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modules internal to fire alarm control panels (FACP), circuit terminations on terminal strips in fire alarm control panels, terminal boxes.

Add to Section 01 11 00 SUMMARY OF WORK a description of the scope of the fire alarm work particular to this project.

Adhere to [UFC 1-300-02](#) Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Adhere to [UFC 1-300-02](#) Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Recommended changes to a NASA/KSC 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

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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.4a (R2006) American National Standard
Specification for Sound Level Meters

ANSI S3.41 (1990, R2008) American National Standard
Audible Emergency Evacuation Signal

ASME INTERNATIONAL (ASME)

ASME A17.1 (2010) Safety Code for Elevators and
Escalators

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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

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

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

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 1971 (2002; Reprint Oct 2008) Signaling Devices for the Hearing Impaired
- 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 1711 (2006) UL Standard for Amplifiers for Fire Protective Signaling Systems, 4th Edition
- UL 2196 (2008) UL Standard for Tests for Fire Resistive Cables, 1st Edition
- UL Fire Prot Dir (2012) Fire Protection Equipment Directory

1.2 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

Submit Evidence of the Contractor's State Certification[; G] to the Contracting Officer for approval, prior to any work being started on the Fire Alarm System, in accordance with paragraph entitled "Services of a Certified Fire Alarm Specialist".

SD-02 Shop Drawings

Submit the following in accordance with the paragraph entitled, "General Requirements," of this section:

Connection Drawings [; G]

Module Schematic Drawings [; G]

Software Programs [; G]

Fire Service Floor Plans [; G]

Record Drawings [; G] (As-Built Drawings after completion of the final acceptance test)

SD-03 Product Data

Where multiple types of the same item are required (Example: indoor, weatherproof, and explosion-proof types) provide separate Catalog Data for each type of device. Submit Manufacturer's Catalog Data for the following items:

Fire Alarm Control Panel [; G]

CFMS Reporting Equipment [; G]

Addressable Modules/Devices [; G]

Annunciator Panels [; G]

Heat-Actuated Detectors [; G]

Flame 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]
Revolving Beacons [; G]
Water Flow Alarm Devices [; G]
Valve Tamper Switches [; G]
Remote Auxiliary Control Relays [; G]
Power Source [; G]
Line Voltage Surge Suppressors [; G]
Low Voltage Surge Suppressors [; G]
Wiring (Wire and Multi-Conductor Cable) [; G]

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

SD-05 Design Data

Design Analysis and Battery Calculations [; G]
Voice Evacuation System [; G]
Flame Detectors [; G]

Submit list of parts and components [; G] for the installed system by manufacturer's name, part number, and nomenclature, and recommended stock level required for normal maintenance and unscheduled repairs.

SD-06 Test Reports

Fire Alarm System Acceptance Test Procedures [; G] (For Both Preliminary and Final Tests)

SD-07 Certificates

Submit Quality Assurance Plan [; G] consisting of the following in accordance with the paragraph entitled, "Quality Assurance Plan," of this section:

Submit listing and/or approval documentation [; G] that all components are Underwriter Laboratory (UL) UL Fire Prot Dir listed or Factory Mutual (FM) FM APP GUIDE approved for their intended use and function.

Submit Contractor Readiness Affirmation - For Preliminary Fire Alarm Testing [; G] in accordance with the paragraph entitled,

"Field Testing" of this section.

Submit [KSC - Transfer of Responsibility](#) [; G] for the designated portion of the Fire Alarm System; in accordance with the paragraph entitled, "Installation," of this section.

Submit [NFPA 72 Fire Alarm System Record of Completion](#) [; G] in accordance with paragraph entitled, "Field Testing" of this section.

[SD-10 Operation and Maintenance Data](#)

Submit [Operation and Maintenance Manuals](#) [; G] bound 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. Submit this information prior to acceptance tests being performed. Provide one single .pdf format of the O&M Manual on a single CD.

1.3 GENERAL REQUIREMENTS

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.

Submit submittals for approval in the following sequence with each approved prior to the next submittal:

- a. Sign and submit the KSC Transfer of Responsibility form no later than [30] [_____] days after notice to proceed.
- b. Submit Product Data (Catalog Data), Contractor's Certifications, and Quality Assurance Plan, within [30] [_____] days after notice to proceed.
- c. Submit Connection Drawings, Module Schematic Drawings, Design Analysis and Battery Calculations within [30] [_____] days after notice to proceed.
- d. Submit new and revised Fire Alarm Control Panel (FACP) and Network Software Program information no later than [60] [_____] days prior to the scheduled preliminary test. Provide two completed sets minimum of the Record Drawings and documentation and make available for reference at the preliminary test.
- e. Submit Acceptance Test Procedures no later than [60] [_____] days prior to the scheduled preliminary test.
- f. Sign and submit the Readiness Affirmation form no later than [5] [_____] days prior to the scheduled preliminary test.
- g. Submit Record Shop Drawings, Panel and Network software programs, and Battery Calculations for approval no later than [30] [_____] days prior to the scheduled final acceptance test. Provide two completed sets minimum of the Record drawings (As-built condition) and documentation and the [NFPA 72 Fire Alarm System Record of Completion](#) Form and make available for reference at the final test. Include submittal of [listing and/or approval documentation](#)

- h. Submit Operation and Maintenance Manuals [14] [_____] days after the final test has been complete and approved.
- i. Include in the Record drawing submittal all Shop Drawings, Panel and Network software programs, Battery Calculations, Completed Final Test Procedures, NFPA 72 Fire Alarm System Record of Completion Form and submit within [14] [_____] days after completion of the final acceptance test. Include in this submittal two (2) sets of CD ROM digital media of all the record drawings, Design Analysis, Battery Calculations and Program software information.

Prepare and submit all drawings generated by computer aided design (CAD). Include in digital media compact disc (CD) submittals .DWG or .DXF format files for all drawings: Connection Diagrams, Module Schematics, Battery Calculations, Floor plans and Fire Service Floor Plans. Also on this CD provide a complete copy of the aforementioned drawings in PDF format.

Provide [Connection drawings](#) consisting of point-to-point wiring diagrams of internal and external wiring including, but not limited to, all fire alarm field devices, panel wiring, and interconnection between other building systems and components and the fire alarm system. Indicate wire label designations matching the field installation on these drawings.

Include in Connection drawings Floor Plan Drawings that indicate equipment locations, device locations with address designation, and conduit/wiring routing from the FACP(s) to all field devices including looped Class A circuit routing requirements. Also include typical mounting requirements for each type of initiation, signaling, notification and control device. Show on Record drawings (as-built) for installations with flame detectors horizontal and vertical field of views for each detector and aiming point of detector with clear dimensions from fixed and readily identifiable structural references. Include riser diagram and sequence of operations in an input/output matrix format that clearly shows interaction of system components.

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

Include in [Record Drawings](#) connection drawings, floor plan drawings, module schematics, software programs, fire service floor plans, design and battery calculations, and all other data required to fully document the completed system. After final testing is complete, submit [Record Drawings](#) including digital media and hard copies of all new and revised software, drawings, and analysis/calculations incorporating approved comments and any changes. Document final system configuration in [Record Drawings](#) including, but not limited to, geographic monitor zone boundaries, location of the FACP, 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 fire alarm system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used), deviations from and amendments to the record drawings, and field installation changes, concealed and visible.

Provide [software programs](#), both hard copy and compact disc, for all new and/or existing programmable FACP(s) affected by the project. Provide system executable file and report file on the compact disc. Program information for FACP including program listings, system point summary, and

addressable device switch settings. Include in corrected program information panel and network programs and sequence of operations in matrix format that clearly shows interaction of system components.

Conduct tests in accordance with approved [Fire Alarm System Acceptance Test Procedures](#), and in accordance with the paragraph entitled "Field Testing" in this specification. Prepare a test procedure and test record form for conducting complete tests on control panels, reporting systems, wiring systems, and field devices installed in accordance with the manufacturer's requirements and these specifications. Identify each device and circuit to be tested in the test procedure, describe the initial condition, each step or function in the test, required test result, and equipment to be employed. Test procedures are to be written to minimally disrupt facility operations (minimize activation of evacuation notification appliances, AHU shutdown, etc.) in support of testing requirements. Ensure test forms have suitable space for recording test results on all equipment, devices, and wiring to be tested. Provide test record forms with identified spaces for verification signatures of official witnesses and dates of the test.

Clearly indicate on [Fire Service Floor Plans](#) the location of the FACP, 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 fire alarm system(s). Also, annotate the location and address setting for each multiplexed addressable device (when used). Do not place borders or title blocks on the Fire Service Floor Plan. Provide a symbol legend, which clearly identifies each device shown on the Fire Service Floor Plan. Install a copy of the Fire Service Floor Plan, minimum size [457 mm by 610 mm 18 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 Battery Calculations](#) for approval for the Fire Alarm and Detection Systems consisting of the battery capacity and loading calculations in accordance with the paragraphs entitled, "Fire Alarm Control Panel," and "Flame Detectors," of this section.

Submit [list of parts and components](#) in accordance with the paragraph entitled "System Requirements," of this section.

1.4 SYSTEM REQUIREMENTS

Provide a fully addressable, modular type, microprocessor based, supervised, non-coded electrical fire alarm system with [NFPA 72](#) Class A initiating device circuits, notification appliance circuits, and auxiliary control circuits. Provide [NFPA 72](#) Class A signaling line circuits, Style 6, and Central Fire Monitoring System (CFMS) network reporting circuits, Style 7. Ensure all styles of Class A initiating device, signaling line, network, notification appliance, and control circuits use diverse routing in accordance with [NFPA 72](#). Do not run the outgoing and return redundant circuit conductors in the same cable assembly, enclosure or raceway.

Electrically connect the fire alarm system to report alarm, trouble, and supervisory signals to the CFMS; to sound the general alarm continuously; and to control auxiliary equipment such as dampers, air handling units, magnetic door latches, elevator recall, etc., upon operation of one or more initiating devices. For initiating, notification, signal, and auxiliary control circuits, use 24 V(DC). Ensure duct smoke detectors transmit to

the CFMS as a silent alarm unless otherwise directed by the Authority Having Jurisdiction (AHJ).

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

Ensure fire alarm systems contain all of the equipment, devices, programming and circuits required for system operation in accordance with NFPA Codes and KSC requirements, including remote reporting to and remote control from existing equipment.

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

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

1.5 [QUALITY ASSURANCE PLAN](#)

Provide manufactured fire-alarm equipment which meets the requirements of the paragraph entitled, "System Requirements," of the latest standard design, and listed by Underwriters' Laboratories or approved by Factory Mutual and be suitable for its intended service. Ensure all devices installed function with the control panel without interference of the operation of the control panel.

1.6 SERVICES OF A CERTIFIED FIRE ALARM SPECIALIST

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

A Fire Alarm specialist is considered 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 will be considered. Provide [Evidence of the Contractor's State Certification](#) and the basis of certification to the Contracting Officer and secure Contracting Officer approval prior to any work being performed at Kennedy Space Center.

PART 2 PRODUCTS

2.1 FIRE ALARM CONTROL PANEL

Provide fully addressable Fire Alarm Control Panel (FACP), of modular construction with solid state, microprocessor based electronics. Include non-volatile programmable operating system memory for all operating requirements in the panel. Addressable components are to include, but not be limited to, addressable monitor modules, control modules, signal modules, addressable notification appliance power supplies and addressable input/output relays. Equip modules with transient surge suppression.

Ensure (FACP) contains power-on, alarm, supervisory, and trouble indicating lights plainly visible when the cabinet is closed; and also contains the following functions accessible only by unlocking and opening the unit:

- Alarm Silence
- Trouble Silence
- Supervisory Silence
- Power On-Off (If standard by the manufacturer)
- Alarm/Trouble Acknowledge
- Auxiliary Devices (AHU shutdown relay) Maintenance By-pass Switches
- System Reset

Ensure FACP contains all components necessary to monitor and supervise all initiating device circuits, and when any detector, manual alarm station (pull box), water flow switch, pressure switch, etc., connected to the fire alarm control panel is activated, the control panel's visual alarm, alarm indicator and audible signal are activated. This causes all notification appliances to be activated, including all associated auxiliary control functions. Verify that the control panel visually indicates the addressable device or zone in alarm and transmits an alarm condition to the remote Central Fire Monitoring System. Provide separate audible and visual notification appliance circuits, with sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity.

Verify that the FACP includes all components and modules required for installation of a multiple addressable device network. Utilize network polling methods and provide two-way Class A, Style 6 supervised communications between the FACP and addressable smoke detectors and monitor, signal, or control addressable modules. Ensure that the FACP contains all components necessary to monitor and supervise all supervisory device circuits. Verify that when any valve tamper switch, low air pressure switch, water level indicator, or other supervisory device connected to the control panel is activated, the control panel supervisory visual indication and supervisory audible device is activated; and that control panel visually indicates the addressable device or zone in supervisory alarm and transmit a supervisory condition to the remote Central Fire Monitoring System.

Provide FACP with all components necessary to operate and supervise the circuits for annunciator panels indicated, auxiliary power supplies indicated, and auxiliary devices controlling equipment such as ventilating fans, air handling units, fan coil units, damper motors, solenoids, magnetic door holders, elevator recall, etc. Ensure circuits for auxiliary control relays are supervised to within 0.91 m 3 feet of the device to be controlled in accordance with NFPA 101. Include maintenance by-pass switches for all auxiliary control devices in the FACP. Ensure by-pass switches are supervised to report supervisory signal when in the maintenance (by-pass) position. Provide switches used for by-pass functions which are either toggle or soft key type, and listed for use with the control panel. In addition, provide each switch with a positive visual indication to show the function is ON.

Provide panel which monitors and reports any 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, [FACP enclosure open,] and activation of the alarm silence switch. Ensure all trouble signals are identified by

initiating, notification appliance, auxiliary control, or signaling line circuit; and that trouble signals activate the control panel trouble visual indication and trouble audible devices, and send a trouble signal to the remote Central Fire Monitoring System.

Provide alarm, supervisory, and trouble reset switches which reset a cleared device in alarm, supervisory, or trouble condition. Ensure alarm, supervisory, and trouble signals do not self-restore without activating the switch.

Ensure that alarm, supervisory, and trouble silence switches silence the alarm, supervisory, and trouble audibles, and that either switch placed in other than the normal position provides the following:

- a. Report as an alarm, supervisory, or a trouble to the Central 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.

When the alarm silencing switches are in the silence position, ensure subsequent alarms reactivate the notification appliances, and the strobes remain operational until the FACP is reset.

Provide [FACP suitable for use with UL listed or FM approved detectors and manual alarm stations and other fire alarm devices specified in this section.] [FACP electronically activating fire suppression systems which are UL listed or FM approved and rated for service as a releasing panel.]

Provide FACP with an individual set of Form C dry contacts which activate for alarm, trouble and supervisory conditions for connection to the Central Fire Monitoring System. Provide additional other fire monitoring or special function relay contacts as indicated.

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

[Install a separate terminal cabinet adjacent to the FACP for interfacing device field wiring to the control panel. Provide outdoor cabinets of stainless steel construction rated NEMA 4X. 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 and associated surge suppressors. Provide copper ground bus within this terminal cabinet for termination of equipment ground conductors.]

Provide steel FACP, terminal cabinets, surge suppression cabinets and battery cabinets (when used), with a hinged cover and an integral pin-tumbler cylinder lock (mortise or standard rim cylinder from Best Access Systems) with removable core that accepts the key presently in use with other control units existing in the area. Lock core will be provided

by the government. Paint cabinets with a prime coat and one or more finish coats of scratch-resistant baked enamel red finish coat unless otherwise indicated.

[Include in FACP 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, expandable to [6] [_____] separate Style B supervised telephone circuits. Include in telephone control switching capabilities with visual indication for phone circuit activation.]

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

Provide system which operates from a power supply with 120 grounded V(AC) input and 24 V(DC) output, and functions satisfactorily with power input voltage varying from 85 to 110 percent of nominal value. Ensure power supply output is capable of powering all initiation, signaling, annunciation, and control devices during alarm condition with 25 percent minimum spare capacity.

Provide all FACPs and auxiliary power supplies with a DC power input and with a DC disconnect switch integral with the equipment provided (2P 30A switch), or provide a separate safety switch. [If supplied within the cabinet, ensure the power on-off switch disconnects all power sources to the control panel. Provide the on-off switch with DC rated contacts.]

Provide the means of automatically supplying the entire fire alarm system with backup power with batteries, charger, and power transfer equipment alarm system with battery backup power in event of a primary power system failure. Ensure system switches to battery power in event of AC power failure, and switches back to AC power upon return of primary power. Ensure control panel(s) and auxiliary power supplies are able to operate when the backup batteries are disconnected for any reason. Also ensure system 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. Confirm primary power, battery, or charging equipment failure results in a FACP trouble signal and visual indication.

Use sealed, spill-proof battery modules to prevent any corrosive fumes. Provide batteries listed for fire alarm service and suitable for high discharge currents required under alarm conditions. Size batteries to operate the fire alarm and detection system (including voice evacuation system and UV/IR flame detectors, where installed), in normal supervisory

condition for 24 [48] [72] hours, minimum, then operate the system in the alarm mode for [5] 10 [15] [_____] minutes, minimum.

2.1.1 Small Capacity FACP

NOTE: Edit the following paragraph for a FACP to be used in small facilities or suppression systems. Design each automatic sprinkler system flow switch to report as a separate device to the FACP. Fill in the blanks for the number of zones to fulfill the job requirements and the maximum number of circuits anticipated.

[Provide a FACP with monitor zones, notification appliance circuits, supervised circuits to remote auxiliary control relays, and local auxiliary relay circuits provided as necessary for system requirements indicated. Provide a minimum of [one] [_____] spare circuit for each of the following circuits types: monitor, notification, auxiliary control, and auxiliary local relays. Make unit expandable to 32 monitor zones and 6 notification appliance circuits.] [Provide FACP using modular, solid-state microprocessor based electronics. Equip all modules with transient suppression. Include in system non-volatile programmable operating system memory for all operating requirements.]

2.1.2 Medium Capacity FACP (Without Voice)

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

Provide a [Siemens MXL] [Simplex Model 4100U] FACP with initiation, notification appliance, auxiliary control, and local auxiliary relays provided as necessary for system requirements indicated. Include a minimum of 25-percent spare circuit capacity, rounded up based on circuits at each equipment location (FACP, auxiliary power supply), for the following circuit types: initiation zones, addressable device zones, notification appliance circuits, auxiliary control circuits and local auxiliary relays. Design unit to be expandable to [3000] [240] addressable devices. Provide FACP that uses modular construction with solid-state, microprocessor based electronics. Equip modules with transient suppression. Include in system, non-volatile programmable operating system memory for all operating requirements.

Include in FACP all components and modules required for installation of a multiple addressable device network. Ensure network utilizes polling methods and provides two-way Style 6 supervised communications between the FACP and addressable smoke detectors and monitor, signal, or control addressable modules.

2.1.3 Large Capacity Fire Alarm Control Panel (With Voice)

NOTE: Select and edit the following paragraphs for

a Simplex, or Siemens FACP to be used in a large size facility or facility requiring addressable devices, voice evacuation, or fire fighters telephone.

Provide a [Siemens MXL] [Siemens Fire finder] [Simplex 4100U] FACP with initiation, notification appliance, auxiliary control, and local auxiliary relay circuits necessary for system requirements indicated. Include a minimum of 25-percent spare circuit capacity, rounded up based on circuits provided at each location (FACP, auxiliary power supply), for the following circuit types: initiation zones, addressable device zones, notification appliance circuits, auxiliary control circuits and local auxiliary relays. Ensure unit is expandable to 2000 addressable devices. Use modular construction with solid-state, microprocessor based electronics. Equip modules with transient suppression. Include in system non-volatile programmable operating system memory for all operating requirements.

Include in FACP all components and modules required for installation of a multiple addressable device network. Utilize Network polling methods and provide two-way Style 6 supervised communications between the FACP and addressable smoke detectors and monitor, signal, or control addressable modules.

2.2 CFMS REPORTING EQUIPMENT

2.2.1 Simplex Small Capacity FACP Reporting

NOTE: Edit this paragraph as required for systems of 6 reporting zones or less.

Provide FACP which reports to the Central Fire Monitoring System using the existing Simplex Model 4100 system summary reporting panel located at the [VABR] [LCC 1P11] [CD&SC]. Provide reporting circuit with a (2) wire, Class B circuit from the indicated Simplex 4100 system summary reporting panel zone module to the FACP alarm relay and trouble relay via base outside cable plant. Provide a 3.3 Kohm, 0.5 watt End-of-Line resistor for each zone (alarm, trouble, supervisory, water flow, as indicated) at the FACP.

2.2.2 Radio Based FACP Reporting

Provide AES/Intellinet Corporation [Model 7788] transceiver with minimum eight (8) zone relays to provide general reporting as specified below:

| FACP | Transceiver | Description |
|---------|-------------|---------------------------------------|
| Relay 1 | Zone 1 | Summary Fire Alarm |
| Relay 2 | Zone 2 | Summary Supervisory |
| Relay 3 | Zone 3 | Summary Trouble |
| Relay 4 | Zone 4 | Summary Water flow |
| Relay 5 | Zone 5 | Summary Silent (Non-evacuating) Alarm |
| Relay 6 | Zone 6 | Spare or as indicated |
| Relay 7 | Zone 7 | Spare or as indicated |
| Relay 8 | Zone 8 | Spare or as indicated |

Provide optional reporting alarm connections to the spare transceiver zones

where indicated. Where serial digital data is required for multiple zone reporting, provide AES/Intellinet Corporation [Model 7770] data tap module. Provide separate enclosure(s) as required for 120 V(AC) power supply components (receptacle and plug-in step-down power transformer), AC power surge suppression, and [24] [60] hour standby battery back-up power. Provide red finish coat on all enclosures unless otherwise indicated.

Provide relays in FACP or use addressable control relay modules grouped in a cabinet as indicated for all remote reporting signals required. Each relay is to include an end-of-line resistor for Class B wiring to the radio transceiver zone per the radio transceiver manufacturer's requirements.

Radio output power is to be 2 Watts with 2.5 db gain antenna mounted on the radio case unless otherwise indicated. [Where indicated provide [_____] db high gain antenna and outdoor mounting provisions indicated. Use manufacturer provided interconnecting cables and surge suppressors for such antennas.]

2.2.3 Simplex FACP Reporting - Proprietary Network

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

Simplex Model GCC Central Fire Monitoring System interface equipment are installed in Room 1P11 of the Launch Control Center, the VABR, and the CD&SC.

Provide network interface cards in the facility FACP and at VABR or CD&SC.

[Provide equipment capable of digital network communication from the Simplex 4100U, using a token ring configuration, to the Central Fire Monitoring System existing Simplex equipment located at KSC communication facilities indicated. Provide software customized reporting for all addressable devices or customized groups of addressable devices/zones as indicated. Ensure that a single open fault on the network communication loop does not degrade network communications. Pass the Token in opposite directions to maintain communications throughout all network nodes. Ensure simultaneous abnormal status condition of the communication loop reports to the CFMS. Make provisions that when a group of nodes becomes isolated from the rest of the network caused by multiple open faults, the isolated group automatically forms a sub-network with all common interaction of monitoring and control remaining intact. Ensure the status of the network faults is transmitted to the CFMS. Provide the network communication in conformance with **NFPA 72** Style 7 [fiber optic] [copper telephone cable plant] signaling line circuits.]

[Provide all FACP hardware required to digitally connect to existing Style 7 networked Simplex FACP's. These existing Simplex networks provide the communications path back to existing Central Fire Monitoring System Equipment. Ensure the FACP equipment provided is able to silence its alarms and reset itself via digitally transmitted remote commands received by and sent through one of the other existing FACP's connected on these mini-networks. Also ensure the FACP equipment provided is capable of digitally communicating with existing networked Simplex FACP's in order to activate interconnect evacuation alarm schemes or for other purposes.

Provide mini-network connections via Style 7 [fiber optic cable] [copper telephone cable plant] [custom installed wiring] as indicated, capable of communicating with other existing network cable or fiber media.]

Provide updated programs, including EPROM, for new or modified fire alarm control systems installed in the existing fire alarm control panels and/or the Central Fire Monitoring System by original equipment manufacturer.

Provide dedicated house communication cable (2 telephone pairs minimum) between the fire alarm control cabinet and the facility telephone terminal cabinet. Install a 4-point minimum terminal strip in the TTC and FACP/FATC for termination of cabling. Install communication circuit surge suppressors at the FACP/FATC location.

[2.2.4 Siemens FACP Reporting - CCAFS Proprietary Network

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

Siemens NCC WAN Central Fire Monitoring System interface equipment are installed in Room 1P10 of the Launch Control Center, the VABR, and the CD&SC.

Provide network interface cards in the facility FACP and at VABR or CD&SC.

Provide FACP which reports to the existing CCAFS Central Fire Monitoring System using the Siemens NCC WAN System in Building XY.

Fire alarm control panel(s) (FACP) includes all hardware and software required for Style 7 communication with the existing Siemens NCC WAN system located at the XY Building. Provide and integrate additional and fully functional Hub-4 cards and ancillary equipment at the XY Building equipment as required to support an independent reporting system connection for all facilities within the scope of the project. Provide reporting circuit that is a 4-wire, Style 7 circuit from the Siemens NCC WAN system to the FACP, via the base outside telephone cable plant. The color graphics units (CGU) are located in facility 49750 (Alternate Central Security Building) and a redundant CGU is located in Building 1711 (Hangar I). The Siemens programmer is to ensure that all information required by the contract drawings and specifications is transmitted and received at both locations, and that all color graphics screens operate properly. Ensuring bi-directional communication between the FACP and the NCC WAN permits individual remote reporting of all monitor zones and remote control of the FACP from both CGU locations.

Provide 4 wire copper **NFPA 72** Style 7 communication circuit (star) connection between the MXL panel and the Central Fire Monitoring System, existing and newly provided Siemens NCCNT-WAN communications interface equipment (COM-1) located at the XY Building. Provide dedicated house communication cable (2 telephone pairs, minimum) between the fire alarm control cabinet and the facility telephone terminal cabinet. Install a 4-point minimum terminal strip in the TTC and FACP/FATC for termination of cabling. Install communication circuit surge suppressors at the FACP/FATC location.

Provide communication interface with remote reporting of all individual addressable devices and remote control of the FACP from the CFMS NCC terminal. Ensure all addressable devices report to the CFMS NCC color graphics terminals located in the CSC and Hangar I. Any single fault, open or short, or combination of a single open or short and a ground fault is not to prevent communications over this circuit. Ensure the status of these faults is transmitted to the CFMS, and that a complete failure of this circuit does not degrade network communications.

Provide all hardware (chassis, cards, modules, wiring, etc.), software, conduit/wiring for remote reporting at FACP and existing CFMS locations except outside communications cable plant (telephone grade pairs). Provide updated programs, including EPROM, for new or modified fire alarm control systems in the existing Central Fire Monitoring System Siemens SXCL multiplexing system or original equipment manufacturer. Secure approval from the Contracting Officer of all EPROM modifications and programming changes prior to installation.

]2.2.5 Color Graphic Screens

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

2.3 ADDRESSABLE MODULES/DEVICES

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

Provide solid-state addressable modules compatible with the FACP. Provide modules which are suitable for individual outlet box mounting or group mounting within a control enclosure. Install outdoor modules in weatherproof enclosures with a neoprene gasket protected from corrosion.

Provide field addressable modules to individually communicate with the FACP using multiplexed communication techniques. Provide communication circuit wiring connections suitable for supervised Class A, Style 6 operation. Derive module power from the communication circuit or 24 V(DC) power supply supervised by the FACP. Ensure invalid address setting, component failure, or power failure initiates a trouble signal at the FACP.

Provide manufacturer's standard outlet box for enclosure housing a single isolated module (not grouped with other modules or no other modules nearby).

Provide enclosures housing more than one addressable module with hinged door type with back panel for module mounting. Provide hinged cover(s) with an integral pin-tumbler cylinder lock (Mortise or Standard Rim Cylinder from Best Access Systems) with removable core that accepts the key presently in use with other fire alarm control units at KSC; lock core will be provided by the government. Provide adequately sized enclosure to allow a minimum of 2-inch wiring space around the cabinet perimeter to include all module termination points. Provide additional spare space for [2] [_____] future modules. Provide terminal strips with 25-percent spare capacity for interfacing all module connections to field wiring. Paint enclosures with a prime coat and one or more finish coats of red enamel to

provide a smooth, hard, and durable finish. Provide enclosures with an engraved phenolic nameplate labeled, "FIRE ALARM MODULE TYPE, Address."

Provide supervised addressable modules for initiation circuits, 4-wire Class A type, unless otherwise indicated. Two-wire Class B modules are acceptable when installed in the same box or enclosure as the connected initiating device.

Provide supervised addressable modules for notification appliance circuits with parallel wired Class A type unless otherwise indicated. Ensure module is suitable for use with bells, strobes, and relays.

Provide addressable relay modules for control and/or remote reporting circuits (addressable relays), including 2 separate fused Form-C contacts rated at 2 Amperes for 28 V(DC) or 120 V(AC).

Provide addressable modules for suppression system releasing service, if used, which are UL listed for use with the fire alarm control panel and the suppression system releasing device [valve] [_____]. Include in module all necessary circuitry to supervise the suppression system release device coil.

2.4 ANNUNCIATOR PANELS

Provide [LED] [Front lighted] [Back lighted] [LCD alphanumeric] type annunciator panels compatible with and supervised from the FACP, with an operating power supply of 24 V(DC). Provide yellow lamp color for trouble/supervisory and red for alarm; also provide a test switch for testing all lamps. Provide each lamp with a nameplate, with zone and function identified for all lamps. Provide engraved phenolic tag nameplates.

[Program annunciator panels to annunciate only alarm and supervisory signals; annunciate trouble signals only at the main FACP.]

[Include with annunciator panel an audible trouble/alarm buzzer with keyed silence switch.]

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

Provide terminal strips suitable for 0.8 mm through 2.0 mm² No. 18 through No. 14 AWG diameter 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 FACP. Paint all exposed metal parts of annunciator panels with a prime coat and one or more finish coats of scratch-resistant baked enamel. Provide red finish coat unless otherwise indicated.

2.5 HEAT-ACTUATED DETECTORS

Provide heat-actuated detectors with alarm-initiating devices designed for use with automatic/manual fire alarm systems in accordance with UL 521.

Provide heat-actuated detectors rated at 58 degrees C 136 degrees F fixed temperature with 9.45 degrees C 15 degree F per minute rate-of-rise feature unless otherwise indicated. Provide only fixed temperature type detectors

at the top of elevator shafts.

Provide self-restorable detectors for the rate-of-rise feature and non-restorable for the fixed temperature feature. Ensure detectors have a rate-of-rise principle of operation, which uses an air chamber, a vent and a flexible metal diaphragm, and a fixed temperature principle of operation using a fusible solder joint. Provide heat detectors which are individually addressable by connection to addressable modules. Provide addressable modules in accordance with the paragraph entitled, "Addressable Modules/Devices," of this section.

Provide electronic addressable type heat detectors where indicated, each listed for use with the FACP, which are only to be used in air conditioned spaces. Ensure electronic type heat detector spacing from lighting fixtures complies with manufacturer's installation requirements.

Provide addressable detector or base including circuitry and user selectable switching required for assigning each detector a unique address on the FACP communication bus. Verify invalid address switch settings or component failure initiates a trouble signal at the FACP. Provide detector head which plugs into a separate receptacle type base wired to the FACP signaling line circuit which powers and monitors the detector. Provide supervised base which initiates a trouble signal at the FACP if the detector is removed. Provide a light emitting diode indicator which gives a visual indication when the detector initiates an alarm.

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

In areas subject to moisture or exterior atmospheric conditions, provide only detectors that are UL listed or FM approved for use in those locations.

Ensure enclosures and detectors mounted in hazardous locations conform to the requirements of Underwriter's Laboratory (UL) or Factory Mutual (FM) for the hazardous location classification indicated. Provide conduit seal-off fittings suitable for the hazardous location classification at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

2.5.1 Line-Type Fixed Temperature Heat Detector

Provide [thermostatic] or [thermister] line-type heat detection cable [with weather-resistant outer covering] where indicated, with cable nominally rated for a temperature of [68 degrees C 155 degrees F] [88 degrees C 190 degrees F] 138 degrees C 280 degrees F and operational on a fixed temperature principle only.

2.5.2 Rate Compensating Heat Detector

Provide hermetically sealed, automatically resetting type detectors which operate when ambient air temperature reaches detector setting, regardless of rate of temperature rise or subject to thermal lag.

2.6 FLAME DETECTORS

**NOTE: Edit paragraphs as necessary for flame
detection characteristics.**

2.6.1 UV/IR Flame Detectors

Provide UV/IR flame detector device that contains all sensing, and processing visual indicators, relay outputs, and interfacing components for connection to the FACP, serving both alarm and fault conditions. Alarm conditions are generated from sensing both ultraviolet (UV) and flickering infrared (IR) radiation directly correlating to flame intensity. Ensure detector logic requires both UV and IR signals to be present at the proper minimum threshold levels before signaling an alarm condition and is not activated by single sources of UV or IR radiation including sunlight (direct, intermittent or reflected), quartz halogen lighting, electric discharge lighting, arc welding, lightning, radiant heat, hot engine exhaust, heating coils, etc. Also ensure detectors are immune to radio frequency and electromagnetic frequency interference.

Provide detectors which have a minimum field of view of [90] [_____] degrees symmetrical; capable of detecting a [0.3 m 1 foot Class A and B] [_____] fire at [13.7 m 45 feet] [_____] in [5 seconds] [_____] typical. Ensure detector response time is 500 msec typical to initiating fire signal, and provide with extended field adjustable time delay setting. Include self-diagnostic features to monitor its sensors, power source, and internal circuitry.

Ensure detector incorporates separate single pole, double throw (SPDT) alarm and trouble contacts rated at 2 Amperes minimum at 30 VDC, with alarm signal processing circuitry requiring UV radiation and flickering IR radiation to exceed minimum threshold levels before signaling an alarm condition. Provide alarm contacts which are field selectable for latching or non-latching operation unless otherwise indicated, with trouble and fault contacts which are non-latching and self-restoring. Provide detectors with Class A wiring configuration and conductors terminated on screw terminals capable of accepting 0.8 mm² through 2.0 mm² No. 18 through No. 14 AWG diameter solid copper conductors. Ensure detectors are individually addressable for alarm and trouble conditions by connection to addressable modules. Provide addressable modules in accordance with the paragraph entitled, "Addressable Modules/Devices".

Power detectors from a 24 V(DC) source. Where an auxiliary power supply other than the FACP is used, ensure the power source incorporates a power supply, battery back-up, and power transfer equipment in accordance with the paragraph entitled "Fire Alarm Control Panel," of this section. Terminate detector power wiring on screw terminals capable of accepting No. 16 through 5.0 mm² No. 10 AWG diameter solid copper conductors. Provide 25 percent spare capacity on the power supply circuit for future expansion.

Ensure enclosures and detectors mounted in hazardous locations conform to the requirements of Underwriter's Laboratory or Factory Mutual for the hazardous location classification indicated. Install conduit seal-off fittings suitable for the hazardous location classification at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70. Use only stainless steel enclosures, rated NEMA 4X, and include threaded conduit connection. Mount enclosures on stainless steel swivel base which

allows 180-degree horizontal and vertical rotation from the pivot point.

Provide detector with an integral built-in test feature, including UV and IR lens testing, with self-test capability.

Provide remote optical integrity test capability for each UV/IR detector from the addressable FACP. Activate the optical integrity test, manually or automatically, when the addressable control module is activated from the FACP, and ensure each control circuit activates the internal UV and IR test lamps simultaneously for each UV/IR detector connected to the control circuit. Include 25 percent spare capacity on each optical integrity test control circuit. Ensure activation of the control circuit via the control addressable module causes all the associated UV/IR detectors to go into an alarm condition. Also ensure that when the optical integrity test switch is restored to its normal position all the affected UV/IR detectors self restore. Provide an addressable device monitoring the UV/IR detector which is a latching type so as to provide alarm identification.

2.6.2 Triple IR Detectors

Provide unitized Triple IR flame detectors incorporating all sensory, signal processing, and alarm system interfacing components to provide fire detection by sensing within the CO₂ emission band for IR radiation. Ensure detector logic requires IR signal from all three (3) sensors present in the proper spectral signature as emitted by a hydrocarbon fire, and retains alarm-initiating capability in the presence of modulated false alarm sources. Ensure detector is not activated by single sources of UV and IR radiation including sunlight (direct, intermittent, or reflected), quartz halogen lighting, electric discharge lighting, arc welding, lightning, radiant heat, hot engine exhaust, heating coils, etc, as well as being immune from radio frequency interference and electromagnetic frequency interference. Detectors using guard band technology are not acceptable.

Ensure detector has a minimum field of view of 90 degrees along the horizontal axis and 70 degrees along the vertical axis, and is capable of detecting a 0.3 m 1 foot gasoline fire at a distance of 64 m 210 feet on axis, and 46 m 150 feet off axis. Ensure detector can detect a 0.6 m 2 foot JP5 pan fire at 30.5 m 100 feet on axis, and 24.4 m off axis, as well as an atomized type fire at 15.2 m 50 feet on and off axis. Ensure detector response time is selectable to 500 msec with typical response under 5 seconds for initiating fire signal, and includes self-diagnostic features to monitor its sensors, power source, and internal circuitry.

Provide a detector which incorporates separate single pole, double throw (SPDT) alarm and trouble contacts rated 5 amperes minimum at 30 V(DC), with alarm contacts which activate upon fire detection and are programmable for latching or non-latching operation; program for non-latching operation unless otherwise indicated. Ensure cycling detector power or momentarily (10ms) activating the manual test line resets latching alarm contacts. Provide non-latching trouble contacts which activate upon loss of unit power or internal diagnostic failure. Provide wiring connections for all contacts suitable for Class A wiring and made on screw terminals capable of accepting 0.8 mm through 3.0 mm² No. 18 through No. 12 AWG solid copper conductors. Ensure detectors are individually addressable for alarm and trouble conditions by connection to addressable modules. Provide addressable modules in accordance with the paragraph entitled, "Addressable Modules/Devices," of this section.

Power detector from a 24 V(DC) source. Where a power source other than the

FACP is used, ensure the power source incorporates power supply, battery backup and power transfer equipment in accordance with the paragraph entitled, "Fire Alarm Control Panel," of this section. Ensure detector power wiring connections are made on screw terminals suitable for No. 16 through 5.0 mm² No. 10 AWG diameter solid copper conductors. Include 25 percent spare capacity on the power circuit.

Ensure enclosures and detectors mounted in hazardous locations conform to the requirements of Underwriter's Laboratory or Factory Mutual for the hazardous location classification indicated. Install conduit seal-off fittings suitable for the hazardous location classification at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70. Provide stainless steel, rated NEMA 4X enclosures, and include threaded conduit connection. Mount enclosure on a stainless steel swivel base, which allows 180 degree horizontal and vertical rotation from the pivot point.

Provide detector with a calibrated integral optical integrity test feature, including individual test lamps for each IR sensor and generate a fault when 50 percent of the detection range is lost. Include calibrated self-test capabilities that generate an alarm when more than 50 percent of the detection range is retained.

Provide remote optical integrity test capability for each Triple IR detector from the addressable FACP. Ensure the optical integrity test is activated, manually or automatically, when the addressable control module is activated from the FACP, and each control circuit activates the internal IR test lamps simultaneously for each Triple IR detector connected to the control circuit. Include 25 percent spare capacity on each optical integrity test control circuit. Ensure activation of the control circuit via the control addressable module causes all of the associated Triple IR detectors to go into an alarm condition. Also ensure that when the optical integrity test switch is restored to its normal position all the affected Triple IR detectors self restore. Provide the addressable device monitoring the Triple IR detector which is a latching type so as to provide alarm identification.

2.7 SMOKE DETECTORS

Provide alarm initiating smoke detectors designed for use with automatic/manual fire alarm systems in accordance with UL 268.

Provide [2.5] [_____] percent per foot nominal obscuration (photo-electric) type smoke detectors, listed for use with FACP installed, including all required accessories, rust and corrosion resistant. Ensure detector head is a plug-in unit, that detector contains no moving parts, nor requires readjustment or removal to resume normal operation after an alarm. Provide all detector openings with screen to prevent the entry of insects and debris.

Provide detector head that plugs into a separate receptacle type base, with base screw terminals suitable for 0.8 mm through 2.0 mm² No. 18 through No. 14 AWG diameter solid copper conductors for all wiring connections required. Ensure base is supervised to initiate a trouble signal at the fire alarm control panel if the detector is removed, and a light emitting diode indicator to provide a visual indication when the detector initiates an alarm.

Provide detectors in areas subject to moisture or exterior atmospheric

conditions that are UL listed or FM approved for such locations.

Provide remote annunciation in a centralized location for devices that are not readily visible or accessible such as detectors installed under raised floors, or other locations where the detector is concealed or not readily visible; or provide an addressable type detector. Ensure annunciator panels are in accordance with paragraph entitled, "Annunciator Panels," of this section.

NOTE: Use the following paragraph where addressable smoke detectors are to be used in lieu of Remote Annunciator Panels.

Provide addressable detector(s) bases where indicated or used in lieu of remote annunciator panels, with detector or base which includes circuitry and user selectable switching required for assigning each detector a unique address on the FACP communication bus. Ensure invalid address switch settings or component failure initiates a trouble signal at the FACP.

Provide detectors with terminals suitable for Class A wiring powered from the panel alarm initiation or communication bus circuit; separate power sources are not acceptable.

NOTE: Use the following paragraph only where smoke detectors are required and there is no FACP available.

[Provide separately powered smoke detectors suitable for 120 V(AC) operation, equipped with a normally open dry contact for alarm operation, and a normally closed dry contact which opens on power failure or trouble within the detector. Secure approval for this type of smoke detector from the KSC AHJ, prior to installation.]

2.7.1 Duct Smoke Detectors

Provide alarm-initiating smoke detector devices designed for use with automatic/manual fire alarm systems in accordance with [UL 268A](#).

Provide addressable type duct smoke detectors connected to an addressable FACP, unless otherwise indicated, with the ability to perform sensitivity testing from the FACP in accordance with [NFPA 72](#).

Provide photoelectric type duct smoke detectors listed by [UL Fire Prot Dir](#) or FM approval guide, including duct housings, mounted exterior to the duct, and perforated sampling tubes extending across the width of the duct. Ensure activation of duct smoke detectors causes shutdown of the associated air-handling unit, annunciation at the FACP, and transmits a silent alarm to the Central Fire Monitoring Station, but does not activate the building evacuation notification appliances. Provide a single maintenance by-pass switch to isolate each air handling unit's duct smoke detectors. Ensure activation of any maintenance by-pass switch inhibits reporting and causes a supervisory condition at the FACP, and when the maintenance by-pass switch is restored to it's normal configuration, the supervisory signal at the FACP self restores. Where duct smoke detectors are installed outdoors, in unconditioned mechanical or electrical rooms, or

in areas with high ambient temperatures and humidity, 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.

Provide duct smoke detectors with terminals suitable for Class A wiring powered from the panel alarm initiation or communication bus circuit; separate power sources are not acceptable.

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 non-coded, manual alarm stations designed for use with automatic/manual fire alarm systems in accordance with [UL 38](#).

Ensure wiring terminals are suitable for Class A wiring and capable of accepting [0.8 mm through 2.0 mm² No. 18 through No. 14 AWG](#) diameter solid copper conductors. Make manual alarm stations individually addressable by connection to addressable modules, provided in accordance with the paragraph entitled, "Addressable Modules/Devices," of this section.

Ensure manual alarm station door has a protected, pull-down operating lever with recessed finger grip. When operated, ensure the station mechanically latches, breaks a glass or plastic rod, closes one or more sets of contacts, and locks 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, nor are stations which are resettable 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 fire-alarm stations on the cover in raised or depressed white-enameled letters. Manual alarm stations constructed of plastics or composite material are not acceptable.

Furnish surface-mounted stations with matching cast-iron or cast-aluminum back boxes with top and bottom threaded-conduit connections. For stations mounted outdoors, provide weatherproof type, with a neoprene gasket, and protect against corrosion. Provide a molded polycarbonate clear protective cover with the provision for a lead seal or plastic supervisory seal in all areas open to the general public. Ensure the protective cover does not have an integral warning horn.

For hazardous locations, provide manual pull stations that are UL listed, FM approved, or approved by a recognized testing laboratory for the hazardous location classification indicated. Ensure unit consists of a complete manufactured explosion-proof manual pull station assembly. Provide conduit seal-off fittings suitable for the hazard classification at each conduit connection to the explosion-proof enclosure in accordance with [NFPA 70](#).

2.9 ALARM BELLS

Provide red fire-alarm bells, [25.4 cm 10 inch](#) diameter, vibrating, under-dome, alarm notification appliances in accordance with [UL 464](#), with

bell which produces at least 87 dB at 3.04 m 10 feet, conforming to NFPA 72.

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

Provide alarm bells which operate from polarized 24 V(DC) FACP, Class A parallel wired supervised notification appliance circuits. Make wiring connection on terminal blocks suitable for 1.0 through 3.0 mm² No. 16 through No. 12 AWG diameter solid copper conductors. Ensure audible notification appliance circuits have sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity per circuit.

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

Ensure surface-mounted alarm bells installed in unfinished areas with conduit exposed are secured to surface-mounted cast-iron, or aluminum back boxes, with threaded conduit connections. If installed outdoors, provide weatherproof alarm bells with a neoprene gasket that are protected against corrosion. 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.

Provide alarm bells in hazardous locations that are UL listed or FM approved for the hazardous location classification indicated. When the bell is not factory sealed, provide conduit seal-off fittings suitable for the hazardous location classification indicated at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70. Ensure explosion-proof bell operating current does not exceed 0.25 amps.

2.10 STROBE UNITS

Provide strobe units designed for use with automatic/manual fire alarm systems, in accordance with UL 1971

Provide UL listed or FM approved strobe units including red cast metal housing, dome polycarbonate white lens with white "FIRE" lettering on two sides, and a xenon flash tube with solid state circuitry. Ensure unit brightness is 15, 30, 75, or 110 candela in accordance with NFPA 72, producing a minimum flashing frequency of 1 Hz and a maximum of 3 Hz. Synchronize all strobes. Ensure strobes remain flashing until the FACP is reset. Ensure visual notification appliance circuits have sufficient capacity to operate all devices connected, plus 25 percent minimum spare capacity per circuit.

Provide units which operate from polarized 24 V(DC), Class A, parallel wired supervised notification appliance circuits, with an operating current not exceeding 0.1 [_____] amperes and capability of operating over a 20 percent variation in nominal input voltage. Ensure wiring connection terminal blocks are suitable for 1.0 through 3.0 mm² No. 16 through No. 12 AWG diameter solid copper conductors.

Provide flush mounted interior units using standard electrical back boxes, and surface mounted units in cast iron or cast aluminum boxes with threaded conduit hubs. Provide weatherproof units with a neoprene gasket, protected from corrosion, in exterior or wet locations. Paint all metal exposed surfaces with a prime coat and one or more finish coats of red enamel paint to provide a smooth, hard durable finish.

If mounted in hazardous locations, provide strobes UL listed or FM approved for the hazardous location classification indicated. When the unit is not factory sealed, provide conduit seal-off fittings suitable for the hazardous location classification indicated at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

2.11 SPEAKERS

Provide speakers UL listed or FM approved for audible signal use, designed for use with automatic/manual fire alarm systems in accordance with UL 1480 and UL 1711, capable of clearly reproducing voice messages and bell tones in a three-pulse temporal pattern over a 400 to 4000 Hz range. Ensure speaker output at 1000 Hz for 1 watt input power is no less than 87 dB at 3.04 m 10 feet.

Provide Notification Appliance mechanism consisting of sealed speaker and multiple-tap impedance matching transformer suitable for 24 V(DC), Class A parallel-wired, supervised audio signaling systems. Include with transformer settings 0.25, 0.5, 1.0, and 2.0 watt taps unless otherwise indicated. Ensure Wiring connections for 4 wire operation are screw terminals suitable for 1.0 through 3.0 mm² No. 16 through No. 12 AWG diameter conductors.

Provide speaker housings made of red impact resistant polycarbonate or cast metal construction. Mount flush mounted interior speakers using standard electrical back boxes. Mount surface mounted speakers using red cast iron or cast aluminum boxes with threaded conduit hubs. If mounted in exterior or wet locations, provide weather-proof type with a neoprene gasket, protected from corrosion. Paint all metal exposed surfaces with a prime coat and one or more finish coats of red enamel paint to provide a smooth, hard, durable finish.

Ensure strobe portion of a combination audible/visual notification appliance is in accordance with the applicable provisions of the paragraph entitled, "Strobe Units," of this section.

If mounted in hazardous locations, provide speakers UL listed or FM approved for the hazardous location classification indicated. When the unit is not factory sealed, provide conduit seal-off fittings suitable for the hazardous location classification indicated at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

2.12 REVOLVING BEACONS

NOTE: Delete this section unless unique requirements dictate the use of revolving beacons. Revolving Beacons are used in place of strobes in areas identified as hazardous classified locations.

Provide a revolving beacon for use as fire warning light conforming to NFPA 72, capable of accepting 75 watt sealed-beam spot lamps. Ensure each lamp projects its beam downward on a reflector that rotates 360 degrees, 60 times per minute at a 45 degree angle. Provide heat resistant red plastic dome lens. Provide unit suitable for upright mounting on conduit sized 13 mm 1/2 inch minimum. 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.

If installed in hazardous locations, provide beacons UL listed or FM approved for the hazardous location classification indicated. When the beacon is not factory sealed, provide conduit seal-off fittings suitable for the hazardous location classification indicated at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

2.13 WATER FLOW ALARM DEVICES

Provide alarm-initiating water flow devices designed for use with automatic/manual fire alarm systems, in accordance with UL 346, conforming to UL or FM requirements for the particular type of sprinkler system being specified.

Ensure contact have a minimum of 2 single pole, double throw contacts rated 5 amps at 28 V(DC) or 250 V(AC). Make water flow devices individually addressable by connection to addressable modules, and provide in accordance with the paragraph entitled, "Addressable Modules/Devices," of this section. Provide weatherproof and corrosion protected flow devices for outdoor installations.

If installed in hazardous locations, provide water flow devices UL listed or FM approved for the hazardous location classification indicated. When the switch is not factory sealed, provide conduit seal-off fittings suitable for the hazardous location classification indicated at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

2.13.1 Pressure Switch

Wire alarm pressure switch to make or break an alarm circuit depending on rise or fall of water pressure. Provide an alarm pressure switch with an instant-recycle pneumatic-retard, or electronic adjustable setting time delay, settable from 45 to 90 seconds.

2.13.2 Vane-Type Flow Switch

Provide vane-type alarm flow switch which makes or breaks an alarm circuit upon deflection by a volume of flowing water that equals or exceeds the capacity of a single sprinkler. Ensure alarm flow switch has an instant-recycle pneumatic-retard, or electronic adjustable setting time delay, settable from 45 to 90 seconds.

2.14 VALVE TAMPER SWITCHES

Provide supervisory initiating valve tamper switches designed for use with automatic/manual fire alarm systems, in accordance with UL 346, conforming to UL or FM requirements of use on the specified valve.

Provide contacts with a minimum of 2 single pole, double throw contacts rated 5 amps at 28 V(DC) or 250 V(AC). Ensure valve tamper switches are individually addressable by connection to addressable modules, in accordance with the paragraph entitled, "Addressable Modules/Devices," of this section. Provide weatherproof, corrosion-protected switches for outdoor installations. In hazardous locations, provide valve tamper switches UL listed or FM approved for the hazardous location classification indicated. If the tamper switch is not factory sealed, provide conduit seal-off fittings suitable for the hazardous location classification

indicated, at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

2.15 REMOTE AUXILIARY CONTROL RELAYS

Provide remote control relays with continuous duty coils rated 24 V(DC). Where relays are used on Class A parallel wired supervised circuits, ensure coils incorporate supervisory current blocking diode. Provide relays with a minimum of 2 single pole, double throw contacts rated 5 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, provide fusing rated to protect the relay contacts in the relay enclosure.

Provide addressable type relays, where indicated, in accordance with the paragraph entitled, "Addressable Modules/Devices," of this section.

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 protection against corrosion.

In hazardous locations, install relays with enclosures UL listed or FM approved for the hazardous location classification indicated. Provide seal-off conduit fittings at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

Paint enclosures 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 stating, "F/A RELAY."

Mount remote auxiliary control relays and supervise within 0.91 m 3 feet of the controlled device in accordance with NFPA 101.

2.16 POWER SOURCE

Ensure normal power to the local systems for all purposes, including separately powered notification appliances and initiating devices, is 120 volts 60 hertz. Ensure system operates satisfactorily between 85 and 110 percent of normal voltage. Provide fire-alarm-system disconnect/protective device as a fused switch with a red factory finish as specified herein for manual alarm stations. Mount this disconnect switch adjacent to the FACP. Mark as FIRE-ALARM DISCONNECT FED FROM (indicate supply circuit) with 1/2-inch high letters in white paint or engraved phenolic identification plates fastened with sheetmetal screws. Ensure switch is capable of being locked in the "on" or "off" position, a feature which can not interfere with the circuit protection capability of the device. Equip switch with surge suppression for all phase and neutral conductors. Install current limiting Class RK1 fuses properly sized to protect the fire alarm equipment.

When power is supplied from a single 20 amp circuit breaker, provide an adjustable set screw type clamping device over the circuit breaker handle to prevent handle operation. Paint only the locking device red.

2.17 WIRING

Provide copper conductor wiring in accordance with NFPA 70 and NFPA 72. Connect all devices to Class A, parallel-wired circuits, per NFPA 72, with the wire types specified in this section, unless specifically noted otherwise in the paragraph entitled, "Wiring (Wire and MultiConductor

Cable). For 120 V(AC) circuits, use 3.0 mm² No. 12 AWG minimum.

Ensure all conductors installed on fire alarm systems are solid copper with an insulation rating of not less than 300 volts, permanently marked with the size, voltage rating and manufacturer's name on the conductor jacket at no less than 610 mm 2 feet intervals. Conductor sizes are listed below.

Where modifications are made to existing systems, match the new or added conductors to the size and color-coding of the existing system. Conductor AWG diameter and Insulation Type are listed below. Required wire colors are listed in the paragraph entitled, "Wiring (Wire and Multi-Conductor Cable)," of this section.

Provide solid copper, shielded, twisted pairs, meeting UL 2196 requirements, for conductors in multiplexed communication circuits, signaling line circuits, speaker audio circuits, remote phone circuits, and remote reporting circuits. Ensure cable is listed as Type FPL, Power-Limited Fire Protective Signaling Cable, with conductor size less than 1.0 mm² No. 16 AWG diameter for data circuits and 2.0 mm² No. 14 AWG diameter for audio circuits.

Air sampling detection units are permitted to use 0.8 mm² No. 18 AWG for connection to addressable modules with maximum conductor length not to exceed 25 ft.

Provide direct current initiating device (manual pull station) circuit conductor size of not less than 1.0 mm² No. 16 AWG diameter, 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.

Size power leads from the control panel for product-of-combustion detectors accordingly, but not less than 2.0 mm² No. 14 AWG diameter, with insulation Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.

Provide direct current notification appliance circuit (strobes, bells) conductor size of not less than 2.0 mm² No. 14 AWG diameter, with insulation Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.

Provide direct current auxiliary control device (AHU shut down relay) circuit conductor size of not less than 2.0 mm² No. 14 AWG diameter, with insulation Type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.

Provide solenoid valve control circuit conductor size of not less than 2.0 mm² No. 14 AWG diameter, with insulation type THHN/THWN for 2.0 mm² No. 14 AWG diameter and larger.

[Ensure all underground circuit wiring meet UL Standards 444 and 13, and TIA 455-82B water infiltration tests; equal to West Penn Aqua Seal.]

2.17.1 Fire Resistive Cables

Provide fire resistive cables for notification appliance circuits designed for use with automatic/manual fire alarm systems in accordance 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. Ensure the CI cable 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.

2.18 SURGE SUPPRESSORS

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 fire alarm circuits which extend beyond a building. Locate protection as close as practical to the point where the circuits leave the building. Install protectors in surge suppression cabinets 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. Where installed outdoors, provide stainless steel NEMA 4X rated cabinets. Provide a copper ground bus inside the cabinet and connect protectors to an earth ground electrode system in accordance with the manufacturer's requirements and NFPA 70. Ensure an etched metal or engraved laminated plastic identification plate labeled, "Fire Alarm Cabinet," is affixed to the cabinet door of the alarm control unit to identify the cabinet as a fire alarm cabinet. For cabinets painted black, ensure the identification plate has white letters on a black background, and for cabinets not painted red, the identification plate has white letters on a red background.

2.18.1 Line Voltage Surge Suppressors

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

2.18.2 Low Voltage Surge Suppressors

Provide for all circuits which leave the building shell and as shown on the contract drawings. When circuits interconnect two (2) or more buildings, provide an arrester at the circuit entrance to each building. Ensure suppressor is [UL 497B](#) listed, with a maximum 30 volt clamping level and a maximum response time of 5 nanoseconds, with multi-stage construction and both differential/common mode protection.

2.19 SOLENOID VALVES

Provide solenoid valves at [pre-action] [deluge] [gaseous] suppression system valves indicated, UL listed or FM approved for operation with the respective fire alarm control/releasing panel and the releasing valve. Provide valves with all fittings, hardware, and fire alarm interface modules as required.

Incorporate a safing key switch in solenoid valve, with safing key switches which accepts a Best Access Systems 7-Pin core (Mortise or Standard Rim Cylinder). Design switch and operator for mounting on the front of a sheet metal electrical enclosure cabinet. Ensure that each key switch disconnects all conductors connected to the releasing solenoid valve, and that switch contacts are rated 5 amps minimum at 28V DC.

When installed in hazardous locations, provide solenoid valves UL listed or

FM approved for the hazardous location classification indicated. When the solenoid valve is not factory sealed, provide conduit seal-off fittings suitable for the hazardous location classification indicated at each conduit connection to the explosion-proof enclosure in accordance with NFPA 70.

PART 3 EXECUTION

3.1 SYSTEM SEQUENCE OF OPERATION

3.1.1 Normal Operation

Ensure all switches are in the normal position; available power lamp is on, the trouble and detector identification lamps are off, and all circuits are electrically supervised.

3.1.2 Supervisory Condition

Per system conditions identified in the paragraph entitled, "Fire Alarm Control Panel," of this section, ensure that a supervisory signal is transmitted to the Central Fire Monitoring System, device indication is provided, a supervisory signal is activated in the FACP, and input is provided to remote annunciators (when used). Ensure supervisory signal in the alarm control unit is comprised of visual and audible indications and is self-restoring.

3.1.3 Trouble Condition

Per system conditions identified in the paragraph entitled, "Fire Alarm Control Panel," of this section, ensure that a trouble signal is transmitted to the remote reporting device of the Central Fire Monitoring System, providing zone indication, activating a trouble signal in the FACP, and providing input to remote annunciators (when used). Ensure trouble signal in the alarm-control unit provides visual and audible indications.

3.1.4 Alarm Condition

Ensure activation of any detectors, manual alarm stations, water flow switches, or other initiating devices closes a contact that activates the appropriate FACP. FACP transmits a signal to the remote reporting device of the Central Fire Monitor System, activates the facility indicating appliances, provides zone identification, controls air handling and ventilating units, provides an input to remote annunciators (when used), and provides indication or control to devices or other systems.

3.2 INSTALLATION

NOTE: If the installation of the specified fire alarm system is on a new facility, then delete the first paragraph under the paragraph entitled, "Installation," of this section.

Prior to performing any installation or modification work to existing Fire Alarm system(s), secure a Transfer of Responsibility Form completed by the COTR and signed by the Contractor and Institutional Services Contractor (ISC) Fire Protective Systems designee. The completed form will be turned over to the Contracting Officer by the COTR. Permanently affix a copy of

the completed "Transfer of Responsibility" Form to the affected FACP throughout the construction period.

Install all equipment in accordance with manufacturer's recommendations and requirements of this Section.

3.2.1 Fire Alarm 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. 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.

Ensure wiring within FACP(s) and reporting equipment is in accordance with the paragraph entitled, "Installation in Cabinets and Boxes," of this section.

Install conductors in accordance with the paragraph entitled, "Wiring," from the [modem cabinet] [code transmitter] [FACP] to a new [4] [8] point terminal strip labeled "FATB" in the indicated telephone terminal cabinet.

When FACP(s) and reporting equipment are installed flush or semi-flush, provide three spare 25 mm 1-inch conduits in accordance with the paragraph entitled, "Conduit and Raceways," of this section, from the FACP 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. Individually identify modules 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.

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

3.2.3 Annunciator Panels

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

Install annunciator panels in each protected building, at locations indicated, complete with all accessories and devices. 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 7.11 cm 28 inch clear aisle way for access to the annunciator panels.

Provide 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. Provide field installation locations complying with [NFPA 72](#).

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

Locate electronic, addressable detectors no closer than [304 mm 1 foot](#) from any part of lighting fixtures. Space separation from lighting fixture in accordance with the manufacturer's requirements, but no closer than [304 mm 1 foot](#). Mount detectors no closer than [0.91 m 3 feet](#) from any supply or return diffuser.

Make provisions for devices mounted in acoustical, lay-in type ceilings to utilize 'T' bar corner plate/bracket. Cut ceiling tile as required to accommodate mounting plate and device wiring.

3.2.5 Flame Detectors

Provide flame detector location and general arrangement as indicated. Adjust location as required to prevent obstruction of the detector field of view, and provide coverage in all protected areas by at least one detector.

Where detectors are installed outdoors, arrange conduit systems to drain away from the detector. Aim detectors to accurately cover the field specified using a laser aimer recommended by the detector manufacturer. Point the aiming spot on the floor for each detector and include the measurements of this spot from fixed structural elements on the shop drawings and record (as-built) drawings.

3.2.6 Smoke Detectors

Provide smoke detector location, number, and general arrangement as indicated. Ensure field installation in accordance with [NFPA 72](#). Do not install detectors until the work of other trades is complete.

Utilize 'T' bar corner plate bracket for devices mounted in acoustical, lay-in type ceilings. Cut ceiling tile as required to accommodate mounting plate and device wiring.

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.

Locate detectors no closer than [1.82 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 [1.82 m 6 feet](#) from any supply diffuser. Ensure detectors installed in areas subject to moisture or exterior atmospheric conditions are UL listed or FM approved for such locations.

3.2.7 Manual Pull Stations (Fire Alarm Boxes)

Mount manual pull stations at locations indicated within 457 mm 18-inch of the latch side of the door. Ensure mounting height is 1219 mm 48-inch above the finished floor measured from the top of the device.

Where manual pull stations are installed outdoors, arrange conduit systems to drain away from the manual pull stations.

3.2.8 Alarm Bells/Speakers

Mount bells and/or audio speaker notification appliances at the approximate locations indicated. Ensure mounting height is 2286 mm 90-inch above the finished floor measured from the top of the bell/speaker, but no less than 152 mm 6-inch below the ceiling.

Where bells or speakers are installed outdoors, arrange conduit systems to drain away from the bells or speakers.

3.2.9 Strobe Units/Combination Audio Visual

Mount strobe notification appliances at the approximate locations indicated. Ensure locations are unobstructed and allow viewing by area occupants in accordance with NFPA 70. Ensure mounting height is 2032 mm 80-inch above the finished floor measured from the bottom of the strobe, but no less than 152 mm 6-inch below the ceiling.

Where strobes are installed outdoors, arrange conduit systems to drain away from strobes. Ensure visual and audible appliances are capable of operating independently via separate and independent circuits for both the audible and strobe portions.

3.2.10 Auxiliary Control Relays

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

3.2.11 Wiring (Wire and Multi-Conductor Cable)

Provide wiring conforming to the requirements of NFPA 70 and the following special requirements:

Install fire alarm 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 allow 60-Hertz power circuits to enter enclosures containing fire alarm circuits except where required to connect to the fire alarm system.

Provide continuous conductors from a terminal point at one device to a terminal point at the next device and from a device to the FACP. Break wires at each terminal; do not loop wires over a terminal. Terminate approved explosion proof devices, provided with pigtail wiring connection leads, on a field installed terminal strip installed in the box on which the device is mounted. 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. Terminate 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. Identify all circuit conductors within each enclosure where a tap, splice, or termination is made. Provide conductor identification by heat-shrink-type sleeves or other approved method. Use point destination type conductor labels to indicate cabinet, circuit board, terminal block and screw terminal location for each individual conductor.

Provide conductor colors as listed below and 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.

Mark conductors for multiplexed communication circuits, speaker audio circuits, remote phone circuits, and remote station signaling circuits with circuit designation, and maintain consistent color-coding for the positive and negative loops throughout the cable system.

Install direct current initiating device circuits (heat detectors, manual pull station) as Class A, parallel-wired circuits per [NFPA 72](#). Ensure the positive loop conductor is colored blue, Color No. 15102, and the negative loop conductor is colored black, Color No. 17038.

Install power leads from the control panel for product-of-combustion detectors as Class A, parallel-wired circuits per [NFPA 72](#). Ensure the positive conductor is colored white, Color No. 17877, and the negative conductor is colored black, Color No. 17038.

Install direct current notification appliance (bells, strobes) circuits as Class A, parallel-wired circuits per [NFPA 72](#). Ensure the positive conductor is colored red, Color No. 11105, and the negative conductor is colored orange, Color No. 12473.

Install direct current auxiliary device control device circuits (AHU shutdown relay) as Class A, parallel-wired circuits per [NFPA 72](#). Ensure the positive conductor is colored yellow, Color No. 13591, and the negative conductor is colored brown, Color No. 10055.

Install solenoid valve control circuits as Class B circuits per [NFPA 72](#). Ensure the positive conductor is colored yellow, Color No. 13591, and the negative conductor is colored violet, Color No. 37100.

3.2.11.1 60-Hertz Power

Provide 60-hertz power to FACP(s) or separately powered devices of 120 volts. Provide one black phase conductor, one white or gray solidly grounded neutral conductor, and one green equipment grounding conductor. Size conductor as shown on the drawing with the minimum size [3.0 mm² No. 12 AWG](#) copper. Install surge arrestors in accordance with [NFPA 72](#) and [NFPA 70](#).

Clearly identify Circuit Breakers used to supply AC power to the FACP. Provide a permanent label with white background and red lettering adjacent to the circuit breaker.

3.2.11.2 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 continuous control wiring from device to device with no splices unless

otherwise indicated. Permanently mark all wires entering or leaving control cabinets, boxes, and devices and terminate on screw terminals. Ensure marking is consistent throughout the fire alarm system and is the same as the identification shown on the connection drawings.

Ensure wire labels correspond to the approved connection drawings and use a method indicating the destination of the other end of the wire. Provide labels in control panel equipment or between fire alarm terminal cabinets which indicate the destination of the other end by cabinet designation-terminal strip designation-terminal number. Provide labels in fire alarm terminal cabinets indicating connection in control panel equipment by fire alarm cabinet designation-module identifier-module terminal strip identifier-terminal number. Provide conductor labels with legible machine-printed black lettering on white background using indelible ink. Ensure labels are heat shrink or wrap around type.

3.2.12 Conduit and Raceways

Minimum size for fire alarm system initiating, notification, signaling line and control circuit conduits and raceways is 12 mm 3/4-inch. Install in accordance with NFPA 70. Ensure all Class A initiating device, signaling line, notification appliance and control circuits use diverse routing in accordance with NFPA 72. Do not run outgoing and return redundant circuit conductors in the same cable assembly, enclosure or raceway. The outgoing and return circuit conductors are only permitted to be run in a single conduit or raceway for drops that enter or exit an initiating device, notification appliance, or control unit enclosure.

Install rigid galvanized steel conduit in all hazardous (classified) locations, exterior locations where the conduit is exposed above grade, interior exposed locations from finished floor to 304 mm 1 foot above finished ceiling unless otherwise shown on the drawings. EMT with hexnut expansion gland-type fittings can be installed in all other locations. Use flexible metal conduit, maximum length 1828 mm 6 feet, as the final connecting raceway to a fire alarm device mounted on vibrating equipment or on a suspended ceiling.

Where devices, junction boxes, and cabinets are installed outdoors, arrange conduit systems to drain away from the box; ensure conduit enters the box side or bottom only and drain type fittings are installed.

Use schedule 80 PVC for conduit direct buried in earth. Ensure that portions of underground raceway systems that penetrate above finished grade are rigid, galvanized, heavy-wall steel conduit with a 40-mil PVC coating or painted with a bitumastic compound.

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

Ensure conduit installed in a vertical position is parallel with walls and perpendicular with the floor and ceiling, and that conduit installed in a horizontal position is parallel with the floor and ceiling and perpendicular to the walls. Make changes in direction of runs with symmetrical bends. For bends of over 25 mm 1-inch in diameter, provide factory made elbows.

3.2.13 Water Flow Alarm and Valve Tamper Switches

Install switches in accordance with the manufacturer's requirements and make final connections using liquid-tight flexible metallic conduit. Adjust time delays on water flow/pressure switches to between 45 and 90 seconds to prevent false alarms due to momentary water movement.

3.2.14 Elevators

Ensure initiating devices to effect control of the elevator(s) in an alarm condition report through the facility fire alarm system and initiate the following actions in the elevator controls in accordance with [ASME A17.1](#) and [NFPA 72](#):

- a. Primary Fire Fighter Recall.
- b. Secondary Fire Fighter Recall.
- c. Power Feed Shunt-Trip.
- d. "Do Not Use Elevator" Warning.

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. Perform the Tests covered in the following paragraphs in two parts:

- a. Contractor Checkout - Perform this test to remove all troubles, ground faults, ensure all devices are fully functional and operational, and test the programming to ensure the installation meets the contract drawings and specifications.

**NOTE: Delete the following requirement if the
installation is for a new fire alarm system**

For modification and rehabilitation work, the Contractor is not responsible for existing troubles and ground faults that are not in contract scope. Clearly convey the existing troubles and ground faults that are not in contract scope in the Transfer of Responsibility form. Upon successful completion of Contractor Checkout, submit [Contractor Readiness Affirmation - For Preliminary Fire Alarm Testing](#) prior to requesting the preliminary test. Also submit [KSC - Transfer of Responsibility](#); and draft of [NFPA 72 Fire Alarm System Record of Completion](#). [Contractor Readiness Affirmation - For Preliminary Fire Alarm Testing](#) and [KSC - Transfer of Responsibility](#) forms can be found in the "Special Conditions" documentation associated with this project.

- b. Preliminary - Perform this test using the approved test procedure and witnessed by the Government construction inspectors. Verify Record (as-built) fire alarm system drawings against the system installed, annotate all red-lines, and summarize on a single set of record (as-built) drawings. Follow the test procedures as written and annotate all red-lines on a single Test Procedure. Secure the initials and date on the summarized set of drawings and test procedures from the

construction inspector and the fire alarm vendor. The Preliminary test is not considered complete until all steps in the test procedure have been satisfactorily completed. This includes any additional steps required to complete 100 percent testing of the fire alarm system and its associated functionality.

- c. Final Acceptance - After the successful completion of the preliminary test, schedule a Final Acceptance test. Incorporate the final acceptance test procedure and record (as-built) drawings including all red lines from the preliminary test. Provide a copy of the consolidated redlines for the record (as-built) drawings and preliminary test procedures from the preliminary test. Ensure the Contracting Officer and the Authority Having Jurisdiction or their designee(s) witness the final acceptance test for the fire alarm system. During the Final Acceptance Test, provide two corrected as-built drawings and Final Acceptance Test Procedures for use in conducting the final acceptance test. Upon completion of the Final Acceptance Test, provide the following documentation to the Contracting Officer; a copy of the Final Acceptance Test procedure (with all steps annotated as complete), a corrected set of as-built drawings and a signed and completed NFPA 72 Fire Alarm System Record of Completion form.

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:

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. Verify resistance reading for each circuit is the value of the end-of-line resistor, plus or minus 10 percent.

Check each wire for grounds with 300-volt and 500-volt insulation resistance test set. Ensure resistance to ground is not less than 20 megohms. Isolate each wire tested from ground, with all other wires within the same conduit grounded. Verify that the conduit system is grounded prior to insulation resistance testing by verifying a short circuit between the conduit and earth ground.

3.3.2 Fire Alarm System Acceptance Test Procedures (For Both Preliminary and Final 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:

With the control panel energized, demonstrate the proper operation of all indicating lights and alarms.

Demonstrate each annunciator panel lamp to operate when its associated device or zone is activated.

Activate each manual pull station to demonstrate proper operation.

Activate each smoke detector in accordance with the manufacturer's

instructions, to demonstrate proper operation; both alarm and trouble.

Perform a static pressure differential test on each duct smoke detector to verify the pressure differential between the inlet and outlet tubes is within the manufacturer's specifications for acceptable operation. For air handling units with variable speed drives, test at both the minimum and maximum operating speeds.

Activate each flame detector in accordance with the manufacturers recommendation; verify both alarm and trouble indications at the FACP.

Activate each optical integrity test switch and verify that each flame detector on this circuit went into alarm and that all the addressable interface modules latched in the alarm condition. Restore the test switch and visually verify the flame detectors returned to normal operation.

Each time an initiating or supervisory circuit is activated, verify that the associated device address, notification appliances circuits, auxiliary control circuits, and alarm reporting to the Central Fire Monitoring System is activated and the correct information is displayed by the color graphics units.

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. Alternate between positive (plus) and negative (minus) leads during the device testing process.

Turn off power to each separately powered panel or device to simulate loss of power and to demonstrate operation of the trouble alarm.

Test the rate-of-rise function on each heat-actuated detector in each zone by application of heat from a heat lamp or hand held hot air blower. Ensure detectors initiate an alarm to the system, sustain repeated tests of the rate-of-rise function without damage to the fixed temperature function. Replace heat-actuated detectors (HADS) subject to operation from body temperature.

Open and close water suppression system valves requiring tamper switches, to demonstrate proper operation.

Activate water flow/pressure switches by water flow at the inspector's test valve to demonstrate proper operation. Set water flow time delay between 45 and 90 seconds.

Verify discharge of electrically activated suppression systems. Verify each initiation device that activates the suppression system to activate the solenoid valve. Fully discharge the overall system at least once.

Demonstrate each alarm initiating circuit to operate its associated alarm-control and auxiliary control units and remote reporting.

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. Alternate between positive (plus) and negative (minus) leads during the device testing process.

Measure and record sound pressure level with a sound level meter meeting ANSI S1.4a, Specifications for Sound Level Meters, Type 2 requirements. Measure and record sound pressure Levels and ambient background levels throughout the protected area. Set the sound level meter in accordance with ANSI S3.41, American National Standard Audible Evacuation Signal, using the time-weighted characteristic F (FAST). Record the maximum output when the audible emergency evacuation signal is on. Verify audible information to be distinguishable and understandable. In locations where voice intelligibility is required, verify by one of the NFPA 72 approved methods. Ensure Acceptable Sound pressure level differentials comply with NFPA 72.

Demonstrate each alarm control unit to operate in all modes.

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 fire alarm (control) panel and operating the system as specified for backup operation.

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.

Verify all maintenance bypass functions operate as specified. Independently verify each device or circuit controlled by the bypass function.

Test multiplex equipment, devices, and wiring in accordance with NFPA 70 and manufacturer's requirements. Remove and ground one lead at each addressable device to demonstrate open circuit trouble, ground fault trouble, and then operation over ground fault with an open circuit. Alternate between positive (plus) and negative (minus) leads during the device testing process.

Test Style 7 network wiring configuration and fault tolerance to verify proper operation.

3.3.3 Reacceptance System Tests

Perform reacceptance 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. 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 are 100 percent tested. 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 require 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 modification, 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 all newly installed devices in accordance with the paragraph entitled, "Fire Alarm System Acceptance Test Procedures (For Both Preliminary and Final Tests)," of this section.

After final acceptance testing has been successfully completed, submit test data under the terms of the "GENERAL REQUIREMENTS" clause of this contract.

3.4 OPERATION AND MAINTENANCE MANUALS

NOTE: If the installation of the specified fire alarm system is a Simplex Fire Alarm Control Panel, then delete the paragraph under the paragraph entitled, "Operation And Maintenance Manuals," of this section.

Submit Operation and Maintenance Manuals. Bind information in manual format and group by technical sections consisting of manufacturer's standard brochures, schematics, procedures, recommended spare parts, recommended test equipment, and safety precautions. Submit this information prior to acceptance tests being performed.

3.5 PAINTING

Bring all manufacturer's standard finish equipment surfaces, damaged during construction, to as-new condition by touchup or repainting to the satisfaction of the Contracting Officer, or replace with new undamaged equipment at no additional cost to the Government.

Paint all fire alarm conduit fittings, junction boxes, and junction box covers red, Color No. 11105 in accordance with FED-STD-595. Mark conduit with a minimum 2.54 cm 1-inch wide band every 6.1 m 20 feet. Alternative compliant method is to use red-colored EMT conduit that is hot-galvanized for durability with a red top coat. If the alternative method is selected, none of the conduit fittings, junction boxes, or junction box covers are required to be painted.

-- End of Section --