Project Manual

For

University of South Carolina

USC UPSTATE FIRE ALARM INSTALLATION / CODE ANALYSIS FOR CAMPUS LANDSCAPE BUILDING

USC Project #CP00341990

University of South Carolina
743 Greene Street
Columbia, SC 29208

April 9, 2012

Plans by: Sims Group Engineers, Inc.

TABLE OF CONTENTS

PROJECT NUMBER: CP00341990
PROJECT NAME: USC Upstate Fire Alarm Installation/Code Analysis for Campus Landscape Building

SECTION

TECHNICAL SPECIFICATIONS

(List the technical specifications using the same Divisions numbers and titles as shown on the individual technical specification sections. Provide the issue date and revision number for each section.)

2011 Edition

SE-311
Invitation for Minor Construction Quotes

SCBO NOTES 2, 4 and 5 APPLY TO THIS INVITATION FOR QUOTES

PROJECT NAME: USC UPSTATE FIRE ALARM INSTALLATION/CODE ANALYSIS CAMPUS LANDSCAPE BLDG.

PROJECT NUMBER: CP00341990 **PROJECT LOCATION:** Spartanburg, South Carolina

BID SECURITY REQUIRED? Yes ☐ No ☑

PERFORMANCE BOND REQUIRED? Yes ☐ No ☑

PAYMENT BOND REQUIRED? Yes ☐ No ☑ **CONSTRUCTION COST RANGE:** less than $50,000

DESCRIPTION OF PROJECT:
Installation of Fire Alarm System for Campus Landscape Building.
Small and minority business participation is encouraged.
Vendor accepts responsibility for all downloaded information on USC's website.

A/E NAME: Sims Group Engineers, Inc. **A/E CONTACT:** Brian Boan

ADDRESS: 800 Columbiana Drive, Suite 208 **PHONE:** 803-765-1007 **Fax:** 803-765-1030

CITY: Irmo **STATE:** Sc **ZIP:** 29063 **E-MAIL:** brian@simsgroupusa.com

PLANS ON FILE AT: AGC: DODGE: OTHER:

PLANS MAY BE OBTAINED FROM: http:/purchasing.sc.edu - see Facilities Construction Solicitations & Awards

PLAN DEPOSIT AMOUNT: $0.0 **IS DEPOSIT REFUNDABLE?** Yes ☐ No ☐

PRE-QUOTE CONFERENCE? ☑ Yes ☐ No **MANDATORY ATTENDANCE?** ☐ Yes ☑ No

DATE: 4/24/2012 **TIME:** 10:00am **PLACE:** Facilities Conf. Rm. - 155 American Way, 29303

AGENCY: University of South Carolina

NAME AND TITLE OF AGENCY COORDINATOR: Ann Derrick, Project Manager

ADDRESS: 743 Greene Street **PHONE:** 803- 777-5811 **Fax:** 803-777-8739

CITY: Columbia **STATE:** SC **ZIP:** 29208 **E-MAIL:** aderrick@fmc.sc.edu

IFQ CLOSING DATE: 5/1/2012 **TIME:** 2:00pm **LOCATION:** Fac Conf Rm, 155 American Way

IFQ DELIVERY ADDRESSES:

HAND-DELIVERY:
800 University Way
Spartanburg, SC 29303
Attn: Fred Scott

MAIL SERVICE:
800 University Way
Spartanburg, SC 29303
Attn: Fred Scott

IS PROJECT WITHIN AGENCY CONSTRUCTION CERTIFICATION? *(Agency MUST check one)* ☑ YES ☐ NO

APPROVED BY: _____ _____
(State Engineer) *(Date)*

CP00341990 USC UPSTATE FIRE ALARM INSTALLATION/CODE ANALYSIS FOR CAMPUS LANDSCAPE BUILDING

Instruction to Bidders

1. Construction time is 60 days from the date of commencement to the date of substantial completion. Liquidated damages in the amount of $100 per day will be assessed after the date of substantial completion.
2. **Base Bid:** Include all work and equipment necessary to install fire alarm system in Campus Landscape Building.

End of Section

CERTIFICATION REGARDING ILLEGAL IMMIGRATION (NOVEMBER 2008)

(An overview is available at www.procurement.sc.gov)

By signing your bid, the contractor certifies that you will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina Code of Laws and agree to provide to the State upon request any documentation required to establish either: (a) that Title 8, Chapter 14 is inapplicable to you and your subcontractors or sub-subcontractors; or (b) that you and your subcontractors or sub-subcontractors are in compliance with Title 8, Chapter 14. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." You agree to include in any contracts with your subcontractors language requiring your subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in their contracts with the sub-subcontractors language requiring the sub-subcontractors to comply with the applicable requirements of Title 8, Chapter 14.

Certificate of Independent Price Determination (May 2008)

GIVING FALSE, MISLEADING, OR INCOMPLETE INFORMATION ON THIS CERTIFICATION MAY RENDER YOU SUBJECT TO PROSECUTION UNDER SECTION 16-9-10 OF THE SOUTH CAROLINA CODE OF LAWS AND OTHER APPLICABLE LAWS.

(a) By submitting an offer, the offeror certifies that—

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to—
(i) Those prices;
(ii) The intention to submit an offer; or
(iii) The methods or factors used to calculate the prices offered.

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory—

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this certification; or

(2)(i) Has been authorized, in writing, to act as agent for the offeror's principals in certifying that those principals have not participated, and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this certification [As used in this subdivision (b)(2)(i), the term "principals" means the person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal];

(ii) As an authorized agent, does certify that the principals referenced in subdivision (b)(2)(i) of this certification have not participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this certification; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this certification.

(c) If the offeror deletes or modifies paragraph (a)(2) of this certification, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure. [02-2A032-1]

SE-331
Quote Form

2011 Edition

Quotes shall be submitted only on SE-331

QUOTE SUBMITTED BY: _____
(Offeror's Name)

QUOTE SUBMITTED TO: University of South Carolina
(Agency Name)

FOR PROJECT: CP00341990 *(Number)* USC Upstate Fire Alarm Installation/Code Analysis Campus *(Name)*

OFFER

1. In response to the Form SE-311, *Request for Minor Construction Quotes*, and in compliance with the *Instructions to Bidders* for the above-named Project, the undersigned **OFFEROR** proposes and agrees, if this Quote is accepted, to enter into a Contract with the **AGENCY** in the form included in the Solicitation Documents, and to perform all Work as specified or indicated in the Solicitation Documents, for the prices and within the time frames indicated in the Solicitation and in accordance with the other terms and conditions stated.
2. Pursuant to Section 11-32-3030(1) of the SC Code of Laws, as amended, **OFFEROR** has submitted Bid Security as follows in the amount and form required by the Solicitation Documents:

☐ Bid Bond with Power of Attorney ☐ Electronic Bid Bond ☐ Cashier's Check
(OFFEROR check one, if Bid Security is required)

3. **OFFEROR** acknowledges the receipt of the following Addenda to the Solicitation documents and has incorporated the effects of said Addenda into its Quote:

ADDENDUM No: _____

4. **OFFEROR** agrees that this Quote, including all bid alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of 60 Days following the Quote Date, or for such longer period of time that **OFFEROR** may agree to in writing upon request of the **AGENCY**.
5. **OFFEROR** agrees that from the compensation to be paid, the **AGENCY** shall retain as Liquidated Damages the amount of for each calendar day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted Contract Time for Substantial Completion, as provided in the Contract Documents.
6. **OFFEROR** herewith submits its offer to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fee, permits, licenses and applicable taxes necessary to complete the following items of construction work:

6.1 **BASE BID** _____
(enter BASE BID in figures only)

6.2 **ALTERNATE NO. 1** _____ **to be ADDED/DEDUCTED from BASE BID.**
(circle one)

6.3 **ALTERNATE NO. 2** _____ **to be ADDED/DEDUCTED from BASE BID.**
(circle one)

FEIN/SSN: _____

SC Contractor's License Number: _____

Address: _____

Telephone/Fax _____

E-mail _____

This Quote is hereby submitted on behalf of the Offeror named above.

BY: _____
(Signature of Offeror's Representative)

_____
(Print or Type Name of Offeror's Rpresentative)

ITS: _____

USC SUPPLEMENTAL GENERAL CONDITIONS FOR CONSTRUCTION PROJECTS

1. Contractor' s employees shall take all reasonable means not to interrupt the flow of student traffic in building corridors, lobbies and stairs. All necessary and reasonable safety precautions shall be taken to prevent injury to building occupants while transporting materials and equipment through the building to the work area. Providing safe, accessible, plywood pedestrian ways around construction may be required if a suitable alternative route is not available.

2. Fraternization between Contractor' s employees and USC students, faculty or staff is strictly prohibited-zero tolerance!

3. USC will not tolerate rude, abusive or degrading behavior on the job site. Heckling and cat-calling directed toward students, faculty or staff or any other person on USC property is strictly prohibited. Any contractor whose employees violate this requirement will be assessed a fine of up to $500 per violation.

4. Contractor' s employees must adhere to the University' s policy of maintaining a drug-free and smoke-free/tobacco free workplace.

5. Contractor must sign a Contractor Key Receipt/Return form before any keys are issued. Keys must be returned immediately upon the completion of the work. The Contractor will bear the cost of any re-keying necessary due to the loss of or failure to return keys.

6. A welding permit must be issued by the University Fire Marshall before any welding can begin inside a building. Project Manager will coordinate.

7. Contractor must notify the University immediately upon the discovery of suspect material such as those potentially containing asbestos or other such hazardous materials. These materials **must not** be disturbed until approved by the USC Project Manager.

8. At the beginning of the project, the USC Project Manager will establish the Contractor=s lay-down area. This area will also be used for the Contractor=s work vehicles. No personal vehicles will be allowed in this area, or in any areas surrounding the construction site that are not regular or authorized parking lots. Personal vehicles must be parked in the perimeter parking lots. Parking permits can be obtained at the USC Parking Office located in the Pendleton Street parking garage. The lay down area will be clearly identified to the contractor by the PM, with a sketch or drawing provided to Parking. In turn, the contractor will mark off this area with a sign containing the project name, PM name, Contractor name and contact number, and end date. Where this area is subject to foot traffic, protective barriers will be provided as specified by the PM. The area will be maintained in a neat and orderly fashion. Vehicles parked in the lay down area (or designated parking areas) will be clearly marked or display a CPC furnished placard for identification.

9. Contractor will be responsible for providing its own temporary toilet facilities, unless prior arrangements are made with the USC Project Manager.

10. Use of USC communications facilities (telephones, computers, etc.) by the Contractor is prohibited, unless prior arrangements are made with the USC Project Manager.

11. For all projects over $100,000, including IDC's, an SE-395, Contractor Performance Evaluation, will be completed by the USC Project Manager and reviewed with the GC at the beginning of the project and a copy given to the GC. At the end of the project the form will be completed and a Construction Performance rating will be established.

12. Contractor is responsible for removal of all debris from the site, and is required to provide the necessary dumpsters which will be emptied at least _____ times per week. Construction waste must not be placed in University dumpsters. THE CONSTRUCTION SITE MUST BE THOROUGHLY CLEANED WITH ALL TRASH PICKED UP AND PROPERLY DISPOSED OF ON A DAILY BASIS AND THE SITE MUST BE LEFT IN A SAFE AND SANITARY CONDITION EACH DAY. THE UNIVERSITY WILL INSPECT JOB SITES REGULARLY AND WILL FINE ANY CONTRACTOR FOUND TO BE IN VIOLATION OF THIS REQUIREMENT AN AMOUNT OF UP TO $1,000 PER VIOLATION.

13. **Contractor must provide all O&M manuals, as-built drawings, and training of USC personnel on new equipment, controls, etc. prior to Substantial Completion. Final payment will not be made until this is completed.**

14. Tree protection fencing is required to protect existing trees and other landscape features to be preserved within a construction area. The limits of this fence will be evaluated for each situation with the consultant, USC Arborist and USC Project Manager. The tree protection fence shall be 5' high chain link fence unless otherwise approved by USC Project Manager. No entry or materials storage will be allowed inside the tree protection zone. A 4" layer of mulch shall be placed over the tree protection area to maintain moisture in the root zone.

15. Where it is necessary to cross walks, tree root zones (i.e., under canopy) or lawns the following measures shall be taken: For single loads up to 9,000 lbs., a 3/4" minimum plywood base shall be placed over areas impacted. For single loads over 9,000 lbs., two layers of 3/4" plywood is required.

16. For projects requiring heavy loads to cross walks tree root zones or lawns. A construction entry road consisting of 10' X 16' oak logging mates on 12" coarse, chipped, hardwood base. Mulch and logging mats shall be supplemented throughout the project to keep matting structurally functional.

17. Any damage to existing landscaping (including lawn areas) will be remediated before final payment is made.

18. Orange safety fence to be provided by the contractor. (USC Arborist, Kevin Curtis may be contacted at 777-0033 or 315-0319)

Campus Vehicle Expectations

1. All motorized vehicles on the University campus are expected to travel and park on roadways and/or in parking stalls.

2. All motorized vehicle traffic on USC walkways must first receive the Landscape Manager=s authorization. Violators may be subject to fines and penalties.

3. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.

4. Contractors, vendors, and delivery personnel are required to obtain prior parking authorization before parking in a designated space. Violators may be subject to fines and/or penalties. See Item 10 below.

5. Drivers of equipment or motor vehicles that damage university hardscape or landscape will be held personally responsible for damages and restoration expense.

6. Vehicle drivers who park on landscape or drives must be able to produce written evidence of need or emergency requiring parking on same.

7. All vehicles parked on landscape, hardscape, or in the process of service delivery, must display adequate safety devices, i.e. flashing lights, cones, signage, etc.

8. All drivers of equipment and vehicles will be respectful of University landscape, equipment, structures, fixtures and signage.

9. All incidents of property damage will be reported to Parking Services or the Work Management Center.

10. Parking on campus is restricted to spaces designated by Parking Services at the beginning of the project. Once the project manager and contractor agree on how many spaces are needed, the project manager will obtain a placard for each vehicle. This placard must be hung from the mirror of the vehicle, otherwise a ticket will be issued and these tickets cannot be "fixed". Parking spaces are restricted to work vehicles only; no personal vehicles.

Project Name: USC Upstate Fire Alarm Installation/Code Analysis for Campus Landscape Building

Project Number: CP00341990

University of South Carolina

CONTRACTOR'S ONE YEAR GUARANTEE

STATE OF _____

COUNTY OF _____

WE _____
as General Contractor on the above-named project, do hereby guarantee that all work executed under the requirements of the Contract Documents shall be free from defects due to faulty materials and /or workmanship for a period of one (1) year from date of acceptance of the work by the Owner and/or Architect/Engineer; and hereby agree to remedy defects due to faulty materials and/or workmanship, and pay for any damage resulting wherefrom, at no cost to the Owner, provided; however, that the following are excluded from this guarantee:

Defects or failures resulting from abuse by Owner.

Damage caused by fire, tornado, hail, hurricane, acts of God, wars, riots, or civil commotion.

_____
[Name of Contracting Firm]

*By _____

Title _____

*Must be executed by an officer of the Contracting Firm.

SWORN TO before me this
_____ day of _____, 2____ (seal)

_____State

My commission expires _____

1350

STATE OF SOUTH CAROLINA
DEPARTMENT OF REVENUE

NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING

I-312
(Rev. 4/27/10)
3323

Mail to: The company or individual you are contracting with.

The undersigned nonresident taxpayer on oath, being first duly sworn, hereby certifies as follows:

1. Name of Nonresident Taxpayer: _____

2. Trade Name, if applicable (doing business as):

_____

3. Mailing Address: _____

4. Federal Employer Identification Number (FEIN): _____

5. _____ Hiring or Contracting with:
Name: _____

Address: _____

_____ Receiving Rentals or Royalties From:
Name: _____

Address: _____

_____ Beneficiary of Trusts and Estates:
Name: _____

Address: _____

6. I hereby certify that the above named nonresident taxpayer is currently registered with (check the appropriate box):
☐ The South Carolina Secretary of State or
☐ The South Carolina Department of Revenue
Date of Registration: _____

7. I understand that by this registration, the above named nonresident taxpayer has agreed to be subject to the jurisdiction of the South Carolina Department of Revenue and the courts of South Carolina to determine its South Carolina tax liability, including estimated taxes, together with any related interest and penalties.

8. I understand the South Carolina Department of Revenue may revoke the withholding exemption granted under Code Sections 12-8-550 (temporarily doing business or professional services in South Carolina), 12-8-540 (rentals), and 12-8-570 (distributions to nonresident beneficiary by trusts or estates) at any time it determines that the above named nonresident taxpayer is not cooperating with the Department in the determination of its correct South Carolina tax liability.

The undersigned understands that any false statement contained herein could be punished by fine, imprisonment or both.

Recognizing that I am subject to the criminal penalties under Code Section 12-54-44 (B) (6) (a) (i), I declare that I have examined this affidavit and to the best of my knowledge and belief, it is true, correct and complete.

_____ (Seal) _____
Signature of Nonresident Taxpayer (Owner, Partner or Corporate Officer, when relevant) Date

If Corporate officer, state title: _____

_____
(Name - Please Print)

33231028

INFORMATION
NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT

Submit this form to the company or individual you are contracting with.

Do not submit this form to South Carolina Department of Revenue.

PURPOSE OF AFFIDAVIT

A person is not required to withhold taxes for a nonresident taxpayer who submits an affidavit certifying that they are registered with either the South Carolina Secretary of State or the South Carolina Department of Revenue.

REQUIREMENTS TO MAKE WITHHOLDING PAYMENTS

Code Section 12-8-550 requires persons hiring or contracting with a nonresident taxpayer to withhold 2% of each payment made to the nonresident where the payments under the contract exceed $10,000. However, this section does not apply to payments on purchase orders for tangible personal property when those payments are not accompanied by services to be performed in this state.

Code Section 12-8-540 requires persons making payment to a nonresident taxpayer of rentals or royalties at a rate of $1,200 or more a year for the use of or for the privilege of using property in South Carolina to withhold 7% of the total of each payment made to a nonresident taxpayer who is not a corporation and 5% if the payment is made to a corporation.

Code Section 12-8-570 requires trusts or estates making distribution of South Carolina taxable income to a nonresident beneficiary to withhold 7% of the beneficiary's distribution which is attributable to South Carolina taxable income.

Our Internet address is: **www.sctax.org**

INCOME TAX CREDIT!!

Reference: SC §12-6-3350 – Income Tax Credit for State Contractors Having Subcontracts with MINORITY Firms

Taxpayers, who utilize certified minority subcontractors, may take a tax credit equal to 4% of the payments they make to said subcontractors. The payments claimed must be based on work performed directly for a **South Carolina** state contract. The credit is limited to a maximum of $50,000 annually. A taxpayer is eligible to claim the credit for 10 taxable years beginning with the taxable year in which the credit is first claimed. After the above 10 taxable years, the taxpayer is no longer eligible for the credit regardless of whether or not the taxpayer claimed the credit in a year subsequent to the year in which the credit was first claimed.

The credit may be claimed on Form TC-2, "Minority Business Credit." A copy of the subcontractor's certificate from the Governor's Office of Small and Minority Business (OSMBA) is to be attached to the contractor's income tax return. Taxpayers must maintain evidence of work performed for a State contract by the minority subcontractor.

Questions regarding the tax credit and how to file are to be referred to:

SC Department of Revenue
Research and Review
Phone: (803) 898-5786
FAX: (803) 898-5888

References: SC §11-35-5010 -- Definition for Minority Subcontractor
SC §11-35-5230 (B) – Regulations for Negotiating with State Minority Firms

The subcontractor must be certified as to the criteria of a "Minority Firm" by the Governor's Office of Small and Minority Business Assistance (OSMBA). Certificates are issued to subcontractors upon successful completion of the certification process. Questions regarding subcontractor certification are to be referred to:

Governor's Office of Small and
Minority Business Assistance
Phone: (803) 734-0657
FAX: (803) 734-2498

SECTION 260500 - ELECTRICAL BASIC MATERIALS AND METHODS

PART 1 - GENERAL REQUIREMENTS

1-01 SCOPE OF WORK

WORK INCLUDED: Furnish all necessary labor, material, plant and equipment, including materials and equipment not specifically mentioned but necessary to complete the work in a neat, correct, and workmanlike manner, to include:

1) Complete branch circuit wiring system for equipment and outlets.
2) Line voltage connections to equipment furnished under other Sections of these specifications, including disconnects, where indicated.
3) Hangers and Supports for Electrical Systems, see Section 260529.
4) Fire Alarm System, see Section 283100.

SPECIAL NOTE: The provisions of the Instructions to Bidders, General Conditions, Supplementary General Conditions and all applicable requirements of Division 1 shall govern the work under this Division the same as if incorporated herein.

1-02 EQUIPMENT WIRING

Furnish and install power circuits to and line voltage connections to all equipment furnished and installed by other trades, including disconnects, where indicated.

CONTROL WIRING: Raceways, wiring, and control devices for HVAC control systems shall be furnished and installed under Division 28 as noted on the drawings.

VOLTAGE: The Electrical Contractor shall supply power to equipment at the voltage indicated on the electrical drawings. The Electrical Contractor and the other applicable trades will be held responsible for coordinating the equipment voltages, the control equipment wiring, and the location and type of disconnect required to comply with the equipment manufacturer's requirements, the National Electric Code, and applicable local building codes. IF EQUIPMENT IS SUPPLIED AT A VOLTAGE OTHER THAN THAT PROVIDED, THE GENERAL CONTRACTOR AND SUBCONTRACTORS WILL BE HELD RESPONSIBLE FOR MAKING ANY NECESSARY ADJUSTMENTS TO CORRECT THE CONFLICT, AT NO COST TO THE OWNER, TO THE SATISFACTION OF THE ELECTRICAL ENGINEER.

1-03 EXISTING CONDITIONS

The Contractor will be held responsible for having visited the site and having familiarized himself with the existing conditions prior to submitting his bid.

1-04 COORDINATION

OTHER TRADES: All work under this Section shall be coordinated with other trades to insure proper location of outlets and equipment connections, and to minimize conflicts with structural members, duct work, piping, etc. Conflicts between equipment and/or material locations shall be corrected as directed by the Architect-Engineer at no additional cost to the Owner.

1-05 CODES AND PERMITS

Installation and materials shall be in accordance with the 2008 National Electrical Code, the 2006 International Building Code, and all local codes. Apply and pay for all permits and fees required for this construction.

1-06 DRAWINGS

The drawings and specifications shall be considered as complementary, one to the other, so that materials and labor indicated, called for, or implied by either shall be furnished and installed as if required by both. Where a disagreement exists between the plans and specifications, the item or arrangements of better quality, greater quantity, or higher cost shall be included in the base bid. Any discrepancies between the drawings, specifications, and field conditions shall be resolved with the Engineer prior to commencing work. All agreements shall be verified in writing.

RECORD DRAWINGS: The Contractor shall maintain one set of clean blueprints for "RECORD" drawings. All changes, revisions, or modifications to the project shall be recorded daily on these drawings with redline pencil. Upon completion of the project, these redline drawings shall be turned over to the Engineer for preparation of final Record Drawings.
Two electronic .pdf copies on disks shall be submitted with close out documents.

1-07 MAINTENANCE AND OPERATING MANUALS

The Contractor shall furnish the Owner two (2) complete maintenance and operating manuals for each piece of equipment and material furnished under this project. These manuals shall be bound in hard cover binders with tabs for each section item or piece of equipment. The manuals shall be furnished to the Engineer prior to the final observation, and final acceptance shall not be given until the Owner's maintenance personnel are instructed in maintenance and operation of all systems.

1-08 GUARANTEE

All materials and labor furnished under this Section of the specifications shall be guaranteed by the Contractor to be free from defects for a period of one year from the date of acceptance. The Contractor shall repair or replace any deficiencies reported in the guarantee period promptly after notification, without any additional compensation from the Owner. Lamps are excluded from this warranty, except that all lamps shall be operational on the date of acceptance.

1-09 MATERIALS

UL LISTING: All materials shall be listed by Underwriter's Laboratories, or an approved equal testing laboratory, and shall bear the "UL" Label, where applicable.

SUBSTITUTIONS: Specific reference in the specifications to any article, device, product, material, fixture, form or type of construction, etc., by name, make or catalog number, with or without the words "or equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition and the Contractor in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction, which in the judgement of the Architect-Engineer, expressed in writing prior to bidding as specified below, is equal to that herein named.

Requests to substitute materials or equipment considered by the Contractor as equal to those specified shall be submitted for review to the Architect-Engineer ten (10) days before bids are taken. Requests shall be accompanied by samples, descriptive literature, and engineering information, as necessary to fully identify and appraise the product. No increase in the contract sum will be considered when requests are not accepted. If the item is found to be equal, the Architect-Engineer will issue an Addendum making it a part of the Contract Documents prior to bidding.

1-10 SUBMITTALS

Within 30 days after award of contract and before any materials are delivered to the site, submit six (6) sets of complete shop drawings and equipment specifications to the Architect-Engineer on the following materials (partial/incomplete submittals will be rejected):

1) Section 260500 - Raceways, Fittings, and Surface Wiring Systems.
2) Section 260500 - Wire and Cable.
3) Section 260500 - Boxes and Wireways.
4) Section 260500 - Wiring Devices.
5) Section 260529 - Hangers and Supports for Electrical Systems.
6) Section 283100 - Fire Alarm Equipment and Drawings.

NOTE: Shop drawings shall be submitted in one complete package containing all items required by this specification and all other Division 26-28 specifications. Partial shop drawing submittals may be rejected by the Architect-Engineer.

PART 2 - MATERIALS

2-01 RACEWAYS AND FITTINGS

GALVANIZED RIGID CONDUIT (GRC): UL 6 and ASA C80.1 with full weight screwed fittings. Bushings shall be malleable iron. Bushings 1 1/4" and larger shall have insulated throat and grounding lug.

INTERMEDIATE GRADE METALLIC CONDUIT (IMC): UL 1242, galvanized, with full weight screwed fittings. Bushings shall be as specified above.

ELECTRICAL METALLIC TUBING (EMT): UL 797 and ASA C80.3 with steel compression or set-screw type fittings. Die-cast fittings are not acceptable. Fittings 1 1/4" and larger shall have nylon insulated throat. Indented or drive-on fittings are not acceptable.

FLEXIBLE STEEL CONDUIT (GREENFIELD): UL 1. Fittings shall be steel.

LIQUIDTIGHT FLEXIBLE STEEL CONDUIT (SEALTITE): UL 360. Fittings shall be steel compression type.

PLASTIC CONDUIT (PVC): Schedule 40 polyvinylchloride. NEMA Standard TC-2 and TC-3 and UL Standards. Conduit, solvent, and fittings shall all be supplied by the same manufacturer. PVC is not permitted above grade.

SURFACE METAL RACEWAY (INDOOR): Wiremold V500 ivory surface metal raceway, or approved equal. Straps, boxes, elbows, etc. shall all be supplied by the same manufacturer. Total cross-sectional area shall be a minimum of 0.20 square inches.

2-02 WIRE AND CABLE

UL STANDARDS: UL 44 and UL 83.

CONDUCTOR: Copper, soft drawn, per ASTM B3. Sizes No. 12 and 10 shall be solid conductor. Sizes No. 8 and larger shall have Class B concentric stranding per ASTM B8. Stranded conductors may be used on No. 12 and No. 10, provided terminations under screw terminals are made using Sta-Con insulated spade connectors, or approved equivalent connectors.

INSULATION: 600 Volt, 75 Deg C rated. Type THHN-THWN-MTW, unless noted otherwise.

SPLICING MATERIALS:

No. 10 and smaller: Acceptable wire nuts or insulated crimped splice caps.
No. 8 and larger: Bronze or copper split bolts, or tinned compression connectors.

Insulation shall be Scotch No. 23 rubber tape and Scotch No. 33 plastic tape, or approved equivalent method.

2-03 BOXES AND WIREWAYS

OUTLET BOXES: Galvanized sheet steel per UL 514. "Through-wall" boxes SHALL NOT BE USED. Back-to-back mounting of boxes is not permitted. All outlet boxes 4"x4" or smaller located on opposite sides of a rated wall shall have a minimum of 24" horizontal spacing or shall be protected with listed putty pads. All outlet boxes larger than 4"x4" (communications outlets, etc.) located in rated walls shall be protected with listed putty pads.

Box sizes shall be as follows:

1) Wall Receptacle Outlets: 4" square by 2 1/8" deep with plaster ring as required.
2) Wall Communications and Computer Outlets: 4 11/16" square by 2 1/8" deep with one gang plaster ring. Provide box with 1 ¼" conduit knockouts.
3) Ceiling outlets: 4" square or octagonal by 1 1/2" or 2 1/8" deep with stud or ears where required for fixture support.
4) Indoor Surface Mounted Outlets: Wiremold V5744S-2 surface metal box unless noted otherwise on the drawings (steel boxes and EMT conduit may be used in equipment rooms, janitor's closets, storage rooms).
5) Exposed Outlets: Malleable iron or heavy duty cast aluminum with threaded hubs. Type FS, FD, or GS. Manufactured by Crouse Hinds, Appleton, Killark, or approved equal. Die cast boxes are not acceptable.

WIREWAYS, PULL BOXES AND JUNCTION BOXES: UL 50. Code gage galvanized sheet steel, aluminum, or steel primed and painted after fabrication. Manufactured by Square D, Austin Berryhill, Hoffman Engineering, B-Line Systems, or approved equal. Wireways shall have hinged covers.

2-04 NAMEPLATES

NAMEPLATE: Provide engraved 3-ply laminated plastic nameplates for each panelboard, safety switch, transformer, enclosed circuit breaker, contactor, and lighting control panel. Attach to equipment cover using metal screws, rivets, or industrial epoxy cement. Manufacturer's sticky-back adhesive is not acceptable. Use 1/4" white letters on black field for normal power items. Use 1/4" white letters on red field for emergency power items (generator).

PART 3 - EXECUTION

3-01 GENERAL REQUIREMENTS

WORKMANSHIP: All work shall be installed in a neat and orderly manner. Devices, cabinets, covers, fixtures, exposed raceways, etc., shall be aligned parallel or perpendicular to the building walls, ceiling, and floor. Wiring in panelboards and cabinets shall be neatly looped and laced, and not wadded. The Owner reserves the right to require repair or replacement of defective workmanship and material without additional compensation to the Contractor.

SUPPORTS: Conduits, boxes, cabinets, enclosures, lighting fixtures, etc., shall be securely supported by structural members or structural walls at intervals required by the NEC or as recommended by the manufacturer. Plaster, gypsum board, acoustical tile, and other ceiling and wall finish materials shall not be used for support.

CUTTING, PATCHING, AND PAINTING: The Electrical Contractor shall perform all boring, drilling, and cutting of walls, ceilings, and floors as required to install and support his raceways and equipment. Provide rough patching to seal penetrations through walls, ceilings, and floors. Provide finish patching and painting to match existing finishes.

PATCHING EXISTING FINISHES: Where existing ceiling tile mounted devices are removed, install new matching ceiling tile. Where wall mounted devices are removed, install oversized metal cover plate to be primed and painted to match.

FIRE WALL PENETRATIONS: Penetrations through fire rated walls and floors shall be sealed to maintain the integrity of the fire rating. Raceways through penetrations shall be in metal raceways. Penetration openings shall be sealed after the installation of the raceway with UL-49 listed fire retardant material, as manufactured by Chase Technology, 3M Co., or approved equal. Penetrations shall be sealed in accordance with UL-49 requirements and the manufacturer's instructions.

ROOF PENETRATIONS: Do not penetrate roof or flashing unless permitted, in writing, by the Architect-Engineer.

3-02 GROUNDING

CODE: Entire system shall be grounded and bonded in accordance with the requirements of Article 250 of the National Electrical Code.

FEEDERS AND BRANCH CIRCUITS: Each feeder raceway shall be bonded to every cabinet, pull box, etc., to which it is connected by grounding bushings and bonding jumpers sized per NEC Table 250.122. Each branch circuit raceway must be connected to every cabinet, pull box, outlet box, etc., with double locknuts. Separate grounding conductors shall be installed on all feeders and on all lighting, receptacle and equipment branch circuits, whether indicated on the drawings or not. Size per NEC 250.122.

3-03 RACEWAYS

WIRING: All wiring shall be installed in raceways, unless noted. Raceways shall be run concealed, unless noted.

BRANCH CIRCUITS: Branch circuits shall be run concealed where practical.

Branch circuits run exposed to weather on exterior walls or on roofs shall be run in GRC or IMC with screwed fittings. Branch circuits run concealed in walls or ceilings shall be run in EMT, GRC, or IMC. Branch circuits run exposed in dry, finished spaces shall be run in Wiremold surface metal raceway. Branch circuits run exposed in damp locations, unfinished spaces (attics), and unoccupied spaces (storage room, equipment rooms, janitor's closet) may be run in EMT in lieu of Wiremold.

Branch circuits run underground shall be run in GRC, IMC, or Schedule 40 PVC plastic conduit. Underground conduits shall be run 24" minimum below grade. Metal conduits installed in contact with earth shall be painted with 2 coats Rustoleum paint or other acceptable preservative. Where plastic conduits are indicated, transition from plastic to GRC or IMC below grade or slab and rise with GRC or IMC. PVC is not permitted above grade. EXCEPTION: Plastic conduit may enter floor mounted switchboards.

FLEXIBLE CONDUITS: Recessed fluorescent and incandescent fixtures located in accessible ceilings may be connected to an outlet box above the ceiling thru flexible conduit "whips". Run a separate ground wire in all conduit, including flexible fixture whips. DO NOT loop flexible conduit from one fixture to another. EXCEPTION: The manufacturer's prefabricated plug-n-play wiring system and/or tandem wiring for Master-Satellite configured light fixtures shall be provided as indicated in the fixture schedule and as permitted by Section 410.32 and 410.77 of the 2008 NEC. Metal-clad cable fixture whips shall be permitted for light fixture whips provided they do not exceed 6-feet in length and are provided by the light fixture manufacturer.

Final connections to motors, motor driven equipment, transformers, and vibrating equipment shall be made thru flexible conduit, 36" maximum length. "Sealtite" flexible metal conduit shall be installed outdoors, in equipment rooms, and in wet locations.

PULL WIRES: Raceways for wiring by others or for future shall contain a No. 14 galvanized steel pull wire or equivalent plastic cord with 200 lb. tensile strength.

INSTALLATION: Ream raceways, butt ends into couplings, 3 quarter bends per run maximum, plug raceways until wiring is pulled in place. Exposed conduits shall be run parallel and perpendicular to walls, floor, and ceiling. Multiple conduit runs shall be racked using Unistrut or Kindorf channels and pipe clamps. Install conduits in concrete slabs between the top and bottom layers of reinforcing steel. Maximum size of conduits in slabs is 1 inch. Crossing of conduits in slabs shall be avoided, if possible.

PULL BOXES: Maximum length between pull points shall be 200 ft. for pulls with two 90 degree bends, and 100 ft for pulls with three 90 degree bends. Furnish and install pullboxes, junction boxes, handholes, or conduit bodies where bends or pulling lengths exceed these specifications.

EXPANSION JOINTS: Furnish and install expansion joints where conduit crosses building expansion joints and for straight runs exceeding 100 ft. in length.

PLASTIC CONDUIT: Do not damage conduit while making field bends and offsets, cutting and joining conduit. Use GRC elbows where length between pulls exceeds 100 ft. Clean conduit prior to applying solvent. Insure that conduit extends fully into coupling or fitting when making joints.

MINIMUM SIZE: Home runs to panelboards shall be 3/4" minimum, otherwise raceways shall be 1/2" minimum, except that flexible conduit shall be 3/8" minimum.

3-04 WIRE AND CABLE

MINIMUM SIZE: No. 12 for power circuits, No. 14 for control circuits, unless noted. Where home run exceeds 75 ft. length on 120 volt circuits, use No. 10 minimum.

COLOR CODE: No. 12 and No. 10 shall have color-coded insulation. No. 8 and larger shall be marked at all terminals and joints with color-coded tape. Color code as follows:

Voltage	Phase A	Phase B	Phase C	Neutral	Grounding
240/120	Black	Orange	Blue	White	Green
208/120	Black	Red	Blue	White	Green
480/277	Brown	Orange	Yellow	Gray	Green

INSTALLATION: Insure that raceway system is complete and that conductors will be free from moisture or physical damage prior to installing conductors. Install all conductors at the same time. Do not exceed cable manufacturer's recommended pulling tension for conductors. Where required, lubricate cables with Ideal Yellow 77, Burndy Slikon, or other acceptable cable lubricant. Do not use lubricants that are not acceptable to the Architect-Engineer.

SPLICING: Splices on Sizes No. 10 and smaller shall be made with wire nuts. Splices on Sizes No. 8 and larger shall be made with split bolt connectors, compression connectors, or solderless lugs. Splices shall be insulated with two or more layers of Scotch 23 rubber tape covered with two or more layers of Scotch 33 plastic tape, or acceptable equivalent method.

MULTIWIRE BRANCH CIRCUITS: Shared or common neutrals are not permitted on this project for multiwire branch circuits. The Contractor shall pull a separate neutral for all 120V & 277V circuits.

3-05 BOXES

WALL OUTLETS: Flush mounted, unless noted. Boxes shall be securely mounted to wall studs or be grouted in masonry. Boxes shall have single or multi-gang plaster rings, as required. "Through-wall" boxes SHALL NOT BE USED. Back-to-back mounting of boxes is not permitted. Boxes on opposite sides of a rated wall shall have a minimum of 24" horizontal spacing or shall be protected with listed putty pads.

CEILING OUTLETS: Flush mounted or concealed above ceiling. Boxes for fixture support shall have studs or ears as required and shall be securely supported by adjustable bar hangers or steel angle.

JUNCTION BOXES, PULL BOXES, AND WIREWAYS: Shall be sized and installed as indicated on the drawings or where required by NEC for pulling or splicing wiring. All junction boxes and pull boxes shall be accessible. Junction boxes and pull boxes shall not be located above inaccessible ceilings.

LOCATIONS: Verify counter heights and arrangement prior to setting boxes. The Owner reserves the right to move any outlet by as much as 10 ft. from its indicated location at no additional cost, provided the Contractor is notified prior to roughing in.

3-06 COMPLETION OF WORK

TESTS: Upon completion of work, the entire system shall be completely operational and tested to conform with these specifications and drawings, and shall be reviewed by the Architect-Engineer. All defects in workmanship and material shall be immediately corrected without additional compensation to the Contractor.

CLEAN UP: Upon completion of all installations and prior to final acceptance by the Owner, remove all debris from the site. Clean and touch up paint on fixture lenses and trims, cabinets, enclosures, cover plates, etc.

END OF SECTION 260500

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1-01 SUMMARY

SECTION INCLUDES:

1) Hangers and supports for electrical equipment and systems.
2) Construction requirements for concrete bases.

1-02 PERFORMANCE REQUIREMENTS

1) Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2) Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
3) Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
4) Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1-03 SUBMITTALS

1) Product Data: For steel slotted support systems.
2) Shop Drawings: Shop Drawings shall show fabrication and installation details and include calculations for the following:

    a. Trapeze hangers. Include Product Data for components.
    b. Steel slotted channel systems. Include Product Data for components.
    c. Equipment supports.

3) Welding Certificates.

1-04 QUALITY ASSURANCE

1) Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2) Comply with NFPA 70.

PART 2 - PRODUCTS

2-01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

1) Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

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

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   i. Allied Tube & Conduit.
   ii. Cooper B-Line, Inc.; a division of Cooper Industries.
   iii. ERICO International Corporation.
   iv. GS Metals Corp.
   v. Thomas & Betts Corporation.
   vi. Unistrut; Tyco International, Ltd.
   vii. Wesanco, Inc.
c. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
d. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
e. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
f. Channel Dimensions: Selected for applicable load criteria.

2) Raceway and Cable Supports: As described in NECA 1 and NECA 101.
3) Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
4) Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
5) Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
6) Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

   a. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
      i. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      ii. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         - Hilti Inc.
         - ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         - MKT Fastening, LLC.
         - Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
   b. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      i. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      ii. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         - Cooper B-Line, Inc.; a division of Cooper Industries.
         - Empire Tool and Manufacturing Co., Inc.
         - Hilti Inc.
         - ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         - MKT Fastening, LLC.
   c. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

d. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
e. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
f. Toggle Bolts: All-steel springhead type.
g. Hanger Rods: Threaded steel.

2-02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

1) Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
2) Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3-01 APPLICATION

1) Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
2) Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
3) Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   a. Secure raceways and cables to these supports with two-bolt conduit clamps.
4) Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3-02 SUPPORT INSTALLATION

1) Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
2) Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
3) Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
4) Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

   a. To Wood: Fasten with lag screws or through bolts.
   b. To New Concrete: Bolt to concrete inserts.
   c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   d. To Existing Concrete: Expansion anchor fasteners.
   e. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

f. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts; beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69; or spring-tension clamps.
g. To Light Steel: Sheet metal screws.
h. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

5) Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3-03 INSTALLATION OF FABRICATED METAL SUPPORTS

1) Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
2) Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
3) Field Welding: Comply with AWS D1.1/D1.1M.

3-04 CONCRETE BASES

1) Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
2) Use 3000-psi, 28-day compressive-strength concrete.
3) Anchor equipment to concrete base.
   a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Install anchor bolts to elevations required for proper attachment to supported equipment.
   c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3-05 PAINTING

1) Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
2) Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
3) Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 283100 - FIRE ALARM SYSTEM

PART 1 - GENERAL REQUIREMENTS

1-01 QUALIFICATIONS OF INSTALLER:

NOTE: EACH AND ALL ITEMS OF THE FIRE ALARM SYSTEM, INCLUDING WIRING, SHALL BE FURNISHED AND INSTALLED BY THE FIRE ALARM SYSTEM SUPPLIER (CONDUIT WITH PULL WIRES AND BOXES MAY BE INSTALLED BY THE ELECTRICAL CONTRACTOR). ANY WIRING OR FIRE ALARM EQUIPMENT FOUND TO BE INSTALLED BY THE ELECTRICAL CONTRACTOR SHALL BE REMOVED, DISCARDED, AND NEW FURNISHED & INSTALLED BY THE FIRE ALARM SYSTEM SUPPLIER AT NO COST TO THE OWNER OR THE ENGINEER.

Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE Fire Alarm System manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "UL" label. All control equipment is to be listed under UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

1-02 GENERAL REQUIREMENTS:

Section 260500, "Basic Materials and Methods" applies to this section, with the additions and modifications specified herein.

NFPA COMPLIANCE: The complete installation is to conform to Local Code Requirements, to the applicable sections of "NFPA 72: National Fire Alarm Code", and to "NFPA 70: The National Electrical Code - 2008" with particular attention to Article 760. The entire installed system and all integrated system operations shall be within the guidelines of the 2009 International Building Code (IBC) and the 2009 International Fire Code (IFC).

ADA COMPLIANCE: The fire alarm installation shall comply with the requirements of Appendix B, "ADA Accessibility Guidelines" of the American Disabilities Act for alarm systems.

All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent compatible UL-listed equipment from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met.

The fire alarm cabinet for this project must be UL 864 Ninth Edition Listed.

Specific reference in the specifications to any article, device, product, material, fixture, form or type of construction, etc., by name, make or catalog number, with or without the words "or equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition and the Contractor in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction, which in the judgment of the Architect-Engineer, expressed in writing prior to bidding as specified below, is equivalent to that herein named.

The drawings and specifications shall be considered as complementary, one to the other, so that materials and labor indicated, called for, or implied by either shall be furnished and installed as if required by both. Where a disagreement exists between the plans and specifications, the item or arrangements of better quality, greater quantity, or higher cost shall be included in the base bid. Any discrepancies between the drawings, specifications, and field conditions shall be resolved with the Engineer prior to commencing work. All agreements shall be verified in writing.

1-03 DESCRIPTION OF WORK:

The work includes the installation of a complete fire alarm system including associated equipment and appurtenances, complete and ready for operation. Equipment, materials, installation, workmanship, review, and testing shall be in strict accordance with the required and advisory provisions of "NFPA 72: National Fire Alarm Code". Devices and equipment for fire alarm service shall be listed by Underwriters Laboratories Inc. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

WARRANTY: All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid. The Contractor shall repair or replace any deficiencies reported in the guarantee period promptly after notification, without any additional compensation from the Owner.

As part of the above one-year warranty, the Contractor shall provide the following maintenance and testing, once at the 6-month point and a second time at the twelve-month point of the warranty period. The date of the two maintenance and testing sessions shall be scheduled as part of the fire alarm system closeout documents and shall be coordinated with the Owner and the Engineer prior to acceptance of the fire alarm system. The cost of this work shall be included in the Base Bid.

a. Examination, adjustment and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays, waterflow switches and all accessories of the fire alarm system.
b. Each circuit in the fire alarm system shall be tested semiannually.
c. Each smoke detector shall be tested in accordance with the requirements of NFPA 72.

The Contractor shall provide lightning protection for the fire alarm system and fire alarm circuits per the Manufacturer's recommendation. The Contractor shall provide lightning protection for the two (2) telephone lines serving the fire alarm system.

Furnish and install wiring materials under this section as specified in Section 260500, "Basic Materials and Methods," with the additions and modifications specified herein. Furnish materials and equipment that are current products of one manufacturer regularly engaged in the production of such equipment.

The existing 120v stand-alone devices shall be removed complete (including conduit and wiring) and turned over to the Owner.

1-04 SYSTEM DESCRIPTION:

A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings. Furnish and install all items hardware, software, programming, and factory setup required to provide a complete and operable fire alarm system.

BASIC PERFORMANCE:

a. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Class B Signaling Line Circuits (SLC).
b. Initiation Device Circuits (IDC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
c. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable

device connected by the SLC Circuit.

d. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
e. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke-zone whichever is greater.
f. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
g. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
h. Two-way telephone communication circuits shall be supervised for open and short circuit conditions.
i. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.
j. All manual pull stations, building smoke detectors, building heat detectors, elevator smoke detectors, and extinguishing systems shall sound the building fire alarm upon activation unless specifically noted otherwise. The sprinkler tamper switch, duct smoke detectors, and door release smoke detectors shall sound a supervisory signal only upon activation, unless noted otherwise. The fire alarm control panel shall allow for on-site programming to change any device(s) signal.

BASIC SYSTEM FUNCTIONAL OPERATION: When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

a. The system alarm LED on the system display shall flash.
b. A local piezo electric signal in the control panel shall sound.
c. A backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
d. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
e. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

1-05 SUBMITTALS:

Submit Manufacturer's Data for:

Control Panel and Cabinet
Digital Communicator (DACT) with Surge Protector
Batteries and Battery Charger
Alarm Horns/Strobe Lights
Synchronization Control Modules (SCMs)
Manual Stations
Smoke, Heat, and Duct Detectors

SHOP DRAWINGS: Fire Alarm Shop Drawings shall comply with the requirements of 907.1.1 of the International Fire Code – 2009. Provide drawings that clearly and completely indicate the function of the control panel and devices connected thereto. Indicate termination points of devices and indicate the interconnection of modules required for proper operation of the system. Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

Equipment Supplier shall submit shop drawings indicating exact routing of raceways and number and size of conductors in raceways for the fire alarm system. The Electrical Contractor shall use the reviewed drawing for rough-in of fire alarm system raceways and outlet boxes.

CALCULATIONS: Verify that battery capacity exceeds supervisory and alarm power requirements. Provide battery calculations and voltage drop calculations with shop drawing submittal.

CERTIFICATION: Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

OPERATION AND MAINTENANCE MANUAL: Provide two (2) copies, bound securely in durable, hard cover, water-resistant binders. Include instructions for operating and maintaining system components, assemblies, and accessories; include a detailed description of the control panel and system operation under both routine and emergency conditions. Include as-built circuit diagrams complete with conductor color codes, a parts list by name, model number, and manufacturer, and a listing of smoke detector locations, with the serial number and firing voltage for each. General system descriptions included in manufacturer's catalogs or advertising media will not be acceptable in meeting the operation and maintenance manual requirement.

TRAINING: Provide training for operating personnel in the system operation. Minimum instruction period shall be four (4) hours. Evidence of completion of training shall be included with closeout documents.

1-06 SPARE PARTS:

Spare parts shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, stamping, or tagging. Keys and locks for equipment shall be identical where possible. Furnish the following:

a. Four keys or tools for resetting manual stations
b. Four keys for locks of control panels or cabinets
c. See Fire Alarm System Notes on drawings for additional items

1-07 LABELING AND IDENTIFICATION:

All devices are to be labeled with specific address as that corresponds to device mapping at Fire Alarm Panel for ease of identification and maintenance. Labels shall be affixed to devices via adhesive and shall consist of black letters on clear background. Labels are to be vinyl type.

PART 2 - PRODUCTS

2-01 SYSTEM DESIGN AND OPERATION:

ACCEPTABLE MANUFACTURERS: Notifier, Simplex, Johnson Controls, or EST. Materials and equipment shall be the standard products of one manufacturer regularly engaged in the production of such equipment and shall be listed by Underwriter's Laboratories (UL).

OPERATOR CONTROL:

a. Acknowledge Switch:

1. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition.

2. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.

b. Alarm Silence Switch: Activation of the alarm silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm condition. The selection of notification circuits and relays that are silenceable by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
c. Alarm Activate (Drill) Switch: The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
d. System Reset Switch: Activation of the System Reset switch shall cause all electronically-latched initiating devices, appliances or software zones, as well as all associated output devices and circuits, to return to their normal condition.
e. Lamp Test: The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

SYSTEM CAPACITY AND GENERAL OPERATION:

a. The control panel or each network node shall provide, or be capable of expansion to 636 intelligent/addressable devices.
b. The control panel or each network node shall include Form-C alarm, trouble, supervisory, and security relays rated at a minimum of 2.0 amps @ 30 VDC.
c. It shall also include four Class B or Class A programmable Notification Appliance Circuits.
d. The Notification Appliance Circuits shall be progammable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
e. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire alarm system.
f. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
g. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
h. The FACP or each network node shall provide the following features:

1. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
2. Detector sensitivity test, meeting requirements of NFPA 72, Chapter 14.
3. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
4. Nine sensitivity levels for alarm, selected by detector. The alarm level range shall be .5 to 2.35 percent per foot for photoelectric detectors and 0.5 to 2.5 percent per foot for ionization detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .03 percent per foot to 1.0 percent per foot. The system shall also include up to nine levels of Prealarm, selected by detector, to indicate impending alarms to maintenance personnel.
5. The ability to display or print system reports.
6. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.

7. PAS presignal, meeting NFPA 72. 23.8.1.2 and 23.8.1.3 requirements.
8. Rapid manual station reporting (under 3 seconds) and shall meet NFPA 72 requirements for activation of notification circuits within 10 seconds of initiating device activation.
9. Periodic detector test, conducted automatically by the software.
10. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
11. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
12. Walk test, with a check for two detectors set to same address.
13. Control-by-time for non-fire operations, with holiday schedules.
14. Day/night automatic adjustment of detector sensitivity.
15. Device blink control for sleeping areas.

i. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."

j. Network Communication: The FACP shall be capable of communicating on a Local Area Network (LAN), a firmware package that utilizes a peer-to-peer, inherently regenerative communication format and protocol.

CENTRAL MICROPROCESSOR:

a. The microprocessor shall be a state-of-the-art, high speed, 16-bit RISC device and it shall communicate with, monitor and control all external interfaces. It shall include an EPROM for system program storage, Flash memory for building-specific program storage, and a "watch dog" timer circuit to detect and report microprocessor failure.

b. The microprocessor shall contain and execute all control-by-event programs for specific action to be taken if an alarm condition is detected by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.

c. The microprocessor shall also provide a real-time clock for time annotation of system displays, printer, and history file. The time-of-day and date shall not be lost if system primary and secondary power supplies fail. The real time clock may also be used to control non-fire functions at programmed time-of-day, day-of-week, and day-of-year.

d. A special program check function shall be provided to detect common operator errors.

e. An auto-program (self-learn) function shall be provided to quickly install initial functions and make the system operational.

f. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in incompliance with the NFPA 72 requirements for testing after system modification.

SYSTEM DISPLAY:

a. The system shall support the following display mode options: 80 character display option. The display shall include an 80-character backlit alphanumeric Liquid Crystal Display (LCD) and a full PC style QWERTY keypad.
b. The display shall provide all the controls and indicators used by the system operator: The 80-character display shall include the following operator control switches: ACKNOWLEDGE, ALARM SILENCE, ALARM ACTIVATE (drill), SYSTEM RESET, and LAMP TEST.
c. The display shall annunciate status information and custom alphanumeric labels for all intelligent detectors, addressable modules, internal panel circuits, and software zones.
d. The display shall also provide Light-Emitting Diodes: The 80-character display shall provide 12 Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM WARNING, SECURITY ALARM, SUPERVISORY SIGNAL, SYSTEM TROUBLE, DISABLED POINTS, ALARM SILENCED, Controls Active, Pre-Discharge. Discharge and Abort.
e. The display shall have QWERTY type keypad: The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
f. The system shall support the display of battery charging current and voltage on the 80-character LCD display.

SIGNALING LINE CIRCUITS (SLC):

a. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Class A or B wiring.
b. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

SERIAL INTERFACES:

a. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.
b. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.

ENCLOSURES:

a. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
b. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
c. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

POWER SUPPLY:

a. A high tech off-line switching power supply shall be available for the fire alarm control panel or network node and provide 6.0 amps of available power for the control panel and peripheral devices.
b. Provisions will be made to allow the audio-visual power to be increased as required by adding modular expansion audio-visual power supplies.
c. Positive-Temperature-Coefficient (PTC) thermistors, circuit breakers, or other over-current protection shall be provided on all power outputs. The power supply shall provide an integral battery charger for use with batteries up to 55 AH or may be used with an external battery and charger system. Battery arrangement may be configured in the field.
d. The power supply shall continuously monitor all field wires for earth ground conditions, and shall have the following LED indicators:

    1. Ground Fault LED
    2. AC Power Fail LED
    3. NAC on LED (4)

e. The main power supply shall operate on 120 VAC, 60 Hz, and shall provide all necessary power for the FACP.
f. The main power supply shall provide a battery charger using dual-rate charging techniques for fast battery recharge and be capable of charging batteries up to 200 AH.
g. All circuits shall be power-limited, per UL864 requirements.

BATTERIES: The battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required. If necessary to meet standby requirements, external battery and charger systems may be used.

AUXILIARY FIELD POWER SUPPLY – ADDRESSABLE:

a. The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24VDC power. The power supply shall also include and charge backup batteries.
b. The addressable power supply for the fire alarm system shall provide up a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 5 amps of 24 volt DC general power. The power supply shall have an additional .5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 7.0 - 25.0 amp hour batteries.
c. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as two Class "A" and two Class "B" or four Class "B" only circuits. All circuits shall be power-limited per UL 864 requirements.
d. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
e. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
f. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire. Data on the SLC shall be transmitted between 24 VDC, 5 VDC and 0 VDC at approximately 3.33k baud.
g. The addressable power supply shall supervise for battery charging failure, AC power

loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.

h. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of eight or sixteen hours shall be Dip-switch selected.
i. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be Dip-switch selectable.
j. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
k. Each of the power supply's four output circuits shall be DIP-switch selected for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
l. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
m. When selected for Notification Appliance Circuits, the output circuits shall be individually DIP-switch selectable for Steady, March Time, Dual Stage or Temporal.
n. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
o. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
p. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

FIELD CHARGING POWER SUPPLY (FCPS): The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.

a. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24 volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
b. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs shall be available for connection to the Notification devices.
c. The FCPS shall include an attractive surface mount backbox.
d. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.

SPECIFIC SYSTEM OPERATIONS

a. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window.
b. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 5 to 30 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
c. Point Disable: Any addressable device or conventional circuit in the system may be enabled or disabled through the system keypad.

d. Point Read: The system shall be able to display or print the following point status diagnostic functions:

   1. Device status
   2. Device type
   3. Custom device label
   4. View analog detector values
   5. Device zone assignments
   6. All program parameters

e. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system status.
f. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
g. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
h. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
i. Software Zones: The FACP shall provide 100 software zones, 10 additional special function zones, 10 releasing zones, and 20 logic zones.
j. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:

   1. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
   2. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
   3. All devices tested in walk test shall be recorded in the history buffer.

k. Waterflow Operation: An alarm from a waterflow detection device shall activate the appropriate alarm message on the main panel display, turn on all programmed notification appliance circuits and shall not be affected by the signal silence switch.
l. Supervisory Operation: An alarm from a supervisory device shall cause the appropriate indication on the system display, light a common supervisory LED, but will not cause the system to enter the trouble mode.
m. Signal Silence Operation: The FACP shall have the ability to program each output circuit (notification, relay, speaker etc) to deactivate upon depression of the signal silence switch.
n. Non-Alarm Input Operation: Any addressable initiating device in the system may be used

as a non-alarm input to monitor normally open contact type devices. Non-alarm functions are a lower priority than fire alarm initiating devices.

o. Combo Zone: A special type code shall be available to allow waterflow and supervisory devices to share a common addressable module. Waterflow devices shall be wired in parallel, supervisory devices in series.

2-03 COMPONENT DESIGN:

MAIN FIRE ALARM CONTROL PANEL: Main FACP shall be a NOTIFIER Model NFS-320, SIMPLEX 4010, or GAMEWELL/FCI Identiflex 600 Series and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

FURNISH & INSTALL SYSTEM SMOKE DETECTORS AT ALL FIRE ALARM CONTROL PANEL LOCATIONS, REMOTE FIRE ALARM ANNUNCIATOR LOCATIONS, AND ALL POWER SUPPLY LOCATIONS REGARDLESS OF WHETHER OR NOT THEY ARE SHOWN ON THE DRAWINGS.

The panel shall be UL listed as a test instrument for the measurement of the sensitivity of connected intelligent analog ionization and photoelectric smoke detectors to comply with the testing requirements of NFPA 72.

ALARM SEQUENCE: The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, within one (1) minute after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within one minute the system is to resume normal operation. The Alarm Verification is to operate only on smoke detector alarms. Other activated initiating devices shall be processed immediately. The alarm verification operation is to be selectable by device.

ALPHANUMERIC LCD TYPE REMOTE FIRE ALARM ANNUNCIATOR (FAA): Mount with panel top 54 inches above finished floor elevation. Annunciator shall duplicate annunciation functions performed by the main control panel. Fire alarm device descriptions shall correspond to the fire alarm control panel device descriptions. Panel shall be flush mounted. Notifier LCD-80TM, provide flush mount backbox as required. Field verify the remote annunciator location with the local building official prior to rough-in.

a. The alphanumeric display annunciator shall be a supervised, remotely located back-lit LCD display containing a minimum of eighty (80) characters for alarm annunciation in clear English text.
b. The LCD annunciator shall display all alarm and trouble conditions in the system.
c. An audible indication of alarm shall be integral to the alphanumeric display.
d. The display shall be UL listed for fire alarm application.
e. It shall be possible to connect up to 32 LCD displays and be capable of wiring distances up to 6,000 feet from the control panel.
f. The annunciator shall connect to a separate, dedicated "terminal mode" EIA-485 interface. This is a two-wire loop connection and shall be capable of distances to 6,000 feet. Each terminal mode LCD display shall mimic the main control panel.
g. The system shall allow a minimum of 32 terminal mode LCD annunciators. Up to 10 LCD annunciators shall be capable of the following system functions: Acknowledge, Signal Silence and Reset, which shall be protected from unauthorized use by a keyswitch or password.
h. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

UNIVERSAL DIGITAL ALARM COMMUNICATOR TRANSMITTER (UDACT): The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station. Furnish and install a digital communicator for transmission of fire alarm signals to a remote monitoring facility via telephone lines. The digital communicator shall conform to UL 864 and NFPA 71 requirements, and shall be UL listed. The communicator shall be capable of transmitting the status of software zones (alarm & trouble), system trouble, panel off-normal, supervisory, bell trouble, low battery, and AC fail, and shall be compatible for use with the Fire Alarm Control Panel. The communicator shall have the capability of supervising two telephone lines, and of seizing the telephone lines and sending an alarm signal on one or both lines without the need for additional equipment. The communicator shall sound a local trouble alarm and transmit a signal to the fire alarm control panel if telephone service is interrupted on either line for more than 45 seconds and simultaneously transmit a signal to both the central monitoring station and the control panel when telephone service is restored. The communicator shall be capable of sending a test signal to the central monitor station every 24 hours at any specific time of day or night by setting a program within the communicator. Alarm signals to the central monitor station shall indicate which of the communicator transmitter initiating device circuits are in trouble and which are in alarm. Restoration to normal shall also be transmitted to the central monitor station. Notifier UDACT.

a. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
b. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to three different telephone numbers.
c. The UDACT shall be completely field programmable from a built-in keypad and 4 character red, seven segment display.
d. The UDACT shall be capable of transmitting events in at least 15 different formats. This ensures compatibility with existing and future transmission formats.
e. Communication shall include vital system status such as:

    - Independent Zone (Alarm, trouble, non-alarm, supervisory)
    - Independent Addressable Device Status
    - AC (Mains) Power Loss
    - Low Battery and Earth Fault
    - System Off Normal
    - 12 and 24 Hour Test Signal
    - Abnormal Test Signal (per UL requirements)
    - EIA-485 Communications Failure
    - Phone Line Failure

f. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 2,040 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.

Provide 2-line telephone surge protector for incoming DACT telephone lines. Surge protector shall be DiTek DTK-MRJ31XSCP-RUV, or approved equivalent of Innovative Technology, EPT, MCG Electronics, or APC. Unit shall be listed per UL 497A, rated for 130 volts, 9000 amps, 76 joules, witha 5 nanosecond response time. Unit shall be provided witn RJ45 modular plugs.

2-04 NOTIFICATION APPLIANCES

SYNCHRONIZED STROBE AUDIO VISUAL ALARMS: UL Listed to Standard 1971 and tested for 75 candela on-axis. Semi-flush mounted combination horn-lamp assembly suitable for use on an electrically supervised circuit. Horn shall be electronic type with a 3-pulse temporal audible signal and shall have a sound rating of 88db at 10 ft, and shall include a minimum of three settings (high/medium/low). All horns in corridors and in spaces larger than 2,000sf shall be set to "high". All other horns shall be set to "low". Lamps shall be synchronized flashing Xenon type with field selectable 15/30/75/110 candela effective intensity and a flash rate of 1 Hz, and shall be protected by a clear plastic lens. The housing shall be finished in textured red plastic with "FIRE" marked thereon in white. Notifier SpectrAlert Series. Provide flush-mount backboxes as required. Strobe setting to be as indicated on the drawings.

SYNCHRONIZED STROBE VISUAL ALARMS: UL Listed to Standard 1971 and tested for 75 candela on-axis. Semi-flush mounted. Lamps shall be synchronized flashing Xenon type with field selectable 15/30/75/110 candela effective intensity and a flash rate of 1 Hz, and shall be protected by a clear plastic lens. The housing shall be finished in textured red plastic with "FIRE" marked thereon in white. Notifier SpectrAlert Series. Provide flush-mount backboxes as required. Strobe setting to be as indicated on the drawings.

SYNCHRONIZATION CONTROL MODULES (SCM): Provide SCM's as required to synchronize all strobes and horns on each notification appliance circuit. Furnish, install, and wire the SCM's per the manufacturer's recommendations.

SPARE CAPACITY: All Notification Appliance Circuits shall be designed with a minimum of 20% spare capacity to allow for future devices.

2-05 INITIATING DEVICES

There shall be no limit to the number of detectors, stations, or modules that may be activated or "in alarm" simultaneously. Detectors shown connected to magnetic door holders or other similar devices shall be furnished with 120V auxiliary SPDT contacts for release of the devices when the detectors are actuated. Detectors shall be suitable for operation on 24V DC power.

INTELLIGENT MANUAL STATIONS: Provide noncoded type with mechanical reset features. Stations shall be semiflush mounted with the base at 48 inches above the finished floor. The manual stations shall be addressable and identifiable by the master fire alarm control panel. Address assignments shall be set electronically and reside within the station in non volatile memory. Addressable pull stations shall contain electronics that communicate the station's status (alarm or normal) to the control panel over two wires that also provide power to the pull station. The stations will be manufactured from high impact red Lexan. Lettering will be raised and painted white. The station will mechanically latch upon operation and remain so until manually reset by opening with a key. Pull stations shall be dual action. The front of the station is to be hinged to a backplate assembly and must be opened with a key to reset the station. The addressable manual station shall be capable of field programming of its "address" location on an addressable signaling line circuit. Stations indicated as weatherproof shall be installed in cast metal, weatherproof housings with side-hinged access doors. Notifier NBG-12LX.

INTELLIGENT MULTI-SENSOR TYPE FIRE DETECTORS: UL 268. Low profile multi-sensor type detectors shall be plug-in units that mount to a twist-lock base. The intelligent multi-criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine it's environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced

electronics that react to slow smoldering fires and thermal properties all within a single sensing device. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes). The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena. No radioactive material shall be used. Notifier FAPT-851 with B710LP base (no relay) or B224RB base (intelligent relay).

INTELLIGENT HEAT DETECTORS: UL 521. Detectors shall be semi-flush mounted intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. No detector shall be located closer than 12" to any part of any light fixture. Notifier FST-851 with B710LP base (no relay) or B224RB base (intelligent relay).

2-06 WIRE

WIRING: Furnish and install in accordance with NFPA 70 and NFPA 72. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Conductors for 120-volt circuits shall be No. 12 AWG minimum. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and 14 AWG (1.63 mm) for Notification Appliance Circuits. Identify conductors within each enclosure where a tap, splice, or termination is made. Identify conductors by plastic-coated, self-sticking, printed markers or by heat-shrink type sleeves. Wire the alarm initiating and notification signal devices so that removal will cause the system trouble device to sound. Pigtail or "T" tap connections to evacuation alarm bells, horns, and fire warning lights are not acceptable. Each conductor used for the same specific function shall be distinctively color coded. Each circuit color code wire shall remain uniform throughout circuit.

a. All fire alarm system wiring shall be new (verify all fire alarm system wiring requirements with the equipment manufacturer prior to starting work). Conductors shall be copper.
b. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
c. Wiring used for the multiplex communication circuit (SLC) shall be twisted and unshielded and support a minimum wiring distance of 12,500 feet. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit.
d. All field wiring shall be electrically supervised for open circuit and ground fault.
e. The fire alarm control panel shall be capable of t-tapping Class B Signaling Line Circuits (SLCs). Systems that do not allow or have restrictions in, for example, the amount of t-taps, length of t-taps etc., are not acceptable.

Wiring types will be approved by the equipment manufacturer. The system must allow up to 2,500 feet wire length to the furthest addressable device. Class A communications will be provided where shown on the drawings. Wire and conduit will be routed to maintain sufficient distance between the forward and return loop as called for by the authority having jurisdiction. Class B communications will be provided where shown on the drawings.

Use solid conductors with 600V Type THHN-THWN-MTW insulation for systems operating at 120V, and 300V Type TF insulation for systems operating at low voltage (24V or less). Stranded wire may be used if Sta-Con connectors are used at all screw terminals.

2-07 RACEWAYS

Galvanized rigid conduit (GRC) or Intermediate grade metallic conduit (IMC) with screwed fittings, or Electrical metallic tubing (EMT) with compression type fittings or all-steel set screw fittings. See Section 260500, Basic Materials and Methods.

All circuits shall be in metal conduit, unless noted otherwise. All raceways shall be run concealed in walls or ceilings in EMT, GRC, or IMC, unless noted otherwise. Where surface raceway is required use EMT with steel boxes as noted on plans. No high voltage wiring will be permitted in the same raceway or electrical box with any wiring of the fire alarm system except where there is a direct interface such as programmable relay controlling an external device. Where this occurs, the box must be clearly marked to indicate the presence of high voltage.

PART 3 - INSTALLATION

3-01 WORKMANSHIP

All work shall be installed in a neat and orderly manner. Devices, cabinets, covers, fixtures, exposed raceways, etc., shall be aligned parallel or perpendicular to the building walls, ceiling and floor. Wiring in panelboards and cabinets shall be neatly looped and laced, and not wadded. The Owner reserves the right to require repair or replacement of defective workmanship and material without additional compensation to the Contractor.

3-02 SUPPORTS

Conduits, boxes, cabinets, enclosures, etc., shall be securely supported by structural members or structural walls at intervals required by the NEC or as recommended by the manufacturer. Plaster, gypsum board, acoustical tile, and other ceiling and wall finish material shall not be used for support.

3-03 MANUFACTURER'S REPRESENTATIVE

The services of a qualified manufacturer's representative or technician, experienced in the installation, operation, testing, and servicing of the type of system being installed, shall supervise the installation, connecting, software documentation, testing, and adjusting of the system, and train the Owner's personnel in operation of the system. Certified test reports of the final satisfactory test shall be submitted to the Architect-Engineer.

3-04 CONDUIT AND WIRING

See Section 260500, Basic Materials and Methods. All wiring shall be run in EMT, GRC, or IMC conduit. All junction box covers shall be spray painted red and labeled "Fire Alarm". Conductors shall be color coded as follows:

Red/Black	Indicating Circuits (Horns/lights)
Blue/Yellow	Manual Initiating Circuits (Different zones shall be numbered)
Brown/Orange	Automatic Initiating Circuits (Different zones shall be numbered)
White/Green	Do Not Use

3-05 INITIATING AND INDICATING DEVICES

Initiating and indicating devices shall be SECURELY installed as indicated on the drawings and connected in accordance with the applicable wiring diagrams. The contractor shall clean all dirt and debris from the inside and outside of the fire alarm equipment after completion of the installation. The smoke detection devices shall be covered with plastic bags or hard covers in accordance with the manufacturer's recommendations after installation to maintain cleanliness. The bags/covers shall be red for quick visual identification for removal at time of occupancy.

3-06 TESTS

Upon completion of work, the entire system shall be completely operational and tested to conform with these specifications and drawings, and reviewed by the Architect-Engineer. Test shall be performed in accordance with the fire alarm system manufacturer's instructions and per NFPA 72 requirements. All defects in workmanship and material shall be immediately corrected without additional compensation to the Contractor.

SMOKE DETECTOR TESTS: Prior to formal review and tests, clean and perform operational test on each smoke detector. Clean the smoke detectors in accordance with the manufacturers recommended procedures.

DUCT MOUNTED SMOKE DETECTOR TESTS: Prior to formal review and tests, clean and perform operational test on each smoke detector. Clean the smoke detectors in accordance with the manufacturers recommended procedures. Provide documentation of duct detector testing per NFPA 72 Table 14.4.2.2-14(g)(6). Air duct detectors shall be tested or inspected to ensure that the device will sample the airstream. The test shall be made in accordance with the manufacturer's published instructions.

FIELD REVIEW AND TEST: Before final acceptance of the work, test each system to demonstrate compliance with the contract requirement. Each system shall be subjected to complete functional and operational tests including tests in place of each heat and smoke detector (smoke testing aerosols containing oil are NOT acceptable). **When tests have been completed and corrections made, submit a signed and dated certificate with a request for formal review and tests.**

FORMAL REVIEW AND TEST: The Engineer will witness formal tests after receipt of written certification that preliminary tests have been completed and that the system is ready for final review. The system manufacturer's technical representative shall be present for the final review and test. Preliminary tests shall be repeated, and functional and operational tests conducted, as requested by the Engineer. Correct defects and conduct additional tests to demonstrate that the system conforms to contract specifications.

All reviews and tests shall be coordinated with USC Upstate Project Manager and include a formal inspection report listing all comments, deficiencies, etc. as required.

3-07 INSTRUCTION

Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

3-08 CLEAN-UP

Upon completion of all installations and prior to final acceptance by the Owner, all debris shall be removed from the site. Cabinets, enclosures, cover plates, etc., shall be cleaned and paint touched up.

END OF SECTION 283100