

- 2.7.1.6 1400 lumen output for a minimum of 90 minutes depending upon lamp type and quantity.
- 2.7.1.7 Approved manufacturers are Bodine, Beghell and Emergi-lite.
- 2.7.1.8 In exterior locations, provide equipment capable of operating at temperatures from 0° F to 130° F.
- 2.8 Fluorescent Lamps:
 - 2.8.1 T8 Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rapid start, low mercury, rated 32 watts, 2950 approximate initial lumens, 24,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.
 - 2.8.2 T5 Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rapid start, low mercury, rated 28 watts, 2900 approximate initial lumens, 24,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.
 - 2.8.3 T5HO Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rapid start, low mercury, rated 54 watts, 5000 approximate initial lumens, 24,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.
 - 2.8.4 Compact Fluorescent: Provide the number, type, and wattage indicated. Lamps shall be rated, 10,000 hours average rated life, 85 CRI, 4100k color temp. Average rated life is based on 3 hours operating per start. Lamps shall be General Electric, Sylvania, Philips.
- 2.9 Fixture Support Components
 - 2.9.1 Comply with Division 16 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.
 - 2.9.2 Single-Stem Hangers: ½-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
 - 2.9.3 Twin-Stem Hangers: Two, ½-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
 - 2.9.4 Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage (2.68 mm).
 - 2.9.5 Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).
 - 2.9.6 Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.
 - 2.9.7 Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.9.8 Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.10 Finishes

2.10.1 Fixtures: Manufacturers' standard, unless otherwise indicated.

2.10.1.1 Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

2.10.1.2 Metallic Finish: Corrosion resistant.

3 EXECUTION

3.1 Installation

3.1.1 Fixtures: Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings. The installation shall meet with the requirements of NFPA 70. Mounting heights specified or indicated shall be to bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting fixtures on the job before installation is commenced and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed. 1' x 4', 2' x 4' and 2' x 2' recessed and semi-recessed fixtures may be supported from suspended ceiling support system ceiling tees if the ceiling system support wires are provided at a minimum of four wires per fixture and located not more than 6 inches from each corner of the fixture. Additionally, for recessed fixtures, provide support clips securely fastened to ceiling grid members, a minimum of one at or near each corner of each fixture. For round fixtures or fixtures smaller in size than the ceiling grid, provide a minimum of two wires per fixture and locate at opposite corners of the ceiling grid in which the fixture is located. Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently or with at least two 3/4-inch metal channels spanning, and secured to the ceiling tees. Provide wires for lighting fixture support in this section. There are many type of ceiling systems available on the market and any number of these ceiling systems may be used as part of this work. Verify the types of ceiling construction before ordering fixture fabrication. Determine that suspension methods and flange arrangements for fixtures coordinate with ceiling types and their suspension systems.

3.1.2 Adjust aimable fixtures to provide required light intensities.

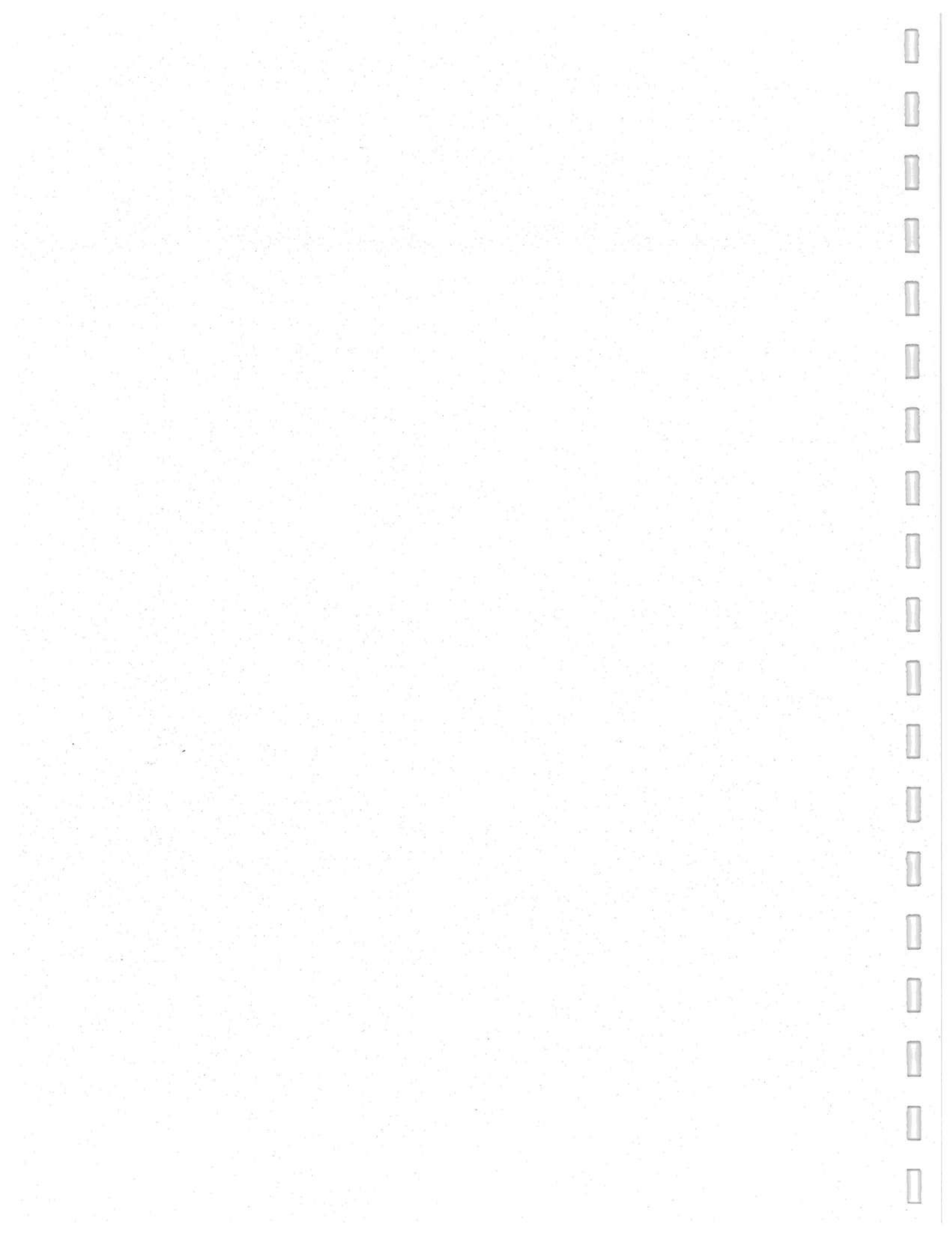
3.2 Connections

3.2.1 Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 Field Quality Control

- 3.3.1 Inspect each installed fixture for damage. Replace damaged fixtures and components.
- 3.3.2 Verify normal operation of each fixture after installation.
- 3.3.3 Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.
- 3.3.4 Clean all fixtures. Wipe down and remove finger prints, dust, dirt, grime, etc.
- 3.3.5 Lamp "Burn-in": All lamps, at initial energization, shall be "burned-in" at 100% output for a minimum of 100 hours.

END OF SECTION



SECTION 16731/FIRE DETECTION AND ALARM SYSTEM - ADDRESSABLE1 GENERAL1.1 Related Documents

1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

1.2.1 This Section includes fire alarm systems.

1.3 Definitions

1.3.1 FACP: Fire alarm control panel.

1.3.2 LED: Light-emitting diode.

1.3.3 NAC: Notification Appliance Circuit.

1.3.4 NICET: National Institute for Certification in Engineering Technologies.

1.3.5 SLC: Signaling Line Circuit.

1.3.6 Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 System Description

1.4.1 Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

1.5 Performance Requirements

1.5.1 Fire alarm signal initiation: Shall be by one or more of the following devices:

1.5.1.1 Manual stations.

1.5.1.2 Heat detectors.

1.5.1.3 Area smoke detectors.

1.5.2 Fire alarm signal: Shall initiate the following actions:

1.5.2.1 Alarm notification appliances shall operate continuously.

1.5.2.2 Identify alarm at the FACP and remote annunciators.

1.5.2.3 Transmit an alarm signal to the remote alarm receiving station.

- 1.5.2.4 Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
- 1.5.2.5 Record events in the system memory.
- 1.5.3 System trouble signal initiation: Shall be by one or more of the following devices or actions:
 - 1.5.3.1 Duct-mounted smoke detectors.
 - 1.5.3.2 Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
 - 1.5.3.3 Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 - 1.5.3.4 Loss of primary power at the FACP.
 - 1.5.3.5 Ground or a single break in FACP internal circuits.
 - 1.5.3.6 Abnormal ac voltage at the FACP.
 - 1.5.3.7 A break in standby battery circuitry.
 - 1.5.3.8 Failure of battery charging.
 - 1.5.3.9 Abnormal position of any switch at the FACP or annunciator.
- 1.5.4 System Trouble and Supervisory Signal Actions: Ring trouble bell and annunciate at the FACP and remote annunciators. Record the event on system printer.
- 1.5.5 Air Handling Units: Air handling units shall shut down.
- 1.6 Quality Assurance
 - 1.6.1 Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project. The fire alarm system shall be installed by a state certified fire alarm system installation contractor. The fire alarm system installation contractor shall have an unlimited electrical license (Type EC) or a fire alarm specialty license (Type EF).
 - 1.6.1.1 The fire alarm contractor shall be an experienced firm regularly engaged in the layout and installation of automatic fire alarm systems. The contractor shall have successfully completed the installation, testing, and warranty of systems of the scope of the largest system on this project at least one year prior to bid, and have regularly engaged in the business of fire alarm systems contracting continuously since.
 - 1.6.1.2 The fire alarm contractor shall have been NICET Level III certified, and certified by an approved equipment manufacturer to perform installation, testing, adjustment, maintenance, and repair on the approved manufacturer's equipment prior to the date of bid. The proposed fire alarm contractor shall commence no work on the project until he furnishes evidence, satisfactory to the aforementioned certifications and receives notice to proceed with the installation from the

Engineer.

1.6.1.3 Firms shall have a factory authorized service organization and stock spare parts.

1.6.2 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. All equipment shall be UL listed.

1.7 Extra Materials

1.7.1 Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7.1.1 Smoke and Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.

1.7.1.2 Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.

1.7.1.3 Keys and Tools: One extra set for access to locked and tamper proofed components.

1.7.1.4 Audible and Visual Notification Appliances: One of each type installed.

1.7.1.5 Fuses: Two of each type installed in the system.

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of device provided.

1.8.2 Calculations:

1.8.2.1 Battery size calculations

1.8.2.2 NAC circuit cable voltage drop calculations.

1.8.3 Qualification Data: For Installer.

1.8.4 Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Engineer for review.

1.8.5 Shop Drawings:

1.8.5.1 Shop Drawings shall be prepared by persons with the following qualifications:

- 1.8.5.1.1 Trained and certified by manufacturer in fire alarm system design.
- 1.8.5.1.2 Fire alarm certified by NICET, minimum Level III.
- 1.8.5.2 System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
- 1.8.5.3 Floor Plans: Submit a "point-to-point" wiring diagram showing the connections to the equipment and terminal cabinets. Indicate the equipment numbers, terminal numbers, wire numbers, address numbers and wire colors. Include the connections for the Mechanical Systems. The submittal shall be made for approval prior to the installation of the wiring in the raceways. Indicate final outlet locations showing address of each addressable device. Show size and routing of cable and conduits.
- 1.8.5.4 System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
- 1.9 Test Reports and Verification Submittals:
 - 1.9.1 Training: Submit letter verifying that Owner training has been received by factory representative
 - 1.9.2 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
 - 1.9.3 Perform the following field tests and inspections and prepare test reports:
 - 1.9.3.1 Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 - 1.9.3.2 Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.
 - 1.9.3.3 Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.
 - 1.9.3.4 Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - 1.9.3.5 Detectors that are outside their marked sensitivity range shall be replaced.
 - 1.9.3.6 Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.
- 1.10 O&M Data Submittals:
 - 1.10.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of

approval submittals (product data & shop drawings) in O&M manual.

- 1.10.2 Comply with NFPA 72, Appendix A, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

2 PRODUCTS

2.1 Manufacturers

- 2.1.1 Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.1.1.1 FACP and Equipment:

2.1.1.1.1 Edwards Systems Technology Inc.

2.1.1.1.2 NOTIFIER; a GE-Honeywell Company.

2.1.1.1.3 SimplexGrinnell LP; a Tyco International Company.

2.1.1.1.4 Siemens XLS.

2.1.1.2 Wire and Cable:

2.1.1.2.1 Comtran Corporation.

2.1.1.2.2 Helix/HiTemp Cables, Inc.; a Draka USA Company.

2.1.1.2.3 Rockbestos-Suprenant Cable Corporation; a Marmon Group Company.

2.1.1.2.4 West Penn Wire/CDT; a division of Cable Design Technologies.

2.2 FACP

2.2.1 General Description:

2.2.1.1 Modular, power-limited design with electronic modules, UL 864 listed.

2.2.1.2 Addressable initiation devices that communicate device identity and status.

2.2.1.3 Smoke sensors shall additionally communicate sensitivity setting.

2.2.1.4 Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

2.2.1.5 Addressable control circuits for operation of mechanical equipment.

2.2.2 Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display

alarm, supervisory, and component status messages and the programming and control menu.

- 2.2.2.1 Annunciator and Display: Liquid-crystal type, two lines of 40 characters each, minimum.
- 2.2.2.2 Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- 2.2.3 Electronic Loop Controller: Electronic Loop Controller shall be provided in each Fire Alarm Control Panel, to interface between the main panel, expansion modules, and the Analytical Microprocessor-based Detectors and modules. No electronic loop controller shall be loaded to more than 50% of the maximum allowable number of devices which can be connected to the electronic loop.
- 2.2.4 Circuits:
 - 2.2.4.1 Signaling Line Circuits: NFPA 72, Class A, Style 6.
 - 2.2.4.2 Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
 - 2.2.4.3 Actuation of alarm notification appliances, emergency voice communications where provided, annunciation, elevator recall shall occur within 10 seconds after the activation of an initiating device.
 - 2.2.4.4 Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.
- 2.2.5 Smoke-Alarm Verification:
 - 2.2.5.1 Initiate audible and visible indication of an "alarm verification" signal at the FACP.
 - 2.2.5.2 Activate a listed and approved "alarm verification" sequence at the FACP and the detector.
 - 2.2.5.3 Sound general alarm if the alarm is verified.
 - 2.2.5.4 Cancel FACP indication and system reset if the alarm is not verified.
- 2.2.6 Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41 60 beats per minute, march-time pattern. All visual appliances shall be synchronized. Do not load any NAC more than 75% of its rated amperage.
- 2.2.7 Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.
- 2.2.8 Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.
 - 2.2.8.1 Silencing-switch operation halts alarm operation of notification appliances and activates an

- "alarm silence" light. Display of identity of the alarm zone or device is retained.
- 2.2.8.2 Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
- 2.2.8.3 When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- 2.2.9 Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.
- 2.2.10 Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.
- 2.2.11 Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter.
- 2.2.12 Service Modem: Port for connection to a dial-in terminal unit.
- 2.2.12.1 The dial-in port shall allow remote access to the FACP for programming changes and system diagnostic routines. Access by a remote terminal shall be by encrypted password algorithm.
- 2.2.13 Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines and trouble signal shall be powered by the 24-V dc source.
- 2.2.13.1 The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
- 2.2.13.2 Power supply shall have a dedicated circuit breaker for this connection at the service entrance equipment. Paint the circuit breaker red and identify it with "FIRE ALARM SYSTEM POWER."
- 2.2.14 Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
- 2.2.14.1 Batteries: Shall be capable of providing power to the system for a minimum of 24 hours.
- 2.2.14.2 Battery and Charger Capacity: Comply with NFPA 72.
- 2.2.15 Surge Protection:
- 2.2.15.1 Install surge protection on normal ac power for the FACP and its accessories.

2.2.15.2 Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

2.2.16 Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 Manual Fire Alarm Boxes

2.3.1 Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box. Mount 48" AFF to center of device.

2.3.1.1 Single-action mechanism requiring one actions to initiate an alarm, pull lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

2.3.1.2 Station Reset: Key- or wrench-operated switch.

2.4 System Smoke Detectors

2.4.1 General Description:

2.4.1.1 UL 268 listed, operating at 24-V dc, nominal.

2.4.1.2 Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.4.1.3 Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring. Removal of the respective detector shall not affect electronic loop communications with other detectors on that loop.

2.4.1.4 Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

2.4.1.5 Integral Visual-Indicating Light: LED type.

2.4.1.6 In the event of a loss of communications of the smoke detector with the Electronic Loop Controller, the smoke detector will automatically revert to the "Standalone Conventional" operation, and Fire Alarm / Life Safety system functions shall not be compromised.

2.4.1.7 Shall be capable of transmitting pre-alarm and alarm signals to the Fire Alarm Control Panel via the Electronic Loop Controller. It shall be possible to program Fire Alarm Control Panel activity and response to each of the following signal levels: Normal, Pre-Alarm, Alarm, Trouble, Detector need cleaning.

- 2.4.1.8 Shall contain an environmental compensation algorithm, which identifies and sets ambient "Environmental Thresholds" continually and periodically. In this manner, the environmental impact of temperature, humidity, environmental contaminants as well as detector aging shall be automatically monitored. This process shall employ digital compensation techniques to adapt the detector to both long term and short-term changes in the environment in which they are installed. The microprocessor shall monitor this environmental compensation value and alert the system operator when the detector 80% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the derived base line sensitivity that the detector has sensed in its environment. The base line sensitivity information shall be automatically and periodically updated and permanently stored in the detector.
- 2.4.1.9 Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
- 2.4.1.9.1 Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F (8 or 11 deg C) per minute.
- 2.4.1.9.2 Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F (57 or 68 deg C).
- 2.4.1.9.3 Provide a minimum of 5 levels of detection sensitivity for each sensor.
- 2.4.2 Photoelectric Smoke Detectors:
- 2.4.2.1 Sensor: LED or infrared light source with matching silicon-cell receiver.
- 2.4.2.2 Detector Sensitivity: Between 1.0 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
- 2.4.3 Duct Smoke Detectors:
- 2.4.3.1 Shall utilize addressable photoelectric smoke detectors arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- 2.4.3.2 Sensor: LED or infrared light source with matching silicon-cell receiver.
- 2.4.3.3 Detector Sensitivity: Between 1.0 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
- 2.4.3.4 Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.
- 2.4.3.5 Duct Housing Enclosure: UL listed for use with the supplied detector.
- 2.4.3.6 Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.

- 2.4.3.7 Integral Visual-Indicating Light: LED type. Provide remote status and alarm indicator where detector is not visible from normal standing position.
- 2.4.3.8 Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
- 2.4.3.9 Each sensor shall have multiple levels of detection sensitivity.
- 2.4.3.10 Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
- 2.4.3.11 Relay Fan Shutdown: Rated to interrupt fan motor-control circuit. Shall be addressable.
- 2.5 Heat Detectors
 - 2.5.1 General: UL 521 listed.
 - 2.5.2 Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 15 deg F (8 deg C) per minute, unless otherwise indicated.
 - 2.5.2.1 Mounting: Plug-in base, interchangeable with smoke-detector bases.
 - 2.5.2.2 Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- 2.6 Notification Appliances
 - 2.6.1 Description: Equipped for mounting as indicated and with screw terminals for system connections.
 - 2.6.2 Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
 - 2.6.3 Audible Alarm Devices
 - 2.6.3.1 Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.
 - 2.6.4 Visible Alarm Devices
 - 2.6.4.1 Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - 2.6.4.2 Rated Light Output: 75 candela synchronized flash outputs. In rooms exceeding 30'X30', a 110

candela strobe shall be used to comply with visual coverage.

2.7 Remote Annunciator

2.7.1 Description: Duplicate annunciator functions of the FACP for alarm, supervisory, and trouble indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.

2.7.2 Mounting: Flush cabinet, NEMA 250, Class 1.

2.7.3 Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.8 Addressable Interface Device

2.8.1 Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

2.8.2 Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall and to a circuit-breaker shunt trip for power shutdown.

2.9 Digital Alarm Communicator Transmitter

2.9.1 Listed and labeled according to UL 632.

2.9.2 Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

2.10 Wire and Cable

2.10.1 Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

2.10.2 Signaling Line Circuits: Twisted, unshielded or shielded (as recommended by manufacturer) pair, not less than No. 18 AWG. Color shall be red.

2.10.3 Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

2.10.3.1 Low-Voltage Circuits: No. 14 AWG, minimum.

2.10.3.2 Line-Voltage Circuits: No. 12 AWG, minimum.

3 EXECUTION

3.1 Equipment Installation

3.1.1 Detector Mounting

3.1.1.1 Smooth ceiling spacing shall not exceed 30 feet.

3.1.1.2 Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.

3.1.1.3 Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

3.1.1.4 Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct. Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.

3.1.1.5 Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

3.1.1.6 Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

3.1.2 Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

3.1.3 NAC Devices: Install 80" AFF to bottom of strobe lens if wall mounted. Ceiling mounted devices shall be coordinated with all other trades work.

3.1.4 FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

3.1.5 Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 Wiring Installation

3.2.1 Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable. Minimum raceway size for all fire alarm circuits is 3/4".

3.2.2 Wiring Method

3.2.2.1 Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.

- 3.2.2.2 Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.
- 3.2.3 Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved pressure-type terminal blocks
- 3.2.4 Cable Taps: Not allowed.
- 3.2.5 Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- 3.2.5.1.1 Horns = Red +/- Black -
- 3.2.5.1.2 Strobes (if separate) = White +/- Purple -
- 3.2.5.1.3 Alarms = Blue +/- Yellow -
- 3.2.5.1.4 A/C Ventilation = Shut Down Brown +/- Orange -
- 3.2.5.1.5 Magnetic Doors = Pink +/- Grey -
- 3.2.5.1.6 Misc. Circuits = Violet +/- Tan -
- 3.2.6 Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- 3.3 Identification
- 3.3.1 Identify system components, wiring, cabling, and terminals according to Division 16 Section "Basic Electrical Materials and Methods" & "Cable Identification."
- 3.3.2 Install instructions frame in a location visible from the FACP.
- 3.3.3 Label power-supply circuit breaker "FIRE ALARM."
- 3.4 Grounding
- 3.4.1 Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.
- 3.5 Adjusting

- 3.5.1 Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

END OF SECTION

SECTION 16900/WORK REQUIRED FOR EQUIPMENT FURNISHED BY OTHER DIVISIONS1 GENERAL

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.1.2 Division-16 Basic Electrical Materials and Methods Sections apply to work of this Section.
- 1.1.3 Review all project drawings to be aware of conditions affecting work herein.

2 PRODUCTS

- 2.1 Materials for this section are specified in the Section "Basic Materials and Methods."

3 EXECUTION

- 3.1 Provide raceway boxes, fittings, devices and conductors for the electrical power to equipment furnished and installed in the other Divisions.
- 3.2 Make connections for the electrical power to equipment furnished and installed in other Divisions.
- 3.3 Verify voltage, phase, and current requirements for all equipment being supplied by other divisions. Any modifications shall be incorporated into the electrical submittals with references to any modification and reason. The electrical system is designed around the specified equipment. Any change in the equipment shall be coordinated so that proper electrical protection is obtained. In addition, if the supplied equipment has higher minimum circuit ampacity than the equipment specified, the contractor shall call the modification to the Engineer's attention and make necessary conduit, wire, circuit breaker and equipment changes to accommodate the higher ampacity requirements.
- 3.4 Any change from the specified equipment requirements shall be the responsibility of the contractor.
- 3.5 The electrical contractor shall meet with the Division 15 contractor and fully coordinate locations of mechanical equipment, duct work and piping to ensure that proper working clearance as required in the NEC is obtained. Any conflict shall be reported to the Engineer in writing prior to the installation of any of the equipment. Refer to additional requirements for planning drawings.
- 3.6 Coordinate exact locations and electrical rough-in requirements with other Divisions prior to installation to ensure proper clearances and code requirements are met.

END OF SECTION

WORK REQUIRED FOR EQUIPMENT FURNISHED BY
OTHER DIVISIONS

REV. 04/29/04

