ADDENDUM NUMBER 1

July 27, 2018

Project: Improve Kentland Facilities
IFB No. VT-229-17830-002
Blacksburg, Virginia 24061

TO ALL BIDDERS:

GENERAL: Addenda are part of the Contract Documents and are issued to amend or interpret the Drawings and Specifications. The Addenda shall be acknowledged in the Bid Form in the space provided for addenda acknowledgement.

Addenda list items by Drawings and Specifications. However, only specification items are referenced to Sections. Drawing changes, as well as Specification changes, described in Addenda shall include all Work required by the various trades involved to effect the changes described.

CHANGES AND CLARIFICATIONS – GENERAL:
1. Pre-bid Attendance List is attached.
2. All pre-bid RFI’s and their responses are attached.

APR SPECIFICATIONS

1. SECTION 264113 – LIGHTNING PROTECTION FOR STRUCTURES:
   A. ADD NEW SECTION IN ITS ENTIRETY.

APR DRAWINGS: NONE

BETR SPECIFICATIONS: NONE

BETR DRAWINGS

1. DRAWING P001-BETR – PLUMBING – LEGEND, NOTES AND SCHEDULES:
   A. Delete “BW-1” from Plumbing Equipment Schedule. There is no boot wash for this building.

2. DRAWING P101-BETR – PLUMBING – FLOOR PLAN:
   A. Add tag “JS-1” to plumbing fixture shown on middle right hand side of plan, near the electric water cooler. The plumbing fixture in the Janitor’s Closet is a floor-mounted service sink, scheduled as JS-1 on Sheet P001-BETR.
3. **DRAWING P401-BETR – PLUMBING – ENLARGED FLOOR PLAN:**

   A. Change “FD-1” to “FD-2” on enlarged plan #1 “BETR ENLARGED MECHANICAL ROOM BELOW SLAB” and on enlarged plan #2 “BETR ENLARGED MECHANICAL ROOM PLAN”. The two floor drains in the mechanical room should be FD-2. Note that FD-2 is scheduled on P001.

   B. Add “HB-1” to mechanical room. Provide hose bibb in 3/4” piping serving wall hydrant WH-1 (bottom right side of mechanical room near double doors). Refer to enlarged plan #2 “BETR ENLARGED MECHANICAL ROOM PLAN”. Note that HB-1 is scheduled on Sheet P001-BETR.

   C. Add “WH-2” beneath lavatories in the men’s toilet room and the women’s toilet room. Typical of one per toilet room. Locate at 18” above finished floor between LAV-1 and LAV-2 in each toilet room. Provide with 1/2” cold water piping connection. Note that WH-2 is scheduled on P001-BETR. Refer to enlarged plan #4 “BETR ENLARGED TOILET PLAN”.

   D. Add one floor drain to each of the two toilet rooms. Floor drains shall be “FD-1”. Use 3” below grade sanitary pipe and 2” vent pipe in toilet room wall.

4. **DRAWING E101-BETR – ELECTRICAL PLAN:**

   A. Replace E101-BETR to show revised locations of the WAPs.

5. **DRAWING E603-BETR – ELECTRICAL SCHEDULES AND DETAILS:**

   A. Lighting fixtures 6A, 8, 8B, 13,14, and 15 are not used.

**MRL SPECIFICATIONS:**

1. **SECTION 284621 – FIRE ALARM:**

   A. ADD NEW SECTION IN ITS ENTIRETY.

**MRL DRAWINGS**

1. **DRAWING C101-MRL – SITE LAYOUT AND UTILITY PLAN:**

   A. Add General Note: “STEEL CATTLE FENCE FOR TRANSPORT, 20’ DOUBLE SWING GATE, 16’ DOUBLE SWING GATE, AND FENCING AT SHAEFER STORAGE AREA IS OWNER FURNISHED, CONTRACTOR SINTALLED.”

   B. Revise note reading “SHAEFER STORAGE AREA” TO “FENCED SHAEFER STORAGE AREA.”
2. **DRAWING A403-MRL – RAILING DETAILS:**
   A. Add General Note “ALL RAILS DETAILED THIS SHEET ARE OWNER FURNISHED, CONTRACTOR INSTALLED.”

3. **DRAWING P001-MRL – PLUMBING LEGEND NOTES AND SCHEDULES:**
   C. Add “FS-1” to Plumbing Fixture Schedule. FS-1 is floor sink in Autoclave Room as shown on Sheet P102-MRL. Schedule should read:
   
   “JOSAM #49320A-NB-4 FLOOR SINK, 12” SQUARE TOP, 6” DEEP, CAST IRON WITH ACID RESISTING INTERIOR COATING, DOUBLE DRAINAGE FLANGE WITH WEEPHOLES, INTERNAL DOME STRAINER. STRAINER SHALL BE NICKEL BRONZE 3/4 GRATE (OPENING FOR PIPE DISCHARGE) WITH 1/2" SLOT WIDTH. THIS FLOOR SINK SHALL BE INSTALLED FLUSH WITH FINISHED FLOOR. FLOOR SINK SHALL HAVE 3” DRAIN TO SANITARY.”

4. **DRAWING P102-MRL – PLUMBING SECOND FLOOR PLAN:**
   A. Change floor drain “FD-3” to “FD-2”. The four floor drains on the Mechanical Platform are scheduled as FD-2 on Sheet P001-MRL.

5. **DRAWING M002-MRL – MECHANICAL DETAILS AND SCHEDULES:**
   A. Airflow Measuring Station (AFMS) Schedule is shown on two different sheets. Delete the AFMS Schedule from Sheet M002-MRL and keep the schedule on Sheet M001-MRL.

6. **DRAWING M102-MRL – MECHANICAL FLOOR PLANS:**
   A. Clarification: The building uses two hydronic heating water pumps “HWP-1” and “HWP-2”. Any references to “BP-x” (boiler pump) or “P-x” (heating water pump) should be considered as HWP-1 or HWP-2. The clarification is for all mechanical sheets.

7. **DRAWING E602-MRL – ELECTRICAL SCHEDULES:**
   A. Light fixtures 6 and 8 are not used.

**ALL OTHER TERMS, CONDITIONS, AND DESCRIPTIONS REMAIN THE SAME. THE BID DUE DATE AND TIME REMAIN AUGUST 8, 2018 AT 4:00 PM. THE BID OPENING DATE AND TIME REMAIN AUGUST 9, 2018 AT 4:00 P.M.**

**END OF ADDENDUM NUMBER 1**
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Date: 7/17/18

Project: IMPROVE KENTLAND FACILITIES
        VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
        BLACKSBURG, VIRGINIA (PC#229-17830-000)
        IFB # VT-229-17830-001

The following question concerns Drawing Sheet (number): ________________________________:

________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________

The following question concerns Specifications Section (number)______, page ________, paragraph _____:

Spec 260523-4 3.5 B

1. Is Lightning protection required for APR, MLR, BETR
   There is a specification but is not shown on prints

Spec 260526-4 3.5 G

2. Is a ground ring counterpoise required for these
   Buildings? There is a specification but are not
   shown on prints.

Question submitted by:  Stephen Baber     Varney, Inc.
                        Name                             Organization

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guilliams
sguilliams@spectrumpc.com

Spectrum Design response:
1. Provide lightning protection per specifications.
2. Provide ground per specifications.
DGS-30-272
(Rev. 04/15)

PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA (PC #229-17830-000)
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) E602-MRL Fixture Schedule

Fixture type 8B is specified as 'monopoint' on the fixture schedule. On drawing E103-MRL, note #1 indicates to provide and install track sections. Please clarify which is to be provided.

Also note that the same contradiction appears on the drawings for the APR facility.

The following question concerns Specification Section (number)_________ , page _________ , paragraph _________

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #101
Name Organization MESC RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guilliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Provide Monopoint for MRL
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA (PC #229-17830-000)
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) ___________ MRL Electrical Drawings

Please provide a disconnect schedule for the MRL facility similar to that provided on the APR and BETR drawings.

The following question concerns Specification Section (number) ___________, page __________, paragraph __________

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #102
Name Organization MESC RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guiliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Disconnect information for the MRL facility is listed on the one-line diagram, sheet E601.
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
        VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
        BLACKSBURG, VIRGINIA (PC #229-17830-000)
        IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number)

_________________________________________________________
_________________________________________________________
_________________________________________________________
_________________________________________________________

The following question concerns Specification Section (number) ________, page ________, paragraph ________

Please provide a fire alarm system specification for the MRL facility.

_________________________________________________________
_________________________________________________________
_________________________________________________________
_________________________________________________________

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #103
Name Organization MESC RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guiliams sguiliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Will be provided as part of Addendum.
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA (PC #229-17830-000)
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) E101-MRL

Regarding raceways for the telephone / data outlets:
General note #21 indicates to 'provide a 1" conduit and stub above accessible ceiling'
General note #22 indicates to 'route conduits from outlet shown to the demarcation point'
Which is required, stub-ups or a complete raceway system?

Note: These notes, numbered differently, also appear on the APR and BETR drawings.

The following question concerns Specification Section (number) __________, page ________, paragraph ________

__________________________________________________________________________________________

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #104
Name Organization MESC RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guiliams sguiliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Conduit shall stub above accessible ceiling. Contractor shall route cables from outlet shown to demarcation point.
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
          VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
          BLACKSBURG, VIRGINIA (PC #229-17830-000)
          IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) ___________ E603-BETR and E102-BETR

The fixture schedule indicates to provide fixture type 1 with a low voltage dimming operator. The floor plans
do not appear to indicate dimming controls only toggle switches are shown for these fixtures. Please
clarify what is to be provided.

The following question concerns Specification Section (number) ___________, page __________, paragraph __________

Question submitted by: Jeffrey A. Wade  Mays Electric Service Corporation
Name Organization
#105 MESC RFI

Bidders shall submit form to Jackie Mayrosh imayrosh@spectrumpc.com and Sonya Guilliams
sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Fixtures will not require the dimming operator for the BETR only.
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA (PC #229-17830-000)
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) E603-BETR and E102-BETR

The fixture schedule indicates that type 1 is to be pendant mounted. Please provide a stem length or mounting height above grade.

The following question concerns Specification Section (number) ________, page ________, paragraph ________

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #106
Name Organization MESR RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guilliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Mount with the bottom of the fixture flush with the bottom of the truss.
PREBID QUESTION FORM  
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES  
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY  
BLACKSBURG, VIRGINIA (PC #229-17830-000)  
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) E101-BETR

General note #1 indicates that the Arena area is to comply with NEC Article 547 and shall be considered a corrosive atmosphere. The note further states to utilize rigid galvanized conduit and fittings in the Arena.

NEC Article 547.5(A) does not include rigid galvanized conduit as an acceptable wiring method for a corrosive atmosphere. Please review and advise wiring method to be used.

Note: This situation also occurs on the APR facility.

The following question concerns Specification Section (number) , page , paragraph

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #107

Name Organization MESC RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guilliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
NEC Article 547.5(A) includes several types, "or other cables or raceway suitable for the location, with approved termination fittings, shall be the wiring methods employed".
NEC Article 344.10(A)(1) states that "Galvanized steel and stainless steel shall be permitted under all atmospheric conditions and occupancies". Utilize Galvanized steel RMC for the Arena.
PREBID QUESTION FORM

(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA (PC #229-17830-000)
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) E101-BETR
Please advise / clarify NEMA rating required for device enclosures located in the Arena area.
(Duplex receptacles in the area are only indicated as WP, having a standard weatherproof metallic cover.)

Note: This situation also occurs on the APR facility.

The following question concerns Specification Section (number) ________, page ________, paragraph ________

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #108
Name Organization MESC RFI

Bidders shall submit form to Jackie Mayrosh imayrosh@spectrumpc.com and Sonya Guilliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Provide a NEMA 4 rated enclosure for these devices.
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA (PC #229-17830-000)
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) E601-APR

Please provide a specification for the EXIT lights to be provided on this portion of the project.

The following question concerns Specification Section (number) , page , paragraph

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #109

Name Organization MESC RFI

Bidders shall submit form to Jackie Mayrosh imayrosh@spectrumpc.com and Sonya Guilliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Utilize Exit Sign-Lithonia LVSRW MVOLT4X
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA (PC #229-17830-000)
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) ____________________________ E101-APR
Please clarify the operation of fixture type 1 with the night light designation.

Typically a NL designation indicates that the fixture is to operate at 100%, 24/7, unswitched. These fixtures are
shown connected to a wall mounted dimmer. Example: Circuit A-8 in the Headlocks area has four type 1 fixtures,
two are night lights. If the nights operate 24/7 then that circuit will have two fixtures operating at 100% and two
that are operating at whatever the dimmer is set at. If the two night light fixture are to be dimmer controlled
then when the dimmer is set to the ‘off’ position there is no light.

The following question concerns Specification Section (number) ________________, page ____________, paragraph _____

Question submitted by: Jeffrey A. Wade  Mays Electric Service Corporation  #110
Name  Organization  MESC RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guilliams
sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Remove night lighting function from fixtures. Emergency function shall remain for lights indicated em. move switch for lighting fed from circuit A-4 to Demonstration area 104, adjacent to Storage 100 door.
Date: July 17, 2018

Project: IMPROVE KENTLAND FACILITIES
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA (PC #229-17830-000)
IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) E101-APR
Please provide a stem length / mounting height for the type 1 light fixtures.

The following question concerns Specification Section (number)
, page , paragraph

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #111
Name Organization

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guiliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Mounts so that the bottom of the fixture is flush with the bottom of the truss.
The following question concerns Drawing Sheet (number) E501-MRL & E502-APR

Regarding the welded wire mesh indicated on the two drawings noted, is this the same mesh that is shown on the structural drawings? It appears that the wire mesh is provided and installed as part of the building reinforcement and that mesh is only indicated on the electrical drawings for purposes of our grounding connections. If the wire mesh on the electrical plans is in addition to the structural materials please provide a specification that defines what material we are to provide.

The following question concerns Specification Section (number) , page , paragraph 


The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:

At the General Contractor's option, the welded wire fabric shown on the APR structural drawings can be used as the equipotential plane reinforcement. At the MRL, a mat of welded wire in addition to the slab reinforcement shall be provided.

Is the responsibility of the General Contractor to ensure all reinforcement is provided and all required connections shown on the electrical and structural drawings are made to construct a complete equipotential plane.
DGS-30-272
(Rev. 04/15)

PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date:    July 24, 2018

Project:  IMPROVE KENTLAND FACILITIES
          VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
          BLACKSBURG, VIRGINIA (PC #229-17830-000)
          IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number)

The following question concerns Specification Section (number) 260526, page ________, paragraph ________

Under the installation specification for section 260526 for all three buildings there is mention of a lightning protection system. I find no other reference in the bid documents to a lightning protection system. Please clarify that either no such system is required or provide a specification for the products that are to be provided.

REVISED 7/25/18: After further review I located the specification for lightning protection in the MRL and BETR specifications but not in the APR specifications. Is lightning protection required for the APR building?

Also, the same spec section indicates to install a ground ring around the building. If no lightning protection system is required is the ring still required?

Question submitted by:  Jeffrey A. Wade  Mays Electric Service Corporation  #113R
                         Name                   Organization                   MESC RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guilliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
Lightning protection specification has been provided for BETR and MRL as specification section 264113 Lighting protection for structures. A similar specification will be provided for APR.
PREBID QUESTION FORM
(Use separate Form for each question submitted.)

Date: July 26, 2018

Project: IMPROVE KENTLAND FACILITIES
        VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
        BLACKSBURG, VIRGINIA (PC #229-17830-000)
        IFB #VT-229-17830-002

The following question concerns Drawing Sheet (number) 263213, page ________, paragraph ________

Regarding the standby generator and automatic transfer switches:
1) Specifications are not clear on the runtime for the fuel tank, 24 or 48 hours?
2) Are both ATS's required to be bypass isolation type? (larger and more expensive) Spec mentions bypass but typically the one-line would indicate what's needed.
3) What is the sound rating required for the generator enclosure? The silencer section mentions 82dBA, does this imply that the entire package needs to meet 82dBA at 23’ under full load?
4) Genset enclosure spec mentions both fixed and automatic louvers. Automatic louvers are rare in this climate, are they required for this project?
5) Is a lighting package inside the generator enclosure required? This is a small generator.

Question submitted by: Jeffrey A. Wade Mays Electric Service Corporation #114
Name Organization MESC RFI

Bidders shall submit form to Jackie Mayrosh jmayrosh@spectrumpc.com and Sonya Guilliams sguilliams@spectrumpc.com

The deadline for submitting bidders questions is 10 calendar days prior to the bid submission deadline.

Spectrum Design response:
1. Provide Generator with 48 hour run time fuel tank.
2. Provide bypass isolation as specified for both ATS's.
3. 82dBA or less at 25' applies to the entire package.
4. Provide generator with fixed louvers. Automatic louvers are not required.
5. A lighting package inside the generator will not be required.
SECTION 264113  
LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lightning protection system for ordinary structures.

B. Section includes lightning protection system for the following:
   1. APR facility.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
   2. Include raceway locations needed for the installation of conductors.
   3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
   4. Include roof attachment details, coordinated with roof installation.
   5. Calculations required by NFPA 780 for bonding of metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Lightning protection system Shop Drawings, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Lightning protection cabling attachments to roofing systems and accessories.
   2. Lightning protection strike termination device attachment to roofing systems, coordinated with the roofing system manufacturer.
   3. Lightning protection system components penetrating roofing and moisture protection systems and system components, coordinated with the roofing system manufacturer.

B. Qualification Data: For Installer.
C. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For lightning protection system to include in maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations. Comply with requirements of Section 017839 "Project Record Documents."

b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

B. Completion Certificate:

1. UL Master Label Certificate.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: UL-listed installer, category OWAY.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ERICO International Corporation
2. Harger Lightning and Grounding
3. East Coast Lightning Equipment

2.2 PERFORMANCE REQUIREMENTS

A. UL Lightning Protection Standard: Comply with UL 96A requirements for Class I buildings.

B. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.3 MATERIALS

A. Air Terminals:

1. Copper unless otherwise indicated.
2. 1/2-inch diameter by 12 inches long.
3. Pointed tip.
4. Threaded base support.

B. Air Terminal Bracing:
   1. Galvanized steel.
   2. 1/2" diameter rod.

C. Class 1 Main Conductors:
   1. **Stranded Copper: 57,400 circular mils in diameter.**

D. Secondary Conductors:
   1. **Stranded Copper: 26,240 circular mils in diameter.**

E. Ground Loop Conductor: Tinned copper.

F. Ground Rods:
   1. Material: Copper-clad steel.
   3. Rods shall be not less than 120 inches long.

G. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet of building. Comply with requirements for concealed installations in UL 96A.

   1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
2. Install conduit where necessary to comply with conductor concealment requirements.

3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Aboveground exposed connections shall be done using the following types of connectors, listed and labeled for the purpose: high compression.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

   1. Perform inspections as required to obtain a UL Master Label for system.

B. Prepare test and inspection reports and certificates.

END OF SECTION
PART 1 – SUMMARY OF WORK

1.1 WORK UNDER THIS CONTRACT

A. The work to be done hereunder includes the furnishing of all labor, equipment and materials for: Providing a complete Simplex 4100ES Addressable Fire Alarm System with Voice at MRL for Virginia Tech, as indicated on the Contract Documents and as specified herein. This includes providing a code compliant system that meets IBC, NFPA 72 and the current version of the Virginia Tech Campus Fire Alarm Design Standards. The installation is to include a complete dedicated raceway with finish to match existing environment.

B. The system shall include addressable initiating devices, addressable 70V speakers with addressable strobes. Color of notification devices are to be provided as determined by owner. Ceiling mounted notification devices shall be used where possible unless otherwise noted herein.

C. If available, the primary 120V input power shall be connected to the nearest available dedicated emergency circuit. Battery backup shall be designed per NFPA 72. All SLC, NAC and 24Vdc circuits shall be Class B. All RUI and Audio Riser circuits to remote transponders shall be Class A. Network cabling to existing Simplex 4120 campus fire alarm network shall be Qty. (6) single mode fibers to the nearest existing network fire alarm control panel.

D. Smoke and Heat Detectors shall be provided for the elevator per BCOM DEB Notice Dated 3/19/09. This includes provisions for elevator recall and shunt trip as well as monitoring current or future sprinkler systems related to the elevator equipment room and elevator pit.

E. Shop drawing submittals shall include: floor plans with device locations and addresses, riser drawing including cabling type and circuit layouts, battery calculations, voltage drops, material list and associated product datasheets. These documents are to be submitted to the responsible Virginia Tech representative whom will submit to the UBO department for permitting and final approval. The shop drawings shall exactly represent the construction drawings without modification.

1.2 CONSTRUCTION SCHEDULE

A. The undersigned understands that time is of the essence and agrees that the time for Substantial Completion of the entire project shall be 120 consecutive calendar days from the date of commencement of the Work as specified in the Notice to Proceed, and Final Completion shall be achieved within 30 consecutive calendar days after the date of Substantial Completion as determined by the Owner.
1.3 CONTRACTOR USE OF SITE

A. The Contractor shall limit his use of the site to the areas indicated under the Contract in order to allow for owner occupancy and use by the public. Portions of the sites beyond areas on which work is indicated are not to be disturbed.

B. Keep existing roads and entrances serving the premises clear and available to the Owner and public at all times. Do not use these areas for parking or storage of materials without prior approval from the Owner.

C. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of office, storage sheds, etc., to the areas agreed upon with the Owner.

D. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use.

E. The Contractor shall issue identification badges to all authorized workers.

F. The school site is classified as a non-smoking/non-tobacco/non-alcohol products area and this policy is to be strictly enforced.

PART 2 – DESCRIPTION AND PRODUCTS

2.1. SYSTEM DESCRIPTION

A. General: Provide a complete, non-coded, addressable/conventional, microprocessor-based fire alarm system with addressable initiating devices, addressable notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory. System shall be capable of storing dual configuration programs with one active and one in reserve. Panel shall be capable of full system operation during a new configuration download.

C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.

D. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the
occurrence. The printout differentiates alarm signals from all other printed indications.

E. Wiring/Signal Transmission:
1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation as required or addressable signal transmission, dedicated to fire alarm service only.
2. System connections for initiating, signaling line circuits and notification appliance circuits shall be Class B.
3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.

F. Remote Access:
1. FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem using the public switched telephone system of a private switched telephone system.
2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
3. FACP shall have the capability to provide third party access through a serial interface connection and be agency listed for specific interfaces and for the purpose.
4. FACP shall have the capability to provide remote access via an Internet/Intranet Interface. The Internet interface shall provide an alternative access to system information using the familiar interface of a standard Internet browser. A remotely located fire professional can use this access to analyze control panel status during non-alarm conditions and can also use this information to assist local fire responders during alarm conditions.

G. Network communication:
1. Network node communication shall be through a token ring configuration.
2. A single open, ground or short on the network communication loop shall not degrade network communications. Token shall be passed in opposite direction to maintain communications throughout all network nodes. At the same time the status of the communication link shall be reported.
3. If a group of nodes becomes isolated from the rest of the network due to multiple fault conditions, that group shall automatically form a sub-network with all common interaction of monitoring and control remaining intact. The network shall be notified with the exact details of the lost communications.
4. The communication method shall be NFPA 72 style 7.
5. Shall provide single mode fiber modems for campus network audio.

H. Required Functions: The following are required system functions and operating features:
1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

2. No interfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.

3. Transmission to Local Monitoring Station: Automatically route alarm, supervisory, and trouble signals to the Truesite Workstation (TSW) in the Virginia Tech Police Department, as well as two other auxiliary TSW’s. All 3 TSW’s must be reprogrammed to include information, site plans, floor plans, etc., as needed to add the new system to the network.

4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the location and type of device.

5. TSW (Truesite Workstation) Maps: After acceptance of the system by the owner, point by point graphic identification and annunciation of all initiating devices shown on floor plans shall be provided.

6. Selective Alarm: A system alarm shall include:
   a) Indication of alarm condition at the FACP and the annunciator(s).
   b) Identification of the device /zone that is the source of the alarm at the FACP and the annunciator(s).
   c) Operation of audible and visible notification devices on the fire floor, floor above and floor below until silenced at FACP.
   d) Selectively closing doors normally held open by magnetic door holders on the fire floor, floor above and floor below.
   e) Unlocking designated doors.
   f) Shutting down supply and return fans serving zone where alarm is initiated.
   g) Closing smoke dampers on system serving zone where alarm is initiated.
   h) Initiation of smoke control sequence through the building temperature control system.
   i) Notifying the local fire department.
   j) Initiation of elevator recall in accordance with ASME/ANSI A17.1, when specified detectors or sensors are activated.
7. Supervisory Operations: Upon activation of a supervisory device such as fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
   a) Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
   b) Pressing the Supervisory Acknowledge Key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
   c) Record the event in the FACP historical log.
   d) Transmission of supervisory signal to remote central station.
   e) Restoring the condition shall cause the Supervisory LED to clear and restore the system to normal.

8. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible [and visible] alarm signals shall cease operation.

9. System Reset
   a) The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-alarming the system. The display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."
   b) Should an alarm condition continue, the system will remain in an alarmed state.

2.2. PRODUCTS

A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."

B. The following FACP hardware shall be provided based on a Simplex 4100ES Platform:
   1. Master Controller with QVGA LCD Display, English User Interface with Raised Keys.
   2. Power Limited base panel with beige cabinet and door, 120 VAC input power.
   3. 2,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
   4. 2,000 points of Network Annunciation at FACP Display when applied as a Network Node.

C. Manual Pull Stations based on Simplex 4099-9004:
   2. Station Reset: Key operated.
3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm.

4. Integral Addressable Module: Arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

D. Analog Smoke Sensors based on Simplex 4098-9714 head and 4098-9792 or 4098-9794 sounder bases:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.

2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.

3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.

4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a CRT Display or printed for annual recording and logging of the calibration maintenance schedule.

5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported [to the Central Monitoring Station]. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit.

6. The FACP shall continuously perform an automatic self-test on each sensor, which will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.

7. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
8. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.

9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

E. Duct Smoke Detectors based on Simplex 4098-9756:
   1. Shall be supplied under this section and installed by HVAC installer.
   2. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.

F. Smoke Detectors: Maintenance and testing service providing the following shall be included with the base bid:
   1. Biannual sensitivity reading and logging for each smoke sensor.
   2. Scheduled biannual threshold adjustments to maintain proper sensitivity for each smoke sensor.
   3. Threshold adjustment to any smoke sensor that has alarmed the system without the presence of particles of combustion.
   4. Scheduled biannual cleaning or replacement of each smoke detector or sensor within the system.
   5. Semi-annual functional testing of each smoke detector or sensor using the manufacturers calibrated test tool.
   6. Written documentation of all testing, cleaning, replacing, threshold adjustment, and sensitivity reading for each smoke detector or sensor device within the system.
   7. The initial service included in the bid price shall provide the above listed procedures on the sixth and eleventh month for a period of one (1) year after owner acceptance of the system.

G. Audible Alarm Notification: By voice evacuation and tone signals on loudspeakers in areas as indicated on drawings.
   1. Automatic Voice Evacuation Sequence:
      a) The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
      b) All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.
H. Speaker: Addressable speaker notification appliances shall be listed to UL 1480. Based on Simplex model 49SVC-WRFIRE, 49SO-APPLW, and 49SVC-CRFIRE
   1. Shall be provided in each dorm room and common living space (if applicable).
   2. The speaker shall operate on a standard 70.7 VRMS NAC using twisted/shielded wire.
   3. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet. Speaker shall be tapped at 2 Watts unless specified otherwise.
   4. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12 kHz for General Signaling.

I. Visual Notification Devices: Based on Simplex 49VO-WRF Wall or ceiling mount.
   1. Shall be addressable type.
   2. Shall be multi-candela 15, 30, 75, 110 or FACP selectable.
   3. Color shall be white or red. Owners preference.

J. Manual Voice Paging
   1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
   2. The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
   3. Facility for total building paging shall be accomplished by the means of an "All Call" switch.

K. Fire Suppression Monitoring and Controlling:
   1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
   2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
   3. Pressure Switch: Activation of low-pressure switch shall initiate system supervisory operations. Activation of high-pressure switch shall initiate general alarm operations.
   4. Suppression System Activation: The FACP shall initiate the activation of all fire suppression systems and be UL, ULC, CSFM listed, FM approved, and CE compliant pre-action/deluge sprinkler or extinguishing release service for single and multiple hazard applications

L. Circuit Capacities:
1. Max limitation on power supplies – The design load placed on the power supply shall not exceed (60) sixty percent of the power supply capacity.

2. Individual signal circuits shall not exceed (60) sixty percent of the card capacity. For voice systems this assumes that all speakers are tapped at their maximum wattage, which is currently 2 watts.

M. Power Requirements

1. The control unit shall receive AC power via a dedicated, emergency, fused disconnect circuit.

2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 10 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.

3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control unit.

4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. A green "power on" LED shall be displayed continuously at the user interface while incoming power is present.

5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.

6. The system shall support NAC Lockout feature to prevent subsequent activation of Notification Appliance Circuits after a Depleted Battery condition occurs in order to make use of battery reserve for front panel annunciation and control.

7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.

8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

N. Spare Equipment

1. Quantity equal to 10% of smoke detectors installed.

2. Quantity equal to 2% of detector bases installed.

3. Quantity 5 of speaker visual devices installed.

4. Quantity 5 of strobe only devices installed.

PART 3 – EXECUTION

1. 1. EQUIPMENT INSTALLATION
a) Heat Detectors in Elevator Pit and Machine Rooms: Coordinate temperature rating, response characteristics, and location with sprinkler rating, response time index (RTI), and location.

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

c) Device Location-Indicating Lights: Locate in public space near the device they monitor.

d) FACP: Flush mount with top of cabinets not more than 72 inches above the finished floor.

2. WIRING INSTALLATION
   a) Install all wiring in a complete conduit system according to the following:
      
      (a) NECA 1.
      
      (b) TIA/EIA 568-A.
   b) Wiring Method: Install wiring in full metal raceway.
      
      (a) Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
   c) Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
   d) Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
   e) Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Paint fire alarm system junction boxes and covers red.
3. IDENTIFICATION
   a) Install instructions frame in a location visible from the FACP.

4. GROUNDING
   a) Ground the FACP and associated circuits.

5. FIELD QUALITY CONTROL
   a) Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
   b) Perform the following field tests and inspections and prepare test reports:

      (a) Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.

      (b) Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a technician certified under the Fire Alarm Systems program at Level III.

      (c) Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.

      (d) Testing: Follow procedure and record results complying with requirements in NFPA 72.

      (e) Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

6. ADJUSTING
   a) Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions.
   b) Follow-Up Tests and Inspections: After date of Substantial
Completion, test the fire alarm system complying with testing and visual inspection requirements in NFPA 72. Perform tests and inspections listed for three monthly, and one quarterly, periods.

7. WARRANTY PERIOD TESTING
   a) During the one-year warranty period, two complete system tests shall be provided and included as part of the initial purchase of the system. The first test shall be done after six months from substantial completion, and the second during the eleventh month. These must be scheduled through the university.

8. DEMONSTRATION
   a) Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices.

END OF SECTION