and 4.5.3 prior to this shock test. Both heat sensors shall be mounted on the (vertical) Fixture 4A of the shock machine. The junction boxes of both sensors will be bolted to the shock machine fixture 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 shock machine fixture. The bottoms of the junction boxes shall rest flush against the faces of the one-inch standoffs.). Both heat sensors shall be powered and monitored by the AFSSS alarm panel. The AFSSS alarm panel shall not be mounted on the shock machine. LS2SWU-1 cables and appropriate stuffing tubes shall be used to connect the two heat sensors to the alarm panel. The LS2SWU-1 cabling shall be routed from the alarm panel to the two sensors and then returned to the alarm panel in a looped NFPA 72, Style 6, Class A signaling line circuit arrangement. Additional AFSSS sensors, detectors, and devices (e.g., other heat sensors not being subjected to this shock testing or other smoke sensors, flame detectors, FDZMs, SCZMs, and isolators also being subjected to this shock testing) may be included on this sensor loop. Heat sensor H3 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. Heat sensor H4 shall have its fixed temperature alarm threshold set to 155 °F and its rate of temperature rise alarm threshold not set (i.e., heat sensor H4 will be a fixed temperature alarm threshold sensor only). After each of the nine shock blows, the operational tests of 4.5.1 shall be conducted on both heat sensors (while mounted on the shock machine). After the shock test, the sensors shall also be subjected to the sensitivity tests of 4.5.2 and 4.5.3 at the fixed temperature and rate of temperature rise alarm thresholds stated in 4.5.2 and 4.5.3 for sensors H3 and H4. Both heat sensors shall meet the requirements of 3.9.2.2.

4.6.2.3 Electromagnetic interference (EMI). Three heat sensors (H5, H6, and H7) (each consisting of a heat sensor head, universal base, and junction box) shall be subjected to EMI testing in accordance with MIL-STD-461. Sensors H5, H6, and H7 shall have been subjected to the operational tests of 4.5.1 and the sensitivity tests of 4.5.2 and 4.5.3 prior to this EMI test. The junction boxes of all three sensors will be bolted to the EMI ground plane using one-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 one-inch standoffs). All three heat sensors shall be powered and monitored by the AFSSS alarm panel. The AFSSS will be EMI tested as a system; thus, the AFSSS alarm panel shall be included in the EMI test. LS2SWU-1 cables and appropriate stuffing tubes shall be used to connect the three heat sensors to the alarm panel. The LS2SWU-1 cabling shall be routed from the alarm panel to the three sensors and then returned to the alarm panel in a looped NFPA 72, Style 6, Class A signaling line circuit arrangement. Additional AFSSS sensors (e.g., other smoke sensors, flame detectors, FDZMs, SCZMs, and isolators also being subjected to this EMI testing) may be included on this sensor loop. The shields of the LS2SWU-1 cables shall connect to the EMI ground plane to provide shield termination (electrical conductivity) at each sensor. The shields of the LS2SWU-1 sensor 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. Heat sensor H5 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. Heat sensor H6 shall have its fixed temperature alarm threshold set to 135 °F and its rate of temperature rise alarm threshold not set (i.e., heat sensor H6 will be a fixed temperature alarm threshold sensor only). Heat sensor H7 shall have its fixed temperature alarm threshold set to 155 °F and its rate of temperature rise alarm threshold set to 20 °F per minute. 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 all three heat sensors and the alarm panel (and any additional smoke sensors, flame detectors, FDZMs, SCZMs, and isolators included in the sensor loop for this EMI test). The operational tests of 4.5.1 shall be conducted on all three heat sensors 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 sensors shall be subjected to the sensitivity tests of 4.5.2 and 4.5.3 at the fixed temperature and rate of temperature rise alarm thresholds stated in 4.5.2 and 4.5.3 for sensors H5, H6, and H7. All three heat sensors shall meet the requirements of 3.9.2.3. EMI requirements for the alarm panel and other AFSSS sensors, detectors, and devices are contained in separate AFSSS component specifications.

4.6.2.3.1 Conducted emissions (CE102) (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 4.5.1 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 and the alarm panel shall be measured over the range of 30 Hz to 100 kHz. The operational tests of 4.5.1 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, and the alarm panel shall be measured over the range of 10 kHz to 18 GHz. The operational tests of 4.5.1 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 operational tests of 4.5.1 shall be conducted after this portion of the EMI test.

4.6.2.3.5 Conducted susceptibility (CS 114) (10 kHz to 30 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 30 MHz. The operational tests of 4.5.1 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 4.5.1 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, 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 operational tests of 4.5.1 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 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 operational tests of 4.5.1 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 materiel 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. The heat sensor is a sensing device that is effective at detecting high temperatures above the sensor's fixed temperature alarm threshold. In addition, heat sensors can also detect a rapid rise in temperature, even if the actual temperatures being measured are always below the fixed temperature alarm threshold setting. Heat sensors can be used for detecting flaming fires in shipboard compartments not suitable for smoke sensors due to potential false alarm problems from particulates in the air. In addition, they are ideal for sensing high temperature conditions caused by heat generated by a fire in an adjacent compartment. Heat sensors are one of several types of sensors used in the AFSSS and intended for use on Navy ships.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number and date of this specification.

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

c. Quantity of first article heat sensors (and an alarm panel, if applicable) required. (see 4.1)

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

e. Proof of UL compliance (see 4.6.1) including a UL listing report that:

(1) Clearly states the spacing limitation obtained for the heat sensor by the UL 521 oven or fire tests and that this spacing limitation complies with 3.8.7.

(2) Verify that the requirements of the UL 521 rain test and corrosion tests (including salt spray) for outdoor use heat detectors have been met.

(3) Verify that the UL 521 low temperature exposure test (at –22 °F for 24 hours) was conducted with all sensors energized/operating and that all sensors met the requirements of 3.9.1.e.

(4) Verify that the UL 521 (high) temperature test (on polymeric materials) (at 194 °F for 7 days) was conducted with all sensors energized/operating and that all sensors met the requirements of 3.9.1.k.

f. Packaging requirements. (see 5.1)

g. Technical manual requirements. (see 6.4)

h. Provisioning requirements. (see 6.5)

i. 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 requirement (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 heat sensors are being procured for use with a previously procured or existing system, ensure that the sensors are compatible and UL listed with the specific alarm panel in that system. Individually addressable heat sensors 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 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.

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

6.8.4 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.

6.8.5 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.

6.8.6 Fixed temperature type heat sensor. A sensor that will respond when its operating element becomes heated to a predetermined level.

6.8.7 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.

6.8.8 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.

6.8.9 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.

6.8.10 Heat sensor – spot type. A sensor whose detecting element is concentrated at a particular location.

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 or smoke sensors or flame detectors, 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 and detectors remaining on both non-isolated sections of the sensor loop will continue to operate and communicate with the AFSSS alarm panel. The sensors and detectors located between the isolators (within the shorted section of cabling) will not be powered nor operational, and the alarm panel will report those sensors/detectors as troubles (missing), thus assisting in isolating the location of the short circuit.

6.8.13 Non-restorable heat detector. A device whose sensing element is intended to be destroyed by the process of detecting a fire.

6.8.14 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.

6.8.15 Rate compensated heat sensor. A heat sensor that will respond when the temperature of the surrounding air reaches the predetermined fixed temperature alarm threshold, regardless of the rate of temperature rise.

6.8.16 Rate of temperature rise type heat sensor. A sensor that will respond when the temperature rises at a rate exceeding a predetermined amount.

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

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

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

6.8.20 Self-restoring heat sensor. A restorable sensor whose sensing element is intended to be returned to normal automatically when the temperature at the sensor lowers, without an operator manually resetting the alarm panel.

6.8.21 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.

6.8.22 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.

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

6.8.24 Spacing. A horizontally measured dimension related to the allowable coverage of fire sensors. The maximum distance permitted between heat detectors mounted on smooth ceilings at a specific height.

6.8.25 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.

6.8.26 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 panel

Alarm signal

Flame detector

Isolator

Smoke detector

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

Review Activities:
DLA – GS, GS2

Preparing Activity:
Navy – SH
(Project 6320-2005-004)

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.