

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT			1. CONTRACT ID CODE	PAGE OF PAGES	
			J	1	1
2. AMENDMENT/MODIFICATION NO. 0002	3. EFFECTIVE DATE 30-Aug-2004	4. REQUISITION/PURCHASE REQ. NO. W13G86-4203-0251		5. PROJECT NO.(If applicable)	
6. ISSUED BY U S ARMY ENGR DISTRICT, NEW ENGLAND 696 VIRGINIA RD CONCORD MA 01742-2751	CODE W912WJ	7. ADMINISTERED BY (If other than item 6) See Item 6		CODE	
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)			X	9A. AMENDMENT OF SOLICITATION NO. W912WJ-04-B-0015	
			X	9B. DATED (SEE ITEM 11) 10-Aug-2004	
				10A. MOD. OF CONTRACT/ORDER NO.	
				10B. DATED (SEE ITEM 13)	
CODE	FACILITY CODE				
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS					
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> is not extended.					
Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.					
12. ACCOUNTING AND APPROPRIATION DATA (If required)					
13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.					
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.					
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).					
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:					
D. OTHER (Specify type of modification and authority)					
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.					
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) (Amendment 0002 incorporates changes to Specification Section 13851 which was inadvertently omitted from Amendment 0001.) POC: Marla levenson (978)318-8757					
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.					
15A. NAME AND TITLE OF SIGNER (Type or print)			16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)		
			TEL: _____ EMAIL: _____		
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY _____ (Signature of Contracting Officer)		16C. DATE SIGNED 30-Aug-2004	

EXCEPTION TO SF 30
APPROVED BY OIRM 11-84

30-105-04

STANDARD FORM 30 (Rev. 10-83)
Prescribed by GSA
FAR (48 CFR) 53.243

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SECTION 13851

FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE

PART 1 GENERAL

1.1 GENERAL PROJECT REQUIREMENTS

1.1.1 Project

This Specification outlines the project requirements for the detailed design, furnishing and installation of a replacement Fire Alarm and Voice/Alarm Communication Systems and related subsystems, hereafter referred to collectively as the fire alarm system or system, to be installed in various buildings on the Natick SSC Campus located in Natick, MA.

1.1.2 Contractor Responsibilities

The Fire Alarm System Contractor (hereafter referred to as the Contractor) shall be responsible for the detailed design and installation of fully operational fire alarm systems in accordance with these Specifications and requirements of the Corps of Engineers, ~~City of Natick~~ and the State of Massachusetts. The Contractor shall be responsible for all material, labor, ~~permits~~, logistical and technical resources and coordination necessary for the complete execution of all particulars of these Specifications. Exceptions (i.e., work to be performed "by others"), if any, will be specifically noted herein.

All work performed pursuant to these Specifications shall be complete in every respect, resulting in fully operational systems installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations, product listings and these Specifications. All work which does not conform to these requirements shall be subject to replacement, at the Owner's sole discretion, with work which does conform, at the Contractor's own expense.

1.1.3 Removal of Existing System

The existing fire alarm control panels, related equipment and shall conductors/wiring not specifically approved to be re-used shall be removed from individual buildings. The control panels and equipment shall be turned over to Simplex.

1.2 GENERAL DESCRIPTION

1.2.1 Contractor Scope of Work

Provide all materials and labor for the detailed design and installation of replacement fire alarm systems for various buildings on the Natick SSC Campus located in Natick, Massachusetts. All work performed shall be in accordance with the Corps of Engineers, State of Massachusetts and the City of Natick requirements.

The project includes all work necessary for complete design and

installation including the removal of the existing systems as described herein.

All work shall be performed in accordance with the Contract Documents. No modifications to the Contract Documents will be accepted without the specific written approval of the Contracting Officer. It is the Contractor's responsibility to obtain Contracting Officer's written approval of any such modifications prior to the execution of work.

1.2.2 Fire Alarm Manufacturer

All fire alarm system components and equipment shall be the standard addressable and networked product of Simplex Grinnell.

1.2.3 Intent of Specifications

The fire alarm systems specified herein are intended for detailed design and installation by a Contractor familiar with the design, manufacturer, installation and proper application of such systems.

The fire alarm systems specified herein are intended to be operated by the site's operation and security personnel. As such, they shall be designed and installed so as to be "user-friendly" to the extent that the building's staff can reasonably be expected to operate them effectively under emergency conditions.

It is intended that the work performed pursuant to the Contract Documents be complete in every respect, resulting in systems installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and Underwriter's Laboratories, Inc. (UL) listings. In addition, all new equipment, devices, components, etc. interfaced with existing equipment, devices, components, etc. shall be cross-listed by UL for such interface.

1.2.4 Documents and Information

It is further required that upon completion of this Work, the Contractor provide the Contracting Officer with:

- a. Complete information and as-built drawings accurately describing and depicting entire systems as installed, including all information necessary for maintaining, troubleshooting and/or expanding the systems.
- b. Complete documentation of all system testing.
- c. Certification that the systems have been inspected and tested per these Specifications and are installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations, UL listings, and these Specifications.
- d. A copy of final software programs both in paper and disk format including any and all necessary passwords.

1.2.5 Equipment

Provide, from manufacturer's current product lines, equipment and components which comply with the requirements of these Specifications. Equipment or components which do not provide the performance and features

required by these Specifications are not acceptable regardless of the manufacturer.

1.3 WORK INCLUDED

1.3.1 General Scope of Work

The Contractor is to provide all devices, equipment, conduit, wiring and labor necessary to provide complete approved fire alarm systems as required by this section and these specifications. Provide and install new fire alarm systems in Building Nos. 1, 2, 3, 4, 5, 7, 8, 14, 15, 16, 19, 20, 30, 32, 36, 38, 39, 42, 44, 45, 66, 77, 78, 80, 86 and 92. Consisting of, but not limited to, the following:

1. New Simplex 4100U fire alarm control units with full voice communication capabilities at the same locations as existing Simplex 4020 fire alarm control panels in each building as shown on the contract drawings.
2. New head-end reporting equipment, with color graphics annunciator, in Building No. 39 and Building No. 1. A graphic annunciator is not required at Building No. 1.
3. Manual fire alarm stations at all exit stairways, circulating stairways, and at grade level exit doors.
4. Spot type smoke detectors in corridors, at all unattended fire alarm control panels and as shown on the Contract Drawings.
5. Duct type smoke detectors in all air handling systems as shown on the Contract Drawings.
6. Heat detectors as shown on the drawings.
7. Fire alarm speakers throughout the buildings.
8. Visible notification appliances in all public or general areas including the lobbies, corridors, hallways, restrooms, lounges, and offices.
9. All wiring and cable shall be installed in steel conduit (3/4-inch minimum). "Wiremold" steel raceways shall be installed in all exposed areas except mechanical areas.
10. Remote control equipment and panels for Building Nos. 1, 3, 4, 15, 36, 42 and 45 as shown on the contract drawings.
11. Alarm signals with synchronized three-pulse temporary pattern in accordance with NFPA 72.
12. "High-end" printer in Building No. 39.
13. Interface of all existing signaling line, notification (both audible and visual), control circuits and power equipment into the new Simplex 4100U control in individual buildings.
14. In Building Nos. 5, 7, 8, 15 and 20, existing addressable initiating and control devices shall be retained and interfaced with the new control equipment.

1.3.2 Preliminary Work

Prior to performing any work in individual buildings, the Contractor shall provide and install two (2) bi-directional couplings for the control equipment in each building as shown on the contract drawings. One (1) for incoming fibers and one (1) for outgoing fibers. Contractor shall "jumper" one (1) of the existing fibers at each control panel in each building to maintain voice communication continuity. The Contractor shall also install all necessary "head-end" equipment in Building Nos. 1 and 39.

1.3.3 General Equipment

The Contractor shall provide and install the following:

1. Terminal strip cabinets on each floor of the Buildings.
2. Provide necessary interface wiring to fan(s) and air handling unit(s) electrical panels for start up or shut down of fans when smoke is detected.
3. Upgrade existing battery back-up, as needed, for all new control equipment.

1.3.4 Existing Equipment

1. The Contractor shall remove the existing fire detection and alarm system(s), including smoke detectors, wiring, raceways, etc., and provide necessary patching and painting during all phases of the project. This shall include all existing Faraday control equipment located in Building No. 1. The existing graphic annunciator installed at the Guard Shack shall also be removed. In Building Nos. 5, 7, 8, 15 and 20 the existing horn/strobe units, associated conduit wiring, cable, etc. shall be removed.
2. The Contractor shall remove all existing isolater modules in individual buildings and return them to the Contracting Officer. Existing backboxes that contain isolater modules may be abandoned in place.
3. Provide protection of previously installed and new smoke detectors per this specification.
4. Existing systems shall be maintained by the Contractor until new systems have been completely installed, tested and accepted.
5. Contractor shall interface existing power circuits to existing Simplex 4020 panels with new 4100U panels.
6. Existing batteries shall be upgraded by the Contractor as necessary to comply with the power requirements of this specification.
7. The Contractor shall interface existing beacons on each building with new control equipment.

1.3.5 Circuits

The system shall be configured by the Contractor as follows:

1. All Class 'A' circuits shall have outgoing and return wiring and conduit separated by no less than 10 feet except when entering control equipment. This includes both horizontal and vertical installations. Incoming and outgoing circuits shall be separated by 10 feet, except for a distance of 10 feet from the control panel from which the circuit originates. The intent of the 10-foot separation is to keep the incoming and outgoing legs of the circuit far enough apart such that single event could not sever the circuit twice, in which case alarm receipt capability would not be achieved along the entire circuit. For existing circuits with initiating devices installed, the circuits may

remain routed as is, and will not require repiping or pulling new wire.

2. A minimum of four (4) separate notification appliance circuits (two (2) visual and two (2) audible notification circuits) shall be provided for each floor of each building. Notification devices shall be alternately spaced on the circuits. A minimum of eight (8) separate notification appliance circuits (four (4) visual and four (4) audible) shall be provided for Buildings 1, 2, 3, 4 and 42.
3. A minimum of one (1) dedicated addressable signaling line circuit shall be provided for each floor of each building.

1.3.6 Control Equipment

1. The new control equipment (i.e., Simplex 4100U panels) shall use the existing fiber optic "back-bone" to be fully integrated with each other (i.e., all fire alarm control panels shall be fully networked for voice, data, etc.).
2. The Contractor shall remove the existing Simplex 4020 control panels in each Building, including existing backboxes as necessary, and install new Simplex 4100U control panels with full voice capabilities at the same locations. Additional control panels shall be provided and installed in individual buildings (Building Nos. 1, 3, 4, 15, 36, 42 and 45) as necessary for complete systems. Existing power circuits shall be used for the new 4100U control panels.
3. The new systems shall be configured such that voice evacuation messages can be initiated from the individual 4100U control panels in each individual building as well as from the 'head-end' control equipment in Building Nos. 1 and 39. Switches shall be provided at the new control equipment in Building Nos. 1 and 39 such that voice announcements can be made to individual buildings and on an all-call basis from such control equipment.
4. Provide and install new remote control equipment as shown on the drawings. New dedicated branch power circuits and battery back-up shall be provided in accordance with NFPA 72 and these specifications to all new equipment.

1.3.7 Alarm Transmission

The contractor shall provide and install devices, equipment, and wiring necessary to transmit all fire, trouble, and supervisory signals to the City of Natick and the head-end equipment in Building Nos. 39 and 1. Contractor shall fully interface new control equipment with existing Digitize equipment located in Building No. 39.

1.3.8 System Monitoring and Control

The contractor shall provide and install:

1. All components and modules necessary to monitor existing sprinkler and standpipe system, waterflow switches, tamper switches, and pressure switches.

2. All components and modules necessary to monitor system status on emergency generators or running conditions, and failure to start.
3. Equipment and fire alarm connections to elevator control equipment in designated buildings to initiate elevator recall function (primary and alternate level).
4. All equipment, devices, wiring, etc. to interface environmental alarms in Building Nos. 3, 4, 19, 42, and security alarms as noted on the drawings. This shall include interface of all existing security and environmental alarms monitored by the existing system.

1.3.9 Warranty and Testing

The Contractor shall:

1. Warranty all new equipment and systems for three (3) years after final acceptance of the system by the Contracting Officer.
2. Provide testing of all devices and repair as necessary new equipment, during the warranty period including annual tests, as required in NFPA 72 as a minimum. Testing shall be performed on a building-by-building and campus-wide basis.
3. Provide acceptance testing and re-acceptance testing (as required) including Test Certificates/Forms certifying that the systems installation and performance are in accordance with NFPA 72.
4. Test and adjust all equipment and systems.

1.3.10 Temporary Protection

Where necessary, the contractor shall be responsible for providing and installing temporary fire alarm devices such as heat detectors, smoke detectors and horns if the existing systems are taken out of service during the installation period. For buildings with existing devices installed, the existing system should remain operational during the installation of the new devices. It should not be necessary to take the existing system out of service, except for final terminations and the change over to the new system. If for some unforeseen reason, the system is taken out of service during installation of the new system, then temporary heat detectors and smoke detectors shall be installed. In the event it becomes necessary to install temporary heat detectors and smoke detectors, an equitable adjustment will be made to the contract to cover the cost of the work.

1.3.11 Locks and Keys

1. Locks shall be keyed alike. Four keys for the system shall be provided.
2. Tags with stamped identification number shall be furnished for keys and locks.

1.3.12 NFPA 72 and UL Compliance

1. All system components for which UL listing categories exist shall be UL listed for the intended application and shall be subject to the approval of the Contracting Officer and the local jurisdiction.

2. The fire detection and alarm system and the central reporting system shall be configured in accordance with NFPA 72; exceptions are acceptable as directed by the Contracting Officer.

1.3.13 Submittals and Permits

The Contractor shall:

1. Prepare and submit shop drawings, contractor record drawings and other submittals required herein. Shop drawings shall be provided on a campus-wide and individual building basis.
2. Obtain, secure, and pay for all permits, plan check approvals, and inspections necessary to perform the work.

1.3.14 Site Considerations

1. The Contractor shall repair all damage resulting from this work in accordance with the requirements of these specifications.
2. The Contractor shall coordinate all work with other Contractors working in the building or concurrent construction/remodeling or installation of other systems.
3. After becoming familiar with details of the work, the Contractor shall verify dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

1.3.15 Labels

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

1.4 REFERENCES

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

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S3.41 (1990; R 1996) Audible Emergency Evacuation Signal

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41 (1991; R 1995) Surge Voltages in Low-Voltage AC Power Circuits

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code

NFPA 72 (2002) National Fire Alarm Code

NFPA 90A (2002) Installation of Air Conditioning

and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1480	Speakers for Fire Alarm Emergency, Commercial and Professional Use
UL 1971	(1995; Rev thru Apr 1999) Signaling Devices for the Hearing Impaired
UL 228	(1997; Rev Jan 1999) Door Closers-Holders, With or Without Integral Smoke Detectors
UL 864	(1996; Rev thru Mar 1999) Control Units for Fire Protective Signaling Systems

All work and materials shall conform to all Federal, State and local codes and regulations governing the installation, including the current editions of the State of Massachusetts Building and Fire Prevention Codes, as modified or interpreted by any authority having jurisdiction to permit use of current NFPA standards.

If there is a conflict between the referenced NFPA standards, federal, state or local codes, and this Specification, it is the Contractor's responsibility to immediately bring the conflict to the attention of the Contracting Officer for resolution. Contractor shall not attempt to resolve conflicts directly with the local authorities unless specifically authorized by the Contracting Officer.

All devices, systems, equipment and materials furnished and installed shall be new and listed by Underwriters Laboratories Inc. (UL) for the intended use. All equipment shall be installed in accordance with the manufacturer's recommendations and the UL listing limitations. Compatibility listing requirements for separate voice, fire alarm systems and smoke detectors shall be met. The Contractor shall provide evidence of listings of all proposed equipment and combinations of equipment.

The Contractor shall be responsible for filing of all documents, securing all permits, inspections and approvals necessary for conducting this work. Fees, charges and other costs associated with the foregoing shall be borne by the Contractor. Upon receipt of approved drawings, executed permits, and inspection reports from the authority having jurisdiction, the Contractor shall immediately forward two (2) sets to the Contracting Officer. These documents shall either be drawings stamped approved or a copy of a letter from the authority having jurisdiction stating approval of this work.

1.5 SUBMITTALS

As a minimum, the following shall be submitted in accordance with this Section.

1. Detail drawings, prepared and signed by a Registered Professional Engineer or a NICET Level 4 Fire Alarm Technician, consisting of a complete list of equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions. The drawings shall also contain complete wiring and schematic diagrams for the equipment furnished, equipment layout, and any other details required to

demonstrate that the system has been coordinated and will properly function as a unit. Detailed point-to-point wiring diagram shall be prepared and signed by a Registered Professional Engineer or a NICET Level 4 Fire Alarm Technician showing points of connection. Diagram shall include connections between system devices, appliances, control panels, supervised devices, and equipment that is activated or controlled by the panel.

2. Data composed of catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.
3. Lesson plans, operating instructions, maintenance procedures, and training data, furnished in manual format, for the training courses. The operations training shall familiarize designated government personnel with proper operation of the fire alarm system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.
4. Spare parts data for each different item of material and equipment specified, not later than 3 months prior to the date of beneficial occupancy. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after 1 year of service.
5. Record drawings.

Contractor shall also provide all documents, information, etc. required by Section 1.5 of this Specification.

1.5.1 General

The Contracting Officer's Fire Protection Consultant shall review and recommend approval/disapproval or take other appropriate action on the Contractor's submittals including shop drawings, samples, documentation and record drawings. This review is to verify conformance to project Contract Documents. This action shall be taken with all reasonable promptness while allowing time to permit adequate review.

Shop drawings and submittals shall be provided on a building-by-building and campus-wide basis. The review of submittals are not conducted for the purpose of determining the accuracy and completeness of other details (e.g., dimensions) or for substantiating installation or performance of equipment or systems designed by the Contractor, all of which remain the Contractor's responsibility to the extent required by the Contract Documents.

The Fire Protection Consultant's review shall not constitute approval of safety precautions of construction or means, methods, techniques, sequences of procedures. Such means, methods and precautions are the sole obligation and control of the Contractor.

If submittals, upon review by the Contracting Officer are found not to

conform to the requirements of the Contract Documents; the Contractor shall be required to resubmit with modifications. The Contractor shall be responsible for the Contracting Officer's extra expenses for subsequent review(s) of rejected submittals necessitated by the Contractor's failure to make the requested modifications. Such extra fees shall be deducted from payments by the Contracting Officer to the Contractor. Approval of the submittals by the Contracting Officer shall, in no case, relieve the Contractor of his responsibility to meet the requirements of this Contract Documents.

1.5.2 Coordination of Submittals

Prior to each submittal, the Contractor shall carefully review and coordinate all aspects of each item being submitted as indicated elsewhere in these Specifications. The individual performing the review and coordination shall stamp and sign each submittal. Failure to do so will be cause for rejection.

The Contractor shall verify that each item and the submittal conforms in all respects with the specified requirements.

1.5.3 Substitutions

The Contract is based on the standards of quality established in the Specifications. Substitutions will only be considered when listed at time of bidding in the bidding documents, and when substantiated by the Contractor's submittal of required data within fifteen (15) calendar days after award of the Contract. Substitutions suggested after the time of bidding shall require ten (10) calendar days.

The following products do not require further approval except for interface within the Work:

1. Products specified by reference to standard Specifications such as ASTM and similar standards.
2. Products specified by manufacturer's name and catalog model number.

Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing for this Work by the Contracting Officer.

1.5.4 "Or Equal"

Where the phrase "or equal" or "or approved equal" occurs in the Specifications, do not assume that the materials, equipment, or methods will be approved as equal unless the item has been specifically so approved for this Work in writing by the Contracting Officer.

1.5.5 Subcontractors

Contractor shall submit with his bid, a list of all proposed Subcontractors. All proposed Subcontractors are subject to the approval of the Contracting Officer.

1.5.6 Equipment List

The Contractor shall submit with his bid a detailed equipment list, identifying types, models and quantities of all materials, devices and

equipment proposed. This submittal shall include manufacturers' data sheets showing the types and models of all equipment, devices, material and wire proposed. The submittal shall include, but not be limited to, the following:

- a. Conduit/raceway
- b. Junction boxes, terminal cabinets, device backboxes, fittings, hangers, and mounting hardware
- c. Wire cable
- d. Connectors and terminal strips
- e. Fire alarm control equipment, annunciators, and all components, modules
- f. Panel and battery enclosures
- g. Manual fire alarm stations
- h. Smoke detectors
- i. Heat detectors
- j. Control and monitor modules
- k. Power supplies (main and remote)
- l. Batteries and UPS systems
- m. Battery charger
- n. Interface panel
- o. Remote annunciator panels
- p. Speakers (including combination units)
- q. Strobes
- r. Transient suppression
- s. Any other materials, devices, or equipment to be provided.
- t. Diagrams supplemented with narrative descriptions as necessary for clarity and completeness.

When a data sheet shows more than one product, the proposed product shall be clearly indicated by arrows or other suitable means. Submittals that do not clearly show the products to be used shall be rejected.

1.5.7 Unit Cost Pricing Schedule

Provide a completed copy of unit cost pricing for individual devices. This list is not all inclusive; include equipment information and unit prices for any manufacturer specific equipment that is necessary to system operation.

1.5.8 Work Schedule

The Contractor shall submit with the bid a proposed work schedule for each building in the project. This schedule shall indicate the time necessary for:

1. Project start-up.
2. Property survey.
3. Shop drawing submittals.
4. Installation.
5. Contractor testing.
6. Final acceptance tests.
7. Record drawings and reports.
8. Project completion.

The proposed work schedule will be reviewed and finalized during the preconstruction meeting and will be updated at each weekly construction coordination meeting.

The project completion date shall be the date when the project has been

accepted by the Contracting Officer and City of Natick and all materials included in this Specification have been received by the Contracting Officer.

1.5.9 Samples

Within 30 days of authorization to proceed, the Contractor shall submit in original factory cartons with all factory documentation, including evidence of UL listing and FM approval, as required, one set of samples of all proposed:

1. Initiation devices (e.g., smoke detectors, heat detectors, monitor modules, manual pull stations, etc.)
2. Notification and Communication appliances (e.g., speakers, strobes, speaker/strobes, remote LED's, and phone jacks)
3. Control output type devices (e.g., auxiliary relays, control modules)
4. Wire and cable. Wire and cable samples shall be a minimum of 24 inches in length and shall be labeled to identify the type of wire or cable, manufacturer, manufacturer's part number, and a description of the intended use for that particular wire or cable.
5. Actual audio sample of digitized voice evacuation messages.

1.5.10 Permits, Licenses and Certificates

Prior to start of installation, the Contractor shall obtain and submit copies of all permits, licenses, bonds, insurance certificates and approvals necessary to conduct this work.

1.5.11 Shop Drawings

Prior to the start of any demolition or installation, but within 45 days after awarding of the contract, the Contractor shall submit four (4) full sets of blue-line shop drawings, one set of reproducible (sepia) shop drawings, one set of AutoCAD version 14 or higher diskettes, five full sets of data sheets as required in Specification Section 1.5.6, and Operation and Maintenance Manual to the Contracting Officer for approval. Installation prior to receipt of approved shop drawings shall be at the sole risk of the Contractor.

The shop drawings shall consist of the following for each building:

1. Name and number of the facility. Each drawing shall also have a compass showing north and a graphical indicator of scale used.
2. Provide the locations of all walls, partitions extending to within 18 inches of the ceiling, exits and anticipated Base Fire Marshall response points. Also include details of ceiling construction, except smooth ceilings, and locations of all HVAC supply and return air diffusers, in all areas to be provided with automatic fire detectors.
3. A drawing legend sheet identifying:
 - a. All symbols used on the drawings, by type of device or equipment, indicating manufacturer and part number. This information shall correspond to the manufacturer's catalog data sheets required elsewhere in this section.

- b. All conventions, abbreviations and specialized terminology used on the drawings, as necessary to understand and interpret the information contained therein.
 - c. All color codes and conduit, conductor/circuit and device numbering schemes.
 - d. A complete drawing list/index identifying all drawings in the shop drawing package by title and drawing number.
4. Clean architectural floor plans, free of all non-fire alarm related details, drawn to scale of no less than 1/8" = 1 foot and a system riser diagram. The title block shall contain the name, address and phone number of contractor and subcontractor on each drawing.
5. The floor plan drawings shall indicate:
- a. Location of all devices, equipment, risers and electrical power connections. Also indicate device addresses for all addressable components shown on each drawing.
 - b. Conductor/conduit schedule(s) (including new and existing to be re-used) outlining number, size, and type of each conductor and conduit used.
 - c. Point-to-point wiring connections showing individual circuits and circuit/conduit routing, number, type and size of conductors used and unique identification for each circuit. This information shall be depicted in sufficient detail to readily locate specific conduits, raceways and circuits in the field (both new and existing to be re-used) and to identify the specific conductors/circuits contained therein. All penetrations of fire rated barriers shall be individually noted. French curve routing is not acceptable for depicting conduits, raceways and circuits.
 - d. Typical wiring diagrams for all alarm initiating devices and notification appliances, showing the size and type of conductors, wiring terminations and terminal identifications.
 - e. All signaling line, notification and initiating circuits shall be clearly identified as such. Any and all conductor connections shall be indicated.
 - f. Clearly identify any control modules that have not been installed within 3 feet of the controlled device and the reason therefore.
 - g. Detailed internal and external wiring diagrams for all alarm control panels, remote transmitting panels, control panel modules, power supplies, electrical power connections, remote signaling equipment, and annunciators, identifying size and type of conductors and all required terminations, including terminal identifications. All unsupervised connections and terminations shall be noted "unsupervised." These diagrams shall include the following:

- (1) Depict and identify all circuit boards, modules, power supplies, standby batteries, wiring harnesses, terminal strips and connections thereto, including spare circuits. Where multiple components of a similar type are provided, each shall be identified by a unique component number.
 - (2) Front-view details of all control panels and annunciators, depicting and identifying all indicators and controls, including proposed nomenclature.
 - (3) Depict the required information to relative scale, actual size or larger, showing proper spatial relationships between components, and shall reflect the corresponding system components as they are to be installed.
 - (4) Indicate individual circuit capacity as listed and circuit load as proposed and designed.
- h. A Cause and Effects Matrix or a sequence of operations section defining the system operation. This matrix or sequence shall cross-reference each initiating device type, control device type and individual initiating devices with unique functions, and shall indicate system operation in the event of each type of alarm, trouble and supervisory condition recognized by the system.
- i. When remote transmitting or control panel power is derived from a "local" source of building emergency power, the shop drawings shall show wire routing and point connection (location, panel number, description and circuit breaker number) to the building emergency circuit.
- j. Conduit fill calculations, in chart form, indicating the cross-sectional area percent fill for the worst case of every combination of wire/cable in each size of conduit used in the system. A maximum of 40 percent fill is allowed per the National Electrical Code.
- k. Standby battery calculations shall list the type of devices (detection, monitoring, control and notification), and quantities, and shall include unit and extended amperage draw for quiescent and alarm conditions, total amperage draw and battery amp/hour rating. For design criteria, the calculated load shall be the design load plus the required 20% spare capacity. In addition, the battery capacity used to meet the calculated load shall be a maximum of 80 percent of the amp/hour rating listed by the manufacturer.
- l. Voltage drop calculations shall list the percentage of drop voltage. Provide power supply calculations that include all system requirements including any requirements for notification appliance circuits, or any other auxiliary function powered by the system. All notification appliance circuit(s) shall be sized with 10% voltage drop at 24 volts, with the last device operating no less than 20.4 volts.
- m. Primary power supply calculations which include all system requirements including any requirements for electrical door unlocking systems, visual signaling appliances, or any other auxiliary function powered by the system. The quantity, location, model or part number, rated capacity and loaded capacity shall be

included for each power supply.

n. Provide a complete address list on the shop drawings identifying each device including type of device, address and the associated label. The address list shall also identify any "software zones" used by the system programming to initiate control functions. In addition, the Contractor shall provide a computer generated print out of the fire alarm system program to include addressable points and "software zones.". The computer generated printout shall match the list on the shop drawings.

6. The riser diagram shall indicate:

- a. Location, number, size, and type of riser conduit/raceways.
- b. Location, number, size, and type of conductors in each riser.
- c. Location and number of each type of device on each circuit on each floor.
- d. Class and style of each circuit as per NFPA 72, Tables 6-5, 6.6.1 and 6.7.

Each drawing shall be cross-referenced to all related drawings and specific drawing details as necessary for the submittal as a whole to clearly depict the proposed installation. Each drawing shall show revision number and date indicated in the title block. Revisions shall be clouded or otherwise highlighted between submissions. Revisions made without clouding or other highlights will not be reviewed and any approval of the revised drawings will not apply to those unnoted revisions. Name and signature of the individual making the revision shall be included.

The Contractor shall not be authorized to start installation until all of the shop drawings and data sheets are received, reviewed and approved in writing by the Contracting Officer.

All drawings shall be reviewed and checked for accuracy meeting these project documents prior to submittal. This shall be done by a designated NICET Certified Level IIII (Fire Alarm) Technician. The NICET Technician shall sign each drawing in the drawing title block indicating and confirming completion of the review.

1.5.12 Operation and Maintenance Manual

The Contractor shall provide the Contracting Officer with a loose-leaf manual for each building containing:

1. A detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, circuit loading and capacity, intended sequence of operations, expansion capability, application considerations, and limitations.
2. A detailed description of the operation of the system, including operator responses.
3. A detailed description of routine maintenance and testing for each type of device installed as required and recommended by the manufacturer and NFPA, including a schedule and detailed instructions. This information shall include:

- a. A listing of the individual system components which require periodic testing and maintenance.
 - b. Step-by-step instructions detailing the requisite testing and maintenance procedures and the intervals at which those procedures should be performed.
 - c. A schedule which correlates the testing and maintenance procedures with a listing of individual components.
4. Manufacturer's data sheets and installation manuals/instructions for all equipment installed with detailed troubleshooting instructions for each specific type of trouble condition recognized by the system, including open circuits, short circuits, ground fault, parity errors, "loop failures", dirty device, etc. These instructions shall include a list of all trouble signals annunciated by the system, a description of the condition(s) which will cause those trouble signals, and step-by-step instructions describing how to isolate those problems and correct them (or call for service, as appropriate).
 5. A list of recommended spare parts provided including type of device and model number and current unit prices (defined costs), as necessary to maintain the system in operation on a continuous basis.
 6. A list of passwords for all Access Levels shall be included under a separate tab. Passwords for Access Levels above Level III and those designated for factory personnel need not be included in the list. However, these Access Levels shall be identified in the list and shall include a cautionary statement detailing the Access Level's purpose and any appropriate warnings (i.e. computer required to return panel to normal operation, etc.). Whenever possible, the Contractor shall not modify the system default passwords. Also include a bullet list of functions that are accessible from each Access Level.
 7. Service directory which includes the main 24-hour emergency service number and at least three alternate numbers which are monitored on a 24-hour basis. Also include the names of at least three (3) NICET Level II technicians qualified to provide emergency service during the warranty period.
 8. Small scale {11 inches by 17 inches) Contractor record drawings of the system {submit in accordance with 1.5.14).
 9. The Cause and Effect matrix as provided on the shop drawings and modified for installed conditions.
 10. Operator instructions for basic system operations including procedures for alarm acknowledgement, system reset, interpreting system output {LED's, CRT display and printout), operation of manual evacuation signaling and auxiliary function controls, changing printer paper, etc.

This manual shall be written, compiled and edited specifically for this project and the system installed. Unedited manufacturer's catalog data sheets and/or equipment manuals are unacceptable as content for this submittal.

The draft manual shall be provided within ninety (90) days of the authorization to proceed. The Contractor shall submit to the Contracting Officer four (4) copies of the draft manual for approval.

The preliminary manual will be reviewed for required content and approved or disapproved on that basis. Upon completion of the project, the Contractor shall revise the approved, preliminary manual to be consistent with the system as installed and specifically to coordinate the testing and maintenance schedule with the approved Contractor testing protocols and with the fire alarm device numbers indicated on the Contractor's record drawings.

The revised manual shall constitute the basis for the Training Sessions required elsewhere in this Specification, and as such shall be both specific to this system, containing a minimum of superfluous information and suitable for that purpose.

The final approved manual shall be provided thirty (30) calendar days prior to the completion of work. The Contractor shall provide six (6) copies of the approved manual for each building to the Contracting Officer.

1.5.13 Administrative Submittals

The following submittals shall be provided by the Contractor on a building-by-building basis as part of the required project administration and coordination.

Prior to start of any construction or installation, submit copies of all necessary permits and licenses.

Prior to the start of any construction or installation, submit a detailed breakdown of the planned installation, on a floor-by-floor basis, identifying specific task items and their associated (percentage of contract) costs. This breakdown shall include mobilization, materials, equipment, installation, testing, coordination, documentation, supervision and any other significant cost items, associated with the work on each floor.

Beginning upon authorization to proceed, the Contractor shall submit weekly construction reports for review during the weekly construction coordination meetings. Requirements for these reports are identified in these specifications.

Prior to conducting any system testing, the Contractor shall prepare and submit written protocols for all required system testing, referencing those procedures on his test documentation. Upon approval of those protocols, they shall be incorporated into the Operation & Maintenance Manual required elsewhere in these Specifications.

1.5.14 Contractor Record Drawings

On a building-by-building basis the Contractor shall provide and maintain on the site an up-to-date record set of approved shop drawing prints which shall be marked to show each and every change made to the fire alarm system from the original approved shop drawings. This shall not be construed as authorization to deviate from or make changes to the shop drawings approved by the Contracting Officer without written instruction from the Contracting Officer in each case. This set of drawings shall be used only as a record

set. These drawings shall be made available to the Contracting Officer upon request.

Upon completion of the work, the record set of prints shall be used to prepare complete, accurate final record drawings reflecting any and all changes and deviations made to the fire alarm system.

Upon completion of the work, two (2) sets of blue-line record drawings shall be submitted to the Contracting Officer for review.

Upon review of the blue-line record drawings before final approval, one (1) set of corrected or amended as necessary reproducible mylar and AutoCAD Version 14 or higher diskettes and four (4) additional sets of blue-line record drawings shall be delivered to the Contracting Officer.

The Contractor record drawings are required to show all information required on the shop drawings and shall specifically identify the location and quantities of junction boxes, spare conductors, color coding of spare conductors, splices, device backboxes and terminal strips. This submittal shall include a schedule of all connections/terminations, indexed by function box, device backbox and terminal strip and shall reference wire identification numbers as installed.

1.5.15 Software Documentation

A copy of all software documentation required by this section shall be maintained on-site by the Contractor, in a binder, arranged in chronological order. This binder shall be turned over to the Contracting Officer at the final acceptance test on a building-by-building basis.

Documentation of software modifications shall include the following:

1. A complete printout of the system program after the Pre-Installation Testing, but prior to installation in the building.
2. A complete printout of the system program prior to the change.
3. A complete printout of the system program subsequent to the change, with all modifications highlighted. Each revision to the system program shall be identified by a unique version number and date.
4. A letter prepared and signed by the individual (with NICET Level and number) who made the change, description of the change made, and the reason for that change. This letter shall certify that the individual making the change has personally reviewed and compared the before and after program printout and verified the correctness of the modification(s).

Once the fire alarm system is placed in service, in whole or in part, and the associated building(s) partially or wholly occupied, no software changes shall be performed without the prior written permission of the Contracting Officer. All software changes to the fire alarm system, once in service, shall be performed by a certified manufacturer's representative, trained in the execution of such changes.

The Contractor shall include one complete reprogramming of the system in each building and campus-wide in submitted bids.

The Contractor shall provide, at no cost to the Contracting Officer, an emergency back-up electronic copy of the entire program. The Contractor

shall also provide any future changes to the program at no charge to the Contracting Officer.

1.5.16 Test Record

System certification and documentation of system testing required by these specifications shall be submitted to the Contracting Officer for review and approval at least fourteen (14) days prior to the final acceptance test. At a minimum, the Fire Alarm Record of Completion depicted in Figure 4.5.21 of NFPA 72 2002 Edition shall be completed and submitted to the Contracting Officer for review.

1.6 WARRANTY

1.6.1 Warranty Period

The Contractor shall warranty all materials and workmanship during the installation period and for a period of three (3) years, beginning with the date of final acceptance by the Contracting Officer. The Contractor shall be responsible during the design, installation, testing and warranty periods for any damage caused by the Contractor, Subcontractors or by defects in the Contractor's or Subcontractors' work materials or equipment.

1.6.2 Service Period

During the warranty period, the Fire Alarm Contractor shall inspect and test the entire Fire Alarm system in each building in conformance with NFPA 72 Chapter 10. Fifty Percent (50%) of the devices and components on each circuit shall be tested during the course of each of the two site visits conducted at a minimum interval of six months apart, with the first visit conducted between 5 and 6 months after the final acceptance. Subsequent to the second test, 100% of the devices and components, in the system and in each circuit shall have been tested. Testing shall include verification of the Cause and Effect Matrix.

1.6.3 Emergency Service

The Contractor shall provide emergency repair service for the system, at no cost to the Contracting Officer, within four (4) hours of a request for such service by the Contracting Officer during both the installation and the warranty periods. This service shall be provided on a 24-hour per day, seven days per week basis.

Acceptable response shall be considered as follows:

1. A technical support telephone call to the Contracting Officer from a technician meeting the minimum qualifications outlined by this Specification, within one (1) hour of a request.
2. Physical response to the facility, by a technician meeting the minimum qualifications, within four (4) hours of the original request.
3. Any response time greater than that above shall be considered deficient unless specifically permitted by the Contracting Officer within the first sixty (60) minutes of a maintenance request.

1.6.4 Spurious Alarms

If the Contracting Officer experiences an unacceptable number of spurious

or unexplained false alarms during the installation and warranty periods, the Contractor shall be responsible for providing the necessary labor, material and technical expertise to correct the problem to the satisfaction of the Contracting Officer.

The following number of spurious alarms, calculated as a ratio of false alarms to number of initiation devices for building, shall be considered unacceptable:

1. Smoke detectors - More than two spurious alarms per 100 detectors per six months during the system warranty period. Any calculated number shall be rounded up.
2. Automatic duct-type smoke detectors -More than two spurious alarms per 50 detectors per six months during the system installation and warranty periods. Any calculated number shall be rounded up.

Any spurious alarms shall be considered unacceptable for the following types of equipment:

1. Manual pull stations.
2. Sprinkler or standpipe system waterflow devices.
3. Sprinkler or standpipe system valve supervisory switches.
4. Range hood and duct fire suppression system monitoring devices.
5. Fire pump and emergency power supervisory devices.

1.7 TRAINING

1.7.1 General

The Contractor shall submit a proposed training agenda for the Contracting Officer's review within 60 days of authorization to proceed. The final, approved training agenda shall be submitted 14 days prior to the final system acceptance test. Training schedule shall be in accordance with Paragraph 3.9 of this Section.

All training shall be conducted by manufacturer's, factory certified personnel regularly engaged in conducting training sessions for manufacturer's technicians and service personnel. All instructors shall be subject to the approval of the Contracting Officer.

1.7.2 Agenda

Training shall include all system operational functions needed by on-site personnel. This shall include, but will not be limited to:

1. Overview of system operation.
2. Alarm acknowledgement.
3. Interpretation of the scheme used to provide identifiers.
4. Voice system operation.
5. Differentiating between trouble signals.
6. Differentiating between trouble and supervisory conditions.
7. System reset.
8. Accessing different access levels.
9. Accessing individual devices.
10. Changing smoke detection sensitivity.
11. Disabling system points for maintenance.
12. Activating control modules.

13. Walk test.
14. Basic maintenance (i.e., cleaning dirty detectors, etc.)
15. Basic troubleshooting.
16. Overview of system equipment and device locations.
17. Periodic testing procedures.

1.8 SPARE PARTS AND SPECIAL TOOLS

1.8.1 Spare Parts

The Contractor shall supply, as part of this contract, the spare parts in new condition in original, unopened boxes with installation guides. Spare parts shall be the same models as those installed in the system and shall include the following:

1. Automatic detection devices -2%, but not less than two (2), of the installed quantity of each type.
2. Manual fire alarm stations -2%, but not less than two (2), of the installed quantity of each type.
3. Glass rods or panels for break glass manual fire alarm stations (if used) -10% of the installed quantity.
4. Audible and visual devices -1 %, but not less than two (2), of the installed quantity of each type.
5. Monitor and control modules -2%, but not less than two (2), of each type of module used in the system.
6. Fuses -Five (5) each for each type, rating and size of fuse used in the system.
7. Printer paper and ribbon -Sufficient quantity to last one year from system approval.
8. Keys -A minimum of three sets of keys shall be provided and appropriately identified.
9. Provide six (6) cans of test gas used to test the functionality of the smoke detectors.
10. Provide one (1) of each size and type of standby battery used in the system.

Training shall include all information required in the Operation & Maintenance Manual required elsewhere by Section 1.5.12.

1.8.2 Special Tools

The Contractor shall supply as a part of the contract, three (3) complete sets of any special tools or keys necessary for normal operation and maintenance of the system.

B. Where the following components are used or required, one (1) of each shall be provided by the Contractor. These include but are not limited to:

1. Smoke detector testers and/or diagnostic equipment.
2. Extension poles and devices for mounting or removing detector heads on both typical and high ceilings.
3. Device calibrators.
4. Screw drivers for all types of tamper resistant screws used in the installation.
5. Approved detector cleaning equipment (except vacuums).

1.9 FINAL APPROVAL AND ACCEPTANCE

Final approval and acceptance of the work will be given by the Contracting

Officer when:

1. The complete system has been inspected, tested and approved in writing by the Contracting Officer and the City of Natick.
2. All required submittals, including system operation and maintenance manuals, accurate contractor record drawings, test reports, spare parts, special tools and training have been provided to, reviewed by and accepted in writing by the Contracting Officer.

1.10 QUALIFICATIONS

1.10.1 Engineer and Technician

- a. Registered Professional Engineer with verification of experience and at least four (4) years of current experience in the design of the fire protection and detection systems.
- b. National Institute for Certification in Engineering Technologies (NICET) qualifications as an engineering technician in fire alarm systems program with verification of experience and current NICET certificate.
- c. The Registered Professional Engineer may perform all required items under this specification. The NICET Fire Alarm Technician shall perform only the items allowed by the specific category of certification held.

1.10.2 Installer

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 4 Fire Alarm Technician shall supervise the installation of the fire alarm system. NICET Level 2 or higher Fire Alarm Technician shall install and terminate fire alarm devices, cabinets and panels. An electrician or NICET Level 1 Fire Alarm Technician shall install conduit for the fire alarm system. Fire Alarm Technicians to perform the installation of the system. A Fire Alarm Technician with a minimum of 4 years of experience shall perform/supervise the installation of the fire alarm system. Fire Alarm Technicians with a minimum of 2 years of experience shall be utilized to assist in the installation and terminate fire alarm devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

1.10.3 Design Services

Installations requiring designs or modifications of fire detection, fire alarm, or fire suppression systems shall require the services and review of a qualified fire protection engineer. For the purposes of meeting this requirement, a qualified fire protection engineer is defined as an individual meeting one of the following conditions:

- a. An engineer having a Bachelor of Science or Masters of Science Degree in Fire Protection Engineering from an accredited university engineering program, plus a minimum of 2 years' work experience in fire protection engineering.

- b. A registered professional engineer (P.E.) in fire protection engineering.
- c. A registered PE in a related engineering discipline and member grade status in the National Society of Fire Protection Engineers.
- d. An engineer with a minimum of 10 years experience in fire protection engineering and member grade status in the National Society of Fire Protection Engineers.

1.11 SYSTEM DESIGN

1.11.1 Operation

The fire alarm and detection systems for each building shall be a complete, supervised fire alarm reporting system. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. Alarm initiating devices shall be connected, to signal line circuits (SLC), Style 6, in accordance with NFPA 72. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Style Z in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed at any point, all NAC and SLC will remain functional. Textual, audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc. Addressable system shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits and shall provide the following features:

- a. Sufficient memory to perform as specified and as shown for addressable system.
- b. Individual identity of each addressable device for the following conditions: alarm; trouble; open; short; and appliances missing/failed remote detector - sensitivity adjustment from the panel for smoke detectors
- c. Capability of each addressable device being individually disabled or enabled from the panel.
- d. Each SLC shall be sized to provide 40 percent addressable expansion without hardware modifications to the panel.

1.11.2 Operational Features

Each system shall have the following operating features:

- a. Monitor electrical supervision of SLC, and NAC. Smoke detectors shall have combined alarm initiating and power circuits.
- b. Monitor electrical supervision of the primary power (ac) supply, battery voltage, placement of alarm zone module (card, PC board) within the control panel, and transmitter tripping circuit integrity.
- c. A trouble buzzer and trouble LED/LCD (light emitting diode/liquid

crystal diode) to activate upon a single break, open, or ground fault condition which prevents the required normal operation of the system. The trouble signal shall also operate upon loss of primary power (ac) supply, low battery voltage, removal of alarm zone module (card, PC board), and disconnection of the circuit used for transmitting alarm signals off-premises. A trouble alarm silence switch shall be provided which will silence the trouble buzzer, but will not extinguish the trouble indicator LED/LCD. Subsequent trouble and supervisory alarms shall sound the trouble signal until silenced. After the system returns to normal operating conditions, the trouble buzzer shall again sound until the silencing switch returns to normal position, unless automatic trouble reset is provided.

- d. A one person test mode. Activating an initiating device in this mode shall activate an alarm for a short period of time, then automatically reset the alarm, without activating the transmitter during the entire process.
- e. A transmitter disconnect switch to allow testing and maintenance of the system without activating the Digitize transmitter but providing a trouble signal when disconnected and a restoration signal when reconnected.
- f. Evacuation alarm silencing switch which, when activated, shall silence alarm devices, but shall not affect the zone indicating LED/LCD nor the operation of the transmitter. This switch shall be over-ridden upon activation of a subsequent alarm from an unalarmed device and the NAC devices will be activated.
- g. Electrical supervision for circuits used for supervisory signal services (i.e., sprinkler systems, valves, etc.). Supervision shall detect any open, short, or ground.
- h. Confirmation or verification of all smoke detectors. The control panel shall interrupt the transmission of an alarm signal to the system control panel for a factory preset period. This interruption period shall be adjustable from 1 to 60 seconds and be factory set at 60 seconds. Immediately following the interruption period, a confirmation period shall be in effect during which time an alarm signal, if present, shall be sent immediately to the control panel. Fire alarm devices other than smoke detectors shall be programmed without confirmation or verification.
- i. The fire alarm control panel shall provide supervised addressable relays for HVAC shutdown.
- j. The fire alarm control panel shall provide the required monitoring and supervised control outputs needed to accomplish elevator recall where shown on the Contract Drawings.
- k. The fire alarm control panel shall monitor the fire sprinkler system, or other fire protection extinguishing system.
- l. The control panel shall be software reprogrammable to enable expansion or modification of the system without replacement of hardware or firmware. Examples of required changes are: adding or deleting devices or zones; changing system responses to

particular input signals; programming certain input signals to activate auxiliary devices.

1.11.3 Alarm Functions

An alarm condition on a circuit shall automatically initiate the following functions:

- a. Transmission of a signal over the campus fire reporting system. The signal shall be common for any device.
- b. Visual indications of the alarmed devices on the fire alarm control panel display in individual buildings and on the remote audible/visual displays in Building Nos. 39 and 1.
- c. Continuous sounding or operation of alarm notification appliances throughout the specific building as required by ANSI S3.41.
- d. Closure of doors held open by electromagnetic devices where applicable.
- e. Deactivation of the air handling units serving the alarmed building.
- f. Shutdown of power to the data processing equipment in the alarmed building where applicable.

1.11.4 Primary Power

Operating power shall be provided as required by these specifications. Transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and not cause transmission of a false alarm. Loss of ac power shall not prevent transmission of a signal via the fire reporting system upon operation of any initiating circuit.

1.11.5 Battery Backup Power

Battery backup power shall be through use of rechargeable, sealed-type storage batteries and battery charger.

1.11.6 Interface With other Equipment

Interfacing components shall be furnished as required to connect to subsystems or devices which interact with the fire alarm system, such as supervisory or alarm contacts in suppression systems, operating interfaces for smoke control systems, door releases, etc.

1.12 TECHNICAL DATA AND COMPUTER SOFTWARE

Technical data and computer software (meaning technical data which relates to computer software) which is specifically identified in this project, and which may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES, and in accordance with the Contract Data Requirements List, DD Form 1423. Data delivered shall be identified by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

- (1) Identification of programmable portions of system equipment and capabilities.
- (2) Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- (3) Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.
- (4) Description of Fire Alarm Control Panel equipment operation.
- (5) Description of auxiliary and remote equipment operations.
- (6) Library of application software.
- (7) Operation and maintenance manuals as specified in SD-19 of the Submittals paragraph.

1.13 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variation, dirt, dust, and any other contaminants.

PART 2 PRODUCTS

2.1 GENERAL

The Natick SSC Campus shall be provided with new point-addressable, peer-to-peer networked fire alarm systems in individual buildings. The systems shall include emergency Voice/Alarm communication systems (two channel) in each building capable of operation from within the specific building and from Building Nos. 1 and 39.

All equipment and system components furnished and installed shall be new and listed by UL for their intended use. All new equipment, devices, components, etc. interfaced with existing equipment, devices, components, etc. shall be cross listed by UL for such interface. The equipment and system components shall be installed in accordance with applicable codes and standards, the manufacturers' recommendations and within the limitations of the UL listings. All equipment and system components shall be the standard product of a single manufacturer. Evidence of UL listing is required, including cross-listing of new and existing equipment, devices, components. All equipment shall be protected from mechanical and moisture damage wherever applicable.

System components shall be modular in design to ensure future expansion capability of the system. Expansion capability shall pertain to capacity and quantities of devices, circuits, primary and secondary power supplies, amplifiers, conductor ampacities (size) and lengths.

The systems shall have spare installed capacity enabling it to support a 20 percent increase in the number of initiating devices, monitor and control points (addressable), and notification appliance circuits, amplifiers, and power supplies. Spare circuit capacity shall be provided for each new system in each building.

The systems shall incorporate an alarm verification function in the control panels for system type smoke detectors. Alarm verification shall not be provided for manual fire alarm stations, waterflow alarm switches, or duct smoke detectors.

The systems shall have forward compatibility with the manufacturer's equipment at least fifteen (15) years into the future. A letter from the manufacturer stating the commitment shall be required prior to installation of any equipment.

2.2 SYSTEM CONFIGURATION

2.2.1 Initiating Circuits

Fire alarm initiating device circuits, including circuits monitoring waterflow switches and devices used for detecting activation of special fire suppression systems shall be Style "D" (Class A) as described in Table 6.5 of NFPA 72, 2002.

Supervisory initiating circuits, including circuits monitoring valve supervisory switches, fire pump functions, air pressure supervisory switches, magnetic contacts, electrical power supervision, low battery and UPS supervision shall be Style "A" as described in Table 6.5 of NFPA 72, 2002. T-tapping is prohibited.

2.2.2 Signaling Line Circuits

Circuits connecting remote annunciation devices (LCD and printers) with the control panel and the main system riser between the remote transmitting panels and the control panel(s) shall be Style "6" (Class A) as described in Table 6.6.1 of NFPA 72, 2002.

The system digital/data circuit shall be run in two separate conduits, physically separated by 2-hour fire resistance rated building construction and arranged such that loss of a circuit in one of the conduits shall not put any portion of the system out of service.

All addressable or digital data circuits shall be considered signaling line circuits. All signaling line circuits shall be Style "A" (Class 6).

A minimum of one (1) signaling circuit (ie. addressable circuit) shall be provided for each floor of the building.

2.2.3 Notification Appliance Circuits

Audio channel circuit risers shall be Style "Z" (Class A) as described in Table 6.7 of NFPA 72, 2002. The system audio channel riser(s) shall be in two separate conduits, physically separated by 2-hour fire resistance rated building construction and arranged such that loss of a circuit in one of the conduits shall not put any portion of the system out of service.

Notification appliance circuits shall be Style "Z" (Class A), 4-wire, arranged to be capable of operation over a single break or single ground. Redundant, separate paths shall be provided for all notification appliance circuits, both horizontally on a floor or vertically in any notification appliance circuit risers.

The following fault conditions on any speaker or strobe circuit shall cause a trouble signal:

1. Single open.
2. Single ground.
3. Wire-to-wire short.

These trouble signals shall be indicated on the control panel located in the main lobby of the individual building, the annunciators at Building Nos. 1 and 39, and the printer in Building 39. Supplementary annunciation of these signals at any other remote control panel(s) is allowed but not required.

The evacuation signaling system shall be configured and wired such that a minimum of two (2) speaker circuits and two (2) visual notification appliance circuits per area/floor are provided in each building. Devices shall be alternately spaced on these circuits. A minimum of four (4) speaker and four (4) visual notification appliance circuits shall be provided for each floor in Building Nos. 1, 3, 4 and 42. Devices shall be alternately spaced.

Provide a separate speaker circuit and associated control for each stair in each building (zoned vertically).

2.2.4 Control Circuits

Control circuits for supervised relays shall be Style "Y" (Class B). All control circuits shall be located within 3 feet of the control equipment unless physically not possible. Such locations shall be indicated on the shop drawings.

Any single open or single ground condition on any non-addressable initiating device circuit or non-addressable auxiliary function circuit, such as the circuits between addressable monitor/control modules and their associated monitored/controlled device(s) shall cause a trouble signal on their associated addressable circuit.

2.2.5 Fault Isolation Modules

Systems employing fault isolation modules on addressable circuits shall be arranged such that the specified circuit style performance is achieved.

2.3 COMPONENT SUPERVISION

All control components shall be supervised such that removal of any component shall cause a trouble signal.

All AC power connections, all standby battery and all UPS connections shall be electrically supervised such that disconnection of any fire alarm system (primary or backup) power supply and low-battery or missing battery conditions shall cause a trouble signal.

The availability of operating power to the fire alarm system, including all required components thereof, shall be supervised to the point of connection to the dependent equipment. Loss of operating power to any required system component(s) shall cause a trouble signal.

All detectors, evacuation signaling devices and auxiliary function relays or other devices (i.e., solenoids) shall be supervised such that removal of any detector, evacuation signaling device or auxiliary function relay or other device shall cause a trouble signal.

Proper operation of addressable initiating devices shall be automatically tested by the system via a continuous polling interrogation/response operation. Failure of one or more addressable initiating devices shall cause a trouble signal.

System printers shall be supervised for out-of-paper condition. An out-of-paper condition shall cause a trouble signal.

All on-line system components and annunciation devices shall be supervised for on-line and power-on status. Off-line or power-off conditions shall cause a trouble signal."

All trouble signals shall cause a trouble signal on the fire alarm control panels in the specific building as well as Building Nos. 1 and 39 and shall print out on the printer in Building 39.

2.4 POWER SUPPLIES

2.4.1 General

Except where otherwise required by local code, all AC power connections shall be to the buildings designated emergency electrical power circuit and shall meet the requirements of NFPA 72, 2002, Chapter 4. Each power circuit shall be provided with an approved transient suppressor dedicated to the individual circuit only. Shop and record drawings shall indicate panel number and location as well as circuit breaker number where terminated for each such connection.

All portions of the fire detection and voice communication system (including printers) shall be designed and equipped with standby (rechargeable) battery power, either directly or by provision of an uninterruptible power supply or supplies.

Upon failure of normal (AC) power, the affected portion(s) of the system(s) shall automatically switch to back-up power (i.e., battery or UPS power) without any disruption to system annunciation or operation. The UPS system(s) shall provide normal power source to all served components and remain in service at all times to provide a true uninterruptible power source.

Any portion of the system operating on secondary power shall annunciate as a trouble signal, identifying the inoperable power supply(ies).

Low capacity conditions of secondary power supplies shall immediately annunciate as a trouble signal and shall identify the power source.

Each control panel (fire detection and voice/alarm communication) shall be provided with independent power supplies and standby batteries/UPS, including independent AC power connections.

All power supplies, including UPS, shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 24 hours maximum. Standby battery capacity may be increased to meet this requirement.

2.4.2 Description of Equipment

Batteries/Secondary Power Sources

1. System control equipment shall receive secondary operating power from batteries integral to the equipment.
2. Low battery conditions shall immediately annunciate as a trouble signal, identifying the deficient batteries.
3. Secondary operating power provided batteries shall be capable of operating all notification appliances simultaneously for a minimum of 15 minutes after a duration of 72 hours on secondary power.
4. Design load connected to any power supply or secondary power source shall not exceed 80% of its rated capacity.
5. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any alarm, trouble or operator acknowledgement signals.
6. All batteries shall be lead-calcium maintenance-free type that require no additional water. Wet-cell lead-acid batteries are prohibited.
7. Batteries shall be provided with overcurrent protection in accordance with NFPA 72. Separate battery cabinets shall have a lockable, hinged cover similar to the fire alarm panel. The lock shall be keyed the same as the fire alarm control panel. Cabinets shall be painted to match the fire alarm control panel.
8. Battery charger shall be completely automatic, 24 Vdc with high/low charging rate, capable of restoring the batteries from full discharge (18 Volts dc) to full charge within 24 hours. A pilot light indicating when batteries are manually placed on a high rate of charge shall be provided as part of the unit assembly, if a high rate switch is provided. Charger shall be located in control panel cabinet or in a separate battery cabinet.

2.5 EMI/RFI/AC VOLTAGE INTERFERENCE

All fire alarm control equipment, devices and wiring shall be protected against unwanted radiated electromagnetic interference (EMI) and radio frequency interference (RFI) or induced voltages caused by AC power circuits, electrical transformers, motors or switch gear, electronic equipment, fluorescent lighting fixtures, hand held portable radios, cellular phones or other devices which can interfere with normal system processing and possibly cause unwanted alarms.

The system shall be designed and installed to be unaffected by the operation of a hand-held portable radio (walkie-talkie) of 5 watts power generating capability within 12 inches of any system device with all appropriate covers installed.

All circuits shall be segregated and/or shielded as necessary to eliminate audio and/or electrical crosstalk between circuits. Where necessary, separate, isolated power supplies, shielded equipment cabinets, or other appropriate means of eliminating interference/crosstalk shall be provided.

2.6 FIRE DETECTION AND VOICE/ALARM COMMUNICATION SYSTEM

The fire detection and voice communication systems shall utilize distributed processing, point-addressable, peer-to-peer networked technology providing a discrete system "address" for each individual initiating device.

The fire alarm systems installed in each building shall be stand alone systems complying with all requirements of these specifications.

The two channel, voice/alarm communication ("public-address") systems shall be on either an automatic or operator selectable "zone-by-zone" or "all-call" basis via the fire alarm speakers. Equipment shall be arranged so that speaker zones can be selected individually or on an "all-call" basis at individual buildings as well as Building Nos. 1 and 39.

A visual alpha/numeric LCD display indicating current status of the entire system shall be provided at the control panel in individual buildings and Building Nos. 1 and 39. The LCD display shall be a minimum 80 character visual alpha/numeric display. Under normal conditions the front panel shall display a "SYSTEM IS NORMAL" message and the current time and date. Upon detection of an abnormal condition, the appropriate LED (Alarm, Supervisory, or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steadily for trouble and supervisory conditions. Upon receipt of an off normal condition, the LCD shall display the 40 character custom location label, the type of device (i.e. smoke, pull station) and the point's status (i.e. alarm, trouble).

A permanent hard copy of all signals received shall be recorded on the 80 column printer at Building No. 39.

Standby power supplies capable of supporting all dependent devices and equipment as required by Specification Section 2.4.

The system control units shall have provision for an alarm verification feature for alarm signals received from smoke detectors as follows:

1. The maximum retard-reset period before an alarm signal can be confirmed and indicated at the control unit shall not exceed 60 seconds. Any alarm during the 90-second alarm confirmation period following the retard-reset period shall result in an immediate alarm from the control panel.
2. The retard-reset period of an alarm verification need not include the polling time of a multiplex system control panel, if alarm verification is provided at the remote transmitting panel to which the smoke detectors are connected, but it shall include the polling time if the alarm verification is provided at the central control panel.
3. Appropriate "warning" signage as shown in Section 46.4 of UL 864 shall be placed on the face of all control panels, data gathering panels and other panels.

Individual switches to affect the following individual functions. Activation of any switch shall cause a trouble condition on the individual control panel and remote annunciators in Building Nos. 1 and 39.

1. Bypass air handling unit shutdown for all duct smoke detectors.

2. Bypass elevator recall functions.
3. Bypass door holder release.
4. Audible device disable for test purposes.
5. Visible device disable for test purposes.
6. Smoke control function.
7. On/off control of all fans.

Devices or controls to effect reset of the system. The control panel(s) shall not be capable of being reset until all alarm conditions have been cleared.

A back-up evacuation signal tone generator shall be provided. At the manufacturer's option this shall be either an auxiliary circuit board in the control unit, a second source of auxiliary tone, or other UL listed backup means of tone generation as provided by the manufacturer.

One backup amplifier shall be provided for each set of primary amplifiers, and shall be equal to the highest rated (wattage) primary amplifier provided. The backup amplifier shall automatically transfer in place of the defective amplifier in a UL listed arrangement.

The control panels shall have a switch for silencing the alarm notification appliances (both audible and visual). The switch shall be key-operated or located within a locked cabinet. Upon activation, any existing alarm shall be transferred to a visual indicator. Any subsequent alarms shall operate the alarm notification appliances. If there is no alarm and the switch is in the "silence" position, a visual alarm indicator shall be lit and a trouble signal shall sound until the switch is restored to "normal." The panel shall also provide a common switch to disable audible and visual signaling devices for system test purposes. When activated ("silence" position) a system trouble signal shall be activated until the switch is returned to the "normal" position.

An event log with the ability to store three hundred (300) events in an alarm log plus three hundred (300) events in a trouble/supervisory log. These events shall be stored in battery protected random access memory (RAM).

All panel control functions required by these specifications shall be capable of being performed at Building Nos. 1 and 39, as well as individual buildings including voice announcer.

The data communication rate between the system CPU and associated annunciators, remote control panels and addressable initiating devices shall be 9600 baud, minimum. The time delay between activation of an alarm initiating device (excluding retarded waterflow switches and smoke detector circuits arranged for automatic alarm verification) and activation of the associated automatic auxiliary control functions shall not exceed 5 seconds.

The fire alarm system CPU shall be field programmable from an integral keyboard. Systems allowing software changes to be stored in RAM are acceptable providing that:

1. RAM is non-volatile or provided with independent backup power supply to prevent loss of software changes upon loss of normal system power.
2. RAM has capacity for 100 program (monitor and/or control point) changes, minimum.

3. RAM shall not be utilized by the Contractor when the system is accepted by the Contracting Officer. All required programming shall be in permanent memory upon final acceptance.

Five (5) pre-recorded field programmable digitized voice messages; evacuation, alert, severe weather, power outage, and all clear type, as selected by the Contracting Officer shall be provided. Evacuation messages shall comply with ANSI S3.41, and Section 6.8.6.4 of NFPA 72, 2002 edition. Contractor shall submit, sample(s) of each audio message for review by the Base Fire Marshall and Contracting Officer. All messages shall be recorded using professional sound recording equipment.

Amplifiers and audio circuits shall be sized to power all connected speakers simultaneously at the minimum required sound level specified in Section 2.17.2, while operating at a maximum of 80% of their rated capacity. Calculations of amplifier capacity shall be provided.

Emergency public address voice messages shall have priority over all other audible signals on the selected floors.

The audio evacuation sequences shall be as follow:

1. Alarm activation of a manual pull station, smoke detector, or heat detector, special extinguishing system or sprinkler system waterflow, shall automatically activate evacuation message and visuals throughout individual buildings. Activation of duct smoke detector shall be a supervisory signal and shall not activate the audio evacuation.
2. Provide a two-position switch for each of the digitized voice messages for manual selection at individual buildings as well as Building Nos. 1 and 39.

The data communication rate between the system CPU and associated annunciators, remote transmitting/control panels and addressable initiating devices shall be such that the time delay between activation of an alarm initiating device (excluding retarded waterflow switches and smoke detector circuits arranged for automatic alarm verification) and activation of the associated automatic notification appliance signaling and automatic auxiliary control functions shall not exceed 15 seconds.

All fire alarm system control equipment shall be housed in locking metal or metal and glass enclosures. All manual controls shall be behind locked cabinet doors or key operated, or both. All locks shall be keyed alike.

2.7 ANNUNCIATION

2.7.1 General

The system shall be designed and equipped to receive, monitor, annunciate and retransmit signals from devices and circuits installed throughout the buildings.

The time delay between activation of an alarm initiating device (excluding waterflow alarm switches with a retard feature or smoke detector circuits arranged for alarm verification) and activation of alarm notification appliance, including automatic evacuation signaling and auxiliary functions shall not exceed 15 seconds.

Receipt of alarm and trouble signals shall activate integral audible

devices at the building specific control panel(s) and at each remote control equipment in Buildings Nos. 1 and 39. Receipt of these signals shall operate as follows:

1. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.
2. Alarm, trouble and supervisory signals shall initiate recognizably different audible outputs. Trouble and supervisory signals may initiate the same audible output if distinction is by visual annunciation.
3. Integral audible devices shall continue to sound until silenced by a system operator actuating a switch designated for that purpose.
4. Receipt of subsequent alarm, trouble or supervisory signals shall cause the integral audible devices to resound.
5. The fire alarm system shall be equipped with "global acknowledge" for all signals.

The system shall recognize and annunciate the following signals:

1. Fire alarms.
2. Supervisory alarms.
3. Trouble conditions.
4. Operator acknowledgement of annunciated signals.
5. System reset.

All alarm signals, supervisory alarm signals and trouble conditions shall be annunciated by the control panels and by each remote annunciation device. Operator acknowledgement of smoke detection signals and system reset shall be annunciated by the control panels, the remote control equipment in Building Nos. 1 and 39.

The panel shall not be capable of being reset until all alarm, trouble and supervisory conditions have been cleared. Trouble and supervisory signals shall be latching (i.e., cleared only after off-normal condition is rectified and panel is reset).

2.7.2 Fire Alarm Signals

Activation of the following devices shall be recognized and annunciated by the system as alarms:

1. Manual fire alarm stations.
2. System-type smoke detectors except duct detectors or sleeping area detectors.
3. Heat detectors.
4. Waterflow switches.
5. Devices monitoring actuation of special fire suppression systems.

2.7.3 Supervisory Alarm Signals

The following conditions shall be recognized and annunciated by the system as supervisory alarms:

1. Valve supervisory switch actuation.
2. Duct detectors.

2.7.4 Trouble Signals

The system will also recognize and annunciate the following trouble

conditions:

1. Initiating device circuit trouble conditions per Table 6.5 of NFPA 72.
2. Signaling line circuit trouble conditions per Table 6.6.1 of NFPA 72.
3. Notification appliance circuit trouble conditions per Table 6.7 of NFPA 72.
4. Power supply trouble conditions as required by Specification Section 2.4.
5. Remote annunciation device trouble conditions.
6. A smoke detector, with automatic drift compensation feature, requiring maintenance when it reaches 80 percent of its threshold limit for a period of 24 hours, or equivalent UL listed performance.

2.7.5 Operator Acknowledgement Signals

Silencing of integral audible devices required by this Specification shall be recognized and annunciated by the system as operator acknowledgement of the signal is displayed.

2.8 REMOTE TRANSMITTING PANELS (Control Panels)

The requirements of this specification section apply to control panels in individual buildings that are located remotely from the main control equipment located at the entrance of each building.

2.8.1 Description of Equipment

Remote control panels shall incorporate integral power supplies meeting the requirements found elsewhere in these Specifications.

Remote control panels shall interface local initiating and notification appliance circuits or addressable devices with the control panel(s) via the signaling circuit riser(s).

Primary operating (electrical) power shall be derived from the remote control panel(s) via a supervised circuit.

Remote control panels shall contain amplifiers for speaker circuits, visible notification appliance circuit controls, addressable interface device boards, LCD display, and secondary power supplies for all its associated interconnected equipment.

Failure or malfunction of a remote control panel shall not impair operation of fire alarm system devices and functions beyond those normally monitored or controlled by the affected remote control panel.

Any remote control panel shall be capable of operating in stand alone mode and be re-connected to the remaining system without a lapse in operation.

Secondary power for remote control panels shall be configured in accordance with this Specification.

Remote control panels shall be networked to each other and the FACP on a peer-to-peer basis.

2.9 ANNUNCIATION DEVICES

2.9.1 Description of Equipment

2.9.1.1 Printers

Each free-standing printer shall produce a permanent hard copy of all signals received, in the order in which they are received with alarm taking precedence over other signals.

The printout shall include a clear English description of the specific type of signal received, the origin of that signal and the time and date at which the signal was received.

Each printer shall be full carriage (80 Columns minimum), high speed (1 line per second minimum), and equipped with tractor feed for use with conventional continuous feed paper .

Primary operating (electrical) power shall be derived from the control panel(s) by a local connection to the building's emergency circuit via an UPS as approved by the Contracting Officer. In all cases, power shall be via the specified UPS system(s).

Power supplied to the printer shall be continuous and uninterrupted by loss of the primary source of system operating power via connection to the specified UPS system.

2.9.1.2 Remote Annunciator

Remote annunciators shall incorporate integral power supplies meeting the requirements found elsewhere in the specifications.

Remote annunciators shall be provided with a visual alpha/numeric LCD display that complies with Specification Section 2.6(C).

Remote annunciators shall be provided with devices or controls to effect reset of the system. The system shall not be capable of being reset until all alarm conditions have been cleared.

Remote annunciators shall comply with specification Sections 2.6(K) and (S) except that the common switch to disable audible and visual signaling devices shall not be provided.

A means for initiating a general alarm condition shall be provided at the remote annunciators.

The graphic annunciator shall be a Simplex 4120 Network, 4190 Series, Graphic Command Center.

2.9.2 Where Required

Remote printers shall be installed in the following locations:

1. Building 39.

Remote Annunciators

1. Building 39.
2. Building 1.

Graphic Annunciators

1. Building Nos. 1 and 39.

2.10 ELEVATORS

Upon activation of the smoke detector in an elevator lobby (other than on the primary recall level) or the elevator shaft, the elevator shall return to the designated primary floor of elevator recall. If the alarm is initiated by a smoke detector in the elevator lobby of the primary recall floor, then the elevator shall return to the alternate floor of elevator recall in compliance with ANSI A 17.1. Elevator recall shall be by bank.

2.11 MANUAL FIRE ALARM STATIONS

2.11.1 Description of Equipment

Manual fire alarm stations shall be of the double-action, non-coded addressable type. They shall consist of a housing, fitted with a pull-down lever, which when operated, locks in position after releasing a spring-loaded contact switch to effect activation of an alarm circuit.

Break glass front stations shall not be permitted. However, pull lever, break glass rod type is acceptable. The body of the manual station shall be permanently attached to the back plate assembly.

Resetting the station after operation shall require the use of a special tool or key.

The manual station shall be suitable for either surface, flush or semi-flush mounting. Manual stations shall be flush or semi-flush mounted in all public areas and semi-flush mounted in all back-of-house areas unless mounted on concrete or masonry surfaces where surface mounting is permissible and approved by the Contracting Officer.

Where mounted in back-of-house areas, manual fire stations shall be protected from physical damage by steel brackets or other approved means which shall not be attached to the station itself.

Manual stations installed outdoors shall be UL listed for such use and shall be so marked. They shall be installed using NEMA Type 3 rain-tight enclosures and raceways meeting NEMA Standard.

Manual fire alarm stations shall annunciate by address and in accordance with the system input/output matrix.

2.11.2 Where Required

Manual fire alarm stations shall be installed so that the top of the handle is 48 inches above finished floor mounted as to not be obstructed when the exit door is open at the following locations:

1. On each floor adjacent to each enclosed stair and at each exit (including those on the roof) from the building, at each existing location, where required by the authority having jurisdiction.
2. As necessary, throughout the building so that travel distance to the nearest manual fire alarm station does not exceed 200 feet.

2.12 SMOKE DETECTORS

2.12.1 Description of Equipment

Spot-type smoke detectors shall be installed as shown on the Contract Drawings, mounted in conformance with the requirements of NFPA 72, 2002 edition. Smoke detectors shall be arranged to by included device. Each smoke detector shall be monitored individually, via an integral, analog addressable element. Detectors shall be listed by UL as "Smoke-Automatic Fire Detectors," tested according to UL Standard 268.

These detectors shall be system operated, photoelectric type plug-in detectors which mount to a twist lock base. The detector shall contain an alarm indicating LED which will illuminate to signal activation of the detector. The detector head shall be equipped with a mesh insect screen to prevent foreign objects from entering the sensing chamber. The sensitivity voltage shall be factory set by the manufacturer.

Smoke detector bases shall have provision for maintaining initiating circuit continuity, without the detector head installed, to allow initiating circuit testing during installation. Installation of the detector head shall automatically disable this feature such that subsequent removal of the detector head will cause a trouble signal. Removal of a smoke detector head from its base shall require the use of a special tool.

Area smoke detectors shall be mounted on the ceiling of finished areas, on the underside of the floor structure above or on the underside of beams in unfinished areas as permitted by NFPA 72, Chapter 5. No smoke detector shall be located closer than three (3) feet from a supply air register regardless of any previously installed location.

Smoke detectors in locked mechanical, electrical and storage rooms shall be provided with a remote LED outside the area or room.

2.13 DUCT SMOKE DETECTORS

2.13.1 Description of Equipment

Duct type smoke detectors shall be installed in conformance with the requirements of NFPA 72 and NFPA 90A, and in accordance with the detector manufacturer's installation instructions. Duct smoke detectors shall be suitable for the full range of expected air velocity conditions. Calculations or measurements of air velocities shall be provided to ensure duct detectors are installed within their UL listed range of airflow. Submit documentation of actual air velocity readings.

Duct smoke detectors shall be system operated, addressable, plug-in type, photoelectric detectors in a duct mounted housing equipped with air sampling tubes providing airflow through the detector housing. Pendant mounted duct detectors shall not be permitted. Duct smoke detectors shall be listed or approved for that application including temperature and humidity listings. Each duct smoke detector shall be monitored individually via an integral, analog addressable element.

Sampling tubes shall extend across the full width of the duct. The ends of the sampling tubes shall be accessible from outside the duct and shall be sealed with removable plugs (to facilitate detector testing). Sampling tubes shall be perforated type. Slot type sampling tubes shall not be acceptable. A short pick-up tube not extending across the widest dimension

of the duct shall not be acceptable. Access hatches shall be provided to inspect sampling tubes. Refer to NFPA 72 Figures A-5.14.5.2 (b) and (c) for guidance.

Each duct smoke detector located more than five (5) feet above the floor shall be provided with a magnetically operated remote test station, incorporating a remote alarm LED. Test stations shall be labeled with engraved, laminated plastic labels identifying the type of detector and detector address and shall be installed within five (5) feet of the floor.

Provide necessary interface wiring and controls to fan and air-handling units for shutdown of fans when smoke is detected and/or smoke control mode operation. Provide all necessary interface and equipment including fan control panel/relays for automatic shutdown and smoke control operation.

2.13.2 Where Required

Duct detectors shall be installed at all locations required by NFPA 90A and all existing locations.

2.14 HEAT DETECTORS

2.14.1 Description of Equipment

Heat detectors shall be, addressable fixed temperature type.

Heat detectors shall actuate when the temperature reaches 135° or refer to Table 5.6.2.1.1 in NFPA 72. (180°F where expected ambient temperature may exceed 100°F).

2.14.2 Where Required

Heat detectors shall be installed as shown on the Contract Drawings.

2.15 ADDRESSABLE CIRCUIT INTERFACE MODULES

The Contractor shall provide, install, and test addressable circuit interface modules as necessary to comply with the Cause and Effect matrix. All circuit interfaces used for supervisory or control functions shall be mounted within Three (3) feet of the monitored switch, circuit or device unless otherwise permitted by NFPA 72 and not physically possible. The Contractor shall provide sufficient quantities of modules to provide proper control and status functions.

Addressable Dry Contact Monitor Module

1. Addressable Monitor Modules shall be provided per conventional alarm initiating devices (any N.O. dry contact device).
2. The Monitor Module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
3. An LED shall be provided that shall flash under normal conditions, indicating that the Monitor Module is operational and in regular communication with the control panel.
4. Addressable circuit interface modules shall be provided for monitoring valve supervisory switches, sprinkler waterflow switches, and conventional initiating devices.

Addressable Control Modules shall be provided to supervise and control the operation of auxiliary functions through control relays. For fan

shutdown and other auxiliary control functions, the control module may be set to operate as a dry relay. Addressable circuit interface modules shall also be provided for control of magnetic door hold-open devices, primary and secondary elevator recall, fire/smoke vents and dampers, and HVAC shutdown.

1. The Control Module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
2. The Control Module relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100 percent of all auxiliary relays may be energized at the same time on the same pair of wires.
3. The Control Module shall provide address-setting means that the control panel shall use to identify the type of device.
4. An LED shall be provided that shall flash under normal conditions, indicating that the control module is operational and is in regular communication with the control panel.
5. The control module shall be suitable for pilot duty applications and rated for a minimum of 2.0 amps at 30 VDC. Applications exceeding these limits shall be provided with suitably rated relays.

Isolator Module

1. Isolator Modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The Isolator Module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor.
2. If a wire-to-wire short occurs, the Isolator Module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the Isolator Module shall automatically reconnect the isolated section.
3. The Isolator Module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an Isolator Module after its normal operation.
4. The Isolator Module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the Isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

2.16 SPRINKLER AND STANDPIPE ALARM SUPERVISORY EQUIPMENT

Connection to all existing and new sprinkler and standpipe alarm and supervisory devices shall be provided under this contract. These devices include:

1. Waterflow switches.
2. Valve supervisory switches.
3. Hi-lo supervisory pressure switches (on dry sprinkler systems only).

All new sprinkler and standpipe supervisory devices shall be connected to the fire alarm system and monitored under this contract.

Waterflow switches shall be monitored as fire alarms. Waterflow zones shall be arranged to annunciate each waterflow detector individually by area served and switch location. All other sprinkler supervisory devices

shall be monitored as supervisory signals.

The Contractor shall make all terminations necessary to monitor sprinkler supervisory devices.

The Contractor shall coordinate with the Contracting Officer for testing these devices. Documentation of sprinkler and standpipe flow and supervisory device testing shall be a part of this contract.

2.17 AUDIBLE/VISUAL NOTIFICATION APPLIANCES

Evacuation signaling shall be accomplished throughout the buildings via fire alarm speakers and visual signaling appliances.

Operating voltage of all fire alarm speakers shall be 24 VDC.

Operating voltage of all fire alarm strobes shall be 24 VDC.

Removal of any evacuation signaling appliance from its associated indicating appliance circuit shall cause a trouble signal.

All evacuation signaling appliances shall be equipped with terminal connectors. Pigtail devices are not acceptable.

Evacuation signaling appliances shall be installed, spaced and tapped so as to produce an audible output on alarm which is clearly intelligible and clearly audible above ambient noise levels throughout the installed space, 70 dBA minimum or 15 dBA above ambient, whichever is greater.

Equipment shall be arranged and zoned so that evacuation signaling zones can be selectively addressed, individually, or in any combination of individual zones in individual buildings and in Buildings Nos. 1 and 39.

The evacuation signaling system shall be zoned by floor, elevator bank and by stairwell in each building. Controls shall be provided at the panel in individual buildings and Building Nos. 1 and 39 to activate evacuation signaling devices on a floor-by-floor and stairwell by stairwell basis. All evacuation signaling devices on a floor shall be arranged to activate simultaneously.

Provide five (5) pre-recorded digitized voice messages, alert and evacuation type, as selected by the Contracting Officer. Evacuation message shall comply with ANSI S3.41 in accordance with Section 6.8.6.4 of NFPA 72, 2002 edition. All messages shall be reviewed by the Contracting Officer and contractor shall submit actual audio sample of all pre-recorded messages for approval.

Actuation of a manual control switch at the fire evacuation control panel in the individual building or Building Nos. 1 and 39 to the "Evacuate" position shall activate the strobes and a standard 3-pulse temporal pattern evacuation signal throughout the selected building. No other controls or switches shall be necessary in order to accomplish this function; "one-switch" manual evacuation signaling capability is required.

1. When the microphone key is pressed, evacuation signal shall be silenced, and the operator shall be able to transmit live voice messages to the selected zone(s). Releasing the microphone key shall cause the evacuation signal to resume. Pressing the microphone key shall not affect the operation of evacuation

- signals in zones selected for "Evacuate."
2. Pressing the microphone key shall not affect operation of the strobe lights.

There shall be no provision to manually shut down the evacuation signals on the floor of fire alarm signal origin or the group of floors within the evacuation scheme, except by actuation of the "Signal Silence" or "System Reset" switches.

The evacuation signaling system shall be wired such that a minimum of two (2) audio speaker circuits and two (2) visual notification appliance circuits per floor are provided with devices alternately spaced on such circuits unless otherwise noted by these specifications.

2.17.1 Evacuation Signaling Control Equipment

The system shall be electrically supervised against faults in speaker circuits and interface wiring, loss of power, module removal, or amplifier failure.

One backup amplifier shall be provided for each set of primary amplifiers and shall be equal to the highest rated (wattage) primary amplifier.

Required amplifier capacity shall be calculated based on the following parameters:

1. Two (2) watt speakers located as shown on the Contract Drawings throughout the associated evacuation signaling zone.
2. A safety/expansion factor of 1.5.
3. An amplifier derating factor of 0.2.
(Example -24,000 square feet evacuation signaling zone will require 20, 1 watt speakers drawing 20 watts total. 20 watts times safety/expansion factor of 1.5 = 30 watts of amplifier capacity required. Amplifier de-rating factor is 0.2; 30 watts divided by 0.8 = 37.5 watt amplifier, minimum.)

Manual controls for evacuation signaling shall be provided at individual buildings and Building Nos. 1 and 39 and shall include:

1. A supervised, momentary contact signal silence switch, with "Normal" and "Signal Silence" positions identified.
2. A supervised, 2-position switch for each evacuation signaling zone, with "Voice," and "Auto" positions identified.
3. A supervised, 2-position "All-Call" switch with "Voice", and "Off" positions identified.
4. A 2-position switch to activate "Slow Whoop" tone.
5. An operator's microphone.
Activation of these switches shall not affect evacuation signaling system operation until the operator's microphone is keyed. Keying the microphone shall momentarily interrupt the Alert and Evacuation signals in the selected zones and permit transmission of voice messages to those zones.

Evacuation signaling controls shall provide automatic digitized voice message transmission capability. A distinct or digitized voice message transmission capability is required. All control cabinets and associated power supplies shall be sized to support this capability.

Manufacturers' standard control switches shall be acceptable if they

provide the required operation, including performance, supervision and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the Contracting Officer is required.

System faults shall be annunciated audibly and visually at the fire alarm control panel and recorded on the associated system printers.

The backup amplifier set shall automatically transfer into operation upon a failure of the primary amplifier.

2.17.2 Fire Alarm Speakers

Fire alarm speakers shall:

1. Be listed in accordance with UL 1480.
2. Be equipped with variable watt input taps at 1/2 to 8 watts.
3. In no case produce a sound output, on alarm, of less than 90 dBA at 10 feet at their lowest or next to lowest tap.
4. The voice communication system shall be installed using twisted, shielded cable and shall be provided for selective communication to any individual floor, zone, combinations of floors or zones, or for general emergency public address announcements throughout the building.
5. The system shall be electrically supervised against faults in speaker circuits and interface wiring, loss of power, module removal, or amplifier, tone generator or preamp failure.
6. Floor or stair speaker zones to be addressed shall be manually connected to the system using speaker zone switches or an "All-Call" switch located at the fire alarm control panel.
7. Speakers shall be located in each sleeping area, public assembly rooms, corridors, elevator lobbies, rooms over 1,000 square feet, and every third floor in interior exit stairs. Speakers shall be zoned by floor, except stairs shall be zoned vertically by individual stairway. Speaker zones for individual floors shall not include exit stairways. (One zone equals one floor, or stair).
8. Be rated for continuous operation at the maximum tap.
9. Have frequency response 400-4,000 Hz.
10. Provide clearly audible, intelligible voice messages, with the Contracting Officer being sole judge of whether or not voice messages are "intelligible".

2.17.3 Visual Notification Appliances

Visible notification appliances shall consist of a Xenon flash tube, high intensity strobe lamp, with clear (nominal white) light having a flash rate of 1 to 3 flashes per second. The maximum pulse duration shall be two-tenths of one second (0.2 seconds), with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.

Visible notification appliances shall be a minimum of 15 cd and maximum of 110 cd as shown on the drawings. Placement shall be in accordance with this section, NFPA 72 and ADA. Wall mounted visible notification appliances shall be mounted such that the bottom of the lens is 80 inches above the finished floor, or 6 inches below the ceiling, whichever is lower. Ceiling mounted visible notification appliances shall not be permitted without specific Contracting Officer approval in advance for each location. Strobe units installed in hearing impaired and accessible

sleeping areas shall be mounted 24 inches below the ceiling within 16 feet of the pillow and shall be rated at 110 cd.

Placement of visible notification appliances in rooms and corridors more than 20 feet wide shall be in accordance with Figure 7.5.4.4.1.1 and Table 7.5.4.1.1 (a) of NFPA 72. Placement of visible notification appliances in corridors 20 feet or less in width shall be in accordance with Table 7.5.4.2 of NFPA 72, 2002.

Visible notification appliances shall be listed in accordance with UL 1971. Visible notification appliance circuits connected to this device shall be configured so that all associated wiring is supervised, and is separate from audible notification appliance circuits. Visible appliances shall activate anytime audible appliances are activated. This activation shall occur when the audible circuit is activated manually or automatically without operating any additional switches.

Where there are two (2) or more strobes within the same view (135 degrees) the strobes shall be synchronized in accordance with Section 7.5.4.1.2 of NFPA 72. Synchronized flashing shall be defined as all strobe lights flashing within 50 milliseconds of one another.

Shall consist of a vibration resistant solid state flasher assembly which, upon activation, illuminates a white or clear lens labeled "Fire" in red letters, the word "Fire" shall read from top to bottom.

Installation shall conform to the requirements for visual signaling appliances found in the "Americans with Disabilities Act."

Accessible and hearing impaired sleeping area visual notification appliance circuits shall be individually controlled, dedicated circuits and shall be separate from the corridor visual notification appliance circuit.

2.17.4 Where Required

Shall be installed in all public areas, public restrooms, meeting rooms, dining rooms, ballrooms, and corridors.

2.18 CONDUCTORS AND CONDUIT

Except as otherwise required by these Specifications, and as noted on the drawings, the installation of fire alarm circuits shall conform to the requirements of Article 760 of the National Electrical Code -2002.

Unless approved otherwise, fire alarm circuit wiring shall be installed in a UL listed metal conduit or raceway. Circuit wiring shall be installed in conduit or raceway in plenums where wiring passes through a floor or wall or where exposed to physical damage. Exposed ends of metal conduit shall be provided with bushings or fittings manufactured for the purpose of preventing wear on wire insulation.

Fire alarm circuit wiring shall be type FPLP (fire power limited plenum).

All cable runs shall be continuous between devices, without splices, wherever feasible. Where a continuous run is not feasible, connections shall be made in a UL listed metal electrical box. Wire nuts shall not be permitted. All splices shall be to terminal blocks inside metal enclosures conforming to the requirements of Chapter 3 of NFPA 70. Conductors connected together shall have the same color and type of insulation. All

connections and splices shall be accessible for inspection and servicing and shall be clearly identified with a permanent approved wire label and noted on the contractor record drawings.

Wire and cable shall be sized, twisted, and shielded as recommended by the fire alarm system manufacturer and Article 760 of the National Electrical Code, but shall not be smaller than 18 AWG.

All conduits shall be grounded by approved ground clamps or other means in conformance with the National Electrical Code, NFPA 70.

Where conduit is imbedded in plaster, the Contractor shall use a type approved by the National Electrical Code for this use. All joints in such imbedded conduit shall be liquid and gas-tight. Continuous runs of conduits without joints are preferred for imbedding.

All electrical enclosures, raceways and conduits shall contain only those electrical circuits associated with the fire detection and alarm system and shall not contain any circuit that is unrelated to the system.

Cable and conductors that have scrapes, nicks, gouges or crushed insulation shall not be used.

The use of aluminum wire is prohibited.

All electrical circuits shall be numerically tagged at both ends with durable tags. Each conductor termination shall be uniquely identified with tags at both ends. The wire tags shall be computer generated printed labels. These tags shall indicate the wire/cable functions i.e.; "XX Floor Speakers", "XX Floor Strobe", "XX, XX, XX, Addressable Loop", and etc. The conductors shall be tagged at every termination. These conductor numbers shall be shown on the Contractor's record drawings (floor plans and detailed wiring diagrams) in a manner allowing ready identification of all conductor terminations.

End-of-line resistors for supervisory alarm initiating device circuits shall be rated per the manufacturer's recommendation.

All system conductors, except grounding conductors, shall be solid copper or bunch tinned stranded copper.

All end-of-line resistors shall be mounted on terminal blocks.

All control panel wiring shall conform to the requirements of this section. All control panel wiring shall be fully dressed and bundled with nylon tie wraps at 3-inch intervals; Bundled wiring shall be routed parallel to terminal strips within control panels, with individual conductors turned out at 90° angles to their associated terminal connections. AC power conductors shall be bundled and routed separately from low voltage conductors. A minimum 2-inch separation shall be maintained between AC power conductors and low voltage conductors wherever possible. All control cabinets shall be sized to accommodate the requirements of this section. All wires shall be numbered to correspond to the chart required by other sections of this Specification. Conductors looped around terminals are not acceptable.

Installation shall comply fully with the manufacturer's requirements for Power Limited Systems and the location of circuit conductors within the control panel enclosure.

Control panels shall not be used as raceways. Conductors that do not terminate within a control panel shall not be routed through that control panel.

Fire alarm conductors shall be separated into three categories:

1. Data circuits, including signaling line circuits, addressable initiating device and auxiliary function circuits and annunciator circuits, and 24 VDC power circuits for addressable devices.
2. Low voltage non-data circuits, including one-way voice communications circuits, pre-amp audio, and notification appliance circuits.
3. AC Power Circuits.

Each category of fire alarm conductors shall be installed in physically separated, dedicated conduits, and shall not interface with one another except at common associated control equipment. Addressable modules or elements used to provide system "addresses" for non-addressable type initiating devices shall be considered "control equipment" for the purposes of this section. Fire alarm system conductors shall be further segregated as necessary to conform to the fire alarm system manufacturer's recommendations and as necessary to prevent electrical and/or audio crosstalk between conductors installed in common conduits.

All conduit penetrations of walls, floors and ceilings shall be sealed around the conduit(s) by the fire alarm Contractor, restoring the walls, floors and ceilings to their original condition, fire resistance and integrity. The fire alarm system Contractor shall be responsible for all patching and touch-up painting necessitated by the performance of his work. Removal and repair of all finished surfaces shall be coordinated with, and is subject to the approval of the Contracting Officer.

All cable and wiring shall be installed in steel EMT (3/4-inch minimum). "Wiremold" shall be used in all areas below drop ceilings.

2.19 BOX LOCATION

All device backboxes, junction boxes and pull boxes shall be accessible for inspection and maintenance. Junction pull boxes shall be installed on 100 foot centers maximum.

2.20 ELECTROMAGNETIC DOOR HOLD-OPEN DEVICES

Devices shall be attached to the walls unless otherwise indicated. Devices shall comply with the appropriate requirements of UL 228. Devices shall operate on 24 Volt dc power. Compatible magnetic component shall be attached to the door. Under normal conditions, the magnets shall attract and hold the doors open. When magnets are de-energized, they shall release the doors. Magnets shall have a holding force of 25 pounds. Devices shall be UL or FM approved. Housing for devices shall be brushed aluminum or stainless steel. Operation shall be fail safe with no moving parts. Electromagnetic door hold-open devices shall not be required to be held open during building power failure.

2.21 SPECIAL TOOLS AND SPARE PARTS

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished

to the Contracting Officer. Two spare fuses of each type and size required shall be furnished. Two percent of the total number of each different type of detector, but no less than two each, shall be furnished. Spare fuses shall be mounted in the fire alarm panel.

PART 3 EXECUTION

3.1 STARTING AND COMPLETION DATES

The starting and completion dates for this work will be established at the pre-bid meeting.

3.2 INSPECTIONS

The job site supervisor shall examine daily all areas in which the work will be performed on the day prior to beginning work. The supervisor shall immediately report unsatisfactory working conditions to the Contracting Officer for resolution. The supervisor shall not proceed with the work until all unsatisfactory working conditions have been corrected.

3.3 INSTALLATION

3.3.1 General

The Contractor shall remove existing walls, ceilings or floors as required for the installation of this work.

All holes made by the Contractor in any wall, ceiling or floor shall be patched by the Contractor, restoring the walls, ceilings, floors to their original condition, fire resistance and integrity.

Removal and repair of all finished surfaces shall be coordinated with the Contracting Officer and is subject to the Contracting Officer's approval.

All piping and conduit shall be installed at a height so as not to obstruct any portion of a window, doorway, stairway or passageway and shall not interfere with the operation of any existing mechanical or electrical equipment.

System riser(s) shall be installed in mechanical raceways or conduit, located to avoid physical harm. They shall be routed through protected spaces, such as electrical closets. Locations such as loading docks and less than 7 feet above the floor in elevator lobbies shall be avoided. Locations of all equipment, controls and system components are subject to the approval of the Contracting Officer.

Contractor is responsible for protecting both new and existing smoke detectors during construction. These detectors shall be covered during construction. All such covers shall be removed upon completion of work.

All systems, components, equipment, devices, conductors, and other fire protection appurtenances shall be installed and dressed in a workman-like manner, so as to maintain such equipment readily identifiable, accessible and serviceable. Any equipment not installed in this manner shall be replaced and reinstalled at the Contractor's expense and to the satisfaction of the Contracting Officer.

3.3.2 Concealment

All wire, cable, conduit, raceways, junction boxes and device backboxes shall be concealed in walls, ceiling spaces, electrical shafts or closets in all finished areas. Wiremold raceways shall be installed in below ceiling areas. Conduit, raceways, junction boxes and device backboxes may be exposed in unfinished back-of-house areas, electrical or mechanical equipment rooms.

Exposed conduit, raceways, junction boxes and equipment backboxes shall be painted to be as inconspicuous as possible. The Contracting Officer shall approve the paint color selected. The Contractor shall prepare color samples for inspection by the Contracting Officer prior to painting. Exposed conduit, raceways, junction boxes, and other associated items related to the conduit network shall be provided with red bands every 10 feet with junction box covers labeled as fire alarm, unless specifically instructed otherwise.

3.3.3 Sequence of Installation

Installation of the systems shall be conducted in stages and phased such that circuits and equipment are installed as agreed during the bid process.

3.4 INSPECTION AND TESTS

The requirements of this section shall apply on a building-by-building and campus-wide basis.

3.4.1 General

The systems shall be tested, and that testing documented, by the Contractor in accordance with the requirements of these Specifications.

System testing shall include operational and supervisory testing of all control equipment, annunciation devices, detectors, indicating appliances, remote signaling apparatus, auxiliary functions, system wiring, with the final iteration of the system software installed in non-volatile memory.

All system testing shall be conducted in accordance with approved test protocols prepared by the Contractor. Written test protocols including detailed test procedures, documentation sheets and expected test results shall be submitted to the Contracting Officer for approval within 90 days of award of contract. The approved test protocols shall be included as a section in the Operation & Maintenance Manual submittal required elsewhere in these Specifications.

The Contracting Officer reserves the right to witness all Alarm Contractor testing and shall be given 10 working days (minimum) notice of the start of all tests.

The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The control panel manufacturer's representative shall be present to supervise tests. The Contractor shall furnish instruments and personnel required for the tests.

3.4.2 Control Equipment Testing

All control equipment shall be tested in accordance with Specification Section 1.5.16.

3.4.3 System Tests

Upon completion of the installation, the system shall be subjected to functional and operational performance tests including tests of each installed initiating and notification appliance, when required. Tests shall include the meggering of system conductors to determine that the system is free from grounded, shorted, or open circuits. The megger test shall be conducted prior to the installation of fire alarm equipment. If deficiencies are found, corrections shall be made and the system shall be retested to assure that it is functional. After completing the preliminary testing the Contractor shall complete and submit the NFPA 72, Certificate of Completion.

Upon completion of installation in individual buildings, the Contractor shall perform a pre-acceptance test to ensure system operation and compliance with the referenced codes and this Specification. NFPA 72 Inspection and Test Report and certifications required above shall be submitted to the Contracting Officer, with written request for an acceptance test, at least thirty (30) days prior to testing. The Contractor shall provide the Contracting Officer with written certification that:

1. The installation, operation and performance of all equipment has been inspected, tested and certified by a signature of manufacturer's certified representative.
2. The system equipment, devices, components and program software are installed in accordance with applicable codes, manufacturer's recommendations and UL listings and is in proper working order.

3.4.4 Dielectric Strength and Insulation Resistance

Test the dielectric strength and the insulation resistance of the system interconnecting wiring by means of an instrument capable of generating 500 volts dc and equipped to indicate leakage current in 1000 megohms. For the purpose of this test, the instrument shall be connected between each conductor on the line and between each conductor and ground at the control panel end of the line, with the other extremity open circuited and all series-connected devices in place. The system shall withstand the test without breakdown and shall indicate a resistance of not less than 500,000 ohms, the measurement being taken after an electrification of not more than 1.0 minute with a dc potential of not less than 100 volts nor more than 550 volts. The Contractor shall notify the Contracting Officer, in writing, seven (7) calendar days in advance of this testing and provide the Contracting Officer the opportunity to observe this testing.

Test shall be done before final terminations are made to devices, the fire alarm control panel, annunciators and other sensitive equipment.

3.4.5 Acceptance Testing

Upon completion of installation in each Building, the Contractor shall perform and document on an approved format, system tests as required herein. All acceptance tests shall be performed in the presence of the Contracting Officer or a designated representative.

Acceptance testing shall not be performed until the Contractor has completed and submitted the Certificate of Completion. Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that previous deficiencies have been

corrected. The Contractor shall complete and submit the NFPA 72, Inspection and Testing Form.

The Contractor shall provide all materials, equipment, coordination and personnel necessary to perform and document all required tests. All test equipment shall be subject to the approval of the Contracting Officer. Acceptance testing shall include at a minimum, but not be limited to:

1. Test of each function of the control panel.
2. Test of each circuit in both trouble and normal modes.
3. Tests of each alarm initiating devices in both normal and trouble conditions.
4. Tests of each control circuit and device.
5. Tests of each alarm notification appliance.
6. Tests of the battery charger and batteries.
7. Complete operational tests under emergency power supply.
8. Visual inspection of wiring connections.
9. Opening the circuit at each alarm initiating device and notification appliance to test the wiring supervisory feature.
10. Stray voltage
11. Loop resistance
12. All conductors, including shielding conductors, shall be tested for continuity, shorts to ground and shorts between pairs. Any circuit board jumpers in the system that inhibit checking for ground faults shall be identified and shown to be in the correct position. Provide a diagram of the circuit board with the above-mentioned jumper highlighted.
13. All control monitor points shall be functionally tested and monitor point identifications verified.
14. All new alarm initiating devices shall be functionally tested and labels shall be verified for correctness at all annunciators.
15. All supervisory functions of each initiating device, signaling line, and notification appliance circuit shall be functionally tested.
16. All fire safety functions (i.e. elevator recall, HVAC shutdown, door release, etc.) initiated by the fire alarm control panel shall be tested.
17. Receipt of all alarm and trouble signals, initiated during the course of the testing, shall be verified at each annunciation device and at Building Nos. 1 and 39.
18. Correct labeling of all annunciation device LEDS shall be verified.
19. The system CPU and annunciators shall be load tested for 4 hours on standby battery power.
20. Any additional tests, required by the referenced codes, standards, or criteria, or by the Contracting Officer, shall be performed. This documentation shall include:
 - a. The date and time of each test.
 - b. A reference set of Contractor record drawings, numerically identifying the individual components and circuits tested, test locations, and indicating the measured sound level in each corridor and guestroom location.
 - c. A description of each test performed.
 - d. A checklist of each device and circuit tested, indicating the results of each test.
 - e. The names and signatures of the individuals conducting and witnessing each test.
 - f. A complete printout of the system program produced by the system printer. This printout shall be produced and dated upon

completion of all required Contractor testing/verification, including any modifications necessary prior to final acceptance testing.

21. The Contractor shall post suitable signs the day prior to, and shall maintain during testing which indicate the date and time fire alarm testing is to occur. The signs shall be located in lobbies, elevator lobbies and other suitable locations so as to notify hotel occupants of the testing.

3.4.6 Final Inspection and Tests

The Contractor shall make arrangements with the Contracting Officer for final inspection and witnessing of the final acceptance tests. The Contracting Officer and the Fire Protection Consultant shall witness the final acceptance test.

The Contracting Officer's consultant will visit the job site to observe the work and witness final acceptance tests when the Consultant has been advised by the Contractor that the work is completed and ready for test. If the work has not been completed or the final acceptance tests are unsatisfactory, the Contractor shall be responsible for the Contracting Officer's extra expenses for reinspection and witnessing the retesting of the work. Such extra fees shall be deducted from the payments made by the Contracting Officer to the Contractor.

The Contractor shall provide at least ten (10) working days notice for all tests.

The final acceptance test shall be in accordance with the acceptance test plan and the requirements of Chapter 10 of NFPA 72, 2002. The acceptance test shall be performed by the Contractor and shall include at a minimum:

1. Functional testing of 100% of the initiating devices.
2. Functional testing of 100% of the evacuation signaling devices. This testing shall include audibility testing with a dB meter.
3. Supervisory testing of 10% of the initiating devices and 100% of the initiating device circuits.
4. Supervisory testing of 10% of the evacuation signaling devices and 100% of the evacuation signaling circuits.
5. Supervisory testing of all printers, CRT's, annunciators, amplifiers and power supplies/standby batteries.
6. Functional testing of all auxiliary functions.
7. 72 hour stand by battery test followed by two consecutive full load tests (all fire alarm initiating devices in alarm and all evacuation signals, annunciators and auxiliary functions activated simultaneously), one under standby battery power and one under normal power, 30 minutes duration each, minimum.
8. Verification of proper annunciation of all signals at all CRT's, printers and graphic/led annunciators.
9. Any additional tests deemed necessary by the parties witnessing the testing.

100% successful performance during Final Acceptance Testing is expected, based on the Contractor's 100% test and certification as required elsewhere in these Specifications. In the event of system performance inconsistent with the Contractor's system certification, the Contracting Officer will make a determination as to whether or not the test

results constitute failure of the Final Acceptance Test. Failure of the Final Acceptance Test shall invalidate the Contractor's System Certification, in which case recertification (including 100% Contractor retesting) and a repeat of the Final Acceptance Test shall be required at no additional cost and no additional time.

If system re-testing is required, upon review by the Contracting Officer, are found not to conform to the requirements of these Specifications, the Contractor shall be required to re-test. The Contractor shall be responsible for the Contracting Officer's extra expenses (\$125.00 per hour plus reimbursable) for subsequent system testing necessitated by the Contractor's failure. The Contracting Officer shall deduct such extra fees from payments to the Contractor. Failure of the Final Acceptance Test shall result in the immediate suspension of all payments to the Contractor, until such time as the required Contractor's retesting/recertification is complete and the failed Final Acceptance Test is successfully repeated.

All system testing, including testing during installation, acceptance testing and warranty testing, involving activation of evacuation signals or other activities disruptive to building operations, shall be performed after normal business hours in accordance with this Specification.

The Contractor shall provide all materials, equipment, coordination and personnel necessary to perform and document all required tests. All test equipment shall be subject to the approval of the Contracting Officer.

3.5 MATERIAL HANDLING

3.5.1 Storage

The Contracting Officer will provide the Contractor with a lockable storage space for the Contractor's use during this project. The Contractor shall be responsible for the security of this space.

Overnight storage of materials is limited to the assigned storage area. Materials brought to the work area shall be installed the same day, or returned to the assigned storage area unless previously approved by the Contracting Officer.

3.5.2 Receiving and Handling

The Contractor shall be responsible for handling all materials delivered to the site.

The Contractor shall remove rubbish and debris resulting from his work on a daily basis. Rubbish not removed by the Contractor will be removed by the Contracting Officer and backcharged to the Contractor.

Removal of debris and rubbish from the premises shall be coordinated with the Contracting Officer.

3.6 INSTALLATION

All work shall be installed as shown, and in accordance with NFPA 70 and NFPA 72, and in accordance with the manufacturer's diagrams and recommendations, unless otherwise specified. Smoke detectors shall not be installed until construction is essentially complete and the building has been thoroughly cleaned.

3.6.1 Power Supply for the System

A single dedicated circuit connection for supplying power from a branch circuit to each building fire alarm system shall be provided. The power shall be supplied as shown on the drawings. The power supply shall be equipped with a locking mechanism and marked in red with the words "FIRE ALARM CIRCUIT CONTROL".

3.6.2 Wiring

Conduit size for wiring shall be in accordance with NFPA 70. Wiring for the fire alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Not more than two conductors shall be installed under any device screw terminal. The wires under the screw terminal shall be straight when placed under the terminal then clamped in place under the screw terminal. The wires shall be broken and not twisted around the terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure, or cabinet shall be connected to screw terminals with each terminal and conductor marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. The use of wire nut type connectors in the system is prohibited. Wiring within any control equipment shall be readily accessible without removing any component parts. The fire alarm equipment manufacturer's representative shall be present for the connection of wiring to the control panel.

3.6.3 Control Panels

The control panels and its assorted components shall be mounted so that no part of the enclosing cabinet is less than 12 inches nor more than 78 inches above the finished floor. Manually operable controls shall be between 36 and 42 inches above the finished floor. Panel shall be installed to comply with the requirements of UL 864.

3.6.4 Detectors

Detectors shall be located and installed in accordance with NFPA 72. Detectors shall be connected into signal line circuits or initiating device circuits as indicated on the drawings. Detectors shall be at least 12 inches from any part of any lighting fixture. Detectors shall be located at least 3 feet from diffusers of air handling systems. Each detector shall be provided with appropriate mounting hardware as required by its mounting location. Detectors which mount in open space shall be mounted directly to the end of the stubbed down rigid conduit drop. Conduit drops shall be firmly secured to minimize detector sway. Where length of conduit drop from ceiling or wall surface exceeds 3 feet, sway bracing shall be provided. Detectors installed in concealed locations (above ceiling, raised floors, etc.) shall have a remote visible indicator LED/LCD in a finished, visible location.

3.6.5 Notification Appliances

Notification appliances shall be mounted 80 inches above the finished floor to the bottom of the strobe lens.

3.6.6 Annunciator Equipment

Annunciator equipment shall be mounted where indicated on the drawings.

3.6.7 Addressable Initiating Device Circuits Module

The initiating device circuits module shall be used to connect supervised conventional initiating devices (water flow switches, water pressure switches, manual fire alarm stations, high/low air pressure switches, and tamper switches). The module shall mount in an electrical box adjacent to or connected to the device it is monitoring and shall be capable of Style B supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed on style B lines. Addressable initiating device circuits modules shall monitor only one initiating device each. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform supervisory and alarm functions as indicated on the drawings and as specified herein.

3.6.8 Addressable Control Module

Addressable and control modules shall be installed in the outlet box or adjacent to the device they are controlling. If a supplementary suppression releasing panel is provided, then the monitor modules shall be mounted in a common enclosure adjacent to the suppression releasing panel and both this enclosure and the suppression releasing panel shall be in the same room as the releasing devices. All interconnecting wires shall be supervised unless an open circuit or short circuit abnormal condition does not affect the required operation of the fire alarm system. If control modules are used as interfaces to other systems, such as HVAC or elevator control, they shall be within the control panel or immediately adjacent to it. Control modules that control a group of notification appliances shall be adjacent to the first notification appliance in the notification appliance circuits. Control modules that connect to devices shall supervise the notification appliance circuits. Control modules that connect to auxiliary systems or interface with other systems (non-life safety systems) and where not required by NFPA 72, shall not require the secondary circuits to be supervised. Contacts in suppression systems and other fire protection subsystems shall be connected to the fire alarm system to perform required alarm functions as indicated on the drawings and as specified herein.

3.7 OVERVOLTAGE AND SURGE PROTECTION

3.7.1 Power Line Surge Protection

All equipment connected to alternating current circuits shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. Fuses shall not be used for surge protection. The surge protector shall be rated for a maximum let thru voltage of 350 Volts ac (line-to-neutral) and 350 Volt ac (neutral-to-ground).

3.7.2 Low Voltage DC Circuits Surge Protection

All IDC, NAC, and communication cables/conductors, except fiber optics, shall have surge protection installed at each point where it exits or enters a building. Equipment shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector shall be rated to protect the 24 Volt dc equipment. The maximum dc clamping voltages shall be 36 V (line-to-ground) and 72 Volt dc (line-to-line).

3.7.3 Signal Line Circuit Surge Protection

All SLC cables/conductors, except fiber optics, shall have surge protection/isolation circuits installed at each point where it exits or enters a building. The circuit shall be protected from surges per IEEE C62.41 B3 combination waveform and NFPA 70. The surge protector/isolator shall be rated to protect the equipment.

3.8 GROUNDING

Grounding shall be provided by connecting to building ground system.

3.8.1 Revisions to Existing Facilities

Existing supervising components shall be modified as indicated on the drawings and programming shall be updated if required to accommodate the revised configuration. Acceptance testing shall include procedures that would demonstrate that operation of existing equipment has not been degraded and that the revised configuration plus interfacing components operates compatibly with the new fire alarm system at the protected premises. Work on existing equipment shall be performed in accordance with the manufacturer's instructions or under supervision of the manufacturer's representative.

3.8.2 Additions to Existing Facilities

Supplemental components shall be added to the existing supervising equipment as required to accommodate the new fire alarm system to be installed at the protected premises. All present functions shall be extended, including recording and storage in memory, and programming shall be updated if required to accommodate the revised configuration. Acceptance testing shall include procedures that would demonstrate that operation of existing equipment has not been degraded and that the expanded configuration operates compatibly with the new fire alarm system.

3.9 TRAINING

Training course shall be provided for the operations and maintenance staff. The course shall be conducted in a building designated by the Contracting Officer. The training period for systems operation shall consist of four (4) training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The training period for systems maintenance shall consist of four (4) training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. The instructions shall cover items contained in the operating and maintenance instructions. In addition, training shall be provided on performance of expansions or modifications to the fire detection and alarm system. The training period for system expansions and modifications shall consist of at least four (4) training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests.

-- End of Section --