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PRE-BID MEETING SUMMARY
DELAWARE ARMY NATIONAL GUARD SITE FIRE ALARM UPGRADE
FMO-DEARNG # 15-008
ADDENDUM #4

QUESTIONS:

1. Can spec sections 26 05 53, 26 28 17, 27 10 05, and 28 31 00 be provided?
   RESPONSE – See Attached

Summarized By: DEDC, LLC
Mike Finamore
Date: 9/3/15

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Large Device Identification.

C. Nameplates and Labels.

D. Wire and cable markers.

E. Voltage markers.

F. Warning signs and labels.

1.02 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
   2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

2.02 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 LARGE DEVICE IDENTIFICATION

A. Identify all disconnect switches, pull boxes, junction boxes (larger than 4" X 4") in unfinished areas with Brady voltage markers, catalog #B-498, series #44xxx (xxx indicates last 3 numbers of model number which vary based on voltage, size, etc. Contractor shall coordinate this information prior to ordering). Sizes for each label shall be as large as possible, style "A", "B" or "C" as the device permits.

B. Identify all disconnect switches, pull boxes, junction boxes (larger than 4" X 4") finished with black engraved lamicoid self-adhesive labels, 1" X 4". The label shall state the power feed, circuit or section number, and the equipment identification number that the large device serves.

2.04 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Materials:

2. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Nameplates: Engraved three-layer laminated plastic, black letters on white background, 2" by 6" in size

D. Locations:
1. Each electrical distribution and control equipment enclosure.
2. Disconnect Switches
3. Panelboards.

E. Letter Size:
1. Use 1/8 inch letters for identifying individual equipment and loads.

F. Labels: Embossed adhesive tape, with 3/16 inch (5 mm) white letters on black background. Use only for identification of individual wall switches and receptacles, and control device stations.

2.05 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady, Bradysleeve, Catalog #B-320 PVC.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

H. Locations: Each conductor at pull boxes, junction boxes, and Termination or connection points including each load connection.

I. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2.06 VOLTAGE MARKERS

A. Minimum Size:

B. Legend:

C. Color: Black text on orange background unless otherwise indicated.

D. Location: Furnish markers for each conduit longer than 6 feet.

E. Spacing: 20 feet on center.

2.07 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Interior Components: Legible from the point of access.
   6. Conductors and Cables: Legible from the point of access.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

END OF SECTION

SECTION 26 28 17
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 26 05 26 - Grounding and Bonding for Electrical Systems.

B. Section 26 05 29 - Hangers and Supports for Electrical Systems.

C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2008.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; International Electrical Testing Association; 2013 (ANSI/NETA ATS).

E. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain one copy of each document on site.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation; Cutler-Hammer Products: www.eaton.com.

B. General Electric Company: www.geindustrial.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens: www.siemens.com.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

H. Provide externally operable handle with means for locking in the OFF position.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

E. Molded Case Circuit Breakers: UL listed for the following service conditions:

2.04 TRIP UNITS

A. Field-Adjustable Trip Circuit Breakers: Provide circuit breakers with frame sizes 600 amperes and larger with mechanism for adjusting long time continuous current, short time pickup current setting for automatic operation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed circuit breakers securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 05 29.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 05 26.

H. Provide identification nameplates for each enclosed circuit breaker in accordance with Section 26 05 53.

I. Provide arc flash warning labels in accordance with NFPA 70.

3.02 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance. Tests listed as optional are not required.

D. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

E. Perform field inspection and testing in accordance with Section 01 40 00.

F. Inspect and test each circuit breaker.

G. Inspect each circuit breaker visually.

H. Perform several mechanical ON-OFF operations on each circuit breaker.

I. Verify circuit continuity on each pole in closed position.

J. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB 1 requirements.

K. Include description of testing and results in test report.

3.03 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

END OF SECTION

SECTION 27 10 05

STRUCTURED CABLING FOR VOICE AND DATA - INSIDE-PLANT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Copper cable and terminations.

C. Fiber optic cable and interconnecting devices.

D. Communications identification.

E. Cabling and pathways inside building(s).

F. Distribution frames, cross-connection equipment, enclosures, and outlets.

G. Grounding and bonding the telecommunications distribution system.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

A. CEA-310 - Cabinets, Racks, Panels, and Associated Equipment; Consumer Electronics Association; Revision E, 2005.

B. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006. (ANSI/NECA/BICSI 568)

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; Telecommunications Industry Association; 2012.

E. TIA-492AAAA-B - Detail Specification for 62.5-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; Telecommunications Industry Association; Rev B, 2009.

F. TIA-526-14 - OFSTP-14 - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant; Telecommunications Industry Association; Rev B, 2010.

G. TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard; Telecommunications Industry Association; Rev C, 2009 (with Addenda; 2012).

H. TIA-568-C.2 - Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components; Telecommunications Industry Association; Rev C, 2009.

I. TIA-569-C - Telecommunications Pathways and Spaces; Telecommunications Industry Association; Rev C, 2012 (with Addenda; 2013).

J. TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Telecommunications Industry Association; Rev B, 2012.

K. TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Telecommunications Industry Association; Rev B, 2012 (with Addenda; 2013).

L. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.

M. UL 444 - Communications Cables; Current Edition, Including All Revisions.

N. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1. Storage and handling requirements and recommendations.
2. Installation methods.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Manufacturer Qualifications.

E. Evidence of qualifications for installer.

F. Field Test Reports.

G. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
1. Record actual locations of outlet boxes and distribution frames.
2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
3. Identify distribution frames and equipment rooms by room number on contract drawings.

H. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
2. Supervisors and installers factory certified by manufacturers of products to be installed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cabling and Equipment:
1. 3M Communications Technologies: solutions.3m.com.
2. TE Connectivity: www.te.com.
3. Siemon Company: www.siemon.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COPPER CABLE AND TERMINATIONS

A. Copper Horizontal Cable: TIA/EIA-568 Category 6 solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444.
1. In locations other than in plenums, provide NFPA 70 type CMG general purpose, CMR riser-rated, or type CMP plenum-rated cable.
2. In plenums, provide NFPA 70 type CMP plenum-rated cable.

B. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
   1. Performance: 500 mating cycles.
   2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

2.03 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. Fiber Optic Interconnecting Devices:
   1. Connector Type: Type SC.
   2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
   3. Maximum Attenuation/Insertion Loss: 0.3 dB.

B. Fiber Optic Backbone Cable: 24-fiber, multimode 62.5/125 um, complying with TIA-492AAAA; covered with orange cable jacket and complying with relevant portions of and addenda to latest edition of TIA/EIA-568.
   1. In locations other than in plenums, provide NFPA 70 type OFNR nonconductive-riser-rated or type OFNP nonconductive-plenum-rated cable.
   2. In plenums, provide NFPA 70 type OFNP nonconductive-plenum-rated cable.

C. Fiber Optic Adapters and Connectors: Duplex SC, push-on-push-off type, multimode adaptors with zirconia ceramic alignment sleeves; complying with relevant parts and addenda to latest edition of TIA/EIA-568 and with maximum attenuation of 0.3 dB at 1300 nm with less than 0.2 dB change after 500 mating cycles when tested in accordance with TIA-455-21.

2.04 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

2.05 CROSS-CONNECTION EQUIPMENT

A. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.

B. Patch Panels for Copper Cabling: Sized to fit EIA standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
   1. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
   2. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
   3. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
   4. Provide incoming cable strain relief and routing guides on back of panel.
   5. Patch Cords: Provide one patch cord for each pair of patch panel ports.

C. Patch Panels for Fiber Optic Cabling: Sized to fit EIA standard 23 inch wide equipment racks; 0.09 inch thick aluminum.
   1. Adaptors: As specified above under FIBER OPTIC CABLING; maximum of 24 duplex adaptors per standard panel width.
   2. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA/EIA-606 using encoded identifiers.
   3. Provide incoming cable strain relief and routing guides on back of panel.
   4. Provide rear cable management tray at least 8 inches deep with removable cover.
   5. Provide dust covers for unused adaptors.
   6. Patch Cords: Provide one patch cord for each pair of patch panel ports.

2.06 ENCLOSURES

A. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
   1. Do not paint over UL label.

B. Equipment Racks and Cabinets: CEA-310 standard 19 inch wide component racks.
   1. Wall Mounted Racks: 8 gage aluminum brackets, hinged to allow access to back of installed components.
   2. Floor Mounted Racks: 16 gage steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.
   3. Wall Mounted Cabinets: Front doors with locks, louvered side panels, top and bottom cable access, and ground lug.
      a. Cover inside of cabinet back with plywood backboard as specified.
   4. Cabinets: 16 gage steel construction with corrosion resistant finish.
   5. Locks: Keyed alike.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:
   1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
   2. 12 inches from power conduits and cables and panelboards.
   3. 5 inches from fluorescent and high frequency lighting fixtures.
   4. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit:
   1. Do not install more than 2 (two) 90 degree bends in a single horizontal cable run.
   2. Leave pull cords in place where cables are not initially installed.
   3. Conceal conduit under floor slabs and within finished walls, ceilings, and floors except where specifically indicated to be exposed.
      a. Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
      b. Treat conduit in crawl spaces and under floor slabs as if exposed to view.
      c. Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.
      d. Under floor slabs, locate conduit at 12 inches, minimum, below vapor retarder; seal penetrations of vapor retarder around conduit.

C. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

D. Firestopping: Seal openings around pathway penetrations through fire-rated walls, partitions, floors, and ceilings in accordance with Section 07 84 00.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Copper Cabling:

1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
3. Use T568B wiring configuration.
4. Copper Cabling Not in Conduit: Use only type CMP plenum-rated cable as specified.

C. Fiber Optic Cabling:
1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
2. Support vertical cable at intervals as recommended by manufacturer.

D. Wall-Mounted Racks and Enclosures:
1. Install to plywood backboards only, unless otherwise indicated.
2. Mount so height of topmost panel does not exceed 78 inches above floor.

E. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

F. Identification:
1. Use wire and cable markers to identify cables at each end.

G. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.
1. Cables: Install color coded labels on both ends.
2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.
3. Patch Panels: Label each jack as to its type and function, with a unique numerical identifier.
4. Patch Cords: Label with jack identifier corresponding to initial installation.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:
1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.
4. Inspect patch cords for complete labels.

D. Testing - Copper Cabling and Associated Equipment:
1. Test operation of shorting bars in connection blocks.
2. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

E. Testing - Fiber Optic Cabling:
1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
2. Multimode Backbone: Perform tests in accordance with TIA-526-14 Method B.

F. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM SPECIFICATION

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION

A. The Delaware Army National Guard (DEARNG) is requesting a proposal/bid for the installation of a new, standard fire alarm and detection system in buildings 115, 139, and 140 at the Bethany Beach Training Site in Bethany Beach, Delaware. The fire alarm and detection system being bid shall be designed and installed in accordance with these specifications.

B. The Bethany Beach Training Site has three buildings in which fire alarm and detection is to be installed. Building 115 is used as the site dining hall and is classified as a Use Group A occupancy per IBC (2009). In addition to the replacement of the fire alarm system, the building is to have new sprinkler system installed. Building 139 and 140 are utilized as site sleeping areas and area classified as a Use Group R-1 occupancy per IBC (2009). Buildings 139 and 140 are not to have new sprinkler systems.

C. The installation of the new fire alarm and detection system is to be coordinated with the existing building conditions and all new construction.

D. Building 115 will have a standalone new fire alarm system as follows:
   1. Voice evacuation speaker audio system
   2. Standard visual alarm
   3. Water flow monitoring
   4. Valve tamper monitoring
   5. Low air pressure monitoring
   6. Duct smoke detection
   7. Remote test switches for duct detection
   8. Kitchen extinguishing system monitoring
   9. Standard manual pull stations.

E. Building 139 will have a standalone new fire alarm system as follows:
   1. Standard Visual alarms
   2. 177 cd residential visual alarms in sleeping rooms
   3. Standard audio alarms
   4. 520 hz audio alarms in sleeping rooms
   5. Duct smoke detection
   6. Remote test switches for duct detection
   7. Standard manual pull stations.
   8. Cellular Alarm Communicator Dialer

F. Building 140 will have a standalone new fire alarm system as follows:
   1. Standard Visual alarms
   2. 177 cd residential visual alarms in sleeping rooms
   3. Standard audio alarms
   4. 520 hz audio alarms in sleeping rooms
   5. Duct smoke detection
   6. Remote test switches for duct detection
   7. Standard manual pull stations.
   8. Cellular Alarm Communicator Dialer

1.02 GENERAL REQUIREMENTS

A. All exceptions taken to these specifications, all variances from these specifications and all substitutions of operating capabilities or equipment called for in these specifications shall be listed in writing and forwarded to the Delaware Army National Guard at the time of bid submission. Any such exceptions, variances or substitutions that were not listed at the time of bid submission and are identified in the shop drawing submittals, installed equipment,

associated work or at the time of acceptance testing, shall be grounds for immediate disapproval without comment.

B. The intent of the system shall meet the minimum code requirements as specified, but in addition, shall meet the specific level of life safety and protection as required by the State of Delaware in these minimum requirements. In almost all cases, these minimum requirements will require a higher degree of protection and workmanship than that specified by the referenced codes.

C. The system shall be designed in a modular fashion to insure future expansion capability. It shall be the intent of the system to monitor all fire suppression systems, fire extinguishing systems and building services as designated. The fire alarm and detection system is the centerpiece of the State of Delaware's life safety systems and is intended to provide a high degree of alarm notification, detection critical system monitoring and selected control outputs. Currently, this design is intended to provide the State of Delaware with a high degree of reliability and NO unwanted alarms.

D. The new fire alarm system shall be a single point addressable fire alarm and detection system. The new fire alarm system shall include several features as follows:
   1. Manually actuated fire alarm boxes. Alarm boxes shall be double-action type. Alarm boxes in public areas are to have safety covers.
   2. Alarm notification devices consisting of horn and strobe devices installed to provide alarm notification throughout the building.
   3. Interface with the new sprinkler system to provide monitoring.
   4. HVAC duct smoke detection installed for the control of smoke spread.
   5. Smoke/Heat detectors
   6. Kitchen hood suppression systems
   7. Post indicator valves

E. The intent of the new fire alarm and detection system is to meet all code requirements as required, but in addition, shall meet the specific level of life safety and protection as specified by through these specifications. The design, installation, workmanship, testing and documentation of the system must be of the highest quality. The design team and the OMB shall be the final judge of quality issues and their decision is final. If bidders or any interested parties have a concern with these conditions, they shall note their concerns in writing at the time of pre-bid meetings and at the time of bid submission.

F. All fire alarm systems shall be a stand-alone fire alarm systems. Building 115 system shall be provided with a digital alarm communicator and be connected with existing phone lines to the Security Instruments monitoring service. Buildings 139 shall be provided with a cellular alarm communicator and be connected with two new cellular phone lines to Security Instruments monitoring service. Buildings 140 shall be provided with a cellular alarm communicator and be connected with two new cellular phone lines to Security Instruments monitoring service.

G. The fire alarm system shall be complete in all respects for operation and interface with new and/or existing building equipment related to or desired to be controlled by the fire alarm system. All work shall be coordinated with other contract work being conducted in the building relating and coordinated with the Delaware Army National Guard. The successful contractor shall include in their design all work necessary to interface, HVAC shut-down, sprinkler and standpipe monitoring and control, building systems monitoring and control and other code specified supervisory functions. Any equipment, wiring, installation or other work necessary to finish all interface and output wiring or equipment shall be included in the design and in this contract under the base bid.

H. All system parts and components shall be NEW, not rebuilt or reconditioned parts or equipment.

1.03 WORK INCLUDED

A. The work covered by these Specifications shall include all labor, equipment, materials, code official approvals, insurance approvals and services to design, furnish, install, test and document a complete fire alarm, detection and audio/visual system protecting the facility.

B. All labor, materials, equipment, components, and tools to provide the fire alarm, detection systems, and wiring as specified herein for the design, installation and testing of the fire alarm and detection system for the entire building.

C. Provide all basic materials applicable to this work in strict accordance with methods specified herein and with manufacturer's recommendations.

D. Fire alarm and detection systems described shall be complete in every respect. Provide each item of equipment in quantities shown and as required by code, design, intent and as necessary to provide a complete system in a complete operating status with final testing and documentation as specified.

1.04 RELATED WORK

A. Documentation, testing and acceptance testing as specified in this document.

B. Two year warranty, two year inspection and two year service. Contractor shall provide in the base bid contract for two year complete warranty, two years of complete inspection, maintenance and service in accordance with NFPA 72.

1.05 REFERENCES/REQUIRED CODE COMPLIANCE

A. IBC – International Building Code, 2009 edition.

B. IFC – International Fire Code, 2009 edition.

C. State of Delaware Fire Prevention Regulations, 2012 edition.

D. State of Delaware Office of Budget and Management (OMB) for Fire Alarm and Detection System Designs and Installations

E. NFPA 1 – Uniform Fire Code, 2009 edition.

F. NFPA 70 – National Electrical Code, 2011 edition.

G. NFPA 72 – National Fire Alarm Code, 2010 edition.

H. NFPA 90A – Installation of Air Condition and Ventilating Systems, 2009 edition.

I. NFPA 101 – Life Safety Code, 2012 edition.

J. Underwriters' Laboratories (UL) equipment listings, approvals and standards.

K. Americans with Disabilities Act (except as modified per these specifications).

1.06 REQUIREMENTS OF REGULATORY AGENCIES

A. All equipment, components, wiring, design and installation of all items as described or implied in this document shall be Underwriters Laboratory listed and approved for the use intended.

B. All equipment, components, wiring, design and installation of all items as described or implied in this document shall be reviewed and approved by listed approving authority. The Contractor shall be responsible to submit all design documents and obtain all approvals from each code authority as listed below. No submission will be made to a code authority until DEDC, LLC approval.

C. Code Authority review required for this project is as follows:
   1. State of Delaware Fire Marshal's Office
   2. DEDC, LLC

D. The Contractor/fire alarm vendor shall be responsible for all submission costs and the Contractor/fire alarm vendor shall be responsible for obtaining of all required approvals, permits, and acceptance inspections/approvals from all legal and/or required agencies, inspection organizations and insurance groups as listed in 1.6B above.

1.07 COORDINATION

A. The alarm contractor shall fully coordinate design, equipment, devices, installation, wiring and connection of all fire alarm systems with the Delaware Army National Guard and all other related trades throughout each developmental stage of the project.

B. Fully coordinate the design and installation of all systems with other contractors and other work in progress or proposed progress at the time of Contractors design and installation. It shall be the Contractor's responsibility to communicate with the Delaware Army National Guard's on-site representatives and identify all other work or trades that will require coordination with the fire alarm system design and installation.

C. The Contractor shall include in his schedule key times to notify the State Liaison Representative for periodic inspection of the system installation. The State requires an inspection of the installation at the following points of:
   1. Shop drawing development
   2. 25% of rough in wiring installation
   3. Device and panel installation
   4. Pre-acceptance inspection by DEDC, LLC.
   5. Final acceptance testing

1.08 SUBMITTALS

A. Submittals at Time of Shop Drawings
   1. Submit five (5) copies of all shop drawings to Delaware Army National Guard. All shop drawings shall be approved by DEDC, LLC and the code authorities as listed in section 1.6 above prior to equipment delivery and installation.
   2. The contractor shall be responsible to submit all approval drawings, shop drawings, and as-built drawings in 1/8th inch scale unless approved otherwise by the Delaware Army National Guard.
   3. All shop drawings shall show proposed wiring diagrams point-to-point with labeled terminal and splice points, data sheets, equipment ratings, layout, dimensions, material type and finishes.
   4. Submit material list indicating proposed manufacturer's name and design/installation data for all systems and materials listed, specified or intended for use by the Contractor.
   5. The Contractor shall be required to submit the following series of drawings in 1/8 inch scale as follows:
      a. Shop drawings
      b. Panel drawings (as-built drawings)
      c. As-built drawings of installation
      d. Schematics of all auxiliary devices and auxiliary system connections such as Emergency Power Off system, HVAC, Power Distribution Unit, etc.
   6. Contractor shall be responsible to provide all shop, panel, schematic and as- built drawings in an AutoCAD (2009 version or higher) format. Drawings shall be multiple-colored ink on high quality, white bond plotting paper of a standard size sheet to include the following parameters:
      a. CAD (Computer aided drafting) form using an acceptable CAD system capable of producing the magnetic media in AutoCAD or an AutoCAD compatible DXF format.
      b. All magnetic media shall be on disk, using one disk per drawing, building or local stand-alone system.
      c. Computer Aided Drafting system and format shall be of the type that is directly transferable through DXF format.
   7. The Delaware Army National Guard shall own all media and original drawings addressed under this specification. The Delaware Army National Guard shall have the right to modify, reproduce, distribute and use the media and original drawings in any fashion or for any use that the Delaware Army National Guard may desire.
   8. The Contractor and manufacturer shall retain a copy of all as-built drawings and documentation as discussed in these specifications. The Contractor and manufacturer shall not have the right to use any magnetic media, drawings, documentation or other material describing or relating to the fire alarm system without the express written permission of the Delaware Army National Guard.

9. All drawings shall show building background features in “green” ink with single narrow pen width. Panel drawings shall show panel box and chassis in green.
10. All drawings shall show fire alarm and detection features in “black” ink with varying pen widths. Separate pen widths shall demarcate devices, point-to- point wiring, device labels, and notes.
11. All drawings shall show underfloor fire alarm and detection features (where applicable) in “red” ink with varying pen widths. Separate pen widths shall demarcate devices, point-to-point wiring, devices labels, and notes.
12. All drawings shall show wire sizes and other similar information in “blue” ink.
13. Contractor shall show exposed conduit in “orange” with a heavy pen width. All fiber optics connectivity and conduit shall be shown in “pink” ink.
14. Contractor may use other colors to demarcate other features of information on the drawings, but such colors shall be consistent from drawing to drawing.
15. Match wiring details, including number of wires per initiating and signal circuit, and location and type of end-of-line device to type of supervision specified.
16. Contractor shall show locations of fire alarm control panel, remote annunciator panels and all associated power supplies on drawings to ensure adequate space is available for power supply equipment and control cabinets.
17. Contractor shall ensure that shop drawings and specifications agree with respect to type of cable specified and that cable specified is suitable for the environment of the specific project.
18. Ensure that door release devices, including combination smoke detectors and door closers, are specified to match existing conditions and locations required.
19. Contractor shall produce and provide electrical schematic diagrams of any electrical connections between the fire alarm system and building equipment. These drawings shall be submitted at the time of shop drawings and as-built drawing submission.
20. As part of this project and included within the base bid cost, the Contractor shall provide the Delaware Army National Guard with “as-built” drawings for the entire fire alarm system showing all features as described in these specifications in their entirety as as-built conditions. These are not shop drawings; this is intended to clearly mean “as-builts”. All changes and/or additions made to approved shop drawings during the system installation and testing shall be documented in field and shown on final as-built drawings.
21. Along with the as-built drawing submission, the Contractor shall supply two complete sets of Computer Aided Drafting files of all drawings including the panel drawings.
22. The Contractor shall provide a wall-mounted cabinet adjacent to the fire alarm control panel (FACP). Cabinet shall contain one set of all system documentation to include as-built drawings, zippered binder, system program software disk and drawing AUTOCAD drawing files. The cabinet shall be locked and keyed using the same key as FACP. The cabinet shall be acceptable to the State of Delaware and be labeled on the front, “FIRE ALARM SYSTEM DOCUMENTATION”, “FOR SERVICE USE ONLY”. The State of Delaware will return one of the three sets of documentation as required by these specifications back to the Contractor for installation into the cabinet.
    a. Note: It is the intent of this section to ensure that a complete and adequate set of documentation exists on site and is available to service technicians, inspectors, and fire department. No documents or other items will be permitted to be stored inside of any fire alarm control equipment or other enclosure.
23. All shop drawing submissions shall include the following:
    a. The Contractor shall provide a narrative description of the fire alarm and detection system proposed design and arrangement. This shall include type and features of the equipment proposed for use. Description should be accompanied by manufacturer cut sheets of each proposed device and control equipment. The narrative description shall include an exact English description of all signaling arrangements, detection arrangements, output and supervisory functions.

b. All panel drawings shall show power and battery calculations for the system. Panel drawings shall show all wiring, ribbon and other cable point connections. Show any field or manufacturer modifications and include dip switch set-up positions, jumpers and snipped components including wire color coding and labeling.
c. The system shop drawings shall have a plan view of each floor and detailed riser diagram.
d. Actual wire, wire molding and conduit layout with anticipated methods of matching backgrounds or concealment of wire and conduit. Wire molding and conduit placement must be approved by the Delaware Army National Guard.
e. System annunciation descriptors for each alarm, trouble and supervisory output signal. Such descriptors shall be in "plain English" for each alarm, trouble and supervisory output signal. The English annunciation descriptors shall use actual terminology used at the Delaware Army National Guard to include floor names and point of compass designations un-coded. Contractor shall confirm descriptors with the Delaware Army National Guard on-site representative prior to shop drawing submission.
    1) Note: Code numbers, zone numbers or abbreviated text will not be approved without exception. Submission of coded, zoned or abbreviated text will be rejected at the time of shop drawing submission without cause or comment! If bidder does not understand this requirement, seek clarification from the Delaware Army National Guard prior to bid submission. Only complete and understandable English descriptors for fire alarm point and trouble annunciation will be approved.
f. Contractor shall show all exposed conduit (if any) at the time of shop drawings and receive approval of the Delaware Army National Guard. All exposed conduit must be clearly annunciated on shop drawings by use of heavy weight pen markings and color.

24. Contractor shall submit one (1) actual sample of each type of device intended for installation. If devices differ from area to area, then two actual samples of each type of device labeled for the specific area must be submitted. These items include but are not limited to the following:
    a. Manual Pull Stations
    b. Audio Devices
    c. Visual Devices
    d. Smoke Detectors
    e. Heat Detectors
    f. Duct Detectors
    g. Conduit and Pipe
    h. Wiring
    i. Junction and Back Boxes
    j. Weather-proof Enclosures
    k. Water Tight Junction Boxes
    l. Mounting Plates
    m. Addressable Modules (if not in Monitor Control Panel)
25. Submit large scale drawings (plan and elevation) showing all architectural and technical features of the following:
    a. Main alarm panel location.
    b. NAC Panels.

1.09 SUBMITTALS AT THE TIME OF ACCEPTANCE TESTING

A. Prior to acceptance test submit manufacturer's descriptive literature of actual equipment installed and the following:
    1. Equipment installation manual.
    2. Equipment and device operating instructions manual.
    3. Equipment maintenance and programming manuals.

4. Equipment/system service and repair data manual.
5. Parts lists.
6. Spare equipment and parts equipment and inventory list.
7. Testing and maintenance schedule as per requirements of 1.9B of these specifications.

B. For testing and documentation submittal requirements, see Testing and Documentation, Part 5

1.10 WARRANTY

A. The successful Bidder shall be responsible for all warranty and guarantee issues regardless of subcontractors, vendors or others operating as subcontractors under the successful Bidder's contract. Bid submission documents shall include a document executed by the successful Bidder's senior corporate or company officer indicating that the successful Bidder understands that he/she is solely responsible legally and financially to the Delaware Army National Guard for compliance to warranty and guarantee issues as follows:
   1. As part of the design/bidding package the Delaware Army National Guard requires the contractor to include two year's testing, maintenance and inspection of the fire alarm system for the duration of the two year warranty period of the system. The contractor shall submit at the time of system acceptance a schedule of maintenance, testing, and service as prescribed by these specifications and referenced standards, for the twot year warranty period, (see National Fire Protection Association 72 for additional requirements). The cost for the two year maintenance and testing shall be included in the base bid price. All system equipment shall be guaranteed for a period of two years from date of final acceptance of the fire alarm and detection system in accordance with Part 5 of these specifications.
   2. All raceways and wiring are guaranteed to be free from inherent mechanical or electrical defects for two years from the date of final acceptance of the systems in accordance with Part 5 of these specifications.
   3. Regardless of typical manufacturer or Contractor canned warranties and guarantees, the base bid price shall include all fees for warranty or guarantee cost to include parts, labor, shipping, stocking, overhead, markup or other costs associated with performing work under the warranty or guarantee agreement. It is the intent of this section that the entire system will be warranted and guaranteed from any fault (other than an act of God or acts by other than the alarm system Contractor). If anything goes wrong with the system, the Contractor shall repair/correct at no cost to the State of Delaware with components, parts and workmanship that are NEW, not rebuilt or reconditioned parts or equipment. If this intent is not clear or understood by the Bidder, the Bidder shall seek clarification from the State of Delaware prior to bid submission.

B. As part of the successful bidder's warranty package, the successful bidder shall submit at the time of system acceptance under Part 5 of the specifications, a schedule of maintenance, testing, and service as prescribed by these specifications and referenced standards, for the first year warranty period, (see NFPA 72 for additional requirements). The cost for the first year maintenance and testing shall be included in the base bid price.

C. All warranty service that impairs the function of the fire alarm system shall be provided with four hours of notification to the Contractor. Cost for this service shall be included within the base bid price.

D. All warranty service that does not impair the function of the fire alarm system but is obligated under the warranty shall be performed within 24 hours of notification to the Contractor unless otherwise approved by the State of Delaware.

E. It is the Delaware Army National Guard policy for fire alarm systems that the warranty period shall begin only after the Delaware Army National Guard has accepted the acceptance test results, verified completion of punch list items and released final payment. Date of commencement of warranty period shall be no greater than 10 working days after verification of completion of punch list. Delaware Army National Guard to provide affective dates of service for warranty period.

1.11 QUALIFICATIONS

A. The fire protection contractor shall be licensed with the Delaware State Fire Marshals Office. Copy of license shall be submitted at the time of bidding and verified at bid acceptance.

B. Contractor shall (or contractually be supported by a company) specialize in fire alarm systems and have a minimum of five years of documented experience with the design and installation of the actual system and devices being installed.

C. Contractor shall have (or contractually be supported by a company) on staff and assigned to the project a NICET Level III certified person for fire alarm systems.

D. The Contractor shall assign the NICET Level III certified person to supervise the preparation of all technical documentation, drawings, installation, testing and acceptance testing as required by these specifications. The NICET Level III certified person shall be present at shop drawing review meetings, design issue meetings and all acceptance testing.

E. All drawings shall include the NICET Level III persons name and license's number. In lieu of a NICET Level III person, the Contractor may substitute a Delaware registered licensee's professional engineer who is specialized in fire protection, electrical engineering or electronic engineering.

F. Equipment manufacturer shall be a company specializing in NFPA 72 fire alarm and detection systems with a minimum of ten years of documented experience.

G. All qualification documentation shall be submitted at the time of bidding and verified at bid acceptance.

H. Contractor shall assign to the project a project manager who is experienced in the installation of fire alarm systems. The Project Manager shall be assigned to the project as a primary responsibility. He shall be dedicated to the design, installation and successful completion of a complete and working system. The Project Manager shall demonstrate qualification through experience and/or education to the satisfaction of the State of Delaware. The Project Manager shall supervise the preparation of all technical documentation, drawings, installation, testing and acceptance testing as required by these specifications. The Project Manager shall have a position within his/her company that allows him/her to make decisions and commit his/her company legally and financially so as to minimize corporate bureaucracy during the resolution of issues and problems.

I. All qualification documentation shall be submitted at the time of bidding and verified at bid acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Simplex

B. Siemens

C. Notifier

D. EST

E. Silent Knight

F. Substitutions – See Section 01 60 00 – Product Requirements

G. CONTRACTOR SHALL REFER TO STATE OF DELAWARE FIRE ALARM SYSTEMS MATRIX INCLUDED IN PART VII OF THE STATE OF DELAWARE'S FACILITY DESIGN STANDARDS FOR APPROVED MANUFACTURERS AND APPROVED FIRE ALARM CONTROL PANELS.

2.02 FIRE ALARM AND DETECTION CONTROL PANELS

A. Fire Alarm Control Panels: As specified under 2.1. Control panel(s) shall be flush wall-mounted enclosure unless otherwise approved by the Delaware Army National Guard. Fire alarm control panels shall be installed in approved areas in accordance with NFPA 72 and the manufacture

listings. The fire alarm control panel and system design shall have alarm verification features for all smoke detection.

B. In the event that the project incorporates automatic suppression and/or extinguishing systems, the Delaware Army National Guard will make the decision whether or not to require the primary fire panel to be Underwriters Laboratory listed as a releasing panel suitable for operation and control of and proposed suppression or extinguishing system. Additional releasing panels shall be incorporated into the design unless approved by the Delaware Army National Guard.

C. Power Supply: Adequate to serve control panel modules, remote detectors, remote annunciators, door holders, (smoke dampers) (relays) and alarm signaling devices. (Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for five minutes. See Section 4.2.4 for additional requirements on batteries.
   1. All fire alarm equipment in the project shall be provided with primary AC power obtained a building electrical subpanel which provides emergency power, if emergency power is provided to the facility. The DC secondary power supply shall consist of a standard fire alarm battery secondary supply, or emergency generator as specified in this document and National Fire Protection Association 72.

D. Initiating Circuits: Supervised remote addressable zone monitor capable of alarm and trouble indication at primary control panel. Each initiating circuit shall have a supervised addressable point which can be switched or have a programmed disconnect feature independent of all other initiating zones or points. Each circuit shall be 18 gauge twisted/shielded.

E. Signal Circuits: Supervised signal module, 14 gauge twisted/shielded circuits sufficient for signal devices connected to system. All signal circuits shall be sized so as not to exceed 70% capacity of amp ratings on cards/circuits.

F. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts (for each detection zone) to provide accessory functions specified.

G. Monitor and control modules shall have separate power supply circuits and not depend upon data circuit power for complete function and operation unless specifically approved by the Delaware Army National Guard on a device-by-device basis.

H. Provide TROUBLE ACKNOWLEDGE, DRILL and ALARM SILENCE switch.

I. Control panel shall have historical record recordation ability inherent in panel memory for Alarm, Trouble and Supervisory signals.

2.03 SURGE PROTECTOR (AC TRANSIENT SUPPRESSOR, AC POWER)

A. All AC power supplies to any fire alarm panel or components shall be provided with separate surge protection as follows:
   1. Suitable for protection of electronic equipment and electrical systems 600 volts and less. Device shall be capable of protection of all AC electrical circuits and equipment from the effects of lighting inducted voltages, external switching transients, and internally generated switching transients resulting from inductive and/or capacitive load switching.
   2. Surge protector and installation shall be in accordance with:
      a. NFPA 70
      b. UL #1449 Standard for Fire and Safety-TVSS/SPD
      c. IEEE Std. 142-Recommended Practice for Grounding Std. 518- Recommended Guide on Electrical Noise ANSI/IEEE C62.41- 1991 Edition. Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
      d. Federal Information processing Standards Publication 94 (FIPS PUB 94)

B. Acceptable Manufacturers:
   1. Transtector Systems, Inc. 10701 Airport Drive Hayden Lake, ID 83835 Tel: 1-800-882-9110 FAX: 208-762-6133

C. Service Protection Panel enclosure shall be a minimum of a (NEMA 4) construction, factory primed and field painted to match mounting surface.

D. The Service Protection Panel system as required shall consist of a Service Protection Panel for each service rated 600 volts or less, and/or Branch Panel Protectors. All devices shall operate as a total coordinated and engineered system, as well as be engineered as a system by the manufacturer.

E. Power supply side surge suppression device(s) shall be installed in a separate enclosure adjacent to each fire control panel but shall not be installed inside of the fire control panel. The enclosure shall be labeled "Power Supply Surge Suppression" and marked with its unique identifier number. The enclosure shall be of sufficient size to contain all components parts of the surge suppression system to include terminal strips. All wire connections between the surge suppression system and the fire alarm control panel shall be in conduit. It is the intent of this specification to require additional and redundant surge protection for all system components where they receive external AC or DC power.

F. Maximum continuous operating voltages of any system component shall not be less than 115% of the nominal system operating voltage.

G. All Service Protection Panel components shall be rated with an operating temperature range of 30 to 120 degrees Fahrenheit, and from 0 to 85% humidity non-condensing.

H. Nominal system frequently is 60 Hertz, operating frequency range of the Service Protection Panel system shall be 0 to 400 Hertz.

I. All Service Protection Panels shall be connected in parallel with the power system they are protecting. Series connected components shall not be used. Suppression paths shall not be ground.

J. All Service Protection Panels shall be UL 1449 listed and bear the UL label.

2.04 REMOTE ANNUNCIATOR

A. When a remote annunciator is proposed for the facility, the contractor shall provide a supervised LCD remote annunciator including audible and visual indication of fire alarm by zone, and audible and visual indication of system trouble. Install in a flush, wall-mounted enclosure. All remote annunciators shall provide the same English descriptor as other required annunciation from printers, CRTs and fire alarm panel annunciators. Provide annunciator at all locations shown on drawings. Annunciation shall be remote LCD annunciators which shall indicate alarm, trouble and supervisory conditions by individual English descriptors. The remote LCD annunciator shall also be provided with a keyed switch keyed alike to the main fire alarm panel - or access code to perform system acknowledgment and system reset.

2.05 DIGITAL ALARM COMMUNICATOR

A. A digital alarm communicator may be installed in the main fire control panel of each building.

2.06 INITIATING DEVICES

A. General requirements for initiating devices are listed below. Not all devices as listed below will be required for this project. Contractor shall review specific types, mounting and colors for each required device with the Delaware Army National Guard during design. Devices subject to mechanical damage shall be suitably protected. If guards or covers are employed, they shall be listed for use with that specific device.

B. Manual Station - Break Glass, Double Action, flush mounted as indicated by the specific building or identified in Part 4 of these specifications.
   1. Note: Manual pull devices shall be flush mounted to all wall surfaces without an extended back box. Where wall surface is exposed concrete or concrete block, the wiring shall be fished or channeled in wall and not exposed. No wire mold or surface mounted conduit permitted.

C. Heat Detector in conditioned spaces: Shall be addressable combination rate-of-rise and fixed temperature, rated 135 degrees F for conditioned spaces. Contractor shall survey areas where heat detector is to be installed for possible need of high fixed temperature rating. Higher temperature ratings must be approved by the Delaware Army National Guard.

D. Heat Detector in unconditioned spaces: Shall be rate-of-rise and fixed temperature Thermotech model 302ET or EPM anticipation type self- restoring 2098-9491 rated at 194 degrees F, no or equal. All heat detectors in unconditioned spaces shall be individually addressable through monitor module. Contractor shall survey areas where heat detector is to be installed for possible need of higher fixed temperature rating. Higher temperature ratings must be approved by the Delaware Army National Guard.

E. Smoke Detectors: NFPA 72: photoelectric sensor with visual indication of detector actuation, bug screen and suitable for mounting on 4 inch outlet box. Must be compatible with alarm verification and environmental compensation where required.

F. Duct Mounted Smoke Detectors: NFPA 72, photoelectric type with auxiliary SPDT relay contact, key-operated remote alarm lamp with NORMAL- RESET-TEST switch, with duct sampling tubes extending width of duct, and visual indication of detector actuation, in duct-mounted housing. Duct detectors must be provided with remote annunciation lamp at key switch as noted on drawings.
   1. Remote annunciation lamp must be located in normal occupied area at the approval of the Delaware Army National Guard. Duct Mounted Smoke Detectors must be securely mounted “without possibility of vibration” and located for accessibility and ease of maintenance/testing. Duct detector shall be provided with a remote test switch: Key-operated switch mounted may be on flush cover with lamp to indicate detector actuation. (Provide one switch for each duct mounted smoke detector). All flex connections from and to duct detector and fan/damper control equipment shall be installed in Sealtight.

G. Contractor shall coordinate with sprinkler contractor in Building 115 to determine number of sprinkler monitoring devices. For Bid purposes, the contractor shall provide monitoring of the following.
   1. 1 dry pipe alarm pressure switch
   2. 1 dry pipe low air pressure alarm switch
   3. 1 water flow switch
   4. 6 valve tamper switches.

2.07 ALARM NOTIFICATION DEVICES

A. General requirements for notification devices are listed below. Not all devices as listed below will be required for this project. Contractor shall review specific types, mounting and colors for each required device with the Delaware Army National Guard during design. Devices subject to mechanical damage shall be suitably protected. If guards or covers are employed, they shall be listed for use with that specific device.

B. Alarm Strobes/Lights - Wall and/or ceiling mount series visible notification appliances. Ceiling mounted appliance assemblies shall have white housing with clear lens. NFPA 72 meeting the requirements of ADA.

C. Horn - the Delaware Army National Guard choice based upon contractor’s recommendations and submittals. Must be approved by the Delaware Army National Guard. Must provide ceiling mounted appliance assemblies with white housing.

D. Combination Horn & ADA Strobe. The Delaware Army National Guard choice based upon contractor’s recommendations and submittals. Must be approved by the Delaware Army National Guard. Must provide ceiling mounted appliance assemblies with white housing.

E. Exterior Alarm Light and Horn. The alarm light shall be a 360º revolving red light, weather tight, seal beams and approved for use in exterior locations. Each exterior light shall be combined with an exterior audio horn in a weather tight and approved enclosure for exterior use. The alarm light can be powered by ordinary building AC power and need not be provided with a secondary power supply.

F. Audio alarms in residential sleeping rooms shall be 520 hz.

2.08 AUXILIARY DEVICES

A. Door Release: Where required, magnetic door holders with integral diodes to reduce buzzing, 24 VDC coil voltage.

2.09 FIRE ALARM WIRE AND CABLE

A. Fire Alarm Power Branch Circuits: Shall be wired in accordance with NFPA 72 Local Fire Alarm and NFPA 70, Section 760. Each power source shall be obtained from an emergency power circuit and the breaker shall be marked “FIRE ALARM POWER SOURCE” and be provided with a “red” locking device so as to prevent accidental power loss. Contractor shall be responsible to run all power from the closest emergency circuit panel to the fire alarm system.

B. Initiating, Signal and Communication Buss Circuits: Shall be Aerospace Wire & Cable Inc. or Substitutions per See Section 01 60 00 – Product Requirements
   1. #7140 18/2 TW/SH 200 deg.C. FPLP (New York City Certified)
   2. #7130 16/2 TW/SH 200 deg.C. FPLP (New York City Certified)
   3. #7120 14/2 TW/SH 200 deg.C. FPLP (New York City Certified)
   4. #7110 12/2 TW/SH 200 deg.C. FPLP (New York City Certified)
   5. Any and all fire alarm cable used in this system shall be “solid copper” conductors. No exceptions.

C. Important Note: 12 inch wire samples for 18 T/S, 16 T/S, 14 T/S and 12 T/S shall be submitted at the time of shop drawings/submittals, prior to material purchase and installation. Samples shall be approved by prior to purchase.

D. Any fire alarm cable which is not required in conduit and is located in a supply or return air plenum space must be a type of cable and insulation which is approved by UL for air plenums regardless of whether a plenum exists.

E. All wiring, connections, junctions, splices and arrangements must be installed in accordance with the national Electrical Code and approved for intended use.

F. All wiring for initiating, signaling and auxiliary devices shall be installed in EMT conduit except those areas where the wire can be fished in walls or hung above suspended ceilings. All wire shall be secured within 12 inches of all junction boxes, back boxes, other devices or splice connections. All conduits shall be secured every 4 feet.

G. Use 14 AWG minimum size twisted/shielded conductors for fire alarm signal (audio/visual) circuit conductors. All communication bus cable shall be 18 AWG twisted/shielded solid copper wiring using fire alarm listed plenum cable in all exposed areas. Any area subject to moisture or the effects of weather shall use water resistant conduit, enclosures, fittings, adapters, and like equipment. No stranded cable shall be permitted.

H. Any area subject to moisture or the effects of weather shall use water resistant conduit, enclosures, fittings, adapters, and like equipment. This includes all exterior mounted devices. Weather tight and water resistant installation shall extend for 12 inches within building envelope.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install fire alarm and detection system in accordance with manufacturer’s instructions, code requirements, and these specifications.

B. All devices, boxes and conduit shall be installed plumb and level.

C. Install manual station with operating handle 48 inches above floor. All visual signal devices where installed on walls shall be installed no less than 80 inches above finished floors.

D. All detectors and other alarm devices shall be securely mounted with approved back box. If visible, back box shall either match color of device or match color of wall surface if surface mounted. Standard back boxes and extension rings with knockouts are not permitted when location requires surface mounted boxes. Contractor must use a finished back box suitable for

painting. Only approved and appropriate type of conduit connectors and/or wire connectors shall be used for connection to back boxes or devices.

E. All wiring for initiating, signaling and auxiliary devices shall be installed in “red” Allied Tube Fire Alarm EMT or equal conduit, or wire molding except those areas where the wire can be fished in walls or hung above suspended ceilings. When wire is installed above ceilings and not in conduit, it must be run above the bottom of any red steel (or other type of super structure) and supported every 4-1/2 feet by a bridle ring or other approved support device. Wiring shall not be laid directly on a ceiling or supported by pipes, duct work or other building equipment. All wiring shall be secured within 12 inches of all junction boxes, back boxes, other devices or splice connections. All conduits shall be secured to building structure every 4 feet. When construction is of a wood frame, wire staples shall not be used to secure wire in place of bridle rings.

F. All fire alarm cabling and/or devices which are installed within 10 feet of water or sprinkler equipment shall be installed in Sealtight conduit with liquid tight connections and liquid tight (waterproof) boxes. When there are three or more monitoring/alarm points within the same area, monitor relays shall be mounted with a NEMA 4 Hoffman.

G. Mount end-of-line device in box with last device or separate box adjacent to last device in circuit. Each EOL device box shall be labeled “EOL” and be visible from front of device. If “EOL” is mounted in separate junction box, the face of the box shall be labeled.

H. Mount outlet box for electric magnetic door hold open and release devices to withstand 80 pounds of pulling force.

I. All wiring connections to fire suppression system waterflow switches and valve tamper switches, fire extinguishing systems, duct detectors and building interface equipment using conduit to within ten feet of device wherein the conduit shall terminate at a junction box. From the junction box to the device, the fire alarm wire shall be run in an approved Sealtight conduit and secured at each connection point to withstand a 50 lb. pull force.

J. Automatic Detector Installation: Devices shall be installed as per the requirements of NFPA 72 and these specifications. All detectors shall be securely mounted with approved back box. All back boxes shall be recessed. Only approved and appropriate type of conduit connectors shall be used for connection to back box or manual pull station.

K. Any wire entry or exit from a device, conduit, Sealtight or Greenfield shall be through an appropriate and approved box which is designed and installed to prevent chafing, cutting or other damage to the cable. All connections to devices, boxes, back boxes and like devices including any wiring exiting properly terminated conduit or EMT shall be provided with strain relief sufficient to secure cable at the point of entry or exit. Strain relief from back boxes, devices junction and panel boxes for wire cable shall consist of Arlington Ind., Inc LPCG50 connectors for single cable entry.

L. All fire alarm cabling and devices which are installed within 10 feet of water equipment and sprinkler equipment shall be installed in Sealtight conduit with liquid tight connections and liquid tight (waterproof) boxes. All seal tight shall be connected so as to tolerate a minimum pull force of 50 lb. without separating from the connected device.

M. Any fire alarm cable which is not required in conduit and is located in a supply or return air plenum space must be a type of cable and insulation which is approved by Underwriters Laboratory for air plenums regardless of whether a plenum exists.

N. All system devices, panel and junction boxes shall have a unique identifier number which shall be:
   1. Labeled on each device, panel and junction box with durable label capable of surviving environmental conditions.
   2. Labeled on all drawings.
   3. Labeled on all parts lists and required testing documentation.
   4. The unique identifier numbering system shall be approved by DEDC LLC at the time of shop drawing submittal.

5. Note: The intent of this requirement is to have each and every device and component (except panel components) have a logical and unique number whereby all inventory, documentation and life effort can be tracked by the unique number.

O. Each conductor (individual wire) shall receive a unique and durable wire number at each terminal block, splice connection, device terminal and any other location where a conductor is landed. Only “Brady Permasleeve” heat- shrink wire markers will be permitted. No other systems shall be approved. Each wire number shall be shown on as-built drawings or a separate document shall be produced in final documentation, which describes the wiring to each devices. In all areas where the atmosphere is unconditioned, the wire number shall be protected with a clear heat shrink protector sleeve or similar method.
   1. System devices that are located above a suspended l ay-in ceiling shall have the heat shrink wire markers installed on each cable 12 inches before entering the back box and 12 inches after exiting the back box.
   2. Cable labeling in junction panels, control panels and other covered boxes shall have the shrink wire marker installed at the end of the cable prior to the protective heat shrink stripping cap. See wiring detail on bid drawings.

P. Each wire number shall be shown on the final as-built drawings or on a separate approved document which shall be included in the final documentation and describes the wiring to each device as follows:

Device Type	Circuit Out to	In From/ Termination	Last/Next No.	Wire Type	Color

Q. Contractor shall provide fire alarm circuit conductors with color coded insulation, or use color tape at each conductor termination and in each junction box. Color code shall be specified by the Contractor at the time of shop drawings and shall be consistent throughout all fire alarm systems. Color code shall be listed on all shop and as-built documentation and/or drawings.

R. Where required, all smoke detectors and alarm monitor or control devices which are installed under a raised floor shall be provide with an approved drip shield to shield the device from water that could drip from above or on top of the raised floor surface. Each device shall also be provided with LED annunciation at an approved location. The design and installation method shall be proposed by the contractor and shall be subject to the approval of the Delaware Army National Guard at the time of shop drawings.

S. Any panel or device needing any type of key (standard, hex, etc.) to open or reset any panel or device must be keyed to the fire alarm system.

T. The power supply surge suppression device(s) shall be installed in a separate NEMA 4 enclosure adjacent to each fire control panel and shall not be installed inside of the fire control panel. The surge suppression enclosure shall be labeled “Power Supply Surge Suppression” and marked with a unique identifier number. The surge suppression enclosure shall be of sufficient size to contain all components of the surge suppression system and including terminal strips. All wire connections between the surge suppression devices and the fire alarm control panel shall be in conduit. It is the intent of this specification to require additional and redundant surge suppression protection for all system components whenever they receive AC or DC power.

U. When installing wire numbers at back boxes, the wire numbers shall be installed on each cable inside of the back box when the back of the back box is not accessible (i.e. when the back box is installed on hard ceilings, on concrete or block surfaces or in gypsum walls). If the back of the back box is accessible, then the wire number shall be installed as listed in section M (1) above.

V. The labeling of system devices and other equipment may be accomplished by using a P-touch type labeling system. No hand written labels or “Sharpie” markers will be permitted.

W. Traditional wire ties are permitted for use in the system to secure wire bundles. The contractor shall provide written instruction to each employee on the correct use of wire ties so as to avoid compression of the cable jacket, shield or conductor insulation. Wire ties may not be used to

secure cables to bridle rings, building structure, back boxes, panel enclosures, conduit or as wire restraint at device and other terminations.

X. All terminal blocks, cards, relays and other devices shall be rigidly mounted within a cabinet enclosure or back box using screws, bolt & nut or epoxy glue. Double back tape or similar mounting systems shall not be permitted.
   1. Wire terminations, splice connections and all other connections shall be made by the use of UL listed compression terminal blocks as follows:
   2. All back box connections for shields and small connections:
      a. "Ideal" #89-608 Barrier Strip, 600V, 20A or equal
   3. No wire nuts or crimp connection devices will be approved. When terminal blocks are added to devices which incorporate a pig tail, the terminal block shall be securely mounted with mechanical fasteners (no double back tape) in the back box or on the back of the fire alarm device.

Y. All conduit, devices and other system components that are installed in areas subject to moisture, water, rain or water drainage shall be installed using approved water resistant and water tight conduit, NEMA 4 enclosures and like equipment.

Z. Provide power supply wiring to fire alarm system components from building electrical panel. Circuit breaker shall be sized in accordance with fire alarm system demand and the NEC. Branch circuit breaker shall be clearly labeled for fire alarm service, contiguous to the circuit breaker toggle switch and the toggle switch shall be provided with a lock to prevent accidental movement.

AA. Provide all low voltage signal wiring for systems specified herein in a workmanlike manner. Provide system raceways in accordance with manufacturer's requirements for installation of system's wiring. Provide and tag conductors at all junction and terminal points and identify by same number on all shop drawings. All conduit, cable, outlet and mounting boxes required as part of mounting arrangements shall be color- coded red if not in public area.

AB. Protect exposed wiring installed above ceiling construction from physical damage where necessary by conduit, guard strips or other approved means. Install all drops to wall devices in wire mold unless fished in walls. Properly support all low voltage cables and conduit from the building structure by the use of Bridle Rings. At those points where the wire descends below the concrete/steel structure, the wire must be provided with adequate strain relief which is designed not to cut or ground the cable shields. The wire shall descend plumb to the device or transition. Secure cable in place at intervals not exceeding 4-1/2 feet and within 12 inches from every cabinet, box or device. Cable stress relief shall be required for all connections to devices and boxes.

AC. In running plenum cable not in conduit, all bridle rings running parallel with red steel (and/or wood framing) shall be turned up on the bottom flange of red steel (and/or wood framing) so as the wire run is on top of the bottom flange and cradled by the bottom flange. Where intersecting beams must be crossed, the wire run shall be routed as follows:
   1. When a corrugated steel flute is available above the red steel, the wire shall be routed through the flute and over top of the steel beam.
   2. When a corrugated steel flute is not available, the wire run shall be taken under the intersecting beam and held off the beam by bridle rings on each side.
   3. When running wire through wood flooring and truss members, the wire shall be secured so as not to be exposed to metal gusset edges or other metal objects that could cause damage to the cable from weight, strain or vibration over time.

AD. When any wire run transitions from above a suspended or hard ceiling into a room or area which has no cei ling and is below an elevation of 7 feet above the floor, the entire wire run shall be run in red EMT through the entire room or until the red EMT terminates within a junction or back box. The intent of this requirement is to not permit any exposed plenum wire in areas without ceilings.

AE. Install all fire alarm wiring in separate raceways. Do not mix 120 volt AC power with fire alarm initiating, signaling or communications cable in the same raceway. All 120 volt AC power wiring shall be separated from initiating, signaling or communications cable inside of FACP, NAC or junction boxes with a paper or fiber board separation.

AF. Be responsible for assuring that conduit sizes and the wire quantity, size and type are suitable for the equipment and conditions as they exist. Review the proper installation of each type of device with the equipment supplier. Make final connections between the wiring and equipment under the supervision of equipment manufacturer's certified technician and NICET person in charge.

AG. Be responsible to seal all floor, ceiling and wall penetrations with approved materials which will provide the equivalent fire resistive rating as that of the wall, floor or ceiling that was penetrated. Contractor shall also be responsible to re-seal or repair any access ways or penetrations made through draft stops or fire stops with materials and workmanship which equals the original intended fire rating of the draft stop. All fire penetrations shall be sealed the same day of penetration.

AH. All fire alarm wiring which is not concealed above ceilings, fished in walls, run in Greenfield or run in Sealtight, shall be installed in conduit and/or wire mold unless specified otherwise on drawings.

3.02 WIRE JACKET ENDS AND SHIELD DRAINS

A. All signal, communications and power wire (low voltage) shall be twisted/ shielded as specified in Section 2.6, B. There shall be no use of unshielded cable on the project with the exception of 120 VAC power to surge suppressors and system power supplies. All cable and shields shall be installed as follows:
   1. Initiating circuits: all shields shall be carried through each device back box through the use of a compression terminal block as specified in Section 3.1 (R) of these specifications. Each shield drain wire shall be insulated with"clear" heat shrink wire insulation installed from the cable end heat shrink strip to the terminal block. The shield shall be landed at the "panel end" as per manufactures recommendations. The "field end" of the shield shall be terminated in the last device back box at the compression terminal strip.
   2. Indicating horn, speaker (where applicable) and strobe circuits: all shields shall be carried through each device back box through the use of a compression terminal block as specified in Section 3.1 (R) of these specifications. Each shield drain wire shall be insulated with "clear" heat shrink wire insulation from the cable end heat shrink strip to the terminal block. Shield landing shall be as follows:
      a. In NAC panels, the shield shall be landed on an acceptabl e ground at the junction panel (See Section 2.2 F) located adjacent to the NAC panel. The field end of the shield shall be terminated in the last device back box, in the compression terminal strip.
      b. In FACP or transponder/data collection panels, the shield shall be landed as specified by the system manufacturer.
   3. Communication, signal and data circuits shall be carried through each device junction box, back box, or other enclosure necessary through the use of a compression terminal block as specified in Section 3.1(R) of these specifications. Each shield drain wire shall be insulated with "clear" heat shrink wire insulation from the cable end heat shrink strip to the terminal strip. The shield shall be landed at the panel as per manufactures recommendations. The field end of the shield shall be terminated in the last device back box, in the compression terminal block.
   4. Wire stripped ends shall be protected with "red" heat shrink insulation placed at the cable jacket end to insulate the transition from the cable to the stripped drain wire.

3.03 FIELD QUALITY CONTROL

A. Test in fire alarm and detection system in accordance with NFPA 72 and these specifications, Part 5.

B. Contractor shall be responsible to install all system components, wiring and conduit in a workmanship like manner and to the satisfaction of DEDC LLC. DEDC LLC shall determine acceptable level of workmanship. Examples of existing installations or other contractor installations shall not be used for evaluation of acceptable workmanship under the fire alarm contract work. Only the highest quality workmanship will be accepted. There are no exceptions to this requirement. Simply said, just because you see another system installed with less than the highest quality of workmanship, doesn't mean it will be acceptable for the fire alarm system.

C. Contractor shall connect and monitor all alarm, trouble, and supervisory points for each fire suppression system, fire extinguishing system and fire pump system with the new fire alarm and detection system. It shall be the responsibility of the contractor to coordinate with the Delaware Army National Guard on- site representative to identify any and all such systems prior to development of shop drawings.

3.04 FIRE ALARM WIRE AND CABLE COLOR CODE

A. Provide fire alarm circuit conductors with color coded insulation, or use color tape at each conductor termination and in each junction box. Color code shall be specified by the Contractor at the time of shop drawings and shall be consistent throughout all fire alarm systems. Color code shall be listed on all shop and as-built documentation/drawings.

3.05 ELECTRICAL SERVICE FOR INSTALLATION OPERATIONS

A. Contractor may use any existing electrical service, outlet or system available. Contractor shall not assume that evidence of existing outlets implies energized circuits.

B. When electrical service is not available, Contractor shall provide his own electrical supplies from generators or other suitable service.

C. Contractor shall provide all necessary cords, leads, generators and other necessary equipment to perform necessary work.

3.06 CEILING AND/OR WALL DEVICE INSTALLATIONS

A. All installations of ceiling devices including smoke detectors, horns and strobes and where installed in a suspended lay-in ceiling shall be provided with a ten foot coil of wire. The wire coil shall be secured at the floor/roof deck level just prior to the device drop using a “lose secured wire tie” so as not to crimp wire shields. In the case of minimal space above a suspended cei ling, the coil shall be secured to a bridle ring or other approved mounting point.

3.07 FIRE ALARM CONTROL PANEL INSTALLATION.

A. All field wiring within the fire alarm control panel shall be dressed and cornered. Wiring shall be run parallel with 90 degree bends for directional changes. Wire ties shall not be used to restrain wire bundles. Wire straps if applied shall not compress wiring jackets.

3.08 VISUAL STROBE SYNCHRONIZATION

A. All visual strobe devices that are within the same viewing area must be in synchronization. The contractor and equipment vendor shall provide a design and installation that meets the requirements of NFPA 72, Section 7.5.4.3.2.

PART 4 - BUILDING SYSTEM DESCRIPTIONS

4.01 SEQUENCE OF OPERATIONS

A. Upon any alarm:
   1. All audio and visual alarms to sound throughout the building upon any initiating alarm device i.e. water flow, manual pull station, smoke detector, extinguishing system, etc.
   2. Annunciate specific device or zone in common plain English at the Fire Alarm Control Panel, printer and remote annunciators in plain English description. Annunciation descriptors shall be the standard terminology used by the State of Delaware the specific building and for each area within the building. Descriptors shall not be abbreviated. All terminology and descriptors shall be approved by the State of Delaware Liaison Representative at the time of shop drawings.

3. Cause transmission of an alarm signal to the owner's representative, Security Instruments. Coordinate with owner.
4. Deactivate electro-magnetic door hold open devices.
5. Output fan shut-down if affected air handler is involved.
6. Activate other outputs as required by design.
7. Note: A general alarm device signal is any device signal that is not identified as a special or supervisory device signal.

B. Special systems may require a special operation sequence.
1. The fire alarm should be programmed to permit a fire drill sequence. The system should be programmed in such a way so as to allow Owner to run a fire drill on any selected floor without interfering with other floors, elevators, smoke control or other alarm control features.
2. For each fire suppression system or fire extinguishing system.

C. Activation of any supervisory or trouble alarm shall cause the following:
1. Annunciate specific device or zone in common plain English at Fire Alarm Control Panel, printer and remote annunciators in plain English description. Annunciation descriptors shall be the standard terminology used by the State, for each area. Descriptors shall not be abbreviated. All terminology and descriptors shall be approved by the State Liaison Representative at the time of shop drawings.
2. Cause transmission of the supervisory or trouble alarm signal to the owner's representative, Security Instruments. Coordinate with owner.

4.02 SPARE CAPACITY AND PARTS

A. Each building system (3) shall be designed and installed with a specified spare capacity (meaning that all cards, modules, power supply, programming and other related head end equipment installed in the control panel) after completion of the system as follows:
1. Spare signal circuits 2 per building
2. Spare output relays 6 per building

B. The Contractor shall include per system, in their base bid the following "installed as spares" parts and devices to be used at the Owners discretion only. The purpose of these spare installed devices is to assure that the base bid price is sufficient to cover most intangible device placements for the proposed building renovations.
1. Manual Pull Stations - 1 of each type used on the project
2. Monitor Modules - 2 of each type used on the project
3. Control Modules - 1 of each type used on the project
4. Smoke Detectors -2of each type used on the project
5. Duct Smoke Detectors - 1 of each type used on the project
6. Heat Detectors - 1 of each type used on the project
7. Audio Device - 2 of each type used on the project
8. Visual Device - 2 of each type used on the project
9. Note: Spare duct smoke detector as listed above shall include the duct detector housing, detector test switch and interface module.

C. In addition to the spare devices and parts listed in section 4.2B, the contractor shall include in their base bid the cost to provide all manufacturer's recommended spare parts and devices. At a minimum, the Contractor shall provide at the final acceptance testing the following spare parts and devices:
1. Manual Pull Stations - 1
2. Monitor Modules - 1
3. Control Modules - 1
4. Smoke Detectors - 1
5. Duct Smoke Detectors - 1
6. Heat Detectors - 1
7. Audio Device - 1

8. Visual Device - 1
9. Note: Spare duct smoke detector as listed above shall include the duct detector housing, detector test switch and interface module.

D. All spare parts shall be listed on all inventory lists and each spare part shall be labeled for the specific system or component it is intended.

E. All secondary power supplies (batteries) shall be calculated in accordance with manufacturer's recommendations and include design spare capacity. Battery size shall be increased by 20% above minimum calculation.

PART 5 - ACCEPTANCE TESTING AND DOCUMENTATION

5.01 GENERAL

A. All fire alarm systems, component parts, and supervisory functions shall be subject to an acceptance test to be conducted by the Contractor but at the direction of the Delaware Army National Guard's Liaison Representative. The system shall be completely operational, finished and ready for acceptance testing in accordance with anticipated project schedule.

B. The Delaware Army National Guard shall be notified 15 working days prior to any acceptance test with the specific date, time and system being tested.

C. All approvals (with the exception of the acceptance test approval) required by these specifications shall be completed and submitted with the notification of acceptance test date. This includes the following groups: Authority Having Jurisdiction, Delaware Army National Guard.

D. Prior to acceptance test submit manufacturer's descriptive literature of actual equipment installed and the following:
1. Equipment installation manual.
2. Equipment and device operating instructions manual.
3. Equipment maintenance and programming manuals.
4. Equipment/system service and repair data manual.
5. Parts lists.
6. Spare equipment and inventory list.
7. Testing and maintenance schedule as per requirements of this document.

E. All as-built completed drawings required by these specifications shall be completed and submitted with the notification of acceptance test date.

F. All Contractor field testing and manufacturer testing documentation as required by these specifications shall be submitted with the notification of acceptance test date.

G. Contractor shall provide three complete manuals of "the specific" fire alarm and detection system being tested. The manuals shall document all components of the system identified by unique number, consistent with the shop drawings and "as- built" drawings.

H. Contractor shall provide all documentation, testing and inspection items as identified under these specifications in bounded and labeled three-ring binders with zippered ends. Each binder shall be labeled on the cover indicating the fire alarm systems and building being documented as follows: (XXX represents the building number)

BBTS Building XXX

Fire Alarm & Detection System

I. Each section of the manuals shall be arranged with section tags and documentation as follows:
1. Project cover sheet listing project name, contractor, vendor, and consultant.
2. Manual index.
3. Service Directory.
4. Fire Alarm System Approvals which shall include:
   a. Copy of Fire Marshal Application for fire protection plan review, completed and marked paid.
   b. Copy of Fire Marshal's Office plan approval form.

c. Copy of Fire Alarm Signaling Systems Company License.
d. Copy of NICET Certification, certificate of technician.
e. Original of NFPA 72 Fire Alarm System Certification and Description.
f. Copy of Fire Marshal's System Inspection and Final Approval Form.

5. Narrative of system description and operation.
6. System installation and service manual. (Note that these are two separate documents.)
7. Equipment inventory list, with unique identifier labels for each device. Include equipment data sheets.
8. Parts list of all components, modules, devices, wiring harness, and cross referenced with unique identifier number/label.
9. Divider section labeled "Punch List Items".
10. Manufacturer/vendor system testing. This section shall contain all installation, check-out and acceptance testing data as per these specifications.
11. Two year warranty and test schedule.
12. Wire list.
13. Alarm and Supervisory Zone Listing; as worded on actual plain English descriptors.
14. As-built drawings. To be installed in protective clear plastic sleeves. One drawing per sleeve.

J. At the conclusion, the Contractor shall document each part or test result from the acceptance test in a form suitable for installation into the required three-ring zippered binder. It is recommended that the test data collected in the acceptance tests be performed and documented during the Contractor's system check-out and documented in the binder prior to delivery to the Delaware Army National Guard. If this recommendation is accepted, acceptance test will be performed much faster and any delays in release of final payment will be avoided.

K. The Delaware Army National Guard acceptance of system shall not be completed until all faults, malfunctions and documentation as required by these specifications have been completed and delivered and than verified by the State of Delaware Liaison Representative.

L. Prior to acceptance testing the Contractor shall purchase and install a documentation cabinet adjacent to the primary fire alarm panel. This documentation cabinet shall be keyed alike with the fire alarm panel and shall be large enough to contain a complete set of documentation as described in these specifications. The cabinet shall be the same color and match the fire alarm panel.

5.02 FIRE ALARM SYSTEM TESTING

A. The fire alarm system shall be tested in accordance with the guidelines set forth in these specifications and NFPA 72. All testing shall be documented in report form to the Delaware Army National Guard Liaison Representative in accordance with these specifications. Documentation and testing shall consist of each item noted in NFPA 72 and the following:
1. Stray voltages between circuit conductors and ground. Verify compliance on as-builts.
2. Ground faults on all conductors other than those intentionally and permanently grounded should be tested for isolation from grounding using an isolation testing devices such as a "megger". Documentation of "megger" testing shall identify each conductor in note form on as-builts or in ledger form identifying tested conductors and test results.
3. Short circuits on all conductors other than those intentionally and permanently connected together for conductor-to-conductor isolation. To be verified on as-builts.
4. Measure and record on as-builts loop resistance with each circuit pair short-circuited at the far end of the circuit with an ohmmeter and record the resistance on each circuit as shown on the as-builts.

B. Manufacturer's representative check. Prior to placing power to the system, a Manufacturer's representative check-out shall be conducted and verified in writing to the Delaware Army National Guard Liaison Representative. The report shall contain the following, but shall not be limited to:
1. A complete list of equipment installed and wired.

2. Indicate that all equipment is properly installed and conforms to the manufacturer's requirements and these specifications.
3. Test individual devices in accordance with NFPA 72 acceptance test criteria.
4. Technician's name, manufacturer certification, and date.
5. Test of individual inputs and outputs for intended function and supervision.
6. Test to verify the functional operation of the central monitoring point and remote annunciators individually and as a complete system under the following conditions:
   a. Normal operational condition
   b. Alarm condition
   c. Under primary power failure
7. Test and demonstrate proper coordinated interfaces with HVAC, suppression and extinguishing systems and any other interfaced system or device, under the following conditions:
   a. Normal operational condition
   b. Alarm condition
   c. Under primary power failure
   d. Output function features
8. Measure, adjust, and record each smoke detector (including duct smoke detection and beam detection), to its medium sensitivity setting. This must be performed at the operational location of the unit and under normal environmental conditions. The sensitivities shall be recorded with serial number, location number and model number for each detector. Confirm that smoke detectors are within their UL listed sensitivity production window. All sensitivity testing shall be recorded in the documentation or as- builts. All sensitivity recordation shall be in "percent per lineal foot light obscuration", not voltage, using an approved smoke detector sensitivity testing apparatus as listed by the manufacturer.
9. Confirm and document that all alarm point annunciation descriptors are correct, in compliance with shop drawings, presented in plain unabbreviated English, and are annunciated to all remote annunciators and printer as required by these specifications.

C. Upon completion of fire alarm testing, the Contractor and respective Manufacturer's authorized field engineer shall conduct functional and instructional tests for the State of Delaware Liaison Representative.

D. Acceptance testing shall be specified by the contractor (see requirements 5.2.4). The Contractor shall develop an outline for approval by the Delaware Army National Guard Liaison Representative, but at a minimum, the testing shall be as follows:
   1. Confirm all documentation has been received:
      a. As-builts - check accuracy
      b. plan views
      c. riser diagram
      d. panel drawings
      e. battery calculations
      f. Disk labeled
      g. Manual - check content
      h. system descriptions
      i. parts list
      j. spare parts inventory
      k. device cut sheets s installed
      l. schedule for first year's maintenance and testing
      m. testing documentation of devices and system
   2. Inspect panel for installation, power, etc.
   3. General walk-down of devices to identify any missing device or obvious problems.
   4. Test horn circuits for audio level with dB measurements.
   5. Test of battery back up including:

a. full load test for five minutes
b. test and record voltage during full load test
c. test and record amps during full load test
d. test and record recharge amp rating
e. test and record battery draw during normally standby mode in amps
f. test and record battery recharge voltage no load = vac
g. test and record battery recharge voltage with load = vac

6. Test of primary power including:
   a. voltage = vac/vdc
   b. circuit breaker tagged and locked open
   c. surge protection under full load after system has been operating on secondary power for 24 hours
7. Audio and visual circuit amp loads.
   a. circuit #1 = amps
   b. circuit #2 = amps
   c. etc.
8. Inspect panel boards for faults.
9. Check spare capacity of system.
10. Check supervision of all circuits, signal and detection.
11. A random sample test of detection and pull station devices for function, supervision and proper installation.
12. Confirm English descriptors and labels for zones.
13. A random inspection of junction boxes, terminal/splice point boxes, conduit, wiring and general installation features. Looking for workmanship and specification issues.
14. Copies of hard and magnetic media of software.
15. Additional tests as required by individual system design or arrangement for each fire suppression system, fire extinguishing system and fire pump system.

E. The Contractor shall be responsible to conduct all acceptance testing with the Contractor's calibrated equipment, in the presence of the Delaware Army National Guard Liaison Representative. The Contractor shall submit at the time of acceptance testing, notification and an outline similar to the one listed in 5.2.4 for approval by the Delaware Army National Guard Liaison Representative.

F. At the conclusion, the Contractor shall document each part or test result from the acceptance test in a form suitable for installation into the required three-ring zippered binders.

G. Owner Instruction

H. Contractor or Manufacturer shall provide the Delaware Army National Guard's Liaison Representative, maintenance personnel and others with a minimum of four hours of formal instruction on the operation, maintenance, service and testing of the fire alarm system, devices and related building interfaces. The instruction shall be scheduled after acceptance testing but prior to final payment.

I. Contractor and/or Manufacturer shall provide to the Delaware Army National Guard Liaison Representative an instructional outline for each class with all visual aids. All classes shall be structured consistently with traditional educational standards with performance objectives and testing for all participants. Each student shall receive an instructional certificate indicating number of hours of instruction and satisfactory completion of the course.

PART 6 - WIRING AND CONDUIT

6.01 GENERAL CONDITIONS

A. This section "General Conditions" shall be used when in conjunction with the specific requirements of Parts 1, 2, 3, 4, 5 and 7. In case of conflicting information, the specific requirements of Parts 1, 2, 3, 4, 5, and 7 shall prevail, but in no case shall any equipment, material or workmanship be less than that specified in Part 6.

B. Contractor shall conceal all conduit and wiring above ceilings unless noted otherwise on drawings. The decision to allow exposed conduit and/or wire molding shall be reviewed with the Delaware Army National Guard Delaware Liaison Representative at the time of design and shop drawings. Any exposed conduit, wiring or wire molding shall be clearly annunciated by the Contractor through the use of color code or other annunciation method on the shop drawings so that it can be easily identified for approval during shop drawing review.

C. All wiring, conduit, junction boxes, terminal blocks, back boxes and like equipment used for or as part of the specified fire alarm system shall be approved for use in fire alarm service by UL and shall be consistent with the appropriate NFPA code and the NEC.

D. Terminations, splice connections and all other connections shall be made by the use of UL listed compression terminal strips as approved by the Delaware Army National Guard Liaison Representative. No wire nuts or crimp connection devices will be approved. When terminal strips are added to devices that incorporate a pig tail, the terminal strip shall be securely mounted with mechanical fasteners (no double back tape) in the back box or on the back of the fire alarm device.

E. All end-of-line resistors shall be landed on terminal strips mounted into back boxes or other appropriate electrical enclosures. All end-of-line device leads shall be insulated from short conditions by use of standard wire insulation material or approved heat treated wire insulation. No electrical tape will be permitted.

F. All conduit, devices and other system components that are installed in areas subject to unconditioned atmospheres, moisture, watering, rain or drainage shall be installed using approved water resistant and water tight conduit, enclosures and like equipment.

G. All installations of each system component and its associated equipment and wiring shall be in strict accordance with the manufacturer's recommendations and instructions and these specifications.

H. Provide and tag conductors at all junction and terminal points and identify by same number on all shop drawings.

I. All conduit, cable, outlet and mounting boxes required as part of mounting arrangements shall be color-coded red if not in public area.

J. Provide power supply wiring to system components from building electrical panel emergency circuits. The primary power supply shall be taken from an existing emergency circuit that is supplemented by the building's emergency generator. Circuit breaker shall be sized in accordance with system demand and the NEC. Branch circuit breaker shall be clearly labeled for fire alarm service, contiguous to the circuit breaker toggle switch and the toggle switch shall be provided with a lock to prevent accidental movement.

K. Provide all low voltage signal wiring for systems specified herein in a workmanlike manner. Provide system raceways in accordance with manufacturer's requirements for installation of system's wiring. Provide and tag conductors at all junction and terminal points and identify by same number on all shop drawings. All conduit, cable, outlet and mounting boxes required as part of mounting arrangements shall be color-coded red if not in public area.

L. Protect exposed wiring above hung/suspended ceiling construction from physical damage where necessary by conduit, guard strips or other approved means. Install all drops to wall devices in conduit or Greenfield unless fished. Properly support low voltage cables and conduit from the structure by the use of Bridle Rings. At those points where the wire descends below concrete/steel structure, the wire must be provided with adequate strain relief which is designed not to cut or ground cable shields (no wire ties). The wire shall descend plumb to the device or transition. Secure cable in place at intervals not exceeding 4-1/2 feet and within 12 inches from every cabinet, box or device. Cable stress relief shall be required for all connections to devices and boxes.

M. In running plenum cable not in conduit, all bridle rings running parallel with red steel shall be turned up on the bottom flange of red steel so as the wire run is on top of the bottom flange and

cradled by the bottom flange. Where intersecting beams must be crossed, the wire run shall be routed as follows:

1. When a corrugated steel flute is available about the red steel, the wire shall be routed through the flute, over top of the steel beam.
2. When a corrugated steel flute is not available, the wire run shall be taken under the intersecting beam and held off the beam by bridle rings on each side.

N. When any wire run transitions from above a suspended or hard ceiling, into a room or area which has no ceiling and is above 7 feet above the floor, the entire wire run shall be run in EMT through the entire room or until the EMT terminates within a junction or back box. The intent of this requirement is to not permit any exposed plenum wire in areas without ceilings.

O. Provide all wiring within air handling plenum areas in conduit, and extend three feet beyond and outside of plenum.

P. All wiring for a system shall be in accordance with Articles 725, 760 and 800 of the NEC and local electrical codes and authorities having jurisdiction.

Q. Provide all fire alarm wiring in separate raceways.

R. Be responsible for assuring that conduit size and wire quantity, size and type are suitable for the equipment and conditions as they exist. Review the proper installation of each type of device with the equipment supplier. Make final connections between the wiring and equipment under the supervision of equipment manufacturer's certified technician and NICET person in charge.

S. Be responsible to seal all floor and wall penetrations with approved materials which will provide the equivalent fire resistive rating as that of the wall, floor or ceiling that was penetrated. Contractor shall also be responsible to re-seal or repair any access ways or penetrations made through draft stops or fire stops with materials and workmanship which equals the original intended fire rating of the draft stop.

PART 7 - SPECIAL CONDITIONS

7.01 DEVICE DEMARCATION

A. Each and every alarm initiating device, supervisory device, monitoring device, control panel and junction box shall be provided with a unique number which shall be intended to specifically identify that item uniquely within its parent system. The unique number shall be clearly marked on the face of the device so as to be visible from 10 feet from a normal visual position. The type and style of unique label shall be approved by the Delaware Army National Guard prior to installation. It shall be a type of label that will survive for a minimum of 10 years under installed conditions.

B. The unique number shall be an identifier within a logical system and numbers shall be assigned in a logical and systematic order.

C. The unique number shall be shown on all shop drawings and other documentation that annunciates, describes or documents said item. This would include inventory listing, materials lists and manuals.

7.02 SOFTWARE AND PROGRAMMING

A. Copies and adequate, explanatory documentation of all software and programming used in any fire alarm system shall be provided to the Delaware Army National Guard at the time of acceptance testing.

B. The Delaware Army National Guard shall own all software and programming both hard copy listing and digital media that is part of the operational, updating, renovation and maintenance need of the system. Software in a hard copy listing and magnetic media acceptable to the compatibility of the equipment supplied by the Contractor.

C. If it is a condition of the Contractor or Manufacturer to require licensing of any software or programming, the Contractor and/or Manufacturer shall provide such licensing to the Delaware Army National Guard as part of this project. Cost of such licensing shall be part of the base bid package.

D. The Delaware Army National Guard shall have the right to modify, use or reproduce for his own use, any software or programming which is part of this project.

---- END OF SPECIFICATION ----