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present.

Recommended changes to a NASAKSC Master Specification Section should be submitted as a Criteria Change Request (CCR) to the appropriate Technical Proponent (TP) through the [SpecsIntact Help Desk](#).

PART 1 GENERAL

NOTE: Include Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS in the project specifications when this section is used.

Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL and Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS apply to work specified in this section.

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text are automatically deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

FM GLOBAL (FM)

FM APP GUIDE

(updated on-line) Approval Guide
<http://www.approvalguide.com/>

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41

(1991; R 1995) Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits

JOHN F. KENNEDY SPACE CENTER (KSC)

KSC-STD-F-0004 (Rev F; 2010) Standard for Fire Protection Design

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2012; Amendment 1 2012) Life Safety Code

NFPA 70 (2011; Errata 2 2012) National Electrical Code

NFPA 70E (2012) Standard for Electrical Safety in the Workplace

NFPA 72 (2010; TIA 10-4) National Fire Alarm and Signaling Code

NFPA 75 (2009; TIA 12-1) Standard for the Protection of Information Technology Equipment

NFPA 90A (2012) Standard for the Installation of Air Conditioning and Ventilating Systems

NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)

NICET 1016-2 (2007) Program Detail Manual Fire Alarm Systems, 8th Edition

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595 (Rev C; Notice 1) Colors Used in Government Procurement

UNDERWRITERS LABORATORIES (UL)

UL 1449 (2006; Reprint Feb 2011) Surge Protective Devices

UL 1480 (2003; Reprint Jun 2010) Standard for Speakers for Fire Alarm, Emergency, and Commercial and Professional Use

UL 1711 (2006) UL Standard for Amplifiers for Fire Protective Signaling Systems, 4th Edition

UL 1971 (2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired

UL 2196 (2008) UL Standard for Tests for Fire Resistive Cables, 1st Edition

UL 268 (2009) Smoke Detectors for Fire Alarm Systems

UL 268A (2008; Reprint Sep 2009) Smoke Detectors

for Duct Application

UL 346	(2005; Reprint Nov 2009) Waterflow Indicators for Fire Protective Signaling Systems
UL 38	(2008; Reprint Dec 2008) Manual Signaling Boxes for Fire Alarm Systems
UL 464	(2009; Reprint Apr 2012) Standard for Audible Signal Appliances
UL 497B	(2004; Reprint Oct 2008) Protectors for Data Communication Circuits
UL 521	(1999; Reprint May 2010) Heat Detectors for Fire Protective Signaling Systems
UL Fire Prot Dir	(2012) Fire Protection Equipment Directory

1.2 ADMINISTRATIVE REQUIREMENTS

1.2.1 Services of a Certified Fire Alarm Specialist

Provide on site services of a Certified Specialist thoroughly experienced in fire detection and alarm work to perform or directly supervise the installation, make all necessary adjustments and perform all tests on the preaction system at the site.

Consider preaction specialist certified when the specialist holds a valid Fire Alarm System, Level III Certification from the National Institute for Certification in Engineering Technologies [NICET 1016-2](#) or a valid Level III Fire Alarm Engineering Technician Certification from the International Municipal Signal Association (IMSA), or is licensed by the State of Florida as a Fire Alarm Contractor I in accordance with Florida State Statute, Chapter 489, Part II.

Certification of other recognized agencies with equivalent requirements are also considered. Provide [evidence of the Contractor's State Certification](#) and the basis of certification to the Contracting Officer and get approved by the Contracting Officer, prior to any work being performed at Kennedy Space Center.

1.2.2 Pre-Installation Meetings

Within [30] [_____] days of Contract Award, the Contracting Officer will schedule a pre-installation meeting. Prior to the pre-installation meeting, submit the following for review and acceptance:

- a. [Quality Assurance](#)
- b. [Fire Alarm Acceptance Test Data and Results](#)
- c. [Approval Agency Test Procedure](#)
- d. [Factory Test Information](#)
- e. [Test Procedure](#)

Also submit the following shop drawings and manufacturer's product data:

- f. Connection Drawings
- g. Schematics
- h. Module Schematic Drawings
- i. Preaction Control Panels

1.3 SUBMITTALS

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Keep submittals to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that reviews the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

- Quality Assurance [; G]
- Fire Alarm Acceptance Test Data and Results [; G]
- Approval Agency Test Procedure [; G]
- Factory Test Information [; G]
- Test Procedure [; G]

SD-02 Shop Drawings

- Connection Drawings [; G]
- Schematics [; G]
- Module Schematic Drawings [; G]
- Preaction Control Panels [; G]

SD-03 Product Data

Preaction Control Panel [; G]
CFMS Reporting Equipment [; G]
Addressable Modules/Devices [; G]
Annunciator Panels [; G]
Heat-Actuated Detectors [; G]
Smoke Detectors [; G]
Duct Smoke Detectors [; G]
Manual Alarm Stations [; G]
Alarm Bells [; G]
Strobe Units [; G]
Speakers [; G]
Fire Resistive Cables [; G]
Water Flow Alarm Devices [; G]
Valve Tamper Switches [; G]
Remote Auxiliary Control Relays [; G]
Power Sources [; G]
Line Voltage Surge Suppressors [; G]
Low Voltage Surge Suppressors [; G]
Wiring [; G]
Recycled Material Content [; G]

SD-05 Design Data

Design Analysis and Calculations [; G]
List of Parts and Components [; G]

NOTE: Coordinate these submittals with Contract
Schedule Section IV, "Inspection Testing
Requirements."

SD-06 Test Reports

Preaction System Acceptance Tests [; G]

SD-07 Certificates

Evidence of the Contractor's State Certification[; G]

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals[; G]

SD-11 Closeout Submittals

Record Drawings[; G]

Revised Programs[; G]

Fire Service Floor Plans[; G]

1.4 QUALITY ASSURANCE

Provide the latest standard design, that is either listed by Underwriters' Laboratories **UL Fire Prot Dir** or approved by Factory Mutual **FM APP GUIDE** and be suitable for it's intended service.

Install all devices to function with the control panel and not interfere with the operation of the control panel.

Provide all additional equipment, cabinets, conduit, and labor to meet the requirements and intent of this specification.

Submit fully verified and dated copies of all Fire Alarm Acceptance test data and results with a copy of the approval agency test procedure and any factory test information.

PART 2 PRODUCTS

In contract provide a **list of parts and components** for the installed system by manufacturer's name, part number, and nomenclature, and recommended stock level required for normal maintenance and unscheduled repairs. Provide proof that all components are Underwriter Laboratory **UL Fire Prot Dir** listed or Factory Mutual **FM APP GUIDE** approved for their intended use and function.

Components installed under this contract can not be more than one (1) year older than the date of installation.

Submit manufacturer's data indicating percentage of **recycled material content** in preaction control panels. Preaction Control Panels to verify affirmative procurement compliance.

2.1 System Description

Provide preaction system that is a fully addressable, modular type, microprocessor based, supervised, non-coded electrical fire alarm system with **NFPA 72** Style D initiating device circuits, **NFPA 72** Style Z notification appliance circuits, and **NFPA 72** Style 7 signaling line circuits. Use diverse routing in accordance with **NFPA 72** for all styles of Class A initiating device, signaling line, notification appliance and control circuits. Do not run the outgoing and return redundant circuit conductors in the same cable assembly, enclosure or raceway. Provide a system that is electrically connected to; report alarms, silent alarms, troubles, and supervisory signals to the KSC Fire Monitoring System; sound the general alarm continuously; and control auxiliary equipment such as

smoke fire dampers, air handling units, magnetic door latches, etc., upon operation of one or more initiating devices. Provide initiating, notification, signal, and auxiliary control circuits that are 24 V DC.

2.1.1.1 Design Requirements

Submit .DGN or .DWG Format computer generated connection drawings, schematics, and fire service floor plans.

Submit connection drawings for approval [30] [60] [90] [_____] days after Notice to Proceed for installation of the Preaction and Detection System(s). On connection drawings include point-to-point wiring diagrams of internal and external wiring, preaction field devices, panel wiring, and interconnection between other building systems and components.

Submit schematics for approval for Preaction and Detection Control Systems consisting of the following:

Provide module schematic drawings (minimum size 216 by 280 mm 8-1/2 by 11 inch) prior to system acceptance testing.

Submit record drawings of as-built conditions indicating all field changes for approval 21 days prior to the acceptance testing phase of the project, as described in the paragraph entitled, "Field Testing," of this section. Provide magnetic media and hard copies of all new and revised software and drawings with the submittal. On As-Built drawings document final system configuration including, but not limited to, geographic monitor zone boundaries, location of the preaction control panel, all initiating and auxiliary control devices, signaling line devices, notification appliances, additional cabinets, wet and dry pipe sprinkler risers, dry pipe control panel, smoke and fire dampers, magnetic door holders and all other equipment associated with the preaction system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used), deviations from and amendments to the drawings, and field installation changes, concealed and visible.

Submit for approval 21 days prior to the acceptance testing phase of the project, as described in the paragraph entitled, "Field Testing," of this section Revised programs information (CMS file), both hard copy and disks, for existing Simplex KSC Fire Monitoring System. Install program information for preaction control panel including program listing, system point summary, and addressable device switch settings.

On Fire Service Floor Plans indicate location of the preaction control panel, all initiating and auxiliary control devices, signaling line devices, notification appliances, additional cabinets, detection systems, wet and dry pipe sprinkler risers, dry pipe control panel smoke and fire dampers, magnetic door holders and all other equipment associated with the preaction system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used). There are to be no borders or title blocks on the Fire Service Floor Plans. [Coordinate with the requirements of the Preaction System Fire Service Floor Plans such that all preaction and suppression system devices are combined on a single Fire Service Floor Plans.] Provide a symbol legend which clearly identifies each device shown on the Fire Service Floor Plans. Install a copy of the Fire Service Floor Plans minimum size 0.457 by 0.61 m 18 inch by 24 inch in a painted metal frame with a Plexiglas cover. Submit the floor plan and it's location for approval to the Contracting Officer prior to installation.

Submit [Design Analysis and Calculations](#) for approval for the preaction and detection systems consisting of the battery capacity and loading calculations in accordance with the paragraph entitled, "Preaction Control Panel," of this section.

2.1.2 Performance Requirements

Provide Program Logic and/or a Sequence of Operations which clearly shows the interaction of system components.

Conduct the [Preaction System Acceptance tests](#) in accordance with the paragraph entitled, "Field Testing," of this section. Prepare a test procedure and test record forms for conducting and recording complete tests on control panels, reporting systems, wiring systems, and field devices installed in accordance with the manufacturer's requirements and these specifications. Submit for approval, the test procedure to the Contracting Officer at least 30 days prior to the preliminary system test described in the paragraph entitled, "Field Testing," of this section. Identify in the test procedure each device and circuit to be tested, describe the initial condition, each step or function in the test, required test result, and equipment used. Provide test forms with suitable spaces for recording test results on all equipment, devices, and wiring to be tested. In test record forms also identify spaces for verification signatures of official witnesses and dates of the test.

In preaction systems, provide and maintain all of the equipment, devices, programming and circuits required for system operation in accordance with NFPA Codes and KSC-STD-F-0004, including remote reporting from existing KSC Fire Monitoring System (CFMS) equipment.

Conform system to all the applicable requirements of [NFPA 70](#), [NFPA 70E](#), [NFPA 72](#), [NFPA 75](#), [NFPA 90A](#), and [NFPA 101](#).

2.2 [PREACTION CONTROL PANEL](#)

Provide Preaction Control Panel (PCP) that contains power-on, alarm, supervisory, and trouble indicating lights plainly visible when the cabinet is closed. Also provide control panel that contains the following functions and is accessible only by unlocking and opening the unit:

- a. Alarm Silence
- b. Trouble Silence
- c. Supervisory Silence
- d. Power On-Off (If standard by the manufacturer)
- e. Alarm/Trouble Acknowledge
- f. Auxiliary Devices (AHU shutdown relay) Maintenance By-pass Switches
- g. System Reset

Provide preaction control panel that contains all components necessary to monitor and supervise all initiating device circuits. When any detector, manual alarm station (pull box), water flow switch, pressure switch, etc., connected to the preaction control panel is activated, the control panel visual alarm indication and audible signal are also activated. Activate

all notification appliances, including all associated auxiliary control functions. On the control panel visually indicate the addressable device or zone in alarm and transmit an alarm condition to the remote KSC Fire Monitoring System. Separate audible and visual notification appliance circuits. Provide audible and visual notification appliance circuits that have sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity. Provide visual notification appliances that remain operational until the PCP has been reset.

Provide preaction control panel that contains all components necessary to monitor and supervise all supervisory device circuits. When any valve tamper switch, pressure switch, or other supervisory device connected to the control panel is activated, the control panel supervisory visual indication and supervisory audible device are also activated. On the control panel visually indicate the addressable device or zone in supervisory alarm and transmit a supervisory condition to the remote KSC Fire Monitoring System.

Provide preaction control panel that contains all components necessary to operate and supervise the circuits for annunciator panels indicated and auxiliary devices that control equipment such as ventilating fans, air handling units, fan coil units, damper motors, solenoids, magnetic door holders, etc. Ensure supervise circuits for auxiliary control relays run to within 0.91 m 3 feet of the device to be controlled in accordance with NFPA 101.

Provide preaction control panel that includes a maintenance by-pass switch for all auxiliary control devices. Supervise by-pass switches to report trouble when in the maintenance by-pass position.

Monitor and report to panel as trouble, open supervised circuits, ground faulted supervised circuits, removal of detector or device, removal or failure of control panel module, maintenance by-pass switch activated, loss of primary power, power supply trouble, low battery voltage, loss of battery voltage, [preaction control panel enclosure open], and activation of the alarm silence switch. Provide all trouble signals to be identified by initiating, notification appliance, auxiliary control, or signaling line device. Provide trouble signals that activate the control panel trouble visual indication and trouble audible devices, and send a trouble signal to the remote KSC Fire Monitoring System.

Provide alarm/trouble reset switches that reset a cleared device in alarm or trouble. Provide alarm or trouble signals that do not self-restore without activating the switch.

Provide alarm, supervisory, and trouble audible silence switches. Provide the following for any switch placed in other than the normal position:

- a. Report as an alarm, supervisory, or a trouble to the KSC Fire Monitoring System.
- b. Transfer audible signal to a panel lamp visual indication.
- c. Re-ring the trouble audible if the problem has been cleared, but the switch has been left in the silence position.

Provide subsequent alarms that reactivate the notification appliances when the alarm silencing switches are in the silence position. Provide strobes that remain operational until the preaction control panel is reset.

Provide preaction control panel that is suitable for use with the detectors and manual alarm stations, and other preaction devices specified in this section.

Provide preaction control panel that has a normally closed set of dry contacts single pole, double throw (SPDT), which opens for trouble conditions and a normally open set of dry contacts single pole, double throw (SPDT), which closes under alarm conditions for connection to the KSC Fire Monitoring System.

Provide continuous duty relays and have self-cleaning contacts of silver or an alloy of equivalent performance. Suitably protect supervisory relays against dust by individual covers. Include at least one set of spare contacts for all relays that provide external functions, such as remote reporting, control device activation, notification appliance activation. Permanently mark relays with the following information: coil resistance, operating-current range, and internal pin connections using standard pin numbers.

[Install a separate terminal cabinet adjacent to the preaction control panel for interfacing device field wiring to the control panel. Install terminal strips for all field wiring circuits plus 25 percent spare. Where a terminal cabinet is installed, install terminal strips to accommodate remote reporting circuits.

]

NOTE: Verify the lock cylinder No. within the bracketed statement below with the Contracting Officer or Administrator.

Provide steel preaction control panel, terminal cabinets and battery cabinets (when used) with a hinged cover and an integral pin-tumbler cylinder lock. [Lock Cylinder: Best Universal Lock Co., No. A8817-XUS26D-7KSC with removable core that accepts the key presently in use with other control units existing in the area; lock core is provided by the government.] Paint cabinets with a prime coat and one or more finish coats of scratch-resistant baked enamel. Paint finish coat red unless otherwise indicated. Permanently affix an etched metal or engraved laminated plastic identification plate labeled, "Preaction Control Cabinet," to the cabinet door of the preaction control unit to identify the cabinet as a preaction control system cabinet. On cabinets painted red, provide an identification plate that has white letters on a black background. For cabinets not painted red provide an identification plate that has white letters on a red background.

Provide system that operates from a power supply with 120 grounded V AC input and 24 V DC output. Provide system that operates satisfactorily with power input voltage varying from 85 to 110 percent of nominal value. Provide power supply output that is capable of powering all initiation, signaling, annunciation, and control devices during alarm condition with 25 percent minimum spare capacity. [If supplied within the cabinet, provide the power on-off switch that disconnects all power sources to the control panel. Provide on-off switch that has DC rated contacts.]

Include batteries, charger, and power transfer equipment that provides the means of automatically supplying the entire preaction system with battery backup power in event of a primary power system failure. Provide system

that switches to battery power in event of AC power failure and switch back to AC power upon return of primary power. Provide control panel that is able to operate when the backup batteries are disconnected for any reason. Provide system that controls charging currents and floating voltage levels to maintain batteries in optimum condition. Provide capability to recharge batteries in event of discharge. Fuse wiring to protect against battery over-current and polarity reversal. In the event of a primary power, battery, or charging equipment failure, provide system that results in a preaction control panel trouble signal and visual indication.

Provide battery modules that are sealed (no corrosive fumes) and spill-proof. Provide batteries that are listed for preaction service and are suitable for high discharge currents required under alarm conditions. Provide batteries that are sized to operate the preaction and detection system (including voice evacuation systems and UV/IR flame detectors) in normal supervisory condition for 24 [48] [72] hours, minimum, then operate the system in the alarm mode for [5] 10 [15] minutes, minimum.

NOTE: Edit the following paragraph for a pre-action control panel to be used in facilities which do not require voice evacuation systems. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of zones anticipated.

2.2.1 Small Capacity PCP

NOTE: Edit the following paragraph for a pre-action control panel to be used in small facilities or suppression systems with 6 zones or less, and 2 CFMS reporting zone. Report each automatic sprinkler system flow switch as a separate device. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of zones anticipated.

Provide unit that is comprised of [_____] active zones, expandable to 6 zones via plug-in modules. Provide unit that has the required number of active zones to perform as indicated and specified herein. Add auxiliary function/control devices as required. Provide panel that includes all equipment required for connection to the existing KSC Fire Monitoring System.

2.2.2 Medium Capacity PCP (Without Voice)

NOTE: Edit the following for a pre-action control panel to be used in facilities which do not required voice evacuation systems. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of zones anticipated.

Provide unit that has a fully addressable system, comprised of [_____] addressable devices, [2] [_____] notification appliance circuits, and [4]

[_____] supervised circuits for auxiliary control relays. Provide unit that is expandable to [8] [_____] notification appliance circuits. Perform construction that is modular, solid-state microprocessor based electronics. Provide all modules that are equipped with transient suppression. Provide system that includes non-volatile programmable operating system memory for all operating requirements. Provide panel that includes all equipment required for connection to the existing KSC Fire Monitoring System.

Provide preaction control panel that includes all components and modules required for installation of a multiple addressable device network. Provide network that utilizes polling methods and provide two-way Style 6 supervised communications between the preaction control panel and addressable smoke detectors and monitor, signal, or control addressable modules.

2.2.3 Large Capacity Pre-Action Control Panel (With Voice)

NOTE: Select and edit the following paragraphs for a pre-action control panel to be used in a large size facility or facility requiring addressable device, voice evacuation, or fire fighters telephone.

Provide a fully addressable system with [_____] addressable points to include addressable monitoring modules, voice evacuation system, fire fighters phone system, addressable input/output relays and supervised circuits to remote auxiliary control relays. Perform construction that is modular with solid-state, microprocessor based electronics. Provide modules that are equipped with transient suppression. Provide system that includes non-volatile programmable operating system memory for all operating requirements. Provide panel that includes all equipment required for connection to the existing KSC Fire Monitoring System.

Provide unit that includes all components and modules required for a local facility maintenance and fire fighters phone system. Install a master telephone set at the control panel with remote phone jacks installed in the facility, as indicated on the contract drawings.

Provide a preaction control panel voice evacuation system that includes all components and modules required for a [single] [multiple] channel audio signaling system distributed over [8] [_____] audio signaling device circuits. Provide an audio system that is capable of accurately reproducing bell tones and pre-programmed voice messages for [staged] building evacuation. Provide audio amplifier input that includes a dedicated power supply with a primary power input of 120 V AC and a battery backup input of 24 V DC. Provide audio amplifier output that has a minimum of 100 watts at 25 V(RMS), with a minimum 25 percent spare capacity provided. Locate a microphone and 102 mm 4 inch speaker at the control panel for fire fighter paging and monitoring. Provide audio system control that includes switching with visual indication for localized facility-wide paging announcements. Provide messages that are multi-lingual voice in five (5) languages, followed by temporal three (3) bell tone until silenced. The languages in priority are English, Spanish, French, Japanese, and Russian. The Contracting Officer will approve the selection of languages.

Provide a unit that includes all components and modules required for installation of a multiple addressable device network. Utilize network polling methods and provide a two-way Style 6 supervised communications between the preaction control panel and addressable smoke detectors and monitor, signal, or control addressable modules.

2.3 CFMS REPORTING EQUIPMENT

2.3.1 Small/Medium Capacity PCP Reporting

NOTE: Edit this paragraph as required for systems of six reporting zones or less, without Simplex Model 2120 compatible communications equipment.

A Simplex Model 4100 system is installed at K6-1193 (VABR) and M6-0138 (CD&SC) for monitoring of small systems in the LC-39 or Industrial Area respectively.

Provide preaction control panel that reports to the KSC Fire Monitoring System using the existing Simplex Model 4100 system, located at the [VABR] [LCC1P11] [CD&SC]. Provide a reporting circuit that is 2-wire, Style B circuit from the indicated Simplex Model 4100 system zone module to the preaction control panel alarm relay and trouble relay, via base outside cable plant. A 3.3K ohm, 0.5 watt End-of-Line resistor is required at the PCP.

[Provide preaction control panel that reports to the KSC Fire Monitoring System using the existing Digitize Model 3000 system located in Building XY which is connected to the Remote Monitor Terminals located in Building 49750 (Alternate KSC Security Building) and the redundant unit located in Building 1708 (Hangar R&D) .

] [Provide reporting circuit that has a 2 wire, Style 6 circuit from Building XY to preaction control panel alarm relay and trouble relay via base outside cable plant. A 15 K ohm, End-of-Line resistor is required at the PCP.

]2.3.2 Large Capacity PCP Reporting

NOTE: Edit these paragraphs as required for systems installed with Simplex or Siemens network communications interface equipment.

Provide network communication interface that permits individual remote reporting of monitor devices and remote control of the preaction control panel from the KSC Fire Monitoring System.

2.3.3 Color Graphic Screens for CFMS Reporting System

Provide update programs for new or modified fire alarm control systems color graphic screens and install in the existing KSC Fire Monitoring System [Siemens] [Simplex] multiplexing system by original equipment manufacturer. Receive approval of all modifications and programming changes by the Contracting Officer, prior to installation.

2.4 ADDRESSABLE MODULES/DEVICES

**NOTE: Select and edit paragraphs as necessary for
the multiplex system designs only.**

Provide addressable modules that are solid state compatible with the preaction control panel. Provide modules that are suitable for individual outlet box mounting or group mounting within a control enclosure. Install outdoor modules in weatherproof enclosures with a neoprene gasket and protect from corrosion.

Provide modules that are field addressable. Modules to individually communicate with the preaction control panel using multiplexed communication techniques. Provide communication circuit wiring connections that are suitable for supervised Style 6 operation. Provide module power that is derived from the communication circuit or 24 V DC power supply supervised by the preaction control panel. Initiate a trouble signal at the preaction control panel during an invalid address setting, component failure, or power failure.

Paint enclosures with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, and durable finish. Include an engraved phenolic nameplate labeled, "PREACTION MODULES" on enclosures.

Provide addressable modules for initiation circuits that are supervised 4-wire Style D type unless otherwise indicated. Provide addressable modules for notification appliance circuits that are supervised parallel wired Style Z type unless otherwise indicated. Provide a module that is suitable for use with bells, strobes, and relays. Include 2 separate fused Form-C contacts rated 2 Amperes at 28 V DC at 120 V AC with addressable modules for control circuits.

2.5 ANNUNCIATOR PANELS

Provide annunciator panels that are [LED] [Front lighted] [Back lighted] [LCD Alphanumeric] type, compatible with and supervised from the preaction control panel. Include operating power supply that is 24 V DC. Provide lamps that are yellow for trouble and red for alarm; provide a test switch for testing all lamps. Include a nameplate on each lamp with the function identified for all lamps. Engrave nameplates with phenolic tag.

[Provide annunciator panel that includes an audible trouble/alarm buzzer with keyed silence switch.

] Provide LED type graphic annunciator panels where indicated. Provide annunciator that includes laminated area display to indicate location and condition (trouble and alarm) of devices connected.

Provide terminal strips suitable for 0.8 mm through 2.0 mm² No. 18 through No. 14 AWG solid copper conductors for all annunciator panel wiring connections.

Mount annunciator panels in manufacturer required enclosures. Where hinged enclosures are used, provide a lock-set matching that of the preaction control panel. Paint all exposed metal parts of annunciator panels with a prime coat and one or more finish coats of scratch-resistant baked enamel.

Paint finish coat red unless otherwise indicated.

2.6 HEAT-ACTUATED DETECTORS

Provide heat-actuated detectors that are alarm-initiating devices designed for use with automatic/manual preaction systems, in accordance with [UL 521](#).

Provide heat-actuated detectors that are rated [136] [190] degrees F fixed temperature with 15 degree F per minute rate-of-rise feature. Provide detectors that are self-restorable for the rate-of-rise feature and non-restorable for the fixed temperature feature. Provide detectors that have a rate-of-rise principle of operation, which uses an air chamber, a vent and a flexible metal diaphragm. Provide for the fixed temperature principle of operation by a fusible solder joint.

Provide detectors that have a set of normally open contacts that close to initiate an alarm. Provide wiring connections that are suitable for supervised Style D operation, and are made with terminal blocks capable of accepting 0.8 mm through 2.0 mm² No. 18 through No. 14 AWG solid copper conductors. Ensure detector components are rust and corrosion resistant.

Locate detectors no closer than 300 mm 12 inch from any part of the lighting fixture and no closer than 600 mm 24 inch from any supply or return diffuser. Install UL listed or FM approve detectors in areas subject to moisture or exterior atmospheric conditions.

Locate electronic heat detectors no closer than 1.83 m 6 feet from a fluorescent light fixture. Locate detectors no closer than 0.91 m 3 feet from any return air diffuser and no closer than 1.83 m 6 feet from any supply diffuser. Install detectors in areas subject to moisture or exterior atmospheric conditions. Install UL list or FM approve detectors in areas subject to moisture or exterior atmospheric conditions.

2.6.1 Line-Type Fixed Temperature Heat Detector Cable

Provide [thermostatic] or [thermistor] line-type heat detection cable [with weather-resistant outer covering] where indicated. Provide cables that are nominally rated for a temperature of [6 8 degrees C 155 degrees F] [88 degrees C 190 degrees F] [138 degrees C 280 degrees F] and operate on fixed temperature principle only.

2.6.2 Rate Compensating Heat Detector

Provide detectors that are hermetically sealed. Ensure detectors are the automatic resetting type that operate when ambient air temperature reaches detector setting, regardless of rate of temperature rise. Do not subject detector operation to thermal lag.

2.7 SMOKE DETECTORS

Provide smoke detectors that are alarm-initiating devices designed for use with automatic/manual preaction systems, in accordance with [UL 268](#).

Provide smoke detectors that are [2.5] [_____] percent per foot nominal obscuration (photo-electric) type. Provide detector that is listed for use with the preaction control panel installed, and includes all required accessories. Provide rust and corrosion resistant detectors and accessories. Provide detector head that is a plug-in unit. Provide unit that contains no moving parts, nor requires re-adjustment or removal to

resume normal operation after an alarm. Screen all detector openings to prevent the entry of insects and debris.

Provide detector base that includes screw terminals suitable for 0.8 mm through 2.0 mm² No. 18 through No. 14 AWG solid copper conductors for all wiring connections required. Supervise detector to initiate a trouble signal at the preaction control panel if the detector is removed. Include a light emitting diode indicator that provides a visual indication when the detector initiates an alarm.

Locate detectors no closer than 1.83 m 6 feet from a florescent light fixture. Locate detectors no closer than 0.91 m 3 feet from any return air diffuser and no closer than 1.83 m 6 feet from any supply diffuser. Install UL list or FM approve detectors in areas subject to moisture or exterior atmospheric conditions.

Provide remote annunciator in locations readily visible and accessible for detectors installed under raised floors or other locations where the detector is concealed or not readily visible; or provide detector that is of the addressable type. Provide annunciator panels that are in accordance with the paragraph entitled, "Annunciator Panels," of this section. Install remote test/light assemblies for installations that are not readily accessible. Where multiple duct smoke detectors are installed, group the remote test switches together at a common location.

NOTE: Use the following paragraph where addressable smoke detectors are to be used in lieu of remote annunciator panels.

Provide addressable detector bases where indicated, or used in lieu of remote annunciator panels. Provide base that includes circuitry and user selectable switching required for assigning each detector a unique address on the preaction control panel communication bus. Initiate a trouble signal at the preaction control panel during an invalid address switch setting or component failure.

Provide detectors that are the 2-wire Style D type, powered from the panel alarm initiation or communication bus circuit; separate power sources are not acceptable.

2.7.1 Duct Smoke Detectors

Provide duct smoke detectors that are alarm-initiating devices designed for use with automatic/manual preaction systems, in accordance with UL 268A.

Provide duct smoke detectors that are photoelectric type listed by UL Fire Prot Dir or FM approval guide for duct smoke detector installation. Provide duct detectors with perforated sampling tubes extending across the width of the duct. Provide duct smoke detectors that cause shutdown of the associated air handling unit, annunciation at the preaction control panel, and transmit a silent alarm to the KSC Fire Monitoring Station during activation, but do not activate the building evacuation notification appliances. Provide addressable type duct smoke detectors connected to an addressable PCP, with ability to perform sensitivity testing in accordance with NFPA 72. Provide a single maintenance by-pass switch to isolate each air handling units' duct smoke detectors. Provide maintenance by-pass switches that when activated

inhibits reporting and causes a trouble condition at the PCP. Provide a maintenance by-pass switch that when restored to its normal configuration, the trouble signal at the PCP self-restores. Where duct smoke detectors are installed outdoors or in high ambient temperature areas, install the detector housing in an additional PVC enclosure with an additional set of supply and exhaust sampling tubes, to prevent condensation from forming within the detector housing.

Install a separate remote test/light assembly for each duct smoke detector. Where multiple duct smoke detectors are installed, group the remote test switches together at a common location.

2.8 MANUAL ALARM STATIONS

Provide manual alarm stations that are non-coded, addressable types, alarm-initiating devices designed for use with automatic/manual preaction systems, in accordance with UL 38.

Provide wiring terminals that are suitable for 2-wire, Style D wiring and are capable of accepting 0.8 mm through 2.0 mm² No. 18 through No. 14 AWG solid copper conductors.

Provide a manual alarm station door that has a protected, pulldown operating lever with finger grip which does not project out from the front of the case. When operated, mechanically latch the station, break a glass or plastic rod, close one or more sets of contacts, and lock the contacts in the operated position until reset. Stations with a pushbutton which depends upon a spring-loaded device to close the contacts when the handle is pulled are not acceptable. Provide stations that are not re-settable without the use of a key or tool.

Paint all exposed metal surfaces of enclosing cases with a prime coat and one or more finish coats of red enamel to produce a smooth, hard, durable finish. Provide identification and directions for operating preaction stations on the cover in raised or depressed white-enameled letters. Manual alarm stations constructed of plastics or composite material are not acceptable.

Provide surface mounted stations furnished with matching cast-iron or cast-aluminum back boxes with top and bottom threaded-conduit connections. Weatherproof mounted outdoor stations with a neoprene gasket, and protect against corrosion.

2.9 ALARM BELLS

Provide preaction bells that are red, 250 mm 10 inch vibrating, under-dome, notification appliances in accordance with UL 464. Provide bell that produces at least 87 dB at 3 m 10 feet and conforms to NFPA 70.

Provide alarm bells that are solenoid-operated plunger sounding devices. Provide operating mechanism that is rustproof, protected from dust and insects, and located behind the gong shell.

Provide alarm bells that operate from polarized 24 V DC preaction control panel Style Z parallel wired supervised notification appliance circuits. Provide wiring connection that is on terminal blocks suitable for 1.0 through 3.0 mm² No. 16 through No. 12 AWG diameter solid copper conductors.

Put the strobe portion of combination audible/visual notification

appliances in accordance with the applicable provisions of the paragraph entitled, "Strobe Units," of this section.

In unfinished areas with conduit exposed to surface-mounted back boxes, secure surface-mounted alarm bells. Provide back boxes that are cast iron or cast aluminum, with threaded conduit connections. Paint all exposed metal surfaces with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, durable finish.

2.10 STROBE UNITS

Provide strobe units that are notification appliance designed for use with automatic/manual fire alarm systems, in accordance with [UL 1971](#).

Provide strobe units that meet the requirements of the Americans with Disabilities Act. Construct of red cast metal housing, clear polycarbonate dome lens with red "FIRE" lettering on two sides, and a xenon flash tube with solid state circuitry.

Provide unit with brightness no less than 75 candela and that produces approximately 80 to 90 flashes per minute. Provide unit that is UL listed or FM approved for fire protective service.

Ensure unit operates from a polarized 24 V DC preaction control panel Style Z parallel wired supervised notification appliance circuits. Synchronize multiple strobes visible from a single area. Provide operating current that does not exceed 0.2 amperes, and a unit that operates over a 20 percent variation in nominal input voltage. Provide wiring connection terminal blocks that are suitable for [1.0 through 3.0 mm² No. 16 through No. 12 AWG](#) diameter solid copper conductors.

Install flush mounted interior units using standard electrical backboxes. Install surface mounted units in cast iron or cast aluminum boxes with threaded conduit hubs.

Paint all metal exposed surfaces with a prime coat and one or more finish coats of red enamel to provide a smooth, hard durable finish.

2.11 SPEAKERS

Provide speakers that are notification appliance designed for use with auto/manual preaction systems, in accordance with [UL 1480](#) and [UL 1711](#).

Provide notification appliance speakers that are UL listed or FM approved for audible signal use, and are capable of clearly reproducing voice messages and bell tones over a 400 to 4000 Hz range. Provide speaker output at 1000 Hz for 1 Watt input power that is no less than 87 dB at [3 m 10 feet](#).

Provide a notification appliance that consists of sealed speakers and multiple-tap impedance matching transformer suitable for 25 V DC Style Z parallel wired supervised audio signaling systems. Provide transformer settings that include 0.25, 0.5, 1.0, and 2.0 Watt taps unless otherwise indicated. Provide wiring connections for 4 wire operation that use screw terminals suitable for [1.0 through 3.0 mm² No. 16 through No. 12 AWG](#) diameter conductors.

Provide red impact resistant polycarbonate or cast metal construction speaker housings. Install flush mounted interior speakers using standard

electrical backboxes. Mount surface mounted speakers using red cast iron or cast aluminum boxes with threaded conduit hubs. Weatherproof speakers mounted in exterior or wet locations with a neoprene gasket and protect from corrosion. Paint all exposed metal surfaces with a prime coat and one or more finish coats of red enamel paint to provide a smooth, hard, durable finish.

Put strobe portion of combination audible/visual notification appliances in accordance with the applicable provisions of the paragraph entitled, "Strobe Units," of this section.

2.12 WATER FLOW ALARM DEVICES

Provide water flow alarm devices that have alarm initiating devices designed for use with automatic/manual preaction systems, in accordance with [UL 346](#).

Conform water flow alarm devices to UL or FM requirements for the particular type of sprinkler system. Provide contacts that have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 V DC or 250 V AC.

2.12.1 Pressure Switch

Wire pressure switch alarm to make or break an alarm circuit depending on rise or fall of water pressure. Provide switch with an instant-recycle pneumatic-retard, or electronic adjustable setting time delay.

2.13 VALVE TAMPER SWITCHES

Provide valve tamper switches that are supervisory-initiating devices designed for use with automatic/manual preaction systems, in accordance with [UL 346](#).

Conform valve tamper switches to UL or FM requirements for use on the specified valve. Provide contacts that have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 V DC or 250 V AC.

Install UL list or FM approve valve tamper switches in hazardous locations for the hazardous location classification indicated. If the beacon is not factory sealed, install conduit seal-off fittings suitable for the hazardous location at each conduit connection to the explosion-proof enclosure, in accordance with [NFPA 70](#).

2.14 REMOTE AUXILIARY CONTROL RELAYS

Provide remote control relays that have continuous duty coils rated 24 V DC. Where relays are used on Style Z parallel wired supervised circuits, incorporate coils supervisory current blocking diode. Provide relays that have a minimum of two (2) single pole, double throw contacts rated 10 amps at 28 V DC or 250 V AC.

Where auxiliary control circuits connected to the relay are protected at a higher ampacity than the relay contacts are rated, install fusing rated to protect the relay contacts in the relay enclosure.

Provide remote auxiliary control relays that are mounted and supervised within [0.91 m 3 feet](#) of the controlled device in accordance with [NFPA 101](#).

Mount remote auxiliary control relays in enclosures indicated or, if not

indicated, in manufacturer's required enclosure. Install outdoor relays in a weatherproof enclosure with a neoprene gasket, and protect against corrosion.

Paint enclosure with a prime coat and one or more finish coats of red enamel to provide a smooth, hard, and durable finish. Label enclosure with an engraved phenolic nameplate labeled, "F/A RELAY."

2.15 POWER SOURCES

Provide normal power to the local systems for all purposes, including separate powered indicating/alarm devices, that is 120 volts 60 hertz. Provide system that operates satisfactorily between 85 and 110 percent of normal voltage. Provide preaction system disconnect/protective device that has a fused switch with a red factory finish as specified herein for manual alarm stations. Mount this disconnect switch adjacent to the fire alarm control panel. In addition, mark it PREACTION CONTROL PANEL DISCONNECT with 12 mm 1/2-inch high letters in white paint or engraved phenolic identification plates fastened with sheetmetal screws. Provide switch that is capable of being locked in the "on" or "off" position. Do not interfere this feature with the circuit protection capability of the device. Provide switch that is equipped with surge suppression for all phase and neutral conductors. Install current limiting Class RK1 fuses properly sized to protect the preaction control panel components.

2.16 WIRING

Provide wiring in accordance with NFPA 70, NFPA 70E, and NFPA 72. Provide copper conductors for 120 V AC circuits that are 3.0 mm² No. 12 AWG minimum. Color code in accordance with KSC-STD-F-0004.

- a. Provide conductors installed on fire alarm systems that are solid copper with an insulation rating of not less than 300 volts. Mark conductors with the size, voltage rating and manufacturer's name permanently marked on the conductor jacket at no less than 610 mm 2 feet intervals. Conductor size is listed below. Where modifications are made to existing systems, provide new or added conductors that match the size and color-coding of the existing system.
- b. Provide conductors for multiplexed communication circuits, signaling line circuits, speaker audio circuits, remote phone circuits, and remote reporting circuits that are solid copper, shielded, twisted pairs meeting UL 2196. Provide cable that is listed as Type FPL, Power-Limited Fire Protective Signaling Cable. Provide conductors of size no less than a 1.0 mm² No. 16 AWG diameter. Provide conductor with insulation Type TFN for 1.0 mm² No. 16 AWG diameter and Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.
- c. Provide direct current initiating device (manual pull station) circuits that are a two loop circuit per NFPA 72, Style D. Provide conductors of size no less than 1.0 mm² No. 16 AWG diameter. Provide conductor with insulation Type TFN for 1.0 mm² No. 16 AWG diameter, and Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.
- d. Size accordingly the power leads from the control panel for product-of-combustion detectors, but do not size less than 2.0 mm² No. 14 AWG diameter. Provide conductor with insulation Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.

- e. Provide direct current notification appliance circuits (strobes, bells) that are parallel wired per NFPA 72, Style Z. Provide conductors of size no less than 2.0 mm² No. 14 AWG diameter. Provide conductor with insulation Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.
- f. Provide direct current auxiliary control device (AHU shut down relay) circuits that are parallel wired per NFPA 72, Style Z. Provide conductors of size no less than 2.0 mm² No. 14 AWG diameter. Provide conductor with insulation Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.
- g. Provide preaction solenoid valve control circuits that are NFPA 72, Style Y. Provide conductors of size no less than 2.0 mm² No. 14 AWG diameter. Provide conductor with insulation Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.

2.16.1 Fire Resistive Cables

Put fire resistive cables for notification appliance circuits designed for use in accordance with automatic/manual fire alarm systems with UL 2196.

Provide UL Fire Prot Dir listed Type FPL-CI fire alarm cable for use with power limited fire alarm notification appliance circuits. Provide CI cable that has a minimum 2 hour fire resistance rating by having passed the applicable testing requirements of UL 2196. Install this cable in locations required to meet NFPA 72 survivability requirements.

2.17 SURGE SUPPRESSION

Provide line voltage and low voltage surge suppression devices to suppress all voltage transients which might damage the control panel components.

Install surge suppression in accordance with UL 497B on each conductor of preaction circuits which extend beyond a building. Locate protection as close as practical to the point where the circuits leave the building. Install protectors in enclosures of adequate size, with terminal strips for all wiring connections plus 25 percent spare. Paint enclosures with a prime coat and one or more coats of red baked enamel finish to provide a smooth, hard, and durable finish. Connect protectors to an earth ground electrode system, in accordance with the manufacturer's requirements and NFPA 70.

2.17.1 Line Voltage Surge Suppressors

Provide suppressor that is UL 1449 listed, with a maximum 330 volt clamping level and a maximum response time of 5 nanoseconds. Provide suppressor that also meets IEEE C62.41, Category B tests for surge capacity. Provide a multi-stage construction suppressor that includes inductors and silicon avalanche zener diodes. Provide a long-life indicating lamp (light emitting diode or neon lamp) suppressor that extinguishes upon failure of protection components. Provide fuses that are externally accessible. Wire suppressors in series with the incoming power source to the protected equipment using screw terminations.

2.17.2 Low Voltage Surge Suppressors

Provide suppressors for all circuits which leave the building shell and as shown on the contract drawings. When circuits interconnect two or more buildings, provide an arrester at the circuit entrance to each building.

Provide a **UL 497B** listed suppressor, with a maximum 30 volt clamping level and a maximum response time of 5 nanoseconds. Provide suppressor that has multi-stage construction and both differential/common mode protection.

PART 3 EXECUTION

3.1 SYSTEM SEQUENCE OF OPERATION

3.1.1 Normal Operation

Put all switches in the normal position. Keep the available power lamp on and the trouble and detector identification lamps off. Electrically supervise all circuits.

3.1.2 Supervisory Condition

Transmit a supervisory signal to the KSC Fire Monitoring System, provide device indication, activate a supervisory signal in the fire alarm control panel, and provide input to remote annunciators (when used). Provide supervisory signal in the alarm control unit that is comprised of visual and audible indications. Provide supervisory signals that are self-restoring.

3.1.3 Trouble Condition

Transmit a supervisory signal to the remote reporting device of the KSC Fire Monitoring System, provide zone indication, activate a trouble signal in the preaction control panel, and provide input to remote annunciator (when used) when system conditions are identified in the paragraph entitled, "Preaction Control Panel," of this section. Provide trouble signal in the alarm-control unit that is comprised of visual and audible indications.

3.1.4 Alarm Condition

Close a contact that activates the appropriate preaction control panel during activation of any detectors, manual alarm stations, water flow switches, or other initiating devices. Preaction control panel transmits a signal to the remote reporting device of the KSC Fire Monitor System; activates the notification appliances; provides zone identification; controls air handling and ventilating units; provides an input to remote annunciator (when used); and provides indication or control to devices or other systems.

3.2 INSTALLATION

3.2.1 Preaction Control Panel(s) and Reporting Equipment

Install equipment in each protected building, located where indicated, and complete with all indicated accessories and devices. Install equipment in accessible locations in such a manner as to prevent damage from vibration or jarring. Equipment requires a minimum of **0.91 m 3 feet** clearance directly in front of the panel for maintenance per **NFPA 70** and **NFPA 70E**. With multiple equipment, the **0.91 m 3 feet** clearance is required directly in front of the complete configuration. In addition, provide a **711 mm 28 inch** clear aisle way for access to the equipment.

Put wiring within preaction control panel(s) and reporting equipment in accordance with the paragraph entitled, "Installation in Cabinets and

Boxes," of this section.

Install conductors in accordance with the paragraph entitled, "Wiring Installation," of this section from the [modem cabinet] [code transmitter] [preaction control panel] to a new [4] [8] point terminal strip labeled "FATB" in the indicated telephone terminal cabinet.

When preaction control panels and reporting equipment are installed flush or semi-flush, install three spare 25 mm 1-inch conduits in accordance with the paragraph entitled, "Conduit and Raceways," of this section, from the preaction control panel wiring termination cabinet to an accessible location.

3.2.2 Addressable Modules and/or Devices

Install zone addressable modules at accessible locations indicated. Configure module address switches to settings indicated on approved shop submittals. Identify modules individually adjacent to their mounting.

Mount control zone addressable modules used for smoke control, AHU shutdown, etc., in accessible locations within 0.91 m 3 feet of the device to be controlled. Do not install control modules connected to separately energized control wiring from auxiliary systems in the same enclosure with initiation and signal zone addressable modules.

Put wiring in accordance with the paragraph entitled, "Installation in Cabinets and Boxes," of this section, where zone addressable modules are grouped within an enclosure.

3.2.3 Annunciator Panels

Install panels in accessible locations in such a manner as to prevent damage from vibration of jarring.

Install annunciator panels in each protected building, locate where indicated, and complete with all indicated accessories and devices. Install annunciator panels in accessible locations in such a manner as to prevent damage from vibration or jarring. Annunciator panels require a minimum of 0.91 m 3 feet clearance directly in front of the panel for maintenance, per NFPA 70. With multiple panels, the 0.91 m 3 feet clearance is required directly in front of the complete configuration. In addition, provide a 711 mm 28 inch clear aisle for access to the annunciator panels.

Install wiring within annunciator panels in accordance with the paragraph entitled, "Installation in Cabinets and Boxes," of this section.

3.2.4 Heat-Actuated Detectors

Ceiling-mount detectors unless otherwise indicated. Location, number, and general arrangement to be as indicated on drawings. Conform field installation locations with NFPA 72.

3.2.5 Smoke Detectors

Smoke detector location, number, and general arrangement as indicated; conform field installation to NFPA 72. Do not install detectors until the work of other trades is complete.

Install duct smoke detectors in accordance with the manufacturer's requirements and **NFPA 90A**. Seal all duct penetrations air- and water-tight.

Configure addressable smoke detector address switch settings as approved on shop drawings and submittals. Do not install detectors until work by other trades is completed.

3.2.6 Manual Alarm Stations

Mount manual pull stations at locations indicated, within **122 cm 48 inch** of the latch side of the door. Mount manual pull stations at height of **122 cm 48 inch** above the finished floor, measured from the top of the device.

3.2.7 Alarm Bells/Speakers

Mount bells and/or audio speaker notification appliances at the approximate locations indicated. Mount bells and/or speaker at height of **228.6 cm 90 inch** above the finished floor, measured from the top of the bell/speaker, but no less than **15.2 cm 6 inch** below the ceiling.

3.2.8 Strobe Units/Combination Audio/Visual

Mount strobe light notification appliances at the approximate locations indicated. Mount in locations that are unobstructed and allow viewing by area occupants in accordance with **NFPA 72**. Mount strobe light appliances at height of **2032 mm 80 inch** above the finished floor, measured from the bottom of the strobe, but no less than **15.2 cm 6 inch** below the ceiling.

3.2.9 Auxiliary Control Relays

Install supervise remote control relays in accessible locations within **0.91 m 3 feet** of the device to be controlled.

3.2.10 Wiring Installation

Provide wiring that conforms to the requirements of **NFPA 70** and the following special requirements:

- a. Install preaction system circuits in a separate raceway system. Route each circuit type (Initiating, Notification, Signaling, and Control) through a dedicated separate conduit or raceway system configured to comply with **NFPA 72** Class "A" conduit system requirements. Do not let 60-hertz power circuits enter enclosures containing preaction circuits, except where required to connect to the preaction system.
- b. Provide conductors that are continuous from a terminal point at one device to a terminal point at the next device to the preaction control panel. Break wires at each terminal; do not loop wires over a terminal. Install solderless ring tongue terminal lugs with manufacturer's required tooling on the device wiring connection leads. Use this ring type lug on stranded wire only. Make termination of solid wire on compression or screw type terminals. When screw type terminals are used, capture the conductor under 80 percent of the screw head surface.
- c. Conductor colors are listed below and put in accordance with **FED-STD-595**. Where modifications are made to existing systems, match the new or added conductors to the size and color coding of the existing system.

- d. Mark conductors for multiplexed communication circuits, speaker audio circuits, remote phone circuits, and remote station signaling circuits with circuit designation and consistent color coding for the positive and negative loops that are maintained throughout the cable system.
- e. Provide direct current initiating device circuits (heat detectors, manual pull station) that are a two loop circuit per NFPA 72, Style D with the positive loop conductor colored blue, Color No. 15102, and the negative loop conductor colored black, Color No. 17038.
- f. Provide one white, Color No. 17877 positive, and one black, Color No. 17038 negative for power leads from the control panel for product-of-combustion detectors.
- g. Provide direct current notification appliance circuits (bells, strobes) that are parallel wired per NFPA 72, Style Z. Provide a positive conductor colored red, Color No. 11105, and the negative conductor colored orange, Color No. 12473.
- h. Provide direct current auxiliary control device circuits (AHU shutdown relay) that are parallel wired per NFPA 72, Style Z. Provide a positive conductor that is colored yellow, Color No. 13591, and a negative conductor colored brown, Color No. 10055.
- i. Provide solenoid valve safing key switch that is a Best Lock, Model 1W702-S4D, which opens both the positive and negative conductors. Provide solenoid positive conductors that are color-coded yellow, and negative conductors that are violet. Comply wiring with KSC-STD-F-0004

3.2.10.1 60-Hertz Power

Provide 60-hertz power to the preaction control panel or separately powered devices that are 120 volts. Provide one black phase conductor, one white or gray solidly grounded neutral conductor and one green equipment grounding conductor. Provide conductor size as shown on the drawing with the minimum size 3.0 mm² No. 12 AWG diameter copper. Install surge arrestors in accordance with NFPA 72 and NFPA 70.

3.2.10.2 Installation in Cabinets and Boxes

Install wiring in control cabinets and boxes in a neat and orderly manner with wire properly grouped, tie-wrapped, or laced parallel and perpendicular to the major axis, supported and identified. Provide control wiring that is continuous from device to device with no splices unless otherwise indicated. Permanently mark and terminate all wires entering or leaving control cabinets, boxes, and devices on screw terminals. Provide marking that is consistent throughout the preaction system and is the same as the identification shown on the connection drawings.

3.2.11 Conduit and Raceways

Provide preaction system initiating, alarm and control circuit conduit and raceways with minimum size of [13 mm 1/2 inch] [19 mm 3/4-inch]. Install in accordance with NFPA 70.

Install rigid galvanized heavy wall steel conduit in all hazardous (classified) locations, exterior above grade and interior exposed, unless otherwise shown on the drawings. EMT with hexnut expansion gland-type fittings is allowed to be installed in all other areas. Use flexible metal

raceway, maximum length 1.83 m 6 feet, as the final connecting raceway to a preaction system device mounted on vibrating equipment or on a suspended ceiling.

Provide conduits directly buried in the earth as Schedule 80 PVC. For portions of underground raceway system that penetrate above finished grade provide rigid galvanized heavy wall steel conduit with a 40 mil PVC coating or painted with a bitumastic compound.

Conceal conduit in interior finished areas. Fire-stop conduit through fire-resistant rated walls, floors, ceilings, in a manner that maintains the fire-resistant rating of the wall, floor, or ceiling.

Install conduit that is in a vertical position parallel with walls and perpendicular with the floor and ceiling. Install conduit that is in a horizontal position parallel with the floor and ceiling and perpendicular with the walls. Install changes in direction of runs with symmetrical bends. Provide factory made elbows for bends over 25 mm one inch in diameter.

Provide preaction solenoid valve control circuits that are NFPA 72, Style Y. Provide positive conductors that are colored yellow, and negative conductors colored violet.

3.2.12 Tamper Switches

Provide tamper switches for all fire protection control valves where closure of the valve impairs service. In addition, provide tamper switches for valves that supervise system conditions where closure or opening of the valve impairs the supervisory function.

3.3 FIELD TESTING

After complete installation of the equipment and at such time as directed by the Contracting Officer, conduct tests to demonstrate that the installation requirements of this specification have been met and that the sequential functions of the system comply with the requirements specified herein. Conduct tests covered in the following paragraphs to be done in two parts:

- a. Preliminary - Verify all the systems and components as an "in house" test. Perform this functional test in the presence of government inspectors and repeat until one full test can be performed without device or system malfunction.
- b. Final Acceptance - After the successful completion of the preliminary testing, fully test the systems formally with full documentation (including As-Built Drawings) using the previously approved recording form. Final acceptance of the system is based upon the written approval of the test witnessed by the Contracting Officer.

On both preliminary and final tests, follow the approved testing procedures.

3.3.1 External System Wiring

Perform the following tests on the external system wiring before connection to the control panel:

- a. Check continuity of circuits with an ohmmeter. Insert temporary

jumpers in appropriate sockets of missing detectors and install the end-of line resistor when this test is performed. Meet the value of the end-of-line resistor, plus or minus 10 percent for the resistance reading of each circuit.

- b. Check each wire for grounds with a 500-volt insulation resistance test set. Provide resistance to ground that is not less than 20 megohms.

3.3.2 Preaction System Acceptance Tests

After completion of the above tests, connect the external system wires to the appropriate terminals in the control panel and perform the following tests:

- a. With the control panel energized, demonstrate the proper operation of all indicating lights and alarms.
- b. Demonstrate each annunciator panel lamp to operate when it's associated device or zone is activated.
- c. Activate each manual alarm station to demonstrate proper operation.
- d. Activate each smoke detector in accordance with the manufacturer's instructions, to demonstrate proper operations; both alarm and trouble.
- e. Provide each duct smoke detector with a static pressure differential test and perform to verify that the pressure differential between the inlet and outlet tubes is within the manufacturer's specifications for acceptable operation.
- f. Each time an initiating or supervisory circuit is activated, verified that the associated device address, notification appliance circuits, auxiliary control circuits, and alarm reporting to the KSC Fire Monitoring System is activated and the correct information is displayed by the color graphics units.
- g. Remove and ground one lead at each alarm initiating device, (manual pull station, smoke detector, flame detector, heat actuated detector, etc.), to demonstrate circuit trouble, ground fault, and then alarm over ground fault with an open circuit.
- h. Turn off power to each separately powered panel or device to simulate loss of power and to demonstrate operation of the trouble alarm.
- i. Test the rate-of-rise, (fixed temperature line-type) function on each heat-actuated detector in each zone, by application of heat from a heat lamp or hand held hot air blower. Indicate an alarm to the system for these detectors. Sustain repeated tests of the rate-of-rise function without damage to the fixed temperature function for these detectors. Replace heat-activated detectors (HADS) subject to operation from body temperature.
- j. Open and close water suppression system valves requiring tamper switches, to demonstrate proper operation.
- k. Activate pressure switches by water flow at the inspectors test valve to demonstrate proper operation.
- l. Demonstrate each alarm initiating circuit to operate its associated

alarm-control and auxiliary control units and remote reporting.

- m. Remove and ground one lead at each notification appliance and auxiliary control device to demonstrate open circuit trouble, ground fault trouble, and then operation over ground fault with an open circuit.
- n. Demonstrate each alarm control unit operates in all modes.
- o. Demonstrate capacity and the operation of the battery backup system to operate as required by these specifications by disconnecting the 120 volt, 60 Hz power from the preaction (control) panel and operating the system as specified for backup operation.
- p. Demonstrate all circuits interconnecting with other systems fire protection, smoke control, HVAC, security and safety, elevators, etc., to operate as specified on alarm from the associated zone or zones.
- q. Test multiplex equipment, devices, and wiring in accordance with **NFPA 70** and manufacturer's requirements.

3.3.3 Re-Acceptance System Tests

Perform re-acceptance testing after system components are added or deleted; after any modification, repair, or adjustment to system hardware or wiring; or after any change to software. 100 percent test all components, circuits, systems operations, or site specific software functions known to be affected by the change or identified by a means that indicates the system operational changes. In addition, also test 10 percent of the initiating devices that are not directly affected by the change, and verify proper system operation.

Changes to all control units connected or controlled by the system executive software requires a 10 percent functional test of the system, including a test of at least one device on each input and output circuit to verify proper system operation.

Upon completion of the modifications, functionally test the existing devices that were reinstalled and test the devices that are on both sides of the point of connection of the new devices. Test in accordance all newly installed devices with the paragraph entitled, "Preaction System Acceptance Tests," of this section.

After final acceptance testing has been successfully completed, submit test data under the terms of the "Performance Requirements" of this section.

3.4 OPERATION AND MAINTENANCE MANUALS

Submit operation and maintenance manuals prior to acceptance tests being performed. Bind information in manual format and grouped by technical sections consisting of manufacturer's standard brochures, schematics, procedures, recommended spare parts, recommended test equipment, and safety precautions.

3.5 PAINTING

Touch up or re-paint manufacturer's standard-finish equipment surfaces that are damaged during construction and bring to as-new condition to the satisfaction of the Contracting Officer, or replace with new undamaged equipment at an additional cost to the Government.

Paint all fire alarm equipment and appurtenances red, color number 11105 in accordance with **FED-STD-595**.

-- End of Section --