







Intercom System Upgrades
at
Santa Rosa High School
and
Jo Nelson Middle School

Due: May 19, 2026 @ 4:00PM

1126 S. Commerce St.
Harlingen, Tx 78550
O: (956) 230-3435
F: (956) 720-0830

Texas Registered Engineering Firm F-15998

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May 7, 2026

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May 7, 2026

SECTION 000100-REQUEST FOR QUOTE (RFQ)

PROJECT: **"Intercom System Upgrades at Santa Rosa High School and Jo Nelson Middle School"**

DATE: **May 7, 2026**

Santa Rosa ISD is seeking requests for Quotes from Cooperative approved vendors as allowed under the Texas Government Code §271.102.

Scope of Work**:** Refer to section 011000.

Alternates: N/A

Allowances: Refer to section 012100

Send Quote Form filled out via email by no later than **4:00 PM CST Tuesday, May 19, 2026** to:

1. Guillermo Quintanilla – Ethos Engineering Principal
   (gquin@ethoseng.net)
2. Ernie Villarreal – Project Management Services, Inc.
   (evillarreal@pmsitx.com)

Document shall be plainly marked, "Quote for **"Intercom System Upgrades at Santa Rosa High School and Jo Nelson Middle School"**. Include the following information:

- Quote Form (000400) **Must Reference Cooperative Contract Number**

Payment and Performance Bond, Contract, Insurance, Texas Ethics Commission Certificate of Interested Parties (1295 Form), and any other pertinent documentation to be provided by Contractor upon selection.

Plans Available: May 7, 2026 (Electronic File Distribution only – No Hardcopies), obtain plans from https://www.srtx.org/departments/business-office/bids or request from Ethos Engineering, 1126 S. Commerce St., Harlingen, TX 78550, 956-230-3435 or via email from gquin@ethoseng.net and imelda@ethoseng.net.

Jobsite Visit: May 11, 2026 at 10:00 AM at the Santa Rosa High School 102 Jesus R. Cruz, Santa Rosa, TX 78593.

Deadline to submit: May 19, 2026 at 4:00 PM CST.

Bid Bond: Not required.

Payment bonds: If quote exceeds $25,000.00 contractor to include cost in Bid Proposal.

Performance bonds: If quote exceeds $100,000.00 contractor to include cost in Bid Proposal.

END OF SECTION 000100

000400 – QUOTE FORM

PROJECT TITLE: **"Intercom System Upgrades at Santa Rosa High School and Jo Nelson Middle School"**

DUE DATE & TIME: Tuesday, May 19, 2026 @ 4:00 PM CST

PLACE: Via Email as listed in form 000100

ESTIMATED COST: **NOT DISCLOSED**

1. The undersigned OFFEROR proposes and agrees, if this proposal is accepted, to enter into an Agreement with OWNER to provide and install Equipment and Materials as specified or indicated in the Contract Documents for the Contract Price and within the Contract, Time indicated in this Proposal and in accordance with the Contract Documents.

2. OFFEROR accepts all of the terms and conditions of the Instructions to Bidders and Supplementary Instructions to Bidders. This Proposal shall remain in effect for a period of no less than sixty (60) days after the date of Proposal opening.

3. In submitting this Bid, OFFEROR certifies that:

   (a) OFFEROR has examined copies of all the documents provided in this Request for Quotes (RFQ):

   (receipt of all of which is hereby acknowledged) and

   (b) This Proposal is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; OFFEROR has not directly or indirectly induced or solicited any other OFFEROR to submit a false or sham Bid; OFFEROR has not solicited or induced any person, firm or a corporation to refrain from proposing; and OFFEROR has not sought by collusion to obtain for himself any advantage over any other OFFEROR or over OWNER.

4. Communications concerning this Proposal shall be addressed to:

   - Guillermo Quintanilla – Ethos Engineering Principal (gquin@ethoseng.net)

   - Ernie Villarreal – Project Management Services, Inc. (evillarreal@pmsitx.com)

It is the intent of the Santa Rosa I.S.D. to award a Contract to the OFFEROR that offers the best value for the District.

The Santa Rosa I.S.D. reserves the right to accept or reject any and/or all quotes to accept the Proposal that, in Santa Rosa I.S.D.'s judgment, is in the Santa Rosa I.S.D.'s best interest.

OFFEROR will supply and install on-site equipment, labor and services as specified in the Project Manual dated **May 7, 2026** for the following price:

BASE PROPOSAL:
[Proposal amount includes **Allowances** as per specifications section 012100].

$_____(number)

_____(words)

SUBSTANTIAL COMPLETION DATE PROPOSED BY CONTRACTOR of the project in its entirety

_____(days)

For accounting purposes, please break down the Base Bid per building:

INTERCOM SYSTEM UPGRADE

1. Santa Rosa High School Building: **$**_____

2. High School Gymnasium Building: **$**_____

3. Jo Nelson Middle School Building: **$**_____

4. High School Locker Room Building: **$**_____

5. Chepe Gymnasium Building: **$**_____

6. De La Fuente Locker Room Building: **$**_____

7. Middle School Weight Room Building: **$**_____

8. CTE Building: **$**_____

9. Fine Arts & Cafeteria Building: **$**_____

10.AG Building: **$**_____

11. Hog Barn Building: **$**_____

12. Total: **$**_____

Our Proposal proposes to use the following Contractors, Subcontractors, Manufacturers, Products, Material Suppliers and Equipment Suppliers for the principal portions of the work.

NAME(S) OF SUB-CONTRACTORS:

_____

NAME(S) OF EQUIPMENT/FIXTURES SUPPLIERS/MANUFACTURER:

_____

000400 – QUOTE FORM

OTHER:

_____

_____

QUOTE IS BEING PROPOSED THROUGH:

COOPERATIVE NAME AND CONTRACT NUMBER:

_____

Name and Address of OFFEROR:

_____

_____

_____

_____

Telephone _____

Signature

_____

Name and Title

_____

_____

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Future work.
7. Purchase contracts.
8. Owner-furnished products.
9. Contractor-furnished, Owner-installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and drawing conventions.
14. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification: "Intercom System Upgrades at Santa Rosa High School and Jo Nelson Middle School".

B. Project Location: See plans Cover Sheet.

C. Owner: Santa Rosa ISD, Santa Rosa, Tx.

D. Engineer: Ethos Engineering, 1126 South Commerce St., Harlingen, Texas 78550.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Specification division numbers are not intended to dictate WHO will be doing the work. The following scope of work includes work specified in the drawings and specifications. All the work must be done and coordinated, regardless of whether it is done under the Sub Contractor or by the General Contractor.

C. Scope of work: “Santa Rosa ISD - Intercom System Upgrades at Santa Rosa High School and Jo Nelson Middle School” consists of multiple existing single-story buildings and an existing two-story building, approximately 218,900 sq. ft.

D. Provide all materials and labor associated with complete operational systems. Major items of work include, but are not limited to:

1. Existing school intercom devices: Before commencing any work, contractor is required to test all devices and document their status (functioning and non-functioning). The repairs will be handled separately by using spare materials or monies in the betterment fund. Testing and report are required to be completed within the first 30 days after notice to proceed.

2. Provide a new intercom head-end system, including but not limited to hardware, switches, software, and programming as outlined on plans and school intercom specifications.

3. The intent is to provide a hybrid intercom system. The new network-based hardware shall utilize the district’s existing fiber backbone and data infrastructure and shall integrate existing to remain wire and analog field devices.

4. Intercom wiring: It is the intent to reuse existing wiring provided it is tested, verified to be in good condition, and compatible with the new system. Where existing wiring is damaged, non-functional, or incompatible, new wiring shall be provided.

5. Existing intercom devices: Call-in switches, speakers, and outdoor horns are to remain unless they do not function (technology comparable) or are not in good condition. If so, provide new devices.

6. Existing IT data fiber optic can be used to communicate between MDF and IDF rooms and new racks. Coordinate new school intercom racks fiber connection with SANTA ROSA ISD IT staff prior to commencing work.

7. Voice and Data Communication Cabling Equipment: Provide cabling, connectors, patch panels, switches, racks, etc. to utilize the existing SANTA ROSA ISD IT fiber infrastructure to interconnect school intercom equipment located at MDF and IDF racks.

8. Hallways, cafeterias, gymnasiums, and building exterior walls with intercom speakers to be wired/transmit general announcements as separate zones as part of all-call.

9. Visual Displays: Contractor to provide and interface them with the new school intercom system. Coordinate programming with each campus end user.

10. Intercom Programming: Contractor to engage with school staff to define all call, emergency announcements, groups of classrooms, etc.

11. Contractor would be allowed to use existing school intercom raceways, some are identified on plans, but not all of them. Contractor would need to confirm on-site prior to bidding.

12. Classrooms Wings and Portable Buildings (detached from main building): Provide new wiring and if necessary, raceways since the new intercom architecture wiring is using the existing fiber optic cable.

13. School Intercom Remote Access: Provide data network at head-end equipment for campus to receive messages (live spoken) via ethernet from school personnel away from campus. Provide all necessary hardware and software required. SANTA ROSA ISD IT to provide IP addresses.

14. Intercom Demolition: Disconnect school intercom console for replacement. All existing wiring that are not needed shall be removed and properly disposed of. Underground raceways to be abandoned in place.

15. Sequence of Construction: The existing intercom system shall remain in operation until the new system is ready for the end user to operate. The work shall be closely coordinated with PMSI, Santa Rosa ISD maintenance and school staff and be scheduled so as not to disrupt school instruction.

16. Electrical requirements associated with work of this section. This includes the following:

    a. Power supply wiring to head-end equipment, field-devices, and other devices requiring power at 120 volts and higher.
    b. UL listed plenum rated cable may be used above ceilings. Control wiring in exposed locations shall be concealed in EMT conduit.

17. Provide ceiling tiles as required to match existing conditions.

18. Please provide storage units for materials as required and coordinate with school personnel.

19. Allowances: The Owner has set aside allowances for unforeseen circumstances. See Section 012100.

E. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

A. Not Applicable.

1.6 WORK UNDER SEPARATE CONTRACTS

A. Not Applicable.

1.7 FUTURE WORK

A. Not Applicable.

1.8 PURCHASE CONTRACTS

A. Not Applicable.

1.9 OWNER-FURNISHED PRODUCTS

A. Not Applicable.

1.10 CONTRACTOR-FURNISHED, OWNER-INSTALLED PRODUCTS

A. Not Applicable.

1.11 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

1. Coordinate details with Owner.

B. Use of the Site: Limit use of the premises to work in areas indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.

2. Limits: Confine operations to areas within contract limits indicated.

3. Driveways, Walkways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
   a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather-tight condition throughout construction period. Repair damage caused by construction operations.

D. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas, and around equipment while site work is in progress.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Work shall take place with minimal disruption to Owner's operations in areas surrounding the job site.

1.12 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
2. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.

1.13 PHASED CONSTRUCTION

A. The Work shall be conducted as one project, but in multiple phases.

B. Before commencing Work, submit an updated copy of Contractor's construction schedule showing the sequence, commencement, and completion dates for all phases of the Work.

C. At no point in time the existing campus intercom systems shall be disconnected/removed when the school is in session.

1.14 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Schedule activities in close coordination with Owner.

C. Contractor should plan for his work to take place after daily school instruction has ended (evenings/nights), weekends and holidays.

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

F. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

G. Controlled Substances: Use of tobacco products and other controlled substances within the existing building is not permitted.

H. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

I. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.15 OUTAGES

A. All electrical, and school intercom systems shall be operational by the next occupancy period.

1.16 COORDINATION

A. Prior to school intercom system installation, contractor shall provide detailed list of inclusion and exclusions to General Contractors at least three days prior to the end of the period set aside to request clarifications so that coordination of any missing items may be addressed and clarified by the Engineer as needed.

B. All questions, requests for information, submittals, and correspondence from the Contractor shall be submitted via the General Contractor, who will forward to the Engineer.

C. Contractor shall not make any changes to design without written authorization from the Engineer. If changes are requested by the Owner, Engineer, General Contractor, Suppliers, Manufacturers, or any others, Contractor should issue a written RFI for response by the Engineer.

D. Contractor shall issue seven (7) days written notice prior to any activities that require the presence of the Engineer at the job-site. This applies to all inspections required by specifications, and particularly to those where work will be covered (below grade).

E. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required:

1. Electrical:
   a. Upon completion of pulling all wiring, making all terminations, labeling and color-coding wires at the panel-boards and prior to installing their covers.
2. When ready for Substantial Completion Inspection.
3. When ready for Final Inspection.
4. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is this contractor’s responsibility to make sure Engineer receives notification.

F. Construction Coordination:

1. The contractor shall supply a complete and comprehensive construction schedule for the project. This schedule shall include durations for the specific tasks required, and shall demonstrate a construction process chain of events, organized to create minimum disruption and minimum inconvenience to building occupants.

2. Contractor shall organize daily work schedules to accommodate the building occupants' functions, comfort, and work schedules. Mandatory achievement of a non-disruptive environment shall be the sole responsibility of the Contractor, and shall at no time incur additional charges for Owner. This shall include weekend and evening work hours, if necessary, to accomplish non-disruptive requirement, and on-schedule completion.
3. A non-disruptive environment shall be defined as: an environment where large-scale activities, or activities causing extreme noise and/or inconvenience are minimal in occupied areas during occupied times. When disruptive tasks must occur during occupied hours, such activities shall be coordinated with Owner's personnel a minimum of one week in advance.

G. Waste Material and Debris: All waste material and debris from this project shall become the property of the contractor and shall be removed from the site. Exterior of the site shall be kept clean and free of material and debris from this project at all times. All waste material and debris generated by any work under this contract shall be handled, transported, stored, and disposed by the contractor and by his subcontractors in accordance with all applicable Federal, State, and local laws, ordinances, regulations, court orders, or other types of rules or rulings having the effect of law including, but not limited to, Executive Order 11752, 17 December 1978; the Federal Water pollution Control Act, as amended, 33 USC, Sec. 1251 et seq; the Clean Air Act, as amended, 42 USC, Sec. 7401 et seq; the Solid Waste Disposal Act, as amended, 41 USC sec 136 et seq; the Endangered Species Act of 1973, as amended, 16 USC, Sec 153 et seq; and the Environmental Protection Agency guidelines on thermal processing and land disposal of solid waste (40 CFR 240 and 241).

H. Contractor shall coordinate safety meetings and communicate safety plans.

1.17 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. SUBMITTALS – see Section 260010 Summary of Electrical Work.

D. SCHEDULE OF VALUES – see section 260010 Summary of Electrical Work

E. MISCELLANEOUS PROVISIONS - see Section 260010

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

SECTION 011000 - SUMMARY

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Engineer from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work.

SECTION 012100 - ALLOWANCES

1.7 ALLOWANCES

A. Use the allowance only as directed by Engineer for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contract Sum shall include Contractor's overhead and profit, insurance and bonding for the Contingency and other specific Allowances.

C. Change Orders or Allowance Expenditures authorizing use of funds from the Contingency or other specific Allowances will not include Contractor's overhead and profit, nor insurance and bonding. Other related costs such as equipment rental, delivery charges, etc. can be included in these costs, but all costs must be submitted by the general contractor with itemized (or unit) pricing from the subcontractor(s) and/or material supplier(s).

D. At Project closeout, credit unused amounts remaining in allowances to Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Include listed Owner's Contingency Allowance for additional work and unforeseen circumstances. Allowance will be used only as directed by Owner and Engineer with a written consent.
   1. Allowance No. 1: **$40,000**.

END OF SECTION 012100

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Engineer at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Engineer.
c. Engineer's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

a. Related Specification Section or Division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

1) Labor.
2) Materials.
3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment shall be as per mutual agreement between Owner and Contractor. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days before the date for each progress payment.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).

4. Products list (preliminary if not final).
5. Schedule of unit prices.
6. Submittal schedule (preliminary if not final).
7. Copies of building permits.
8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

9. Certificates of insurance and insurance policies.
10. Performance and payment bonds.
11. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."

6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of Engineerural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show Engineerural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, intercom and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. MDF/IDF Rooms: Provide coordination drawings showing plans and elevations of intercom and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Intercom/Electrical Work: Show the following:
    a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Location of pull boxes and junction boxes, dimensioned from column center lines.
6. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make changes as directed and resubmit.
7. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three days of the meeting.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
2. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
3. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

C. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than 30 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.

d. Requirements for preparing operations and maintenance data.

e. Requirements for delivery of material samples, attic stock, and spare parts.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.

j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

3. Minutes: Entity conducting meeting will record and distribute meeting minutes.

D. Progress Meetings: Conduct progress meetings at regular intervals.

1. Coordinate dates of meetings with preparation of payment requests.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.

2) Status of submittals.

3) Deliveries.
4) Off-site fabrication.
5) Access.
6) Site utilization.
7) Temporary facilities and controls.
8) Progress cleaning.
9) Quality and work standards.
10) Status of correction of deficient items.
11) Field observations.
12) Status of RFIs.
13) Status of proposal requests.
14) Pending changes.
15) Status of Change Orders.
16) Pending claims and disputes.

17) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 8 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Include the following information for processing and recording action taken:

a. Project name.
b. Date.
c. Name of Engineer.
d. Name of Contractor.
e. Name of subcontractor.
f. Name of supplier.
g. Name of manufacturer.

h. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.
m. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

3. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will discard submittals received from sources other than Contractor.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01).

Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Engineer.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number, numbered consecutively.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.
    d. Product name.

F. Options: Identify options requiring selection by Engineer.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals via email as PDF electronic files.

2. Submittals: Submit 3 paper copies of each submittal unless otherwise indicated. Engineer will return 2 copies.
3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format:

a. PDF electronic file.
b. Or 3 paper copies of Product Data unless otherwise indicated. Engineer will return 2 copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Submit Shop Drawings in the following format:

a. PDF electronic file.

b. Or 3 opaque (bond) copies of each submittal.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ENGINEER'S ACTION

A. Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Submittals not required by the Contract Documents may be returned by the Engineer without action.

END OF SECTION 013300

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

J. "Installer": An installer is the Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

K. The term "experienced," when used with an entity, means having successfully completed a minimum of **five** previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following

list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product 7 days prior to bidding. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will not** be considered unless otherwise indicated.

4. Manufacturers:

    a. Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.

5. Utilities and Intercom and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

6. Engineer's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection. When cutting and patching structural elements, retain a licensed Structural Engineer. Notify Structural Engineer of locations and details of cutting and obtain written approval before proceeding. Shore, brace, and support structural elements during cutting and patching.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Mechanical systems piping and ducts.
f. Control systems.
g. Communication systems.
h. Fire-detection and -alarm systems.
i. Conveying systems.
j. Electrical wiring systems.
k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Exterior curtain-wall construction.
d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner

that would, in Engineers's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including intercom and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical, plumbing, and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.

B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

C. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for intercom and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.

2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

F. Existing Utility Services and Intercom/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.

5. Intercom and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017320 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.

2. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:
   a. Roofing.
   b. Firestopping.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND INTERCOM/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and intercom/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove intercom systems, equipment, and components indicated on Drawings to be removed.
    a. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    b. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    c. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 024296 "Historic Removal and Dismantling."

D. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.

4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.

1. Remove existing roof membrane, flashings, copings, and roof accessories.
2. Remove existing roofing system down to substrate.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 017320

SECTION 017400 - GUARANTEES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. Refer to Instructions to Bidders for substitution of materials and products.

C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

A. Unless stated otherwise on the Certificate of Substantial Completion, all guarantees shall commence with the date of Substantial Completion.

B. Unless otherwise stated in these specifications, all guarantees shall include labor, material and delivery costs required for correction.

C. General: In addition to the General Contractor's one year guarantee for the entire project, guarantees shall be furnished by subcontractors and suppliers. These guarantees shall be submitted to the Engineer in duplicate prior to application for final payment. Refer to individual specification sections for additional guarantees and requirements.

1. One Year Guarantees
   a. Electrical.
2. Two Year Guarantees
   a. School Intercom System
3. Three Year Guarantees
   a. NA
4. Five Year Guarantees
   a. NA
5. Other: See Div. 26 for more details.

PART 2 - PRODUCTS

2.1 GUARANTEES

A. Where guarantees are indicated to be provided by subcontractor or supplier, a detailed warranty written on the required form shall be provided. Refer to Section 017700 for Warranty forms.

B. Manufacturer's standard warranties shall be adjusted as required to include all specified requirements in addition to manufacturer's normal provisions. Manufacturer guarantees shall be written on appropriate printed letterhead.

2.2 MATERIALS

SECTION 017400 - GUARANTEES

A. Unless otherwise approved by the Engineer, all replacement materials shall be new and provided by the same manufacturer as the original installation.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall arrange for all required inspections during the warranty period. Regardless of the wording of individual warranties, the Owner shall not be responsible for notification requirements for routine inspections during the General Contractor's warranty period.

B. Upon receipt of written or verbal notice by the Owner or Engineer of a deficiency, the Contractor shall promptly respond with inspection and repair during the General Contractor's warranty period.

C. The General Contractor shall be responsible for coordinating the activities of subcontractors, suppliers and manufacturers during the General Contractor's warranty period and the subcontractor/supplier/manufacturer extended warranty period.

END OF SECTION 017400

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. “Construction Contract Close Out Checklist”, of this Section.
2. Additional requirements from Owner.
3. Section 017300 "Execution" for progress cleaning of Project site.
4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
6. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 15 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Engineer's signature for receipt of submittals.

5. Submit test/adjust/balance records.

6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 15 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection:
1. It is expected that Contractor will have thoroughly verified that all requirements have been fulfilled, and deficiencies repaired, **before** notifying Engineer that system is ready for final inspection, and **before** arranging final acceptance testing with Owner. Owner and Engineer therefore expect to make but one final inspection of system.
2. Submit a written request for final inspection for acceptance. Provide at least 7 days' notice to Owner and Owner's representative before test. Arrange mutually convenient time for conducting test.
3. On receipt of request, Engineer will either proceed with inspection. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

4. Reinspection:
   a. Should more than one "final" inspection be required due to significant deficiencies, Contractor will be required to reimburse Engineer at a rate of $200.00 per hour for expenses to cover any and all re-inspections required.
   b. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

   a. Project name.
   b. Date.
   c. Name of Engineer.
   d. Name of Contractor.
   e. Page number.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.10 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings, where applicable.

D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings, where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.
2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner, through Engineer with at least **seven** days' advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:

1. System design and operational philosophy.
2. Review of documentation.

3. Operations.
4. Adjustments.
5. Troubleshooting.
6. Maintenance.
7. Repair.

3.2 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.

k. Wipe surfaces of intercom and electrical equipment and similar equipment. Remove excess foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements.

3.3 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including intercom and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

PART 4 - PROJECT CLOSEOUT MANUAL AND FORMS

4.1 FORMS

A. The following forms shall be submitted to the Engineer during the construction contract close out process:
1. Contractor’s Affidavit of Payment of Debts and Claims
2. Contractor’s Affidavit of Payment of Release of Liens

3. Consent of Surety to Final Payment
4. General Contractor Affidavit and Release
5. Subcontractor/Supplier Affidavit and Release
6. General Contractor Guarantee
7. Subcontractor Guarantee
8. General Contractor Hazardous Material Certificate
9. Subcontractor/Supplier Hazardous Material Certificate

B. Use only the listed or enclosed forms.

4.2 PROJECT CLOSE OUT MANUAL

A. The Contractor shall assemble and deliver to the Engineer two (2) complete copies of the Project Close Out Manual consisting of the documents listed below and others as may be required under other sections of the Project Manual. Manual shall be constructed of a good quality vinyl 3 ring binder with all pages 8½" x 11".

B. First sheet shall identify the project, Owner, Engineer, Engineer's project number, Consultants and Contractor. Provide company name, address, telephone number and contact representative for each.

C. Subsequent pages shall include the Table of Contents as included herein and all project data included in the Table of Contents. Provide identifying tabs between all sections.

4.3 CLOSEOUT CHECKLIST

A. The Construction Contract Closeout Checklist included herein recaps the major items to be addressed during the close out process. This list is to be used by the Engineer and Contractor.

B. <u>Standard AIA forms are not included in this section, but shall be attached in the order given below.</u>

C. CONSTRUCTION CONTRACT CLOSEOUT MANUAL TABLE OF CONTENTS

1. Section 1: Contractor's Affidavit of Payment of Debts and Claims (AIA G706)
2. Section 2: Contractor's Affidavit of Release of Liens (AIA G706A)
3. Section 3: Consent of Surety to Final Payment (AIA G707)
4. Section 4: Certificate of Substantial Completion (AIA G704)
5. Section 5: General Contractor Affidavit and Release
6. Section 6: Subcontractor/Supplier Affidavit and Release (from each subcontractor and supplier)
7. Section 7: General Contractor Guarantee
8. Section 8: Subcontractor Guarantee (from each subcontractor)
9. Section 9: List of Final Subcontractors/Suppliers (AIA G805)
10. Section 10: Manufacturer's Guarantees and extended service contracts (NA)
11. Section 11: General Contractor Hazardous Material Certificate
12. Section 12: Subcontractor/Supplier Hazardous Material Certificate
13. Section 13: Miscellaneous
14. Section 15: Intercom Systems
15. Section 16: Electrical Systems

GENERAL CONTRACTOR AFFIDAVIT AND RELEASE

STATE OF TEXAS

COUNTY OF _____

PROJECT: _____
_____
OWNER: _____
ENGINEER_____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____, the contractor who constructed the project referenced above, and that, he/she is duly authorized to make this General Contractor Affidavit and Release.

2. That to the best of his/her knowledge and belief, all work required under the contract of the subject construction project has been performed in accordance with the terms thereof, there are no unsatisfied claims for damages resulting from injury or death to any employees, subcontractors, or the public at large arising out of the performance of said contract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.

3. That upon full payment of all sums due him/her for materials furnished and services rendered by the undersigned in connection with the performance of said contract, as evidenced by the amount shown on the Final Application and Certificate for Payment, the Contractor will release the Owner, the Engineer and the Engineer's consultants from any and all claims of any character arising out of or in any way connected with performance of said contract.

ATTEST (If Corporation)

_____
Name of Contractor

_____ _____ _____
Secretary By Date

Subscribed and sworn to before me on this _____ day of _____ , 20__.

Notary Public: _____

My Commission Expires: _____

SUBCONTRACTOR / SUPPLIER AFFIDAVIT AND RELEASE

STATE OF TEXAS

COUNTY OF _____

PROJECT: _____
_____
OWNER: _____
ENGINEER_____
CONTRACTOR: _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____, the subcontractor/supplier who supplied, installed, and/or erected the work described below, and that, he/she is duly authorized to make this Subcontractor/Supplier Affidavit and Release:

   Work Performed: _____

   Specification Section(s): _____

2. That all work required under the subject subcontract or purchase order of the subject construction project has been performed in accordance with the terms thereof.

3. That to the best of his/her knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said contract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.

4. That upon full payment by the Contractor of all sums due it for materials furnished and services rendered by the undersigned in connection with the performance of said contract, as evidenced by the final payment amount shown below, the Subcontractor/Supplier will release the Owner, the Engineer and the Engineer's consultants from any and all claims of any character arising out of or in any way connected with performance of said contract.

   a. Total Amount Paid to Date to this Subcontractor/Supplier: _____

   b. Final Payment Amount owed to this Subcontractor/Supplier: _____

   c. Final Subcontract Amount: _____
   (a + b = c)

ATTEST (If Corporation)

_____
Name of Subcontractor / Supplier

_____ _____ _____
Secretary By Date

Subscribed and sworn to before me on this _____ day of _____ , 20__.

Notary Public: _____

My Commission Expires: _____

GENERAL CONTRACTOR GUARANTEE

STATE OF TEXAS

COUNTY OF _____

PROJECT: _____

_____

OWNER: _____

ENGINEER_____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____, the contractor who constructed the project referenced above, and that, he/she is duly authorized to make this General Contractor Guarantee.

2. The undersigned Contractor warrants to the Owner and Engineer that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy from damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Owner or Engineer.

4. The Contractor warrants the entire project for a period of **12** months from the Date of Substantial Completion and specific sections of work for such additional periods as enumerated in the Contract Documents, except as follows:

_____

_____

ATTEST (If Corporation)

_____
Name of Contractor

_____ _____ _____
Secretary By Date

Subscribed and sworn to before me on this _____ day of _____ , 20__.

Notary Public: _____

My Commission Expires: _____

SUBCONTRACTOR GUARANTEE

STATE OF TEXAS

COUNTY OF _____

PROJECT: _____

_____

OWNER: _____

ENGINEER_____

CONTRACTOR: _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____, the subcontractor who supplied, installed, and/or erected the work described below, and that, he/she is duly authorized to make this Subcontractor Guarantee:

   Work Performed: _____

   Specification Section(s): _____

2. The undersigned Subcontractor warrants to the Owner and Engineer that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy from damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.
3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Engineer.
4. The Subcontractor warrants the work performed for a period of _____ months from the Date of Substantial Completion, except as follows:

   _____

   _____

ATTEST (If Corporation)

_____
Name of Subcontractor / Supplier

_____ _____ _____
Secretary By Date

Subscribed and sworn to before me on this _____ day of _____ , 20__.

Notary Public: _____

My Commission Expires: _____

GENERAL CONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

STATE OF TEXAS

COUNTY OF _____

PROJECT: _____
_____
OWNER: _____
ENGINEER_____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he/she is the _____ of _____, the contractor who constructed the project referenced above, and that, he/she is duly authorized to make this Certification.

2. That to the best of his/her information, knowledge, and belief none of the below listed hazardous materials have been incorporated into the project:
   - Asbestos
   - Lead
   - P.C.B. (Polychloride Biphenyls)
   - Refrigerant R-11, R-12, R-113, R-114, R-500 and R-502

SUBCONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

STATE OF TEXAS

COUNTY OF _____

PROJECT: _____
_____
OWNER: _____
ENGINEER_____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

3. That he/she is the _____ of _____, the contractor who constructed the project referenced above, and that, he/she is duly authorized to make this Certification.

4. That to the best of his/her information, knowledge, and belief none of the below listed hazardous materials have been incorporated into the project:
   - Asbestos
   - Lead
   - P.C.B. (Polychloride Biphenyls)
   - Refrigerant R-11, R-12, R-113, R-114, R-500 and R-502

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Engineer.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Engineer will return copy with comments.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Engineer.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.

2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent,

and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 260010 - SUMMARY OF ELECTRICAL WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections, and other Division 26 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Scope of Work:

1. "Intercom System Upgrades at Sant Rosa High School and Jo Nelson Middle School" - See Section 011000 – SUMMARY.

1.3 ALLOWANCES

A. Electrical: See Division 1 for electrical allowances.

1.4 COORDINATION

A. All electrical work shall be done under sub-contract to a General Contractor, who is ultimately responsible for the entire project. Electrical Contractor shall coordinate all work through General Contractor, even in areas where only electrical work is to take place.

B. All questions, requests for information, submittals, and correspondence from the Electrical Contractor shall be submitted via the General Contractor, who will forward to the Engineer.

C. Electrical Contractor shall not make any changes to design without written authorization from the Engineer. If changes are requested by the Owner, General Contractor, Suppliers, Manufacturers, or any others, Contractor should issue a written RFI for response by the Engineer.

D. Electrical Contractor shall issue seven days written notice prior to any activities that require the presence of the Engineer at the jobsite. This applies to all inspections required by specifications, and particularly to those where work will be covered (underground raceways, electrical raceways above ceiling).

E. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

F. Issue written notification of the following tasks and allow five days for Engineer to respond and schedule an inspection as required:

1. Upon completion of underground raceways installation and prior to covering up.
2. Upon completion of installing all raceways, labeling all j-boxes and prior to suspended ceiling installation.
3. Upon completion of pulling all wiring, making all terminations, labeling, and color-coding wires at the and prior to installing their covers.

4. When ready to request manufacturer’s start-up of each piece of equipment.
5. When ready for Substantial Completion Inspection.
6. When ready for Final Inspection.

G. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is this contractor’s responsibility to make sure Engineer receives notification.

1.5 UTILITIES

1. Coordinate with power, water, telephone, cable, and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.6 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Temporary fencing around equipment while site work is in progress.

C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the job site.

1.7 SUBMITTALS -Special Requirements

A. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information, which is not applicable to the equipment being supplied for this project. Including Bill or List of Materials.

B. Faxes and copies of faxes are not acceptable.

C. Electrical Submittals shall be submitted electronically. **Please organize the files as noted below** (PDF format - searchable). Files would need to be properly identified (cover letter, stamped, etc.) from the general contractor.

1. **Miscellaneous Electrical – Submittal #1**
   a. 260519 Low-Voltage Electrical Power Conductors and Cables
   b. 260526 Grounding and Bonding for Electrical Systems
   c. 260529 Hangers and Supports for Electrical Systems
   d. 260533 Raceways and Boxes for Electrical Systems
   e. 260544 Sleeves and Sleeve Seals for Electrical Raceways and Cabling
   f. 260553 Identification for Electrical Systems

2. Special Systems - **Submittal #2**
   a. 267230 School Intercom
   b. 269750 Voice and Data Communication Cabling Equipment

D. Individual submittals shall not be reviewed until a complete package is received.

E. Allow two weeks for initial review by Engineer, from the day it is received.

F. After being released by GC, Subcontractor shall have one week to respond to our submittal/re-submittal review comments.

G. Allow one week for review of resubmittals by Engineer.

H. All submittal review comments shall be forwarded by Engineer, who will distribute as per Division 1.

1.8 SCHEDULE OF VALUES - Special Requirements

A. Per Campus - electrical contractor shall submit a Schedule of Values reflecting the total value of Electrical Work in the Contract and broken down into the following items as a minimum, with a line item for Materials/Equipment and another for Labor.

ELECTRICAL
1. Demolition.
2. Raceways including wiring.
3. Voice and data communication cabling equipment.
4. School intercom equipment
5. Testing.
6. Programing.
7. Allowances.
8. Miscellaneous.
9. Administrative and project management.

1.9 CODE COMPLIANCE:
The design for this project is based on:
1. Occupational Safety and Health Act (OSHA)
2. National Electric Code (NEC)
3. International Building Code
4. Local ordinances

END OF SECTION 260010

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of NETA or an NRTL.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturer:

1. Senator Wire & Cable Company.
2. Southwire Company.
3. Encore Wire

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

D. Multiconductor Cable: Comply with UL 1569 and NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC and Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and large.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls and Partitions: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN/THWN-2, single conductors in raceway.

D. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

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

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

    a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

B. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Branch circuits.
2. Receptacle circuits.
3. Flexible raceway runs.
4. Metal-clad cable runs.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

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

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

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
5. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Hangers.
b. Steel slotted support systems.
c. Nonmetallic support systems.
d. Trapeze hangers.
e. Clamps.
f. Turnbuckles.
g. Sockets.
h. Eye nuts.
i. Saddles.
j. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Trapeze hangers. Include product data for components.
2. Steel slotted-channel systems.
3. Nonmetallic slotted-channel systems.
4. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which hangers and supports will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Projectors.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.; a division of Cooper Industries.
    c. ERICO International Corporation.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Material: Plain steel.
3. Channel Width: 1-1/4 inches.

4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
8. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored 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 made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. 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.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
   a. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

b. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
c. Toggle Bolts: All-steel springhead type.
d. Hanger Rods: Threaded steel.
e. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
f. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
g. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
h. Toggle Bolts: All-steel springhead type.
i. Hanger Rods: Threaded steel

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in] NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, and RMCs may be supported by openings through structure members, according to NFPA 70.

C. 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.

D. 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:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. 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 thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
6. To Steel: Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. 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.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Architectural Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. 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.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Sections "Exterior Painting", "Interior Painting" and "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. 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 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. EMT: Electrical metallic tubing.

C. FMC: Flexible metal conduit.

D. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For raceways, wireways and fittings, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.
10. Hylsa

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. EMT: Comply with ANSI C80.3 and UL 797.

E. FMC: Comply with UL 1; zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

a. Material: Steel (Zinc is not acceptable).
b. Type: set-screw.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVCcomplying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Wiring Device-Kellems
b. Thomas & Betts Corporation.
c. Walker Systems, Inc.; Wiremold Company (The).
d. Wiremold Company (The); Electrical Sales Division.
e. Panduit.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Spring City Electrical Manufacturing Company.
10. Thomas & Betts Corporation.
11. Walker Systems, Inc.; Wiremold Company (The).

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.

I. Gangable boxes are allowed as along is permitted by the NEC.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 for indoor applications and Type 3R outdoor with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

K. Cabinets:

1. NEMA 250, Type 1, Type 3R box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC.

4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Concealed in Ceilings and Interior Walls and Partitions: EMT
3. Damp or Wet Locations: GRC.
4. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew steel fittings. Comply with NEMA FB 2.10.

4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

G. Install surface raceways only where indicated on Drawings.

H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches of enclosures to which attached.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Surface Raceways:

1. Install surface raceway with a minimum 2-inch radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
d. Attics: 135 deg F.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 3 for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 3."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12

inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 3."

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Grout.
3. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

2. Sealant shall have VOC content of 150 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

C. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

D. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

E. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Colors for Cables Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical- resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical- resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Apply identification devices to surfaces that require finish after completing finish work.

C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Underground-Line Detectable Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot maximum intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Power.
2. UPS.
3. Intercom System.

C. Power-Circuit Conductor Identification: For secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

I. Locations of Underground Lines: Identify with underground-line detectable warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self- adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

    a. Power transfer switches.
    b. Controls with external control power connections.

K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

L. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

    a. Indoor Equipment: Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
    b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches high.
    c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

    a. Panelboards, electrical cabinets, and enclosures.
    b. Access doors and panels for concealed electrical items.
    c. Intercom system master and staff stations.
    d. Uninterruptible power supply equipment.
    e. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.3 INSTALLATION

Verify identity of each item before installing identification products.

END OF SECTION 260553

SECTION 267230 – SCHOOL INTERCOM AND PROGRAM EQUIPMENT

PART 1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The scope of work of this section consists of the design, installation, and programming of all materials to be furnished under this section, and without limiting the generality thereof, consists of providing all labor, materials, equipment, plant, transportation, appurtenances, and services necessary and/or incidental to properly complete all work as shown on the drawings, as described in the specifications, or as reasonable inferred from either or, in the opinion of the Owner, as being required.

B. School intercom systems will be installed in a professional manner using standard industry practices. Loudspeaker systems are distributed throughout the facility to provide a constant sound level in the desired zones or locations.

C. The system has been designed to utilize the Telecor IP-based processor and logic control.

D. The system will integrate the existing Telecor devices (speakers,clocks and calling switches, etc.) including Cisco telephone system and visual display. The new network-based hardware shall utilize the district's existing fiber backbone and data infrastructure and shall integrate existing to remain wire and analog field devices.

E. The new intercom system shall be a network-based communication system where consoles, stations, amplifiers, displays, and other devices communicate directly over the facility's Ethernet LAN. This communication shall occur using standard Ethernet switching at Layer-2 and do not rely on internet connectivity or cloud services.

F. The system specified is based on the Telecor eSeries Supervised Network based Communications System providing at least the features and functions outlined below. The System shall be installed and programmed by a local authorized and certified Telecor dealer.

G. Supply and install a complete supervised network-based intercom system. Field wiring shall be CAT 5E or CAT 6 cable, control wiring for power distributions and very long runs, and utilize an optional fiber backbone (when distances exceed normal Ethernet limitations). All station equipment shall utilize standard RJ-45 modular connections. All remote devices utilizing standard structured cabling shall be capable of PoE (Power over Ethernet) or power supplied within the CAT 5E or CAT 6 cable jacket. Wiring shall be capable of either being installed in conduit or cable trays, where shown on the plans.

H. The system shall be capable of interconnecting with the building LAN (Local Area Network). This connection shall be minimal and utilize only one Ethernet 100 Mbps (or optionally 1 Gb) connection per station to accomplish all intercom operations. Ethernet ports and associated network switches that are required to connect any intercom devices will be provided by the OWNER.

I. Provide a separate circuit for each room and administrative office so each room, speaker, amplifier, and emergency messaging display/clock can be individually addressed.

J. Overall intercom communications network shall utilize Ethernet or VoIP communications between all major components: administrative consoles, intercom stations, amplifiers and individual paging speakers, and network switches. Systems not utilizing Ethernet or VoIP communications protocol to each end-point device will not be acceptable. Systems not capable of supervising all networked devices including network amplifiers, network speakers, notification switches, and emergency messaging display/clocks will not be acceptable.

K. The network shall support a VLAN configuration to separate activity in the intercom system from other in building LAN traffic. In locations where the supervised network communications system will be considered as part of the facilities life safety systems, a dedicated and isolated network shall be required.

L. The system shall interface to the facility's IP-PBX via SIP trunk connectivity.

M. The Communications System shall include master clock support and synchronization of digital secondary clocks, event scheduling, and messaging software allowing the facility to configure multiple schedules per school, multi zone time tone signaling for class changes, and message notification.

N. The Communication System shall include alarm features, including a comprehensive command center and alarm-focused emergency management capabilities. In the event of an alarm condition, all nonessential system operations shall be automatically suspended. Control of the system shall be transferred to a command center console operated by the incident commander. All call-ins placed from room stations shall be re-routed automatically to the command center console.

O. Programming, provide as noted according to the buildings noted on intercom site plan.

1.3 DEFINITION OF TERMS

A. Installer(s): Shall refer to the person, persons, or company who or which contracts to perform the work specified herein.

1.4 SUBMITTALS

A. Submit the shop drawings, product data, and quality control submittals specified below at the same time as a package.

B. Shop Drawings: Composite wiring and/or schematic diagrams of the complete system as proposed to be installed. Drawing shall include relative position of all major components, typical connections, field components, accessories, and cable types.

C. Product Data: Include catalogue data sheets, manufacturer's default specifications, user operation guides, and bill of materials.

D. Quality control shall include the following:

1. Name, address, and telephone number of the nearest fully equipped service organization.
2. Submit a certificate of completion of installation and service training from the system manufacturer.
3. Submit a list of comparable completed projects. Furnish the name, address, telephone number, and contact name of end user.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Include record of final matching transformer-tap settings and signal ground-resistance measurement certified by Installer.

F. Maintenance Data: For equipment to be included in maintenance manuals specified in Division

1. Record of Owners equipment-programming option decisions.
2. All instructions necessary for proper operation and manufacturer's instructions.
3. "Proof of Performance" information.
4. Manufacturer's maintenance information.
5. Copies of non-proprietary computer programs and system set up disks documenting all programmable features of the installed system.

G. Record Drawings: Prior to final acceptance, provide three (3) complete sets of drawings indicating all cable numbers and construction details in accordance with the actual system installation. Revise all shop drawings to represent actual installation conditions. These Record Drawings will be used during "Final Acceptance Testing".

H. System Training: Submit the following information describing the training programs and system trainers as outlined in paragraph 1.6 of this specification and in accordance with Division 1 specifications.

1. Include with the submittal a preliminary staff development training program in outline form for review and approval by the owner's representative.
2. Include with the submittal a current copy of the trainer's certification from the manufacturer that certifies and identifies the trainer(s) who are eligible to provide training and support for the project.
3. Include with the submittal a current copy of trainer's needs assessment form which will be reviewed with the owner's designated representative for the system's preliminary system programming and configuration.
4. Include with the submittal copies of all documentation used to identify for the owner those participants attending and completing the training programs.

I. A copy of the manufacturer's standard statement of warranty proving all equipment provided for the school communications network is covered with the required five-year warranty shall be included with the project submittal. This statement of warranty shall be provided on the manufacturer's stationary.

1.5 QUALITY ASSURANCE

A. Manufactures: Firms regularly engaged in manufacture of integrated communication systems, time keeping systems, and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for no less than five years.

B. Installer's Qualifications: Firms with at least **five (5)** years of successful installation experience with projects utilizing integrated communications systems and equipment similar to that required for this project.

C. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

D. The Contractor shall be an established communications and electronics Contractor that has had and currently maintains a locally run and operated business for at least five years. The Contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.

E. The Contractor shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system. The Contractor shall maintain at their facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

F. Except where specifically noted otherwise, all equipment supplied shall be the standard product of a single manufacturer of known reputation and experience in the industry. The Contractor shall have attended the manufacturer’s installation and service school and upon request must show proof of attending such a school.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

H. Comply with NFPA 70.

I. Comply with NEMA Standard SB-40 for Emergency Communications in K-12 schools.

1.6 IN-SERVICE TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members, and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. All staff development training is to be coordinated through the owner’s designated representative. As training sessions are completed, the trainer will provide the school’s administrative staff and school district’s staff a document listing all the staff and faculty members who attended, received, and completed the training program.

1.7 WARRANTY

A. Provide **manufacturer’s five-year extended limited warranty** for the new school intercom equipment against defects in material and workmanship. This warranty will cover all new system components including but not limited to new head-end equipment, intercom devices, cabling, wiring, and associated hardware. The warranty shall exclude any existing to be reused equipment, devices, or material. If any defects are found within the warranty period, the defective equipment shall be replaced at no cost (equipment only); a one-year warranty shall be provided for labor.

B. The Contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

C. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

1.8 MANUFACTURERS

A. Manufacturers: Full Network Based solution Subject to compliance with requirements, provide a system by one of the following manufacturers which are currently in use by the owner:

1. Telecor Hybrid, no substitutions

PART 2. PRODUCTS

2.1 SYSTEM REQUIREMENTS

A. The system shall utilize a decentralized network structure not requiring any head-end equipment, central server, or any other control hardware to maintain system operation. Systems utilizing centralized electronics and subject to a single-point-of-failure (power supply, CPU, server, power, etc.) shall not be accepted unless the system has 100% duplication of all centralized operating equipment running concurrently and can automatically take over, including up to the minute programming configuration in the event of a failure of the main system head-end electronics or any required, centralized electronics required to make the system fully operational. Systems that are not based on decentralized structure or systems that do not provide 100% duplication of head-end or systems that operate in a "down-graded" operational mode as the result of a centralized failure are not acceptable.

B. All station devices shall receive power and data through a Power-Over-Ethernet switch. Once plugged into the LAN through a Power-over-Ethernet network switch, all networked devices shall be immediately operational and as applicable shall place or receive calls and pages from stations as well as page all devices in the network. Consoles, intercom stations, clocks, emergency displays, or speakers connected to the network shall not require any network configuration or administration to function.

C. Each Intercom Station, Loudspeaker, clock/message display, shall be assignable to all or any combination of Unlimited Paging, Program Distribution or Time Zones in the system.

D. Speech shall be transmitted in the frequency range from 50 Hz to 7 kHz and shall use a maximum of 128 kbps of bandwidth during a call. In order to assure maximum intelligibility, all system audio shall be HD Audio as defined in Intel™ High Definition Audio Specifications, June 17, 2010.

E. Intercom communications between consoles and system devices shall be non-blocking with no channel restrictions or limitations (other than network capacity) to the number of simultaneous conversations at any time between pairs of intercom stations, intercom station to console, console to console, console to speaker or zone of speakers, program source to a speaker or zone of speakers, or bell tones to a speaker or zone of speakers regardless of number of stations or consoles.

F. Any and all devices shall have the ability to have their programming downloaded, individually or simultaneously via the network. Programming shall be downloadable in a series of human readable, industry standard comma-separated values (CSV) files that can be saved and edited using common spreadsheet applications. Consoles, intercom stations, clocks, displays, and speakers residing on a network shall have the ability to update their programming, simultaneously from a CSV file. Furthermore, all devices shall also have the capability to be configured directly, such that device numbers, names, zones, and call-in destinations can be altered in real time without the uploading or downloading of their programming. System shall be capable of uploading firmware updates to all device classes simultaneously, via the network, without the requirement of tools, by authorized technician or qualified facility technician or representatives.

G. Audio communications between all devices shall be accomplished with latency values of a maximum of 0.1 seconds and connection times of 0.01s for 1 to 500 speakers.

H. The system shall support a minimum of 50 channels of simultaneous duplex communication paths on the intercom system LAN, plus a minimum of 10 simultaneous duplex channels for PBX integration.

I. The system shall support Common Alerting Protocol (CAP) Messaging. Any CAP messages received shall be broadcast to the devices on the communications system. Messages shall be configured to be broadcast to all zones or to specific zones of devices in the facility.

J. Text-to-Speech, shall be provided allowing a user from a PC to key text which shall be converted to Audio and broadcast to speakers on the communications system.

K. The system shall provide Automatic Feedback Management. Room station devices shall be configured to automatically reduce the volume of paging announcements in order to prevent feedback when a paging announcement originates from a console in the vicinity of a speaker, when made from specific devices.

L. The system shall be capable of routing calls from the Public Switched Telephone Network (PSTN) into any classroom, zone or the entire school via the District's SIP enabled Telephone System. This shall allow for remote monitoring and two-way voice communications from outside the facility to classrooms as well as paging into areas of the school. Additional features shall include:

1. The ability to place call-ins from classroom call stations to SIP Telephones.
2. The ability to initiate calls from SIP Telephones to eSeries Classroom Speakers.
3. The ability to initiate zone and all call paging announcements from SIP Telephones to eSeries Speakers throughout the facility.
4. The ability to make outside calls from Administrative Consoles to the PSTN via the Districts Phone System.
5. The ability to receive Live District Wide Paging Announcements from the District Office

M. The System shall allow users to configure multiple schedules per school, with an unlimited number of programmable events in each schedule. Each Event shall sound a user selectable tone, play a user provided audio file or an external audio source. In addition, a textual message shall be programmed to display on associated message displays throughout the school. All scheduling assignments shall be performed via a simple to use, Graphical User Interface (GUI) from a non-dedicated PC, residing in the School. Programming shall also be accomplished from a non-dedicated PC at the District Office. The following features and functions shall be provided. Systems that cannot provide these, shall not be acceptable.

1. The system schedules shall facilitate the requirements of combined facilities (e.g. elementary and middle schools in a common building) where multiple schedules running concurrently would be required.
2. Each event shall play any of the available tones, audio files or audio sources provided. Events shall be directed to any one or more Time Zones in the systems.
3. Events shall include textual messages to clock/message displays. These shall be formatted as fixed, flashing or scrolling displays that can include up to 200 characters in length.
4. Time Tones may be manually activated from Administrative Consoles or selected SIP phones residing on the schools IP PBX.
5. An integral Master Clock shall provide time synchronization to all secondary, digital clock/Message Displays throughout the school. The communications shall be capable of obtaining it's time synch signal from any NTP timeserver.

N. The System shall be capable of automatically distribute SMS and email notifications to relevant staff members when an emergency event is occurring the facility. Notifications shall be distributed to user alert devices such as mobile phones and smart devices. Mobile phones shall receive the notifications as SMS messages while smart devices shall receive email messages. Emergency events include:
   1. The activation of emergency-themed element icons on a PC GUI (e.g., Lockdown, Evacuate, etc.)
   2. Emergency Calls placed from Call Stations located room locations.

O. The system shall automatically distribute SMS and email notifications to appropriate technical support staff in the event that the system is experiencing a fault.

2.2 EQUIPMENT AND MATERIAL

A. Supervised Interactive Graphical User Interface (Part No. EVC V1.3)
   1. The system shall include an Interactive Graphical User Interface (subsequently referred to as IGUI). The software shall reside on Telecor provided PC and should have ability to interface to District Wide Emergency Communication system located in the district office.
   2. The IGUI shall be supervised and shall utilize an easy-to-use graphical user interface for quick and easy graphically aided navigation to access functionality for all intercom stations, paging zones, and program distribution sources. Emergency operations shall be simplified through the IGUI allowing stored audio files and alphanumeric messages for message displays to be activated from the IGUI. The IGUI shall allow common operations such as daily announcements to become simplified into single touch activated icons; removing multi-step console set ups and dial strings.
   3. The voice device used to originate voice communication for the IGUI to selected locations shall be a system console, telephone handset, or microphone independent from the computer hosting the IGUI. The voice device shall remain functional and accessible regardless of the operational state of a computer supporting the IGUI.
   4. The IGUI shall allow the creation of a custom operating screen(s) based on the floor plans of the facilities. Icons representing intercom stations, zones used for paging, tone distribution, textual Message distribution, and audio program distribution shall be incorporated onto the floor plans. The IGUI software shall provide:

a. Simple routine call processing, including: hold, transfer, and forward
b. Activation of remote station auxiliary relays for applications such as door lock or release
c. Emergency functions
d. Paging
e. Audio program distribution
f. Customizable page elements
g. Customizable operating screen
h. Element library for emergency event icons
i. Initiation of emergency and non-emergency messaging, textual and audible
j. Remote station volume adjustment
k. Remote activation of do not disturb status and/or message waiting status
l. Remote station trouble indication
m. Remote station background music channel selection
n. Dynamic zone management for interactive on-the-fly console specific zones
o. Single touch emergency response (supporting both actual emergencies and drills) including but not limited to all or any combination of the following:
    i. Live voice notification
    ii. Pre-recorded audio message
    iii. Digital plain text messaging with simultaneous numerically coded message capability
    iv. Remote system activation, i.e., access control systems, CCTV systems, door release systems, etc.

5. The IGUI must provide an efficient and reliable method of notifying the occupants within the facility of critical situations. A variety of emergency tone signals that reside within the intercom/paging system shall be activated by clicking on pre-programmed buttons on the IGUI screen, initiating the transmission of tone signals to speakers, and alphanumeric messages to message displays/digital clocks. A “lockdown” icon shall be designed as per Owner direction, with Owner selecting the appropriate tone. Whole building macros for emergency or off-normal response shall be built into the internal communication system as directed by the Owner. Each macro shall be capable of being activated by the console, the IGUI as indicated on plans or as directed by the Owner or AHJ. It shall be possible to activate a WAV file message or Owner selected tone coinciding with multi-language textual messages for distributions to zones as directed by the Owner, all from a single activation icon located on the IGUI. Other single action macros shall be activated in similar fashion via the IGUI and a custom-labeled icon. Plain language labeling of all icons on the IGUI shall be user changeable.

B. Supervised SIP Trunk IP/PBX Interface (Part No. ESIP)

1. The system Session Internet Protocol (SIP) Interface shall be a VoIP PBX phone interface of the same manufacturer as the supervised network intercom and paging system. Third party gateway devices shall not be accepted.
2. The SIP Interface shall be supervised and shall connected directly to the facilities network and the PBX's network and shall provide the following:
3. Establish a barrier gateway between the intercom and paging network and the PBX and/or common computer network.
4. Transparent audio operation between VoIP PBX phones and any device on the supervised network intercom and paging system. Paging access from any telephone on the facility system VoIP PBX to any intercom speaker, speaker zone, intercom station, console, all speakers, or paging horns and zones throughout the facility.
5. Any call-in from the supervised network intercom and paging system shall be capable of being routed directly to a VoIP PBX phone. Call-in stations can be configured and programmed to automatically dial any number on the publicly switched telephone network, landline, or cellular number through the SIP interface and via the PBX.
6. Ability to escalate a call-in to be redirected to a VoIP PBX connected phone via the SIP Interface. Escalation can also include the ability to dial any number on the publicly switched telephone network, landline, or cellular number through the SIP interface via the PBX.
7. Ability to initiate alarm and crisis response protocols from any VoIP PBX connected phone.
8. Ability to require security access code to utilize the intercom or paging system emergency communication features.
9. Minimum of 10 simultaneous telephone channels of access to/from VoIP PBX phone system. Full caller ID support from any supervised network intercom call-in device to a VoIP PBX connected phone identifying the calling station ID/Location.
10. Emergency level call-in to be uniquely identified as emergency on the VoIP PBX phones.
11. Activation of all supervised networked intercom and paging system emergency tones and pre-recorded announcements from any phone connected to the building VoIP PBX phone system.
12. The SIP Interface shall additionally allow for calls to be placed from a console to any phone number on the publicly switched telephone network (landline or cellular). Additionally, intercom calls at a console may be transferred to any number on the publicly switched telephone network to any landline or cellular number through the SIP interface via the PBX.
13. Systems that connect to a building or district phone system and are limited to a SLT or CO connection will not be accepted as a substitute for a fully operational SIP Interface.

C. Control Interface (Part No. ECI-MA)

1. The Control Interface shall provide a Desktop Application for PC interaction with the Intercom and Paging system, a Command Interface Protocol for external system interaction with third party systems, Group Zone functionality, and a Scripting Engine supporting multiple sequential operations.
2. The system shall incorporate a Windows based Desktop application that makes use of a Command Protocol Interface, allowing external systems to interact with the Network Intercom and Paging System. Combined with the Scripting and Group Zones features, the Desktop application shall generate a preprogrammed series of operations from a single action. These features shall be used in conjunction with a graphical user interface and the Microsoft Windows desktop.
3. Default Scripts shall be used to generate customized shortcuts according to the needs of a facility. These shortcuts shall then be placed directly on the Windows desktop and shall activate virtually any Intercom and Paging function by clicking on the shortcut icon. These shall include activating:
    a. Alerts, audio distributions, coded and plain text messages, intercom operations.
    b. Pre-Recorded Evacuate, Lockdown, and All Clear audio files.
    c. Companion text messages for audio alerts.
    d. Coded messages on all secondary digital clocks and displays.
4. The Desktop Application shall also activate SMS text messages, computer pop-up notifications, and email distributions in conjunction with any script. Desktop icons such as a Panic Button shall send SMS notifications to a crisis team, advance warning to building occupants through pop-ups to heighten the level of awareness.
5. Any Desktop location running the Application shall have the ability to create and send an instant message using the Desktop's keyboard and display. The textual message can be sent independently or as a companion message to an audible alert.
6. The Desktop Application shall be capable of utilizing Soft Call and Panic buttons. Soft Call buttons shall be created to operate as a call button on the desktop with a normal or emergency call priority. They shall also be combined with other preset or on-the-fly custom text messages. Panic buttons shall allow a user to unobtrusively activate an audio path from the panic button location to another eSeries device at a security location. This shall allow security personnel to listen to an occurring situation and provide the appropriate response.
7. The System shall be capable of streaming multiple audio programs over 10 available channels, simultaneously, to speaker locations in the facility. The ability to turn the broadcast on or off to a specific location shall be controlled from the Desktop Application.
8. A user from the Desktop Application shall enable or disable Do Not Disturb (DND) mode for a group of devices such as speakers or intercom stations.
9. Volume Adjustments to individual devices, devices in a zone, or all devices in the intercom and Paging System shall be made from the Desktop Application.
10. The Desktop Application shall be used to create a call directory to provide the user with the ability to quickly and easily place calls to a large number of prospective recipients and locations. The shortcuts shall be customized with the name of the call recipient or location. The call directory shall also contain shortcuts that activate message-waiting indications in addition to the option of placing calls.

11. The system shall interface with other external systems using a Command Interface Protocol. External systems include integrated security management or building management systems via devices such as computers, programmable logic controllers, or software-based annunciator panels.
12. The Command Interface Protocol shall be used to send real time commands and receive real time status messages between the third party system and eSeries devices. The Command Interface Protocol shall be an ASCII protocol that includes both outbound messaging, and support for inbound command via a virtual COM port and a physical USB connection.
13. Scripting shall allow operations to be carried out in sequence. Scripts shall be activated in various ways including: automatically based on the day of week and time of day, using a Console or a phone, by using the Desktop Application, or from other scripts.
14. When scripts from a Console or PBX phone (via a SIP interface), the name of the script shall be displayed on the Console or phone. Then the user shall be presented with options to enable or disable the script (depending on the current state of the script). Consoles and PBX phones that dial the script number shall hear voice prompts for enabling or disabling the script.
15. Scripts shall be used for scheduling time tone programs that include tones, pre-recorded messages, and textual messages displayed on Message Display/Calendar Clocks reoccurring at specific times and days.
16. Scripts shall perform cascading evacuation operations where evacuation audio messages are automatically first distributed to zones closest to the location of an emergency before spreading outwards to other zones according to a time schedule, thus reducing evacuation route congestion throughout the facility.
17. Group Zones shall allow groups of page zones or devices to be defined as a group zone with a dial number. Group Zones shall be accessed from the Desktop Application, Consoles or PBX phones.
18. Group zones shall be the destination for various functions including textual messages, or audio operations, such as pages or audio program distributions). Group zones shall be assigned customized names, which will appear on Console or phone displays when they are dialed.
19. Group Zones shall make it possible for a dial number to be forwarded to different destinations based on time and day. For example, common audio operations directed to a Group Zone dial number shall be configured to go to the usual destination during regular hours but to a different destination outside of regular hours.
20. Group Zone shall support designated priorities, such as emergency. Operations that are to a zone with a priority are automatically elevated to override any normal or lower priority operations the devices in that group zone are receiving.

D. Alarm Manager (Part No. eAM and eVCAM)

1. The Alarm Manager shall be a Telecor Model eAM equipped with eVCAM software or approved equal. The Alarm Manager shall manage system wide communications during an alarm condition in the facility through a GUI and associated software. The Alarm Manager and associated software shall reside on the facility-provided PC.

2. During an alarm condition, all non-emergency operations shall be restricted. Operations shall be transferred to an Alarm Management Console located at the Command Center location within the facility. The command Center shall be equipped with a Console, associated GUI, PC and software to manage emergency operations during an alarm condition.
3. Included in the GUI shall be ICONS that represent the following alarm types:
    a. Lockdown
    b. Lockout
    c. Evacuation
    d. Reverse Evacuation
    e. Severe Weather
    f. Tornado
    g. Fire
    h. CO Detection
    i. General Emergency
    j. All Clear
4. Alarms shall be activated by “Clicking” on the respective ICON on the GUI. When the corresponding alarm becomes active, the ICONS shall visually change to reflect the current condition.
5. Operation of the Alarm Management Console shall be consistent with NFPA72 Emergency Communication Requirements. Operations activated by an Alarm Management Console shall have the highest priority and shall not be overridden by another operator. This shall eliminate the risk of different operators issuing conflicting instructions.
6. The Alarm Management Console shall perform live paging announcements which shall automatically suspend a pre-recorded portion of an alarm until the conclusion of the paging announcement.
7. From the Command Center, it shall be possible to change the type of alarm, silence an alarm, perform live paging in the alarmed areas, covertly listen to stations, as well as clear the alarm.
8. Call-ins placed from stations in an alarmed area shall automatically be routed to the Alarm Management Console during an alarm condition.
9. Locations designated for “Shelter in Place” such as classrooms, offices, and areas of refuge shall be equipped with Alarm Acknowledgment call stations. These stations shall be used to confirm the status of the occupants in these locations during a Lockdown Alarm Condition. Call stations shall receive pre-recorded verbal instructions to be carried out to secure the “Shelter in Place” locations. Once secure, the status shall be acknowledged by pressing a touch point on the Alarm Acknowledgement Call Station.
10. All “Shelter in Place” locations shall be monitored on the Command Center GUI in real time using the Alarm Manager software. A graphic of the school floor plan shall display the status of the room with color-coded ICONS.
    a. Orange shall indicate that the room has received instructions to secure the room and acknowledgement is pending.

b. Green shall indicate that the room has acknowledged that the room is secure

c. Red shall indicate that the room status is unknown as no acknowledgement has been received from the room.

11. If the Alarm Acknowledgement is not received from the room location after a preset period of time, the station shall automatically place a call to the Alarm Management Console. The Console Operator shall answer the incoming calls utilizing the covert listen function, which allows the operator to aurally monitor the room without the occupant's knowledge. During a convert listen operation, the pre-announce and supervisor tones are suspended. Once the operator determines that the conditions in the room are typical of the situation, the operator shall establish a two-way intercom conversation with the classroom to determine why people in a Shelter-in-Place location did not complete the emergency response procedure.

12. The Alarm Manager shall support Medical and Security Alert Calls from Alert Call stations. Calls from these stations shall be annunciated at the Alarm Management Console, identifying the origin and type of Call. In addition, a pre-recorded announcement stating the origin and type of alarm shall be broadcast over the local speaker, and a textual message shall be scrolled on the local Message display. The audio broadcast and the textual message shall also be broadcast to one of more zones of loudspeakers.

E. Master Clock/Message Host (Part No. EMH)

1. The Master Clock/Message Host shall be a time master device for the eSeries network which enables configuration and activation of eSeries operations from a web-based graphical user interface (GUI). An unlimited number of operations shall be managed for activation by schedules or users. The application shall be web-based and secured via HTTPS certification. It shall be preconfigured with a variety of default operations, schedules, audio, and icons for quick customization. Users shall log into the application from any desktop computer or mobile smart device using a supported web-browser. Supported web browsers shall include Microsoft Edge, Mozilla Firefox, Google Chrome, and Apple Safari.

2. Master Clock/Message Host functionality shall include central time keeping and synchronization of all other eSeries devices throughout the eSeries network.

3. The Master Clock/Message Host shall manage an unlimited number of calendar-based schedules, which are collections of operations intended to be performed frequently, periodically, or on specific dates and times. For example, a schedule may be a series of bell tones that consistently indicate class changes. Users shall set schedules so that the operations they contain will activate accordingly.

4. Schedules shall be viewed, enabled or disabled in a calendar. The calendar shall display schedules on a daily, weekly, monthly or yearly basis. The Master Clock shall support scheduling operations up to 10 years into the future.

5. An unlimited number of holidays shall be specified and marked on the calendar. This shall indicate days where disabling all schedules may be appropriate.

6. The Master Clock/Message Host shall obtain time from and synchronizes with Network Time Protocol (NTP) servers directly or via an NTP-enabled SIP interface present on the eSeries network.

7. Operations shall include several components, including: pre-announce tones, pre-recorded audio, scrolling textual messages, and coded messages. If desired, specific details of the components shall be customized. Customization shall include: the number of times the pre-announce tone plays, the message scroll speed, and the delay before pre-recorded audio repeats. Depending on the operation type, user-activated operations shall be distributed immediately or queued for later distribution.
8. The Home page shall provide a quick overview of Master Clock/Message Host managed operations. This shall include the next scheduled operation, the schedules that are currently active, and the next scheduled school drill. The Master Clock/Message Host shall include user specific short tutorial videos that explain various aspects of the GUI and provides built-in on demand training.
9. The Live page shall show currently active and upcoming operations. A history of recently performed operations shall confirm operations occurred as intended. Also, users shall easily initiate on-the-fly operations on the Live page by configuring and activating them on demand.
10. Routine operations shall include an unlimited number of pre-configured common audio distributions. Examples shall include announcements for special assemblies, bus arrivals, staff meetings, and festive events.
11. Operations shall be associated with eSeries scripts so that they shall be activated by users. The Master Clock/Message Host GUI shall indicate if the script is active even if it was activated via other means such as dial access code or IGUI. Other emergency operations (such as Lockdown) shall also be seamlessly integrated with the IGUI.
12. Audio files shall be used for tones or announcements while images shall be used as icons throughout the GUI to represent different operations or schedules. Audio file formats shall include (WAV and MP3) and images to support operations.
13. Access shall be user-account controlled. An unlimited number of users shall be supported with a high level of individual customization. Users shall be given access to only the pages and operations relevant to their intended roles. For each page, users shall be granted permissions to activate or configure operations and schedules from a desktop or, for certain users, from mobile devices. An administrator account shall have full access to view and make configuration changes on all pages, while an operator account shall be limited to activating routine or emergency operations and enabling or disabling schedules.
14. Users with administrative privileges shall have the ability to configure the site name, time, time zone, test zone, and import and export databases. To aid installers with initial configuration, a test mode shall be provided as well as a database import/export feature. Test mode shall redirect all activated operations to a test zone (that only the installer occupies) to prevent disrupting other people during configuration and testing. Database import/export shall allow the configuration to be exported for backup purposes or to copy to other installations.
15. The system shall be configured for an unlimited number of dedicated emergency response operations. A corresponding drill operation shall be automatically created for each emergency situation. Users shall activate emergency response operations from facility PCs or remote mobile devices.
16. The Master Clock/Message Host shall support the operation of Virtual Call Stations that reside on client PCs, including management of all network connections between Virtual Call Stations and the Network Intercom and Paging System.

17. The Master Clock/Message Host shall feature a Maintenance Portal. The portal shall provide trouble notifications for faults being experienced by any eSeries device on the eSeries Network.
18. The notification includes a details fault report that provides the device name, dial number and the nature of the fault. These shall be easily copied into other documents and emails.
19. The Portal shall be configured to use an email account to automatically send trouble notification emails to a list of designated addresses. These emails shall list the details of all the current faults.
20. A link to the Master Clock/Message Host web interface shall be provided in order for the recipient to perform trouble shooting actions such as viewing up to-do-date fault information, enabling service mode status, and making configuration changes.

F. Supervised Speaker Breakout Module (Part No. ESBM-TB)

1. The Speaker Breakout Module shall provide the means of integrating traditional analog speakers and call initiating devices to the eSeries System. The Speaker Breakout Module shall also be a Single Zone Paging Adapter that can drive an amplifier to provide paging coverage in a facility. The Speaker Breakout Module shall have three relay outputs that can activate automatically during a call processing operation.
2. The Speaker Breakout Module shall receive power and data through a Power-Over-Ethernet switch. Once plugged into the LAN through a Power over Ethernet network switch, the Speaker Breakout Module shall place or receive calls and pages from the eSeries network. The Speaker Breakout Module shall not require any network configuration or administration to function.
3. Speech shall be transmitted through the Speaker Breakout Module in crystal-clear HD Audio. Audio shall be transmitted in the frequency range from 50 Hz to 7 kHz and shall use a maximum of 128 kbps of bandwidth during a call. Audio between the Speaker Breakout Module and Consoles shall be non-blocking.
4. The Speaker Breakout Module shall support Ceiling Inlay Speakers which shall connect to the Speaker Breakout Module via a standard CAT5 cable or conventional 8Ω/25V/70V speakers to provide paging and talkback operation from Consoles or phones via a SIP interface and an IP-PBX.
5. The volume of the speakers shall be adjustable individually, by zone, or across the entire eSeries network via the Management Interface or Control Interface. Volume controls incorporated into certain call station models shall also allow a user to adjust the speaker volume locally. Volume levels shall be set by specific functions: intercom, paging, emergency paging, and Public Channel operations.
6. Call-in capabilities shall be provided with the addition of call stations. Call stations models shall be able to initiate normal calls, emergency calls, or both. Advanced stations that provide additional features shall also be available. These features shall include Privacy mode, Do Not Disturb mode, volume control, and Public Channel select. All call stations shall also provide "message waiting" indication.
7. The Speaker Breakout Module shall also support placing normal and emergency priority call-ins from simple pushbutton call switches. Pressing the normal call switch shall initiate a normal call-in, and either pressing it three times quickly or pressing and holding it for three seconds to shall place an emergency call-in. Pressing the emergency switch once shall place an emergency call-in.

8. The Speaker Breakout Module shall support Receivers which shall detect signals from Wireless Panic Buttons. When a signal is detected, the receiver shall initiate an emergency level call-in to the Administrative Console identifying the location of the call. The console operator shall immediately establish two way communications with the location that initiated the call.
9. The Speaker Breakout Module shall have the ability to direct normal and emergency call-ins to different devices. If the device that is configured to receive the call-in loses network connectivity, the Speaker Breakout Module shall automatically search for an alternate destination. If no other suitable call-in destinations exist, the Speaker Breakout Module shall audibly and visually indicate a fault.
10. The Speaker Breakout Module shall have a call-in roll-over feature where if a call-in to the primary call destination is not answered after a pre-set amount of time, the call shall be automatically copied to a secondary call destination. If both the primary and secondary call destinations are unavailable, the call shall be redirected to a back-up Console.
11. The Speaker Breakout Module shall have the capability to be configured as a member of one or more paging zones.
12. The Speaker Breakout Module shall have a built-in 4-watt audio amplifier that shall drive up to 4 watts of audio to a small zone of 25/70 volt loudspeakers. The Speaker Breakout Module shall provide a line level audio output that can connect to an external power amplifier for applications where the speaker zone load exceeds 4 watts.
13. The Speaker Breakout Module shall be monitored for network connectivity. If the Speaker Breakout Module 's network connection is lost, targeted Consoles shall report that station as absent and display its dial number. When the Speaker Breakout Module is used with Call Stations, the Speaker Breakout Module shall also provide full supervision and monitoring for Call Station and call-in destination connectivity. If a wiring fault is detected between a Call Station and the Speaker Breakout Module, the Speaker Breakout Module shall audibly and visually indicate the error utilizing the status LEDs on the Speaker Breakout Module. The Call Stations shall pulse their status LED to indicate a trouble condition. In case of a fault, the Management Interface or Logging Interface shall log the location, time, date and type of fault. If so configured, the Management Interface, Logging Interface, and Network Amplifiers shall also generate an alarm tone.
14. The Speaker Breakout Module’s status LED that shall flash in different patterns to indicate normal operation, call-in assurance, message-waiting, a call or paging audio in progress, or to indicate an error.
15. The Speaker Breakout Module shall be equipped with three relays that can be used to operate auxiliary devices such as strobe lights, tone initiating devices and door locks.
16. The Speaker Breakout Module shall be wall-mounted using the attached mounting brackets.

G. General Purpose I/O Device (Part No. eNODE)

1. The General Purpose Input/Output Device shall be a Telecor model eNODE or approved equal. It shall allow third party devices and systems to interface with Network Intercom and Paging System through contact closures.
2. The I/O Device shall have a minimum of 4 inputs and 4 outputs.

3. The inputs shall connect to dry relay contacts of third-party devices and shall activate any eSeries operations. Each input shall be configurable and shall support connection to sustained or momentary contact closures. Inputs shall differentiate between single or multiple momentary contact closures
4. Outputs shall activate third party devices and systems. Outputs shall activate in response to:
    a. Paging Audio or Intercom Calls
    b. Scripts
    c. Alarms
    d. Events in the Master Clock / Message Host
    e. Manual Dialing of a dial number
    f. Analog Clock Correction
    g. Trouble Status Indication
    h. Service Mode
5. The I/O Device shall support tracking features where the output will automatically activate if the I/O Device detects the activation of paging audio, call-ins, Scripts and Alarms.
6. The I/O Device Output shall be capable of being manually dialed and activated from a console, or a phone on the facility's PBX. Once dialed, the caller shall be prompted by voice commands.
7. The I/O Device shall be integrated with the Master Clock/Message Host, allowing outputs to be activated according to scheduled events. The outputs can also be programmed to provide correction to synchronous movement analog clocks.
8. All I/O Device Inputs and Outputs shall be monitored and shall detect opens, shorts and ground faults on the connection between the third-party device and the I/O device. If any of these conditions are detected, a fault condition shall be raised on the system

H. Supervised Network Administrative Console (Part No. E300-MA)

1. The Administrative Console shall be supervised and allow the operator to establish two-way communications with an intercom station, talkback speaker, or another Console using the handset or speakerphone. VOX functioning shall be automatically enabled when the handset is used. The Push-to-Talk button shall toggle the Console between talk and listen mode when the speakerphone is used. The Console shall provide a 2-line by 20-character LCD display. The display shall be adjusted to a range of angles for optimum viewing. When there are no active calls, the display shall show the Console name and dial number. If a time server is connected to the network, the display shall also show the time and date.
2. Incoming calls to a Console shall show the originating station dial number and name on the Console display. Calls shall be displayed in the order they are received. The operator shall scroll through the list of calls and answer them out of sequence. Emergency call-ins shall be distinctly annunciated both visually and audibly.
3. The Console shall allow call-ins to be forwarded to another Console, or for calls to be put on hold or transferred to another Console location. Additionally, call-ins or calls shall be forward/transfer-able to PBX telephone extensions via a SIP trunk interface.

4. The Console shall select remote audio sources connected at any location on the local area network, and distribute the audio broadcast from the source to all speakers in a facility or to selected areas such as a speaker zone or a selection of speakers. The Console shall be capable of audio source verification by attendant prior to page zone activation. In this manner, attendants shall listen to the audio source locally, including listening to pre-recorded announcements, prior to system broadcast.
5. The Console shall select a tone or a pre-recorded announcement and broadcast the tone or announcement to all facility speakers or to select areas, such as a speaker zone or a selection of speakers.
6. The Console shall be equipped with digital volume control that shall allow for the separate adjustment of the speaker listen and handset listen volumes. The levels for intercom listen, tones, and program distributions shall be independently adjusted and stored in memory.
7. The system shall allow user programming of alphanumeric architectural room names and numbers. The Console shall be capable of using 1 to 7 digit sequences for dial out and call-in identification, and shall display station numbering, station name, and call-in priority.
8. The end-user shall be allowed to choose and determine the number and location of Consoles. The end-user shall not be limited by pre-set manufacturer limitations of the number of Consoles required by this project; allowing for unrestricted future expansion. Consoles may be added at any time. Consoles added by the end-user that exceed the engineered design for this project shall be at owner's expense. Communication between consoles or consoles and intercom stations or rooms shall not be inhibited by channel number restrictions.
9. The Console shall be capable of displaying room statuses such as Privacy and Do Not Disturb and shall have the ability to override any status limiting communication between the Console and a station with Privacy or Do Not Disturb status activated. Temporary override shall not interfere with continued activation of Privacy and Do Not Disturb after communication has been established and electively terminated.

I. Supervised Ethernet Termination Board Unit (Part No. eTBU-MI and C5PPL)

1. The Ethernet Termination Board Unit shall reside on the facilities LAN providing provide two-way intercom communications between Consoles and industry standard 25 Volt speaker stations.
2. The Ethernet Termination Board Unit shall distribute program audio to speaker locations and detect call-in annunciation from call switches in room locations. It shall selectively transmit Paging, Audio Programs and Time Tone Signals originating on the eSeries Network Devices, to individual rooms, all rooms, selected rooms, or zones of loudspeakers.
3. The Ethernet Termination Board Unit shall be consistent with the ANSI/NEMA SB 40 Standard for Communications Systems for Life Safety in Schools, supporting multiple call-in locations per room. These include the support of call-in devices with LED call assurance and privacy or do-notdisturb indication for each room. Multiple devices at a room location shall be configured to place call-ins with different destinations and priority levels. If the call-in destination of these devices is a Console or an IP-PBX phone extension, the device display shall indicate the calling room location dial number, a textual room name, and the priority level of the call-in. Room locations can be configured with a primary, secondary, and back-up call-in destinations. Emergency priority call-ins placed from a room location shall be configured with a different call-in destination.

4. The Ethernet Termination Board Unit shall support a Message Waiting (MW) feature. This feature shall use the LED on call stations to indicate waiting messages to room occupants. If no one is present in a room location to respond to a call or if the room is in Privacy or DND mode, the caller has the option to activate a MW indication. This causes the LED on the call station to pulse. When a call-in is initiated from the room, it shall be directed to the device that activated the MW indication and the MW indication will be deactivated.
5. The Ethernet Termination Board Unit shall support the Privacy function on Call Stations that are equipped with a Privacy button. When pressed, the Privacy button shall place the room location in privacy mode. This shall prevent monitoring of audio in the room. In privacy mode, the LED on the Call Station shall illuminate to indicate privacy mode. When a call-in is placed from the room location, privacy mode shall automatically be suspended for the duration of the call and re-enabled afterwards. If a call is placed to the room location while in privacy mode, the caller shall be alerted to the privacy mode and given the option to connect the call, leave a messagewaiting indication, or to cancel the call.
6. The Ethernet Termination Board Unit shall include support for the Do Not Disturb mode. Call Stations equipped with a Do Not Disturb (DND) button shall place the room in DND mode when pressed. In DND mode, the LED on the Call Station shall flash to indicate that the station is in the DND mode. This shall suspend zone pages and normal priority audio distributions from being broadcast into that room. DND mode shall not prevent emergency priority operations from reaching the location. If a call is initiated from a room location that is in the DND state, the DND shall be automatically suspended for the duration of the call and re-enabled afterwards.
7. The Ethernet Termination Board Unit shall also provide synchronization and correction of traditional Digital and Analog Clocks, as well as Electronic Message Displays. The digital signaling that provides support for these devices shall originate in the eSeries Network. Analog Clock correction formats supported by Legacy T2 or XL systems, shall also be supported by the Ethernet Termination Board Unit.
8. The Ethernet Termination Board Unit shall monitor the wiring of all room location call devices for call line failure. It shall analyze the wiring for an open circuit, short circuit, or short to ground conditions. In the event of a fault, the Ethernet Termination Board Unit shall detect the fault and provide trouble notification messages to devices equipped with trouble LED and buzzers which will annunciate the trouble signals.
9. The Ethernet Termination Board Unit shall be equipped with an integrated 25 watt, dual-purpose intercom/paging amplifier. It shall be used to provide amplification for two-way intercom communications to room stations, as well as amplification for paging, audio programs, and time tone signals to speaker locations. In the event that the audio load is greater than 25 watts, a line level output shall provide for the connection of an external power amplifier.
10. All speakers, when connected to the Ethernet Termination Board Unit shall reside on an “Off Bus.” This shall ensure failsafe operation, where even in the event that network connectivity is lost, a redundant audio source can be connected to the “Off Bus” and emergency paging announcements can be transmitted to all speakers connected to the Ethernet Termination Board Unit.

11. The Ethernet Termination Board Unit shall mount in a standard rack panel measuring 19" W x 1.75" H and shall occupy a single rack unit. It shall be ideally suited for use with a patch panel. Alternatively, two 50-pin, RJ-21 connectors shall provide termination facilities to a pair of terminal blocks for connecting field devices. The unit shall be powered from an external 24 VDC Power Supply.

J. Power Amplifiers (Part No. SI-125 or SI-250)

1. Power Amplifiers shall be used to drive groups of speakers located in corridors and outdoor locations that are assigned to speaker zones. Amplifier Zones shall be sized at 1 watt per corridor speaker, and 3.5 watts per horn. The amplifier load shall not exceed 80% capacity.
2. The Power Amplifiers shall be capable of producing an audio output of 60, 125 or 250 watts RMS at less than 1% distortion with balanced output.
3. They shall be designed to operate on a line voltage of 115 AC.

K. Call Stations (Part No. CS-1, CS-2, CS-3 or Equivalent)

1. The Call Stations, as indicated on the drawings, shall be used to initiate calls from remote locations to eSeries Consoles. Call Stations are designed to be used in conjunction with a Multi Input Buffer Unit, IP Termination Unit (Multi-Input), or the Ethernet Termination Board Unit on a single pair of wires.
2. Call Stations with a “PUSH TO CALL” momentary contact touchpoint shall initiate a normal priority level call from a remote location when the touchpoint is pressed. A Call Assurance LED shall provide call confirmation. When a call is placed, the LED shall flash, confirming call placement. The LED shall continue to flash until the call is answered by the console operator.
3. Privacy Call Stations shall, when pressed, place the room into privacy mode, preventing monitoring of audio activity in the classroom. When in privacy mode, the LED on the station illuminates, indicating privacy status. When a call-in is initiated from the room, the privacy status shall be automatically suspended for the duration of the call and automatically re- enabled afterwards. If a console calls a room that is in Privacy, the operator shall be alerted and given the option to cancel the call, leave a message-waiting indication or to connect regardless. If they connect, the room occupants will hear the operator, but the operator will not hear the room until an occupant turns off the Privacy feature.
4. Do Not Disturb (DND) Call Stations shall, when pressed, place the room into DND mode. When enabled, the LED on the station shall illuminate, indicating DND, and scheduled events, zone pages and normal priority audio programs will not sound in the room. However, emergency pages, manual tones and high priority audio distributions shall continue to be broadcast into the room. When a call-in is initiated from the room, the DND status shall be automatically suspended for the duration of the call, and automatically re-enabled afterwards. If a console calls a room that is in DND, the operator shall be alerted and given the option to cancel the call, leave a message-waiting indication, or to force the connection regardless of DND. If they connect, the intercom call to the room shall proceed normally; this allows an immediate option to reach the rooms occupants in the event of an emergency.

5. Call Stations shall indicate waiting messages to staff members. If no one is present in a room to respond to a call, or the room is in Privacy or Do Not Disturb mode, the console operator shall have the option to leave a Message Waiting indication. If the MW option is chosen, the LED indicator on the room call stations shall begin to pulse. When a call-in is initiated from the room, the MW indication shall be automatically deactivated.
6. Emergency Call Stations shall be capable of being paired with other call stations and, when pressed, shall initiate an emergency priority level call-in from a remote location. A Call Assurance LED shall provide call confirmation. Then a call is placed, the LED flashes to confirm call placement. The LED shall continue to flash until the call is answered by the console operator. Consistent with the NEMA SB 40-2008 Communications Systems for Life Safety in Schools standard, the Emergency Call Station shall allow the establishment of multiple call-in locations per room and a separate emergency call-in, without the investment in additional wiring infrastructure. The Emergency Call Station shall be connected with a pair of wires from the other associated call station.
7. An alternative model Emergency Call Station shall be able to operate independently without having to be paired with another call station.

L. Vandal Resistant Horn/Loudspeaker (#VT SERIES)

1. The Vandal Resistant Horn/Loudspeakers, as indicated on the drawings, shall be a vandal-resistant loudspeaker assembly that utilizes a double re-entrant horn compression type loudspeaker. It shall be used in locations as indicated on the drawings.
2. These are weatherproof units that are designed for outdoor installation. They are capable of delivering 16 watts of continuous power and include an integral 25/70 volt line-matching transformer. The transformer features color-coded primary taps at 16, 8, 4, 2, and 1 watts. The nominal frequency range is 350 Hz to 10 kHz, with a sensitivity of 96 dB SPL (1 watt/1 meter).
3. The Vandal Resistant Horn/Loudspeaker shall be assembled onto a 16-gauge steel baffle that incorporates a unique interwoven steel security screen for maximum speaker protection while remaining acoustically transparent. This shall prevent any object from penetrating the loudspeaker. The baffle shall be finished in a powder epoxy coating that provides a resilient surface suitable for harsh environments.
4. The Vandal Resistant Horn/Loudspeakers shall be secured to the backbox with “pin-in-torx” tamper-proof screws, which are included with the unit. The Vandal Resistant Horn/Loudspeakers shall be suitable for flush mounting using the H16 Recessed Back Box. Alternatively, surface installations shall be accommodated using the SH-16 Surface Enclosure.

M. Loudspeakers (Part No. STB-12, STB-10 or Equivalent)

1. The Speakers, as indicated on the drawings, shall be 24” x 24 Lay-in Tile Speaker Assemblies, and Pre-assembled 8” Packaged Ceiling Speakers or approved equals.
2. The 24” x 24” Lay-in Tile Speaker Assembly shall incorporate an 8" cone loudspeaker, equipped with a dual 25/70 volt line-matching transformer, pre-assembled into a 24" x 24" square perforated steel baffle and combination backbox, designed to be installed flush in a suspended ceiling

3. The loudspeaker shall have a wide frequency response for general-purpose voice and music reproduction. The line-matching transformer shall have primary taps at 5, 2.5, 1.25, 0.63, and 0.32 watts. The baffle is finished in a mar-resistant, white epoxy coating. The baffle is finished in a mar-resistant, white epoxy coating.
4. The speaker assembly shall be designed to be installed in a suspended ceiling. Installation is quick and simple as the 24" x 24" is designed to fit into a common 2-foot square ceiling grid. Tie off tabs allow the assembly to be secured to the building structure or ceiling grid to address any safety concerns.
5. The Pre-assembled 8” Packaged Ceiling Speaker shall include the loudspeaker/transformer/baffle assembly.
6. The loudspeaker size shall be 8 inches in diameter and have a power handling capacity of 15 watts. The voice coil shall be of high-temperature bonded construction, be one inch in diameter and have an impedance of 8 ohms. The speaker shall have a frequency range of at least 65 Hz to 17,000 Hz and an axial sensitivity of 92dB at 1 m, with a 1 watt input signal @ 1000 Hz. The loudspeaker shall be equipped with a factory wired 25/70 volt line-matching transformer. The transformer shall have the primary taps at 5/16, 5/8, 1-1/4, 2-1/2, and 5 watts. The insertion loss shall be no greater than 1.0 dB. The transformer shall be mounted to the speaker with the secondary leads soldered to the speaker terminals.
7. The assembly shall include a baffle constructed of 22 gauge, cold-rolled steel finished with a mar-resistant white, semi-gloss, epoxy coating. The baffle shall have a diameter of 13".
8. The Pre-assembled 8” Packaged Ceiling Loudspeaker shall mount to a T7 support bridge, used to attach the assembly to suspended ceilings. The support bridge shall accept an enclosure, model H7, for applications where a protective enclosure is required. The H7 enclosure shall attach to the support bridge with appropriate mounting screws. The enclosure shall be a Telecor H7 or approved equal. A circular molded polystyrene damping pad shall be fitted to the inside top of the enclosure to prevent acoustical and mechanical resonances. The pad’s surface shall be molded with a triangular pattern for enhancing low frequencies and shall optimize the audio response of the enclosure.

N. Digital Message Display/Calendar Clock (Part No. 2421)

1. The Digital Message Display/Calendar Clocks, as indicated on the drawings, shall simultaneously display the current time and date. The time is displayed in hours, minutes, and seconds. Hours and minutes are displayed with large 2.25” digits. Seconds are slightly smaller for easy distinction. The date is displayed in plain text by a 10 character, dot matrix display showing the day of the week, followed by the month and date.
2. These clocks are designed for use in conjunction with the Master Clock/Message Host and Ethernet Termination Board Unit. All secondary clocks shall be synchronized with the Master Clock/Message Host. Corrections are done instantaneously and all clocks display the identical time and date. In the event of a power failure, the eSeries System maintains accurate timekeeping during the outage. Once power is restored, all clocks shall be immediately updated with the correct time and date.
3. In addition to displaying the time, the Digital Message Display/Calendar Clocks shall display messages in the dot matrix section of the display. These messages can be used to alert personnel of an emergency or a situation of concern.

4. Messages shall be programmed using software or from a web based Graphical User Interface (GUI). Messages can be activated by the Master Clock/Message Host Event Scheduler, allowing text to be displayed at specific times and days of the week. Messages can be displayed using a variety of visual effects including scrolling or flashing single lines of text, as well as alternating between different lines of text. The dot matrix display defaults back to the date when not displaying messages.
5. The Digital Message Display/Calendar Clock shall be capable of being used as an elapsed digital timer, providing stopwatch functionality, indicating elapsed time on the six-digit display. Elapsed timer functions shall include the ability to count upwards from zero to 24 hours, as well as counting down to zero from a specified value. The elapsed timer shall be controlled using a Timer Button Panel, providing start, stop, and reset functionality. When not operating as an elapsed timer, the Display shall default back to displaying the current time.
6. The Digital Message Display/Calendar Clock shall be suitable for surface or recessed installations using the appropriate enclosure. For surface installations, the surface enclosure is required. For recessed installations, the flush enclosure is used. Two surface-mount enclosures shall be mounted back-to-back with a Dual Mounting Kit, creating a double-faced version.

PART 3. EXECUTION

3.1 EXAMINATION

A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the School Communications and School Safety Network.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.

B. Furnish and install all material, devices, components, and equipment for a complete operational system.

C. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

D. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

E. All housings are to be located as indicated.

F. The contractor shall provide necessary transient protection on the AC power feed, all copper station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

G. Wiring within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.

H. Provide physical isolation from speaker-microphone, telephone, line-level wiring, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12-inch minimum separation between conductors to speaker-microphones, telephone wiring and adjacent parallel power. Provide physical separation as recommended by equipment manufacturer for other system conductors.

I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams.

J. Weatherproofing: Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

3.3 GROUNDING

A. Provide equipment grounding connections for Integrated Electronic Communications Network systems as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounds.

B. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

C. Provide all necessary transient protection on the AC power feed and on all copper station lines leaving or entering the building. Note in system drawings, the type and location of these protection devices as well as all wiring information.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection: Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.

C. Testing: Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.5 FINAL ACCEPTANCE TEST

A. The Final Acceptance Testing shall be provided to the Owner or the Owner’s designated representative only. Final acceptance testing to any other trade or service provider for the project will not comply with the requirements of this section.

B. The contractor will provide a Final Acceptance Test record document signed by both the contractor and the Owner or designated Owner’s Representative establishing the “In Warranty” date. The warranty period will not commence until the Final Acceptance Test is completed.

C. Be prepared to verify the performance of any portion of the installation by demonstration, listening and viewing test, and instrumented measurements. Make additional adjustments within the scope of work and which are deemed necessary by the Owner because of the acceptance test.

3.6 COMISSIONING

A. The contractor shall train the Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventative maintenance of the system. This training will be in accordance with the training as outlined in Section 1.6 of these specifications. In addition to the Training Materials provided, the contractor will also furnish Operators Manuals and Users Guides at the time of this training.

B. Schedule training with Owner through the owner’s representative, with at least seven days advance notice.

3.7 OCCUPANCY ADJUSTMENTS

A. The contractor shall provide Occupancy Adjustments in accordance with Section 1.6 of these specifications. A response scenario amenable to both the owner and the contractor will be established and followed for the first year of service.

3.8 CLEANING AND PROTECTION

A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All blank spaces in equipment cabinets will be covered with blank panels. Top and side panels, and all cabinet doors will be installed. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up. No cabinets will be left unlocked and all cabinet keys will be turned over to the owner or designated owner’s representative.

END OF SECTION 267230

SECTION 269750 - VOICE AND DATA COMMUNICATION CABLING

PART 1 - GENERAL REQUIREMENTS

The primary scope of work is to provide a complete, "turn-key" structured cable infrastructure, if applicable, that will serve the district reliably for many years. All cabling, copper, and fiber optic must be plenum rated. Vendor is responsible for old cable removal, rack, and old network equipment, when needed.

1.1 Infrastructure components, including but not limited to switches, patch cables, patch panels, wire managers, racks, cabling, ladder, pig tails etc., to be provided and installed by contractor.

1.2 The scope of work is limited and strictly associated with data cabling, PoE switches, patch panels, patch cables, racks, ladder, etc. for the school intercom system upgrades.

1.3 TECHNOLOGY SYSTEM DESIGN REQUIREMENTS

A. The back boxes, raceways, and conduit needed to support these services are to be included in design and construction documents.

B. Data and voice cabling projects are separate from audio visual, video, security, building control systems that are not directly associated with IDEA’s IP-based data/voice network.

C. At time of construction award, notice of final data cabling subcontractor selection to be made available to IDEA Technology for coordination.

1.4 WORK INCLUDES

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

B. Communication Systems complete including cabling, special backboxes, hardware and all other required devices and equipment.

C. Installation of system equipment per specifications.

D. To supply in a timely manner to the electrical contractor special backboxes for installation as required.

E. Coordinate wireway, raceway, power, and outlet requirements with the builder and the electrical contractor.

F. Communication Systems Contractors shall provide and install prior to cable installation plastic snap in bushings at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves to protect the cabling from damage.

G. Furnishing of all required materials, equipment, tools, scaffolding, labor, and transportation necessary for the complete installation of the communication systems as shown on the drawings and as specified herein.

H. Cable pathways, conduit, and cable support systems shall be complete with bushings, de-burred, cleaned, and secure prior to installation of cable.

I. It is the intent of these specifications to provide complete installations although every item necessary may not be specifically mentioned or shown.

1.5 WORK TO BE INCLUDED BY THE ELECTRICAL CONTRACTOR IN BASE CONTRACT PROPOSAL

A. Provide utility services conduit as outlined on drawings as required.

B. All required conduit for accessibility to attic space.

C. Furnishing and installation of all required standard back boxes and conduit.

D. Installation of special back boxes supplied by the Division 27 contractor(s).

E. Furnishing and installation of all floor boxes, surface raceways, and other wireways which are detailed or specified under Division 26.

F. Provide equipment-mounting boards as outlined on drawings.

G. Provide equipment grounding system, conductors, and bus bars and as outlined in Division 26.

H. Provide 120-volt power and hook-up to equipment provided in Division 26.

I. Coordination of requirements of Division 26 with the Builder.

1.6 WORK NOT INCLUDED

A. Contractors shall make no agreement that obligates the Owner to pay any company providing communications, monitoring, or other services. Contractors shall not make selection, purchase, or installation of interconnect instruments/equipment to be used on this project.

1.7 SUBMITTALS

A. Product Data: Include data on features, ratings, and performance for each component specified.

B. Shop Drawings: Include dimensioned plan and elevation views of components. Show access and workspace requirements.

1. System labeling schedules, including electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Owner.
2. Fiber pathways and interconnects between MDF and IDF rooms
3. Total cable drop counts per IT closet (MDF/IDF) assignment
4. Cable drop counts per purpose/room/outlet

C. Samples: For workstation outlet connectors, jacks, jack assemblies, and faceplates for color se- lection and evaluation of technical features.

D. Product Certificates: Signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article. Provide evidence of Current COMMSCOPE certification. Contractor shall be certified under manufacture before bid date.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

G. Maintenance Data: For products to include in maintenance manuals specified in Division 1 found in Construction Specs document.

H. Submittal procedures shall be per Division 1 - General Requirements.

I. Provide a complete submittal for each section as specified.

J. Submit complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

K. Submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

L. Each Product data submittal shall include:
   1. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.
   2. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.
   3. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
   4. Cut-sheets or catalog data illustrating the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
   5. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
   6. When the contract requires extended product warranties, submit a sample of warranty language.
   7. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

M. Submit shop or coordination drawings, when specified or the required for the scope of work, which include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary, guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted

portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program.

N. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of final responsibility for furnishing all materials required for a complete working system and in complying with the Contract Documents in all respects.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Proposed contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements herein described will be disqualified.
2. Contractor shall have installed similar systems in at least (5) other projects in the last five years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document. Contractor shall provide information on prior pro- jects including, but no limited to: items such as name and location of project contacts and numbers, total square footage, total number of cables/drops, types of media, etc
3. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.
4. The proposed contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper operation of the system, and to provide service throughout the warranty period. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.
5. The proposed contractor shall be fully experienced in the design and installation of the type of system herein specified and shall furnish with the contract proposal an itemized list of the installations of the type specified herein. The list shall include the name of the project, date of completion, the amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150-mile radius of the proposed project to allow owner’s officials to visit the job site for review of the system installation and service. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.
6. An experienced installer who is a registered communication distribution designer certified by the Building Industry Consulting Service International.
7. The Contractor (Company) shall have a minimum of two full time employees’ who have completed the Manufacturers Certification for the submitted product(s). Copies of Certification shall be included in the submittals.
8. The head installer should be a Registered Communication Distribution Designer (RCDD) and should follow all BICSI recommendations for Telecommunication Infrastructure Copper and Fiber installations.
9. The Contractor (Company) must be able to prove to the satisfaction of the Owner/Engineer that it has significant experience in the installation of fiber optics cable systems and communication systems. Installation must include installation of fiber

optics cable, fiber termination, a knowledge of interconnect equipment, and a thorough knowledge of testing procedures.

10. The Contractor (company) shall provide current CommScope certification before bid date.
11. The Contractor shall not sub any portion of the scope of work. This scope shall be performed and certified by contractor awarded.
12. The ability of a proposed contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the contractors' competency and responsibility to meet the requirements and obligations of the contract.
13. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.
14. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed contractor shall furnish to the Owner with any information or data requested for this purpose.
15. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfill of any part of the contract or to complete the work contemplated therein.
16. The Owner reserves the right to reject the proposal of any contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

B. Codes: Comply with applicable sections of the following for interior and exterior installations. Ensure you are using the latest and most current standards and regulations applicable.

1. International Building Code (IBC)
2. National Electrical Code (NEC/NFPA 70, 101, 2002)
3. National Electrical Safety Code (NES IEEE C2-1997)
4. IEEE Std. 1100-1999 Recommended Practice for Powering and Grounding Sensitive Electronic.
5. IEEE-SA 802.3, 803.11, and 803.16 series Standards for Ethernet, PoE, and Wi-Fi Information Technology.
6. Local Codes, amendments, and ordinances.
7. ANSI/TIA Standards, current revisions of 568, 569, 606, 607, 1152 standards

C. Comply with NFPA 70.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for in- tended use.

1.9 WARRANTY

A. The guarantee shall be such, that during the 25-year period, if Owner determines that any cable no longer certifies at 1Gb/sec, the contractor shall correct it within 5 working days.

1.10 COORDINATION

A. Adjust arrangements and locations of distribution frames, patch panels, and cross connects in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

B. Coordinate work of this section with IDEA IT Network Services Department for their system specifications, telephone instruments, workstations, equipment suppliers, etc.

1.11 PLANS AND SPECIFICATIONS

A. The intent of the project drawings is to establish the types of systems and functions, but not to set forth each item essential to the functioning of the system.

B. Electrical drawings are generally diagrammatic and show approximate location and extent of work.

C. Install the work complete including minor details necessary to perform the function indicated. Provide communication systems (including all hook-ups) complete in every respect and ready to operate.

D. If clarification is needed, consult the Architect/Engineer.

E. Review pertinent drawings and adjust the work to conditions shown. Where discrepancies occur between drawings, specifications, and actual field conditions, immediately notify the Architect/Engineer for his interpretation.

F. The Architect/Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

1.12 MANUFACTURERS' INSTRUCTIONS

A. All equipment and devices shall be installed in accordance with the drawings and specifications, manufacturer's instructions, and applicable codes.

B. Where specifications call for installation of a product to be in accordance with manufacturer's instructions and/or where manufacturer's instructions are required for installation of a product, it shall be the contractor's responsibility to obtain the necessary applicable manufacturer's instructions and install the product in accordance with the manufacturer's instructions.

C. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown on the plans and as called out in these specifications even if manufacturer's instructions are absolutely unattainable.

1.13 ACCEPTABLE MANUFACTURERS AND SUBSTITUTIONS

A. Descriptions and details, acceptable manufacturers' names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose systems which differ in manufacturer, features, functions, or operating characteristics from those outlined in these specifications must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified and include relevant technical and cost data. This shall include a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.

D. The Engineer will consider all such submittals and the Architect will issue an addendum listing items that the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.

E. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of the alternate system shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure the system will be an acceptable equivalent.

F. It is the responsibility of the Contractor to provide all features and functions as outlined in these specifications. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

G. The selected contractor must be a certified Integrator/Installer authorized by one of the Manufacturers listed below to provide an extended warranty to the Owner covering all network cable and connectivity hardware products comprising this installation site. All UTP cable, fiber optic cable, and all wiring devices installed shall be products of one approved manufacturer or joint manufacturers program and approved for use in their extended warranty program. The Contractor and Manufacturer shall jointly provide the Owner an extended warranty of the installed system against defects in material or workmanship; provide a copy of contractor certification.

H. The manufacturers model numbers, functions, and features described in this specification section are those of the CommScope Uniprise with a 25-Year Extended Product Warranty and Application Assurance per District standards, no exceptions.

I. The Contractors' proposal represents that the contract proposal price is based solely upon the materials, equipment, and labor described in the Contract Proposal Documents (including addenda, if any) and that he contemplates no substitutions or extras.

J. The manufacturer of the proposed substitute unit shall provide samples for evaluation, when required, at no charge and non-returnable.

K. Requests for substitution are understood to mean that the Contractor:

1. Has personally investigated the proposed substitution and determined that it is equivalent or superior in all respects to that specified.
2. Will provide the same guarantee for the substitution that he would for that specified.

3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
    a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
    b. The specified product is unavailable through no fault of the Contractor.
    c. The manufacturer refuses to warranty the specified products as required.
    d. Subsequent information indicates that the specified product is unable to perform properly or to fit in the designated space.
    e. In the Engineer's sole judgment, the substitution would be in the Owner's best interest.
    f. Revisions to the electrical system caused by substitutions shall be under the supervision of the Engineer, at a standard hourly rate charged by the Engineer. Charges from the Engineer, Architect, and Electrical Contractor shall be paid by the Contractor originating the changes.

1.14 FUTURE USE CABLING

A. When cabling is installed for future use, it shall be identified with a tag of sufficient durability to withstand the environment involved.

1.15 LOCATIONS AND EXISTING CONDITIONS:

A. Location and condition of any existing equipment or services, when shown, have been obtained from substantially reliable sources, are shown as a general guide only, without guarantees as to accuracy.

B. The Contractor will examine the site, verify all requirements, service points, and availability of all services required to complete this project. No consideration will be granted for any alleged misunderstanding of the materials and labor to be provided as necessitated by nature of the site including those items that may be fairly implied as essential to the execution and completion of any and all parts of this project.

1.16 PROTECTION OF EQUIPMENT AND MATERIALS

A. The Contractor shall take such precautions as may be necessary to protect his apparatus from damage.

B. This shall include the creation of all required temporary shelters to protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.

C. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by the Contractor.

1.17 CUTTING AND PATCHING

A. Notify the Builder sufficiently ahead of construction of any floors, walls, ceiling, roof, et cetera, of any openings that will be required for his work.

B. The Contractor shall see that all sleeves required for his work are set at proper times to avoid delay of the job.

C. All necessary cutting of walls, floors, partitions, ceilings, et cetera, as required for the proper installation of the work under this Contract shall be done at the Subcontractor or at the Subcontractor's expense in a neat and workmanlike manner, and as approved by the Architect/Engineer.

D. Patching of openings and/or alterations shall be provided by the communications Subcontractor or at the Subcontractor's expense in an approved manner.

E. No joists, beams, girders, or columns shall be cut by any Contractor without first obtaining written permission of the Architect/Engineer.

F. All openings in firewalls and floors shall be completely sealed after installation for a completely airtight installation. Sealing material shall be non-combustible and UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated structure to be decreased.

G. All openings in exterior walls shall be sealed watertight.

H. Seal voids around conduits penetrating fire-rated assemblies and partitions using fire stopping materials and methods in accordance with NFPA and local codes.

1.18 INSTALLATION

A. Cooperation with trades of adjacent, related or affected materials or operations, and or trades performing continuations of this work under subsequent contracts are considered a part of this work. In order to effect timely and accurate placing of work and to bring together, in the proper and correct sequence, the work of such trades, including work provided under a Division 1 allowance.

B. The Communications Contractor shall coordinate installation of the communication systems with the Builder, Electrical, Mechanical, and Plumbing Contractors to insure a complete working system for the Owner.

C. Where required for accessibility all conduit and boxes for all communication systems shall be provided by the Electrical contractor as specified, including systems in Division 27, any and all allowances shall be included. Normally low voltage wiring shall run open and supported in accessible attic space. All low voltage wiring in exposed areas such as gyms, stages, shops, and field houses shall be enclosed in conduit. Coordinate with and verify with Division 26 to provide required conduit and boxes at locations and heights as required.

D. Conduit, innerduct, track, or raceway shall conceal and protect wiring in exposed areas, within walls, through in- accessible areas, floors, chases, under slab, crawlspaces, or underground.

E. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

F. All work must be performed by workers skilled in their trade. The installation must be complete whether the work is concealed or exposed.

G. Provide stainless screw/bolt hardware wherever stainless devices are used and in potentially wet areas.

H. Coordinate the actual locations of devices and outlets and equipment with building features and mechanical equipment as indicated on architectural, structural, and mechanical drawings. Review with the Architect any proposed changes in outlet or equipment location. Relocation of devices, before installation, of up to 3 feet from the position indicated, may be directed without additional cost. Remove and relocate outlets placed in an unsuitable location when so requested by the Architect.

1.19 FINAL OBSERVATION

A. It shall be the duty of the Contractor to make a careful observation trip of the entire project, assuring themselves that the work on the project is ready for final acceptance before calling upon the Architect/Engineer to make a final observation.

B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, et cetera, called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Architect/Engineer at or before the time of said final observation. The Contractor is cautioned to check over each bond, receipt, et cetera, before preparing for submission to verify that the terms check with the requirements of the specifications.

C. The following and other provision of Division 1 General Conditions will be required at time of final completion:
   1. Final clean up completed.
   2. All systems are fully operational, all material and devices installed.
   3. As built (as installed) drawings and operations manuals

1.20 DRAWINGS, MANUALS, AND TRAINING

A. As-built drawings and operating and maintenance manuals may be electronically transmitted in PDF file format.

B. Upon completion of the installation, and prior to final inspection, the Contractor shall furnish as-built drawings.

C. In addition, the contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Place final cable certification test results in manuals.

D. All cable paths and wiring methodology shall be documented. All cables shall have both ends labeled and included in the as-built documentation. Provide an MS Excel worksheet compatible format spreadsheet file cross referencing all cable run numbers, architectural room number, and owners room number for the origin and destination of each cable run.

E. A formal on-site training session shall be provided by the Contractor to the Owners Representative / Maintenance personnel and shall include instruction on the documentation, location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of two (2) hours of documented general instruction.

1.21 QUALITY ASSURANCE

A. All Vendors must meet all applicable codes / standards defined below, and any others that may be defined.

B. The Vendor will follow the National Electric Code (NEC), the National Electric Safety Code (NESC), any applicable State of Texas code, and local codes.

C. The Vendor will provide materials and equipment that is new and will conform to the NEMA, UL, ANSI, IEEE, and IPCEA standards. All cabling will follow the BISCI standards of installation, testing and maintenance.

D. The vendor is required to provide a CommScope 25-year Extend Product Warranty and Application Assurance at job completion.

E. Standards:

1. ANSI/TIA/EIA Standards 568D - Commercial Building Telecommunications Cabling Standard
2. ANSI/TIA/EIA Standard 569 - Commercial Building Standards for Telecommunications Pathways and Spaces
3. ANSI/TIA/EIA - 606 - Administration Standard of the Infrastructure of Commercial Buildings
4. ANSI/TIA/EIA - 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
5. ANSI/TIA/EIA - 758 - Customer Owned Plant Telecommunications Cabling Standard
6. TSB-67, 95, and 72 - Testing standards and reporting

PART 2 - SCOPE OF PROJECT/SCOPE OF WORK

2.1 SCOPE OF WORK

A. The Horizontal Structured Cabling System shall consist of Category 6 cables placed from the Telecommunications Room on each floor to the outlets as shown on drawings. All Category 6 outlets will terminate in the Telecommunications Room on 24-port or 48-port Category 6 patch panels. Wire management shall be used to provide cable management above, below and to each side of the patch panel.

B. Cabling for horizontal cabling shall be routed through J-hooks placed above ceiling and below floor as needed to accomplish proper cable routing to work areas. J-hooks and all cable pathways they create shall follow building lines and allow access to cabling from

hallway and open area locations and not be placed over other end user offices. J-hooks should follow all building lines.

C. All structured cabling shall be from a single manufacturer to insure optimum performance.

D. Cable Routing and Installation

1. System wiring and equipment installation shall be in accordance with good engineering practices as established by the EIA and the NEC. Wiring shall meet all state and local electrical code requirements.
2. Cable pathways, conduit, and cable support systems shall be complete with bushings, de- burred, cleaned, and secure prior to installation of cable.
3. All wiring shall test free from opens, grounds, or shorts. All communications cable shall be supported from the building structure and bundled. Do not attach any supports to joist bridging or other lightweight members.
4. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.
5. Communications cable must not be fastened to electrical conduits, mechanical ductwork/piping, sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel with line voltage electrical conductors.
6. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles.
7. The cable pathway of supports must be positioned at least 12 inches above the ceiling grid. Communication cables shall not be run loose on ceiling grid or ceiling tiles.
8. Communication cables shall be run in conduits, where stubs are provided, from wall or floor jacks to accessible areas above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access.
9. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.
10. Communication cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with cable Velcro hook ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.
11. For Work Area outlets/endpoints, each cable run shall include a 15-foot service loop with Velcro hook ties located above the ceiling. This is to allow for future relocation, re-termination, or repair.
12. For MDF/IDF rooms, each cable run shall include a three-foot service loop with Velcro hook ties located in the ceiling above the rack. This is to allow for future re-termination or repair.
13. All cabling shall be placed with regard to the environment, EMI/RFI interference, and its effect on communication signal transmission.
14. Non-conductive fiber optic cable is immune from EMI/RFI interference. Give priority when selecting a route to minimize exposure to possible cable damage from maintenance or service of all systems in the attic space.

15. Do not route any data cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.
16. Communication cable will not be installed in the same conduit, raceway, tray, duct, or track with line voltage electrical cable without a metallic barrier meeting NEC requirements.
17. Maximum cable pulling tension should not exceed 25 pound-force (110 N) or the manufactures recommendation, whichever is less.
18. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.
19. No terminations or splices shall be installed in or above ceilings, other than in designated end point housings.
20. Cable bends shall not be tighter that the manufacturers' suggested bend radius.
21. Mount all equipment firmly in place. Route cable in a professional, neat, and orderly installation.
22. Provide for adequate ventilation to all equipment racks and take precautions to prevent electromagnetic or electrostatic hum.

E. Faceplate types are as follows:
   1. Flush Wall mount
   2. 1, 2, 3, or 4-port faceplate mounted on wall in device box at the work-area.
   3. White in color

F. Contractor will provide all materials to place and terminate all outlet types.

G. Workstation and Equipment Room Category 6 and Category 6a outlets will be color coded to match applications as noted in section 4.2 and 6.4C.

H. Category 6 and Category 6a patch cords to complete work area patching shall be provided by the contractor, as detailed in section 4.3 and 6.4D.

I. Contractor will be responsible for supplying and installation of equipment room (MDF/IDF) patch cords.

J. Contractor will be responsible for supplying and coordinating drop/sign-off with customer for work area patch cords.

K. Customer staff will be responsible for work area patch cord installation.

2.2 BACKBONE-FIBER

A. The Backbone Fiber Riser System shall consist of fiber cables with 12 (twelve) 50-um OM4 multimode interlocking armor cable placed from the each IDF and terminating in the MDF, as shown on the drawings.

B. Sharp edges of interlocking armor will be terminated with MC-type connector and attached to Rack mount bracket or to Fiber shelf.

C. Interlocking armor will be bonded to ground per manufacturer's instructions.

D. All fiber terminations shall be fusion spliced pigtails with LC connectors.

E. Fiber will be terminated and routed through rack mount fiber panels.

F. 2 duplex 7’ LC OM4 riser-rated patch cords will be provided for each closet.

2.3 CABLE SUPPORT

A. Conduit, duct, or track shall be used for communication cable in exposed areas.

B. Cable fill shall not exceed the manufacturers’ instructions for each type of support.

C. All conduit, ducts, track, and raceways

D. Solid, ladder, or mesh cable tray/duct shall be required for narrow depth cable routes that would allow sags to rest upon the ceiling, electrical conduits, HVAC equipment, ducts, or lighting fixtures.

E. Vertical cable runs exceeding 12” in equipment closets shall require ladder or mesh type cable support tray. Attachment shall utilize appropriate mounting hardware and accessories for vertical placement and allow a minimum of 2” clearance between the wall and runway. Cable attachment shall be made by Velcro hook ties in a basket type configuration.

F. All vertical supports shall be attached to the building support structure or concrete ceiling with anchors load rated for 100-lbs. minimum. Down rods shall be a minimum of 1/4” diameter. Steel uni-strut cross supports shall be 2” minimum.

G. Cable runway or tray shall be grounded to an appropriate building ground at each end and bonded at each joint.

H. Rubber or plastic boots shall be installed at the ends of horizontal support rails to prevent cable damage or injuries to personnel.

2.4 J-HOOKS

A. The cabling from the Telecommunications Rooms will be routed to their respective outlets utilizing J-Hooks above ceiling and below floor. Cables will be bundled in groups of less than 50 and placed no more than 5’ apart following the pathway from Telecommunications Room to work area outlet. J-Hooks and all mounting hardware as well as any placement of these devices are the responsibility of the contractor.

B. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center. Cable bundles shall not be allowed to sag down more than 12-inches mid-span between attachments.

C. Category 6, all attachments shall be approved for Category 6 cabling. Attachments shall be Caddy part numbers as follow, or equivalent, sized as follows:
   1. CAT16HP, 1” diameter Capacity 15 Category 6 cables.
   2. CAT21HP, 1.31” diameter Capacity 40 Category 6 cables.
   3. CAT32HP, 2” diameter Capacity 60 Category 6 cables.
   4. Split bundles greater than 2" dia. or provide cable tray.

D. Category 6A, all attachments shall be approved for Category 6A cabling. Attachments shall be Caddy part numbers as follow, or equivalent, sized as follows:
   1. CAT16HP, 1” diameter Capacity 10 Category 6A cables.
   2. CAT21HP, 1.31” diameter Capacity 12 to 24 Category 6A cables.
   3. CAT32HP, 2” diameter Capacity 25 to 35 Category 6A cables.
   4. CAT48HP, 3” diameter Capacity 48 Category 6A cables.
   5. Split bundles greater than 48 cables (maximum allowed bundle size) or provide cable tray.

E. Do not mix different signal strength cables on the same J-Hook (i.e. fire alarm with data and telephone cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

2.5 RACK HARDWARE

A. Rack Hardware will be utilized in the IDF’s and MDF to house terminated Category 6 patch panels, fiber termination hardware, and network switch equipment. All rack hardware will be secured to the floor with appropriate hardware and overhead by cable tray. All racks will be 7 feet in height and 19 inches wide with 3-inch channels.
B. Vertical cable management will be utilized between each rack and at the end of each rack row to manage vertical patch cables (in front) and horizontal cable runs (in back). 6” vertical cable managers will be used between racks to provide cable management vertically.
   1. CPI Part No. 13912-703 6” wide vertical cable manager shall be provided at each open end of a row of racks and on both sides of a single rack.
C. Horizontal wire management shall be provided so there will be wire management above and below each copper patch panel.
D. Alternately, as noted on the drawings, wall-mounted racks shall be utilized in the IDF to house terminated Category 6 patch panels, fiber termination hardware, and network switch equipment. All rack hardware will be secured to the wall with appropriate hardware.

E. All rack hardware shall be grounded to an approved building ground.

2.6 CABLE TIE WRAPS (PLENUM RATED)

A. Plenum rated Velcro hook cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required. Provide and install Panduit TAK-TY HLTP series cable ties with UL 94-V2 flammability rating, or equivalent.

B. Hard plastic or metal tie wraps will not be allowed on any data cable (Category rated UTP).

2.7 MEASURING PULLING TAPE (MULE TAPE)

A. All future use innerduct and conduit cable pathways shall include a Measuring Pulling Tape (Mule Tape) made of woven Polyester, Aramid, Kevlar, or an equivalent fiber blend. Measuring Pulling Tape shall have a minimum tensile strength of 1250 lbf. or as required and shall be pre-lubricated for prevention of burn though and marked for measuring in feet.

B. Measuring Pulling Tape installed in underground pathways shall incorporate a 22 gauge minimum solid corrosion resistant copper conductor for use in radio signal locating procedures.

2.8 LADDER TRAY

A. Ladder tray shall be placed inside the IDF's and MDF to provide a pathway into the room and routing the cables to the rack mounted termination hardware. Ladder tray will be 18" wide and mounted to walls and racks. Ladder tray shall be mounted above racks and doors to allow a natural cable drop from the ladder tray to the rack.

B. All cable trays shall be grounded to an approved building ground.

C. Ladder type cable tray shall be routed over all floor mounted racks from wall to wall, provide all necessary hardware to attach the ladder rack to the top of the floor rack and to the walls. All field cuts shall be filed smooth, dressed square, and painted to match with CPI Part No. 25401-700 Black Touch-up Paint. Utilize tray splicing, support, and coupling hardware supplied by and installed as recommended by the manufacturer. Cable tray and rack shall be securely supported and grounded. Cable tray shall be of heavy-duty tubular steel construction with black powder coat finish, 12" wide, with cross members at 12" intervals. Chatsworth Product Inc. (CPI) Part No. 10250-712 Tubular Runway. At each ladder rack joint, provide a CPI Part No. 40164-001 Grounding Kit. Provide CPI Part No. 10642-001 fire-retardant flat black colored rubberized material end caps to cover all exposed ends of ladder rack. At the top of each rack, provide a CPI Part No. 10595-712 Rack-to-Runway Mounting Plate, CPI Part No. 10506-702 Cable Runway Elevation Kit, and CPI Part No. 12100-712 Cable Runway Radius Drop. At each wall, provide a CPI Part No. 11421-712 Horizontal Wall Angle Support. Provide CPI 12362-712 Cable Runway Center Support hanger brackets and similar and 5/8" all-thread rod hanger supports from the building structure at any span that exceeds 60" from other support (rack and wall mounting locations), at intervals of 60" on center maximum.

2.9 FIRE-STOPPING SYSTEMS

A. Suitable fire-stopping shall be used to prevent the spread of smoke and fire throughout the building. Contractor will be responsible for installing fire-stopping system for every wall or floor penetration as required by code.

2.10 UPS

A. An Uninterruptible Power System shall be placed into each Telecommunications Room to provide conditioned power and back-up in case of power failure. UPS shall be mounted in the bottom of the rack housing the network equipment. Customer is responsible for ordering/installing this device.

2.11 GROUNDING

A. Contractor shall provide a ground bar at each termination location (Telecommunications Rooms and Equipment Room). Contractor shall provide a #6 AWG stranded copper wire cable between ground bars located at each TR and ER to the building main service ground point.

B. This ground conductor shall be utilized for grounding termination equipment, equipment rack and cable tray.

PART 3 - TELECOMMUNICATION NETWORK SYSTEM REQUIREMENTS

3.1 The Structured Cabling System shall consist of any one or all of the following structured cabling elements or subsystems:

A. Work area
B. Horizontal cabling
C. Telecommunications room (or horizontal cross connect)
D. Backbone cabling
E. Equipment room
F. Entrance facility
G. All cable support structure

3.2 SUPPORTED APPLICATIONS

A. The Structured Cabling System shall be capable of supporting and/or integrating the following:
   1. Analogue and digital voice applications
   2. Data applications
   3. Local area network services
   4. Wide area network services
   5. Video /Imaging services
   6. Low voltage devices for building controls

3.3 Additional requirements

A. Categorized copper product shall be used in conjunction with an equivalent or higher Category cable as verified by ETL or TSV.

B. All structured cabling products shall be installed according to any applicable instructions.

C. All networks and other applications shall be installed per applicable standards and manufacturers' guidelines and transmitted over the appropriate minimum Category copper cable or fiber cable for which it was intended to operate on.

D. All applicable local, state, national, and federal electrical and fire safety standards shall be adhered to during and after installation.

PART 4 - WORK AREA OUTLET

4.1 The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:

A. Patch (equipment) cords
B. Faceplates

4.2 Category 6 and Category 6a Copper Outlets

A. All category 6 information outlets designed for termination of 4-pair balanced twisted-pair category 6 copper cables must possess the following characteristics at the minimum:

1. Be able to be a gravity feed (45 degree angled) as well as flush mount utilizing the same jack.
2. Have 110 style insulation displacement connectors with quadrant pair isolation and a pyramid wire entry system. Termination is accomplished with a single conductor impact tool.
3. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.
4. Have rear protective strain relief caps rear entry, which will be installed onto cable after termination.
5. Support industry standards for T568A or T568B wiring options (568B wiring scheme applicable to this project) on each individual outlet.
6. Be side-stackable for high-density solutions.
7. Provide color-coded and labeled for VOICE, DATA or Blank, Snap-In icons for circuit identification.
8. Be constructed of high impact, flame-retardant thermoplastic.
9. Must be Third Party Verified to all claims.
10. Verified to ETL TSV performance in a channel

4.3 Face/Wall plates

A. The faceplates shall support the network system by providing high-density in-wall, surface mount or modular office furniture cabling applications. The outlets consist of faceplates for flush and recessed in-wall mounting as well as mounting to the modular office furniture systems. The surface mount boxes can be mounted where in-wall applications are not possible or to support applications where surface mount is the best option.

B. Faceplates shall be available in single gang design in White and available in (1,2,3, or 4) port openings.. They shall feature openings on both sides to allow easy identifications of the ports and accept Uniprise information outlets. They shall come equipped with mounting screws, label covers, and label cards.

1. CommScope – M14L-262 (4-port outlet)
2. CommScope – M13L-262 (3-port outlet)
3. CommScope – M12L-262 (2-port outlet)
4. CommScope – M10L-262 (1-port outlet)

C. Outlets at faceplate will color code according to application

1. CommScope Uniprise- UNJ600-BL (for all Data Drops)
2. CommScope Uniprise- UNJ600-VL (for all Projectors)
3. CommScope Uniprise- UNJ600-OR (for all Analog)
4. CommScope Uniprise- UNJ600-YL (for all Security Cameras)
5. CommScope Uniprise- UNJ600-262 White (for all intercom)

D. All category 6a information outlets designed for termination of 4-pair balanced twisted-pair category 6a copper cables must possess the following characteristics at the minimum:

1. Be able to be a gravity feed (45 degree angled) as well as flush mount utilizing the same jack.
2. Have 110 style insulation displacement connectors with quadrant pair isolation and a pyramid wire entry system. Termination is accomplished with a single conductor impact tool.
3. Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.
4. Have rear protective strain relief caps rear entry, which will be installed onto cable after termination.
5. Support industry standards for T568A or T568B wiring options (568B wiring scheme applicable to this project) on each individual outlet.
6. Be side-stackable for high-density solutions.
7. Provide color-coded and labeled for VOICE, DATA or Blank, Snap-In icons for circuit identification.
8. Be constructed of high impact, flame-retardant thermoplastic.
9. Must be Third Party Verified to all claims. Verified to ETL TSV performance in a channel

E. Outlets at faceplate will color code according to application

1. CommScope Uniprise- UNJ10G-GN (for all WAP Drops)

4.4 Above Ceiling/Structure Mounted Jack Locations

1. Jack type to match colors above and shall be as follows:
2. CommScope part number M101SMB-B-262 securely mounted to structure above the finished ceiling with Category 6 jacks and blanks as required.

4.5 Patch Cords

A. All category 6 Patch (Work-area) Cords shall use 4-pair balanced twisted-pair category 6 23 AWG stranded twisted pair copper cable and be available in both Booted and Non-Booted options.

B. For work area data drops, we require the following length and quantity of patch cords.
1. Twenty-Five (25) CAT 6 work area patch cord, 1 foot in length and Blue in color shall be provided. UC1BBB2-0ZF001
2. Fifty (50) CAT 6 work area patch cord, 10 feet in length and Blue in color shall be provided. UC1BBB2-0ZF010
3. Ten (10) CAT 6 work area patch cord, 15 feet in length and Blue in color shall be provided. UC1BBB2-0ZF015
4. Five (5) CAT 6 work area patch cord, 25 feet in length and Blue in color shall be provided. UC1BBB2-0ZF025
5. Two (2) CAT 6 work area patch cord, 50 feet in length and Blue in color shall be provided. UC1BBB2-0ZF050

C. For Projector Drops, provide one Purple category 6 10’ patch cord per drop. UC1BBB2-0LF010

D. For Analog Drops, provide one Orange category 6 10’ patch cord per drop. UC1BBB2-06F010

E. For Security Camera Drops, provide one Yellow category 6 10’ patch cord per drop. UC1BBB2-09F010

F. For Intercom Drops, provide one White category 6 10’ patch cord per drop. UC1BBB2-08F010

G. For WAP Drops, provide one Green category 6a 10’ patch cord per drop. UC1AAA2-04F010

H. Patch cords shall be from the same manufacturer as the horizontal cabling to insure optimum performance.

PART 5 - HORIZONTAL CABLING SUBSYSTEM

5.1 The horizontal cabling system is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the TC.

A. Horizontal cabling in an office should terminate in a TC located on the same floor as the work area being served

B. Horizontal cabling is installed in a star topology (home run)

C. Bridged taps and splices are not permitted as part of the copper horizontal cabling

5.2 Copper UTP Cable

A. Category 6 UTP Cable
1. * Maximum cable length is 90 meters

B. These requirements are for cables of four unshielded twisted pairs of 23 AWG bare copper, thermoplastic insulated solid conductors enclosed by a thermoplastic jacket. The finished cable shall exceed the requirements of ANSI/TIA/EIA-568-B.2-1 Category 6.

C. All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. All cable shall be listed with an OSHA approved laboratory and carry labeling of either CMP or CMR whichever is appropriate for the installation environment.

D. The cable manufacturer shall be ISO 9001 registered.

5.3 Cabling Testing Criteria

1. Tested to 650 MHz
2. Maximum Delay Skew < or = 25 ns
3. Typical Positive Power Sum ACR ≥ 400 MHz
4. Capacitance Unbalance of 58.2 pF Max @ 23 degrees Celsius.
5. Typical PSUM NEXT & NEXT ≥ 10dB better than category 6 standard

5.4 Cable Color Scheme

A. Color scheme for cable runs and patch cables are indicated below. Selected cabling vendor should confirm quantity of each with construction and IT to ensure correct number and type of runs.

B. The color code shall be as follows:

Purpose	**Color**
Data (wall jacks)	Blue
Wireless Access Points	Green
Projectors	Purple
Analog (security/fire/elevator x-connect)	Orange
Security Cameras	Yellow
Intercom	White

5.5 Cable Run Designator Labeling Scheme

A. Each patch panel jack, wall plate jack, terminal cabinet connector, both ends of each cable run and on the ceiling grid bar at jack locations that are concealed above a drop ceiling shall be labeled with a cable scheme run designator machine printed labels installed according to EIA/TIA 606 standards. All labeling shall conform to industry standards and best practices. Labeling types and scheme shall be verified and coordinated with the Owner prior to any installation.

B. Patch panels are to be labeled based on room number (or closet number), sequential order and purpose as indicated in the below example.

C. <Room #>-<Sequence on patch panel>-<Purpose>

IT Closet (Patch Panel)	***Room (Faceplate)***
RM228-004-AP	MDF-004-AP
RM228-005-P	MDF-005-P
RM228-006-D	MDF-006-D

D. Third Party Systems are to be terminated on the patch panel and labeled as indicated below. At the device, the cable should be labeled indicating closet and patch panel label. No devices should be connected directly into the switch and third party vendors are expected to coordinate needed drops with the selected cabling vendor.

IT Closet (Patch Panel)	***Device***
HVAC001	MDF-HVAC001
Lighting001	MDF-Lighting001
Marquee001	MDF-Marquee001

E. Fire/Security/Elevator Cross Connects.

1. Cross connect cables should be labeled at the demarc punch block to indicate purpose using a wrap around tag. On the far end panel, the cable should be labeled with the phone number using a wrap around label

Demarc/Punch Block	***Device Panel***
Fire1	<phone # on punch block>
Fire2	<phone # on punch block>
Security	<phone # on punch block>
Elevator	<phone # on punch block>
911 (to voice router)	<phone # on punch block>
SRST (to voice router)	<phone # on punch block>

PART 6 - MDF/IDF ROOMS

6.1 The MDF/IDF Rooms includes those products that connect the networking equipment to the horizontal and backbone cabling subsystems. These products include termination hardware (connectors and patch cords), racks, cable management products and cable routing products.

6.2 Data / Telephone Cabling Plan

A. Provide adjacent to the equipment rack in each MDF and IDF a plan view of all building areas covered by the equipment closet meeting the following requirements:

1. Framed and secured to the wall and plan covered with clear acrylic panel.
2. Size to clearly show all required information.
3. "YOU ARE HERE" indicator with arrow.
4. Room names and numbers. Verify with Owner.
5. Show each device with symbol and identification address number as designated by owner.
6. Symbol legend.
7. True north arrow
8. Scale indicator

6.3 Cable Management

A. The Cable Management System shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprised of vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius, and providing cable strain relief.

B. Rack Systems

1. Standard Rack
   a. The 7’H x 19” W UL listed standard equipment rack is an Underwriters Laboratory listed 22Y9 communications circuit accessory designed specifically for use in telecommunications equipment installations where codes require UL Listed equipment racks.

2. Double-Sided Vertical Management
    a. The 7’H x 6” W vertical managers are double-sided to allow for front and back side cable management. The doors are lightweight, but sturdy. Doors are equipped with dual hinge latching to enable opening from the right or left.
    b. Recessed handles eliminate snag potential for clothes and arms. C Channel bracket allows for easy access to the cable trough. Tool-less installation of Cable Spool.
3. MDF and IDF Racks:
    a. APC AR3150 – Netshelter
    b. Isolated ground power strip mounted on the lower portion of the left side of each rack to be:
    • Middle Atlantic Products Part No. PDT-2X320, or equivalent.
    c. Ladder type cable tray shall be routed over all floor mounted racks from wall to wall.
    d. Mount fiber termination cabinets in the top portion of the rack and then the patch panels. Reserve the lower 50% of rack space for mounting of network electronics by the Owner.D
4. IDF-Portable buildings
    a. Chatsworth 12419-748 Tinted CUBE-iT PLUS Cabinet System with 30" Depth, 48" Height - 48"H x 24"W x 30"D (1220 mm x 610 mm x 760 mm); 26U; #12-24 Tapped Rails; Tempered Glass Door; Black
    b. Include one (1) per rack, Chatsworth 12820-705 20-amp power strip, 8 outlets, NEMA 5-20P, 19” wide (1 RU).
    c. Include one (1) per rack, Chatsworth 10610-019 Horizontal Rack Busbar with a Chatsworth 40162-902 2-hole lug with 3/4" bolt-hole spacing and #6 AWG green insulated copper wire to the building ground.

C. Cable Tray

1. The Cable Tray in a Telecommunications Room / Equipment Room shall be placed to allow easy access into the room and formed as shown on drawings. Tray shall route cables from room entrance to their termination location. Tray shall use a stand-off bracket to allow cables to be routed above racks and flow easily into vertical managers.
2. All cable trays shall be grounded to ground bar located in the termination location.

6.4 Cable Termination Hardware

A. Each horizontal or backbone cabling run will be terminated using appropriate connectors or connecting blocks depending upon the cable type. Matching patch cords will be used to perform cross-connect activities or to connect into the networking/voice hardware.

B. U/UTP Modular Patch Panel

1. The modular patch panel must be capable of housing M-Series outlets.
2. The discrete distribution module (DDM) panels should be available in a 24- or 48-port, straight configuration.
3. The panel should consist of a rack mounted base unit, rear cable management hardware, and labels for port numbering.
4. Panel should mount in a 19-inch (483mm) equipment rack with universal hole spacing.

5. The modular patch panel will be installed above and below switches. 24-port patch panels shall be installed above the top switch and below the bottom switch in each rack. 48-port patch panels shall be installed between switches in each rack.
    a. CommScope CPP-UDDM-2U-48 Patch Panel, 48 port
    b. CommScope CPP-UDDM-1U-24 Patch Panel, 24 port

C. Outlets installed in the Modular Patch Panel will be color-coded to match application, workstation drop, and patch cord as follows-

1. CommScope Uniprise- UNJ600-BL (for all Data Drops)
2. CommScope Uniprise- UNJ600-VL (for all Projectors)
3. CommScope Uniprise- UNJ600-OR (for all Analog)
4. CommScope Uniprise- UNJ600-YL (for all Security Cameras)
5. CommScope Uniprise- UNJ600-262 White (for all intercom)
6. CommScope Uniprise- UNJ10G-GN (for all WAP Drops)

D. Copper Patch (Equipment) Cords

1. Category 6 and Category 6a patch cords to complete closet patching shall be provided by the contractor.
2. One (1) foot patch cords are preferred in the closet to avoid the need for horizontal and vertical management of patch cords. Patch cords shall be from the same manufacturer as the horizontal cabling to ensure optimum performance and the color should match their respective cable run color and patch panel outlet.
3. Provide 1 per drop, plus an additional 5 each of each color and type.
    a. Data- Blue category 6, UC1BBB2-0ZF001
    b. Projectors- Purple category 6, UC1BBB2-0LF001
    c. Analog- Orange category 6, UC1BBB2-06F001
    d. Security Cameras- Yellow category 6, UC1BBB2-09F001
    e. Intercom- White category 6, UC1BBB2-08F001
    f. WAPs- Green category 6a, UC1AAA2-04F001
4. Uniprise Category 6 and Category 6a patch cords are high-performance UTP components available in a broad range of lengths and easy-to trace colors. They are designed to meet or exceed all Category 6 specifications yet are fully backward compatible with Category 5e and lower systems.
5. 23 AWG conductors are securely mated with a patented RJ45 plug design to deliver superior electrical performance with excellent repeatability. The unique anti-snagging feature simplifies removal and replacement of patch cords.

E. Fiber Termination Enclosure

1. All fiber optic rack mount enclosures shall be CommScope. All adapter panels shall be CommScope for Multi-mode applications. All rack mount enclosures shall be CommScope Uniprise Ready enclosures.
    a. CommScope SD-1U Enclosure

F. Fiber Patch (Equipment) Cords

1. All fiber optic patch cords shall be duplex MM OM4 CommScope fiber patch cords. Connector type shall be CommScope LC connectors for Multi-mode applications. All

fiber patch cords shall be CommScope factory assembled and tested, and supplied for each terminated fiber connection per section 7.10

G. Fiber Pigtail Kits

1. All fiber optic pigtails and connectors shall be CommScope. Connector type shall be CommScope LC connectors for Multimode applications. Multimode pigtails shall be constructed with LazrSPEED 550 OM4 fiber.
   a. CommScope FAXLCUC0C-M003 Pigtail Kit (50-um)

PART 7 - BACKBONE CABLING SYSTEM

7.1 The Backbone Cable Subsystem in a building is the part of the premises distribution system that provides connection between equipment rooms, telecommunication rooms, and telecommunications service entrance facilities. A backbone subsystem provides either intra-building connections between floors in multi-story buildings or inter-building connections in campus-like environments.

7.2 All cables shall be run using a star topology (home run) from the Main Cross-Connect (MC) in the Equipment Room to each Horizontal Cross-Connect (HC) within the Telecommunications Room. The length of each individual run of backbone fiber cable shall not exceed 2000 meters for multimode and the length of each UTP cable run for voice applications is not to exceed 800 meters (90 meters for data) as specified under TIA/EIA-568-A.

7.3 The type of backbone fiber cable shall be 50/125 m multimode fiber optic cable. The bending radius and maximum pulling tension of the cable shall be adhered to during handling and installation.

7.4 Fiber Backbone

A. The type of fiber cable used shall contain Laser Optimized 50-micron OM-4 Multimode fiber.

B. Termination enclosure will be located at the top of the rack housing the network equipment in the MDF Room.

7.5 Fiber Cable

A. Fiber Optic Backbone Cable shall be rated OFNP or OFNR per the installation environment as defined by the NEC and local authority having jurisdiction.

B. Multi-mode:

1. Fiber construction shall be multi-mode with a core/cladding size of 50/125 microns. Contractor shall purchase and install the appropriate CommScope fan out and breakout materials where dictated by the application and choice of fiber optic cable type. The maximum attenuation of the cable shall be 3.0 dB/km at 850nm and 1.0 dB/km at 1300nm. The cable shall be capable of supporting 10 Gigabit Ethernet to 550 meters.

C. Fiber Optic Cable size shall contain 12 fibers, and termination shall be as per the backbone diagram, or Customer requirements. All Fiber Optical Cable shall be constructed to the requirements listed in Fiber Cable Specifications.

D. All fiber links shall be tested for attenuation using a power meter and light source. The allowable attenuation for any link shall be calculated using the CommScope link loss calculator.

E. All testing shall be accomplished according to Section 11 of ANSI/TIA/EIA-568.1-D

1. CommScope 50 micron LazrSPEED 550 Multimode fiber cable P-012-DZ-5K-FSUAQ
2. CommScope Powered fiber cable, OS2, 4 Fibers, Outdoor, 12AWG conductor (printed per feet) –PFC-S04O12F [Provide all POE extenders, connectors, power express modules, Slimline SPS DC Rectifier, and other items for complete system]

F. 1. Fiber Optic Backbone Cable shall be rated OFNP or OFNR per the installation environment as defined by the NEC and local authority having jurisdiction.
1. Multi-Mode
   a. Fiber construction shall be multi-mode with a core/cladding size of 50/125 microns. Contractor shall purchase and install the appropriate CommScope fan out and breakout materials where dictated by the application and choice of fiber optic cable type. The maximum attenuation of the cable shall be 3.0 dB/km at 850nm and 1.0 dB/km at 1300nm. The cable shall be capable of supporting 10 Gigabit Ethernet to 300 meters.
   b. When tested in accordance with FOTP-3, “Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components,” the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550 nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550 nm

7.6 Fiber Cable Specifications

A. This optical fiber backbone cable shall be suitable for installation in building riser systems, in conduit, in cable tray and/or in innerduct.
1. Optical fiber cable shall be encased in an interlocking armor with an overall jacket.
   a. Optical fiber cable shall carry an OFCP (Optical Fiber Conductive Plenum) or OFCR (Optical Fiber Conductive Riser) rating, depending on installation environment.
   b. Outer Sheath: The outer sheath shall be marked with the manufacturer’s name, date of manufacture, fiber type, listing (OFCP or OFCR), manufacturer’s identification number, and sequential length markings every two feet.
2. Temperature Range:
   a. Storage: -40ºC to +70ºC (no irreversible change in attenuation).
   b. Operating: -20ºC to +70ºC.
3. Humidity Range: 0% to 100%.
4. Single Unit Cables:
   a. Maximum Tensile Strength (2 fibers).
   - During Installation: 1001 Newton (225 lb. force) (no irreversible change in attenuation).
   - Long Term: 300 N (67 lb. force).

b. Maximum Tensile Strength (≥4 fibers):
- During Installation: 1335 Newton (300 lb. force) (no irreversible change in attenuation).
- Long Term: 400 N (90-lb. force).

5. Multiple Unit Cables:
   a. Maximum Tensile Strength (≤ 24 fibers).
   - During Installation: 2670 Newton (600 lb. force) (no irreversible change in attenuation).
   - Long Term: 180 N (801 lb. force).
   b. Maximum Tensile Strength (36 to 48 fibers):
   - During Installation: 3560 Newton (800 lb. force) (no irreversible change in attenuation).
   - Long Term: 1068 N (240-lb. force).
   c. Maximum Tensile Strength (≥60 fibers):
   - During Installation: 4450 Newton (1000 lb. force) (no irreversible change in attenuation).
   - Long Term: 1335 N (300-lb. force).
6. Bending Radius:
   a. During Installation: 20 times cable diameter.
   b. No Load: 10 times cable diameter.

7.7 Fiber Hardware

A. All Fiber Optic Termination Hardware shall be CommScope. Termination hardware in the Equipment Room shall be CommScope for Multi-mode applications. All rack mount enclosures shall be CommScope Uniprise Ready enclosures.

1. CommScope SD-1U Enclosure
2. CommScope SD-2U Enclosure
3. CommScope SD-4U Enclosure

7.8 LC Connectors

A. When fusion splicing is not practical, Qwik-II connectors shall be used to terminate multimode fiber. All Fiber Optic Connectors shall be CommScope. They shall be available in LC style connectors.
   1. CommScope MFC-LCF-09-5X LC Connector for 0.9 mm Fiber (MM)

7.9 Fiber Optic Adapter Splice Cassettes

A. The splicing cassette is designed for use in the SD fiber shelf, which has a LGX/1000 style footprint. Fusion splices are utilized and managed inside the cassette after splicing. The cassettes are available with 12 fiber LC duplex connections in 50-micron Multi-mode fiber and Single mode Fiber versions. The splice cassette is provided with pigtails in the appropriate fiber type and fusion splice protection sleeves. Break out kits are not required when utilizing the splice cassette.
B. This product is intended for indoor use or can be used outdoors in a suitable protective enclosure.
   1. CommScope PNL-CS-12LCX-PT Splice Cassette (MM)

7.10 Fiber Optic Patch Cords

A. All fiber optic patch cords shall be available in LC connector type. Cords shall be available in multiple jumper lengths. CommScope's fiber optic jumpers connect the patch panel/shelf to the equipment bay.
B. Contractor will provide Six Duplex 5 foot and Six Duplex 10 foot patch cords per 12 strand backbone cable, enough to fully patch out both sides of the backbone cable.
   1. CommScope FEXLCLC42-MXF005
   2. CommScope FEXLCLC42-MXF010

PART 8 – GROUNDING

8.1 ER to the building main service ground point. This ground conductor shall be utilized for equipment, termination, equipment rack, cable tray and computer equipment grounding.

8.2 All grounding and bonding shall meet the National Electrical Code (NEC) as well as local codes, which specify additional grounding and/or bonding requirements.

8.3 Bonding and Grounding

A. Communication bonding and grounding shall be in accordance with the NEC and NFPA. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. When required by local code, provide a Telecommunications Bonding Backbone utilizing a #6-AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure) and is independent of equipment or cable.

PART 9 – EXECUTION

9.1 UTP CABLE TERMINATION PRACTICES

A. Insulation Displacement Contact (IDC) connectors shall be used and installed per the manufactures' recommendations.

B. Strip back only as much cable jacket as required to terminate.

C. Preserve wire-pair twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.

D. Avoid twisting cable jacket during installation.

E. Take care to ensure all data UTP wiring devices are designed for T568B wiring, T568A devices use a different pair assignment and should not be mixed.

9.2 OPTICAL FIBER CABLE INSTALLATION AND TERMINATION PRACTICES

A. The following fiber optic connector installation methods are acceptable; fusion splice connection of factory-made pigtail connectors, epoxy/polish style connectors, or non-epoxy compression cam gel style connectors. In each case, the connector manufactures'

instructions shall be followed and the recommended tools and supplies, including break out kits when required, shall be used for termination and testing. All Fiber strands to be terminated including future use pairs.

B. As per industry standard - IEC 61300-3-35 during optical fiber connector termination, certify, all terminations with a 200-power microscope (minimum). Follow all of the connector manufacturers' recommendations. Unacceptable flaws in the termination's will include, but not be limited to, scratches, full or partial cracks, bubbles, pits, or residual dirt, dust, oil, moisture, grinding or sanding debris in the connector. The acceptable final inspection shall show a connector tip that is properly aligned and free of imperfections in 100% of the core and 80% of the cladding. Any connectors that fail testing shall be inspected and re-tested after rework.

C. During installation of optical fiber cable, do not allow pulling tension to exceed cable manufacturers' specification for the cable being installed. Only the strength member of the cable shall be subjected to the pulling tension.

D. Clean all optical fiber connector tips prior to inserting them into mating receptacles or bulkheads and re-install dust covers. Clean the tester launch cord prior to each insertion, as well.

9.3 WARRANTY, SERVICE, TESTING, CERTIFICATION

A. The Contractor must provide an extended warranty that is inclusive of the Manufacturer's warranty to the Owner covering all network cable and connectivity hardware products comprising this installation site. The Contractor and Manufactured shall jointly provide the Owner an extended warranty of the installed system against defects in material or workmanship for a period of no less than twenty-five years (period as is customary for the Manufacturer) from the date of substantial completion. Any equipment or cabling shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner.

B. The System Contractor shall make a thorough inspection of the complete installation to ensure the following:
   1. Complete and functional system.
   2. Installed in accordance with manufacturers' instructions.
   3. All cabling shall test free from all grounds, opens, and shorts.
   4. A representative of the Owner shall have an opportunity to be present for all final testing. Coordinate final testing with Owner, schedule as near as possible to acceptance date.

9.4 UTP CABLES AND LINK TESTING

A. Acceptance Testing: Test each conductor of every cable on the reel to verify length and continuity. Cables that have been damaged in transit must be replaced. Installed cable that proves to be defective will be replaced at the contractor's expense.

B. Final Testing: All UTP cabling will be certified to meet and or exceed the specifications as set forth for Permanent Link Testing of all Power over Ethernet electrical parameters including alien crosstalk performance. Mechanical requirement testing and test methods shall meet ANSI/CEA S–90–661 or ANSI/CEA S–102–732. Certified cable channel

performance shall meet or exceed the requirements of ANSI/TIA-568, ANSI/TIA-1152-A, and ISO/IEC 11801 Standards for Structured Telecommunications Cabling Installations in a configuration up to 100 meters at swept frequencies of:

1. 1 to 250 MHz Level III Class E for Category 6
2. 1 to 500 MHz Level IIIe Class EA for Category 6A.

C. Test alien crosstalk (near-end and far-end loss) for a cabling system using a network analyzer with 100-Ω pair terminations as follows;
   1. The test device consists of two jacks; one jack is connected to a main test unit and the other to a remote test unit; the main test unit and the remote test unit are connected with a field tester communication channel (patch cord or link);
   2. Six-around-one cable-bundle configuration throughout the tested length;
   3. Cable ties placed 12 inches apart for the entire length of the bundle, except the last 3.2 feet from each end; no cable-tie-induced deformation of the bundle;
   4. Modeling four-connector channel configurations using the worst-case maximum and minimum configurations to determine the worst-case for different parameters;
   5. Long channels with 90 meters of permanent link, 5 meters between the consolidation point and the telecommunications outlet, 10 meters of patch cords used to connect active equipment and cross-connect panels;
   6. Measurement of alien crosstalk (near-end and far-end loss) between all pairs of the middle disturbed cable and each pair of all adjacent cables;
   7. Measurement of power sum of all 24 adjacent pair cables.

D. The cable tester shall be ETL verified to IEC Level V accuracy or equivalent with the latest version of firmware and shall produce an electronic or printed report, noting label information, for each cable run. These reports are to be included in the close-out documentation. Testing shall be conducted with a Fluke DSX-5000 with OLTS and OTDR functions, or equivalent, permanent link adapters, high-performance channel adapters, termination plugs, 8-pin modular couplers and analysis software. Certifications shall include the following parameters for each pair of each cable installed:
   1. Characteristic Impedance 100 Ω +/- 15%
   2. Wire map (pin to pin and ground connectivity)
   3. Cable Length Permanent Link Test, station (horizontal) cable from patch panel to jack, should not exceed 295 feet (Channel length not to exceed 328 feet)
   4. DC Loop Resistance
   5. DC Resistance Unbalanced (Difference in DC Resistance between conductors of the same pair)
   6. DC Resistance Unbalanced (Difference in DC Resistance between conductors between pairs)
   7. Return Loss
   8. Insertion Loss
   9. Near End Crosstalk Loss (NEXT)
   10. Power Sum Near End Crosstalk Loss (PSNEXT)
   11. Far End Crosstalk Loss (FEXT)
   12. Attenuation Crosstalk Ratio Far End (ACRF)
   13. Power Sum Attenuation Crosstalk Ration Far End (PSACRF)
   14. Transverse Conversion Loss (TCL)
   15. Equal Level Transverse Conversion Transfer Loss (ELTCTL)
   16. Coupling Attenuation
   17. Propagation Delay
   18. Propagation Delay Skew

19. Power Sum Alien Near–End Crosstalk Loss (PSANEXT)
20. Average Power Sum Alien Near End Crosstalk Loss (Average PSANEXT)
21. Power Sum Alien Far–End Crosstalk Loss (PSAFEXT)
22. Power Sum Alien Attenuation to Crosstalk Ratio Far–End (PSAACRF)

9.5 OPTICAL FIBER TESTING

A. Acceptance Testing: Test each strand of every optical fiber cable on the reel with an OTDR, to verify length and continuity. Fiber cables that have been damaged in transit must be replaced. Installed fiber cable that proves to be defective will be replaced at the contractor's expense.

B. Final Testing: After termination, each individual fiber of each cable segment shall be tested bi- directionally using an OTDR, both to determine the installed length and continuity. All individual fibers of each cable segment will be tested using a power meter to determine the actual loss. These readings will be taken at the 850 nm and 1300 nm windows for Multi-mode and 1310 nm and 1550 nm windows for single-mode. Testing will be in both directions. The final readings shall be listed in the certification report. These readings must not be higher than the "Optimal Attenuation Loss." The OAL will be calculated using the manufacturers' factory certified test results, (dB/Km) converted to the actual installed lengths plus the manufacturers' best published attenuation losses for the connector and/or splice installed on this project. (0.20 for Connectors and 0.10 for splices.) The OAL shall be used for comparison with the end to end power loss test results prior to acceptance by the construction manager.

C. Fiber optic cable shall be subjected to bi-directional testing meeting ANSI/TIA-568 requirements. The cable tester shall produce a printed report, noting label information, for each cable run. These reports are to be included in the close-out documentation.

END OF SECTION 269750