PROJECT MANUAL FOR

MURRIETA VALLEY UNIFIED SCHOOL DISTRICT

ALTA MURRIETA ELEMENTARY SCHOOL
MVUSD ALTA MURRIETA FA MOD

DSA APPLICATION NO. 04-124843
LIONAKIS NO. 025164

DSA Submittal Specifications

November 7, 2025

LIONAKIS

PROJECT MANUAL

FOR

MURRIETA VALLEY UNIFIED SCHOOL DISTRICT
ALTA MURRIETA ELEMENTARY SCHOOL
MVUSD ALTA MURRIETA FA MOD

DSA APPLICATION NO. 04-124843

LIONAKIS JOB NO. 025146

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 04-124843 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 12/11/2025

OWNER:
MURRIETA VALLEY UNIFIED SCHOOL DISTRICT
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951-696-1600

ARCHITECT:
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949-955-1919

LICENSED ARCHITECT
ANTHONY D. PACHECO-TAYLOR
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REN. 06-30-27
STATE OF CALIFORNIA

Anthony D. Pacheco-Taylor License # C35462

ELECTRICAL ENGINEER:
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Vista, CA 92081
760-560-0100

REGISTERED PROFESSIONAL ENGINEER
EDUARDO A. DAVID
No. E18809
Exp. 6/30/27
ELECTRICAL
STATE OF CALIFORNIA

Eduardo A. David License # E18809

Agency Approval: _____

PROJECT MANUAL

FOR

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ALTA MURRIETA ELEMENTARY SCHOOL
MVUSD ALTA MURRIETA FA MOD

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SECTION 01 31 14

ADDITIONAL REQUIREMENTS FOR DSA REVIEWED PROJECTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Additional requirements for projects reviewed by the Division of the State Architect (DSA).

1.2 REFERENCES

A. The publications listed below form a part of this Section to the extent referenced. The publications are referred to in the text by the basic designation only.

B. Standards, manuals, and codes refer to the latest edition of such standards, manuals, and codes in effect as of the date of issue of this Project Manual, unless indicated otherwise in CBC Chapter 35 and CFC Chapter 80.

C. California Code of Regulations (CCR).

1. Title 8, Division 1, Chapter 3.2 – California Occupational Safety and Health Regulations (Cal/OSHA).
2. Title 8, Division 1, Chapter 4, Sub-Chapter 4 – Construction Safety Orders.
3. Title 8, Division 1, Chapter 4, Sub-Chapter 7 – General Industry Safety Orders.
4. Title 19, Division 1 –State Fire Marshal (SFM).
5. California Code of Regulations, Title 24, Part 1 - California Administrative Code.
    a. All Code Section numbers in this Section refer to Chapter 4 “Administrative Regulations for the Division of the State Architect – Structural Safety”, Group 1 “Safety of Construction of Public Schools”.

D. Division of the State Architect Interpretation of Regulations Manual (DSA IR)

1. DSA IR A-6 – Construction Change Document Submittal and Approval Process.
2. DSA IR A-7 – Project Inspector Certification and Approval.
3. DSA IR A-8 – Project Inspector and Assistant Inspector Duties and Performance.
4. DSA IR A-12 – Assistant Inspector Approval.

E. Division of the State Architect Website: www.dsa.dgs.ca.gov.

1.3 GENERAL REQUIREMENTS

A. Contractor’s Duties:

1. Comply with California Administrative Code, Chapter 4, Article 6, Paragraph 4-343, “Duties of the Contractor” in addition to the duties described in the Contract Documents.
2. Comply with CCR Title 8, Division 1, Chapter 3.2, California Occupational Safety and Health Regulations (Cal/OSHA).
3. Comply with CCR Title 8, Division 1, Chapter 4, Sub-Chapter 4, Construction Safety Orders.
4. Comply with requirements of CCR Title 19, Division 1, State Fire Marshal (SFM).

B. Architect's and Architect's Consultants' Duties: Comply with requirements of California Administrative Code, Chapter 4, Article 6, Paragraph 4-341, "Duties of the Architect, Structural Engineer or Professional Engineer" and Paragraph 4-344, "Duties of Mechanical and Electrical Engineers", in addition to the duties described in the Contract Documents.

C. Arbitration: DSA is not subject to arbitration proceedings.

D. Should any existing conditions such as deterioration or non-complying construction be discovered which is not covered by the DSA approved documents wherein the finished work will not comply with Title 24, California Code of Regulations (CCR), a Construction Change Document (CCD), or a separate set of Drawings and Specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.

1.4 REGULATORY REQUIREMENTS

A. Perform all work in accordance with applicable laws, codes, ordinances, rules, and regulations including, without limitation, 2022 California Building Code (CBC) Parts 1 through 6 Part 9, Part 11, and Part 12 in accordance with Title 24, Part 1, 4-305. Maintain a copy of these documents at the project site at all times.

B. Codes adopted by the City, County, State, and Federal agencies govern minimum project requirements. Comply with the latest edition of applicable regulatory requirements and standards unless otherwise indicated or specified.

C. Work as described in Drawings and Specifications shall not be construed as to permit work not in accordance with applicable laws, codes, ordinances, rules, and regulations.

1.5 INSPECTION AND SUPERVISION

A. Supervision by DSA shall be in accordance with California Administrative Code, Chapter 4, Article 5, Paragraph 4-334.

B. Owner shall select and pay for the services of a Project Inspector, certified and approved by the Architect, the Structural Engineer (when applicable), and DSA in accordance with Title 24, Part 1, 4-333(b).

1. When required, Owner will select and pay for the services of additional full-time Assistant Project Inspector(s) certified and approved by DSA in accordance with DSA IR A-12.

C. Project Inspector shall have and maintain on the job at all times, the edition of CCR Title 24, Part 1 through Part 6 referred to in the Drawings and Project Manual per Title 24, Part 1, 4-342(b)3.

D. Project Inspector shall inspect construction in accordance with California Administrative Code, Chapter 4, Article 5, Paragraph 4-333(b), "Inspection by a Project Inspector", and Article 6, Paragraph 4-342, "Duties of the Project Inspector", and DSA IR A-8.

1. Project Inspector performance rating by DSA shall be in accordance with DSA IR A-8, Section 3.1, "Project Inspector Performance Review".

E. Reports: Project Inspector shall submit the following:

1. Semi-Monthly Reports: Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-337.

2. Verified Reports: Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-336.

F. Special Inspection Requirements:

1. Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-333(c), “Special Inspection”.
2. Special inspection costs to be paid by Owner.
3. Conduct special inspection in accordance with DSA-103, Statement of Structural Tests and Inspections.

1.6 TESTING AGENCY REQUIREMENTS

A. Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-335, “Structural Tests and Special Inspections”.

B. Owner will select and pay for the services of a Testing Lab, certified and approved by the Architect, the Structural Engineer (when applicable), and DSA in accordance with Title 24, Part 1, 4-333(b).

C. Sampling and testing shall be performed by properly qualified persons in accordance with applicable American Society for Testing and Materials (ASTM) standards.

D. Conduct tests in accordance with DSA-103, Statement of Structural Tests and Inspections.

E. Submit one copy of test reports to DSA.

1.7 SUBSTITUTIONS AND REQUESTS FOR INFORMATION

A. Substitutions and Requests for Information (RFIs) that affect structural safety, fire and life safety, access compliance, or energy (as applicable) are Construction Change Documents and shall be submitted to DSA for review and approval prior to fabrication and installation on the project.

1.8 ADDENDA AND CONSTRUCTION CHANGES

A. Comply with California Administrative Code, Chapter 4, Article 5, Paragraph 4-338, “Addenda and Construction Changes”.

1. Addenda and Construction Changes, including supplementary drawings when applicable, shall be signed and stamped by the Architect and approved by DSA in accordance with Title 24, Part 1, 4-338(b).

B. Comply with DSA IR A-6.

C. Obtain DSA approval for changes to DSA approved Drawings and Specifications which affect Code-regulated construction and inspection/testing functions prior to start of that Work. Code-regulated construction refers to Work that is regulated by Code provisions applicable to public school construction, including those adopted by Division of the State Architect-Structural Safety Section (DSA/SS), Division of the State Architect-Access Compliance Section (DSA/AC), and Division of the State Architect-Fire and Life Safety Section (DSA/FLS).

1. All changes, substitutions, and Requests for Information (RFIs) that affect Structural Safety, Fire and Life Safety, Access Compliance, or Energy, as applicable, shall be submitted to DSA for review and approval as a Construction Change Document (CCD) prior to fabrication and installation of the Work in accordance with DSA IR A-6 and Title 24, Part 1, 4-338(c). Substitutions shall be for any material, system, or product that would otherwise be regulated by DSA.

D. Changes can be approved by DSA through the CCD Category A or the CCD Category B review process, as applicable. Comply with DSA IR A-6, Article 3, Section 3.1, “CCD Category A” and DSA IR A-6, Article 3, Section 3.2, “CCD Category B”.

1. CCD Category A is defined as changes to or affecting the Structural, Access, or Fire-Life safety portions of the Project.
2. CCD Category B is defined as changes not affecting the Structural, Access, or Fire-Life safety portions of the Project.
3. Construction Change Documents (Section 4-338(c)) must be signed by all of the following: A/E of Record, Structural Engineer (when applicable), Delegated Professional Engineer (when applicable), and DSA.

E. Do not begin any work under addendum or construction changes until required DSA written approval is obtained.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Contractor’s construction progress schedules.

C. Shop drawings.

D. Proposed products list.

E. Product data.

F. Samples.

G. Design Data.

H. Test Reports.

I. Manufacturers' instructions.

J. Manufacturer’s field reports.

K. Manufacturers' certificates.

1.2 RELATED SECTIONS

A. Section 01 60 00 – Product Requirements: Substitutions.

B. Section 01 70 00 – Execution and Closeout Requirements; for Contract warranties and manufacturer's certificates closeout submittals.

1.3 SUBMITTAL PROCEDURES

A. Electronic File Availability:

1. Architect’s electronic drawing files for this project will be available to Contractor upon written request. The request shall include the drawing sheet number of each drawing being requested. Architect shall respond to the written request using the Delivery of Electronic Files Agreement Form attached at the end of this Section. Contractor shall sign and date the form and return it to Architect prior to the electronic files being delivered to Contractor.

    a. Electronic drawing files developed by Architect’s Consultants for this project may be available under separate agreement with each consultant. Refer to the directory on the Title/Cover Drawing Sheet for listing of consultant information.

2. Architect's Building Information Model (BIM) for this project will be available to Contractor upon written request. Architect shall respond to the written request using the Delivery of BIM Model Agreement Form attached at the end of this Section. Contractor shall sign and date the form, return it to Architect prior to the BIM files being delivered to Contractor.

B. All submittals shall be provided in electronic format using software acceptable to Architect.

C. Transmit each submittal with a Submittal Form acceptable to Architect. Limit each transmittal to a single submittal item or series of related items.

D. Sequentially number the transmittal forms. Resubmittals shall retain original number with an alphabetic suffix.

E. Identify Project, Contractor, Subcontractor or Supplier; pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.

F. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and the Contract Documents.

G. Schedule submittals in accordance with construction to expedite the Project, and deliver to Architect at business address. Coordinate submission of related items.

H. Unless otherwise agreed upon in advance, all submittals required within any one specification Section shall be submitted at the same time, in a single package.

I. Identify variations from the Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.

J. Revise and resubmit submittals as required, identify all changes made since previous submittal; re-submit within such time as necessary to avoid delay to the Work of the re-submitted item, related Work, and the Project.

K. Acceptance of submittals by Architect is general in nature and shall not relieve Contractor from responsibility for proper fitting and construction of work, nor from furnishing products, materials, and work required by Contract which may not be indicated on submittals.

L. No portion of Work requiring submittals shall be commenced until submittal has been reviewed and accepted by Architect. All such portions of Work shall be in accordance with accepted submittals.

M. Distribute Architect reviewed submittals electronically to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

N. Submit requests for substitution under provisions of Section 01 60 00.

1.4 CONTRACTOR’S CONSTRUCTION PROGRESS SCHEDULE

A. Within thirty days after the Notice to Proceed submit a fully developed, Contractor’s Construction Progress Schedule which meets the following minimum criteria:

1. Submit a computer-generated schedule generated using Primavera P6 or equivalent CPM scheduling software, with a separate timeline for each significant construction activity.

    a. Equivalency of a proposed substitute CPM scheduling software shall be determined by the Architect at their sole discretion at Contractor’s request.

2. Critical Path Management (CPM) Network Definition: CPM network is a graphic description of the construction plan, showing the sequential steps needed to reach the completion of the Work. It shall depict events and tasks, and their interrelationships, and shall recognize the progress that must be made in one task before subsequent tasks can begin. The CPM network shall be comprehensive and shall include all interdependencies and interactions required to perform the Work of the Project. The only activity in the schedule that will not have a predecessor is the Project Start or Notice to Proceed

Milestone. The only activity in the schedule that will not have a successor is the Project Completion Milestone. All other activities in the schedule shall have predecessor and successor logic ties.

3. Contractor shall submit the schedule in Portable Document Format (PDF). Contractor shall also submit an electronic copy of the data used to produce the PDF submittal in a format compatible with Primavera P6, unless an equivalent CPM scheduling software has been accepted by Architect.
4. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work. Indicate early/late start, early/late finish, float dates and duration.
5. Coordinate Contractor's Construction Progress Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules. Indicate submittal dates on the schedule for shop drawings, product data, samples, and product delivery dates.
6. Schedule shall allow time for Project closeout procedures.
7. Indicate Final Completion date on Progress Schedule.
    a. Construction Progress Schedule Final Completion date shall be the same as contractual completion date. If dates differ, Construction Progress Schedule will be returned without review.

B. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.

C. In the event the contractor submits a viable, contractually compliant construction schedule which indicates project completion at a date earlier than the contractually provided contract duration, the acceptance of such a schedule will not change the contract time. In such an event, a schedule activity entitled "project float", of a duration equal to the difference between the proposed construction duration and the contract duration, will be added to the schedule. All project float is a project resource for the Contractor and the Owner, and is not for the exclusive use of either party.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area shall be sequenced or integrated with other activities.

E. Cost Correlation: At the head of the Schedule, provide a two item cost correlation line, indicating "precalculated" and "actual" costs. On the line show dollar-volume of Work performed as of the dates used for preparation of payment requests.

F. Initial Schedule will be reviewed by Architect and Owner solely to ensure compliance with the Contract Documents. Architect's response to Contractor will indicate acceptance if the Schedule complies with the Contract Documents, or non-acceptance if it does not comply with the Contract Documents.

G. Distribution: After Architect's review of entire Construction Progress Schedule, distribute the schedule electronically to Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

H. Revisions to the Construction Progress Schedule shall be as follows:

1. Contractor shall not revise the contractual completion date without an executed Change Order.
2. All revisions shall accurately reflect the Record Schedule as of date of revision.
3. Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the revised schedule concurrently with the minutes of each meeting. A combined three week Look-Ahead Schedule with a one week Record Schedule for the previous week shall be submitted by Contractor to Owner and Architect for review at each progress meeting. The Contractor shall status the schedule on a weekly basis. This Look-Ahead Schedule shall be derived from this weekly statusing. The cumulative status of the Look-Ahead schedules shall be the basis for the Monthly Update submittal. In no event shall the Contractor utilize a separate schedule for generation and maintenance of the Look-Ahead schedules. If the superintendent's and revised Baseline Schedule schedule's logic deviate significantly, a reconciliation of the two schedules shall be required.
4. Revise the Schedule at the time of each Application for Payment, and clearly identify changes from the previous version. Submit the revised Schedule with the Applications for Payment. Payments are conditional upon Contractor providing the updated schedule.

I. No more than twenty percent of the total number of activities shown on the schedule shall be critical or near critical. Near critical is defined as float less than ten days.

J. Include a critical path activity titled "Remaining Inclement Weather Days" on the Initial Contract Schedule. This activity shall have an initial duration equal to the number of days shown in the West Regional Climate Center website: https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca2805; on the left side scroll down to "General Climate Summary Tables", then click on "Precipitation". The inclement weather days with 0.10 inch of precipitation or greater are the average number of monthly inclement weather days normally experienced within the region, and are non-compensable. The total number of days used for the initial duration shall be equal to the contract time indicated in the Contract Documents and the specific months of construction. It shall be the last activity in the schedule prior to the activity titled "Contract Completion". All predecessor activities must pass through the Inclement Weather Days activity. Contractor shall apply to Architect to use an Inclement Weather Day when a critical path activity has been delayed because of inclement weather. This application shall occur in the same month as the inclement weather delay. The Remaining Inclement Weather Days activity shall not be statused with an actual start or finish date, or percentage of completion. Rather, it is a graphical accounting tool where the original duration shall be reduced by the agreed to weather impact. Inclement Weather Delays to non-critical activities will not be considered. Inclement Weather Days with actual daily rainfall less than 0.10 inch will not be considered. If, at Completion, there are inclement weather days still remaining, the Completion date shall not be adjusted. If, at completion, additional inclement weather days are required, Owner shall adjust the Completion date accordingly. Any time extension granted to Contractor due to inclement weather delays shall be in the form of non-compensable days.

K. As a condition precedent to final acceptance of the Project, submit a final Record Construction Schedule and all final reports which accurately reflect the manner in which the Project was constructed and includes actual start and completion dates for all work activities on the Baseline Schedule.

1.5 SHOP DRAWINGS

A. Shop Drawings: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Shop drawings that are copies of the Contract Document drawings are not allowed.

C. Provide shop drawings to scale showing all details of proposed construction. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. When required by individual specification Sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.

1. Include signed and sealed calculations to support design.
2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
3. Make revisions and provide additional information when required by authorities having jurisdiction.

E. Submit shop drawings in electronic format.

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.

F. After review and acceptance by Architect, Contractor shall distribute electronically to concerned parties and provide copies for Record Documents described in Section 01 70 00.

1.6 PROPOSED PRODUCTS LIST

A. Within fifteen days after the date of the Owner-Contractor Agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.7 PRODUCT DATA

A. Product Data: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit product data as required by individual Specification Sections.

C. Submit product data in electronic format.

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.

D. Mark each submittal to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

E. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

F. After review and acceptance by Architect, Contractor shall distribute electronically to concerned parties and provide copies for Record Documents described in Section 01 70 00.

G. Maintain a copy of all Material and Safety Data Sheets (MSDS) at the jobsite at all times, and be ready to furnish MSDS upon request or have ready access to MSDS in emergencies.

1.8 SAMPLES

A. Samples: Submit to Architect for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

C. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Architect’s selection.

D. Include identification on each sample, with complete product information.

E. Submit the number of samples specified in individual specification Sections plus one additional sample which will be retained by Architect. Provide a minimum of two samples.

F. Reviewed samples which may be used in the Work are indicated in individual specification Sections.

G. Samples will not be used for testing purposes unless specifically stated in specification Section.

1.9 DESIGN DATA

A. Submit for Architect's knowledge as contract administrator or for Owner.

B. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 TEST REPORTS

A. Submit for Architect's knowledge as contract administrator or for Owner.

B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.11 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification Sections, submit manufacturers' written instructions for delivery, storage, assembly, installation, adjusting, and finishing, in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

C. Identify conflicts between manufacturers' written instructions and the Contract Documents.

1.12 MANUFACTURER’S FIELD REPORTS

A. Submit reports for Architect's benefit as contract administrator or for Owner.

B. Submit report within three days of observation to Architect for information.

C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.13 MANUFACTURER'S CERTIFICATES

A. When specified in individual specification Sections, submit manufacturers' certificate to Architect for review, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits and certifications, as appropriate.

C. Certificates may be based on recent or previous test results of materials or products, and shall be acceptable to Architect.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

DELIVERY OF ELECTRONIC FILES AGREEMENT FORM

Date: _____

Recipient's Name: _____

Recipient's Address: _____

Project: _____

At your request, Lionakis will provide Architectural and/or Engineering electronic files of the images depicted on each drawing sheet for your convenience and use in the preparation of shop drawings related to _____, subject to the following terms and conditions:

Lionakis makes no representation as to the compatibility of electronic files with your hardware or your software.

Data contained in these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving these data through or from you for any purpose other than as a convenience in the preparation of shop drawings for the referenced project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to Lionakis. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against Lionakis, Lionakis' officers, directors, employees, agents or sub-consultants that may arise out of or in connection with your use of the electronic files.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold Lionakis harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from your use of these electronic files.

These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction, as-built, or record documents. Lionakis makes no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed and sealed hard-copy construction documents prepared by Lionakis and the electronic files, the signed and sealed hard-copy construction documents shall govern.

You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the Contract Documents, including, but not limited to, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with the work of others for the project.

Because information presented in the electronic files can be modified, unintentionally or otherwise, Lionakis reserves the right to remove all indications of ownership and/or involvement from each electronic file.

Lionakis will furnish you electronic files of the following Architectural and/or Engineering drawing sheets:

_____

_____

_____

_____

Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by Lionakis, and Lionakis makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall Lionakis be liable for any loss of profit or any consequential damages as a result of your use or reuse of these electronic files.

Electronic files will be sent to you after signed acknowledgement of this letter is received by Lionakis.

Accepted By:

Recipient: _____

Company: _____

Address: _____

City, State, ZIP: _____

Recipient's Signature: _____ Date:_____

Printed Name: _____

Title: _____

DELIVERY OF BIM AGREEMENT FORM

Date: _____

Recipient's Name: _____

Recipient's Address: _____

Project: _____

At your request, Lionakis will provide the Building Information Model (BIM) for your convenience and use related to the Project, subject to the following terms and conditions:

Lionakis makes no representation as to the compatibility of the BIM with your hardware or your software beyond the specified release of the applicable software.

Data contained in the BIM is part of our instruments of service and shall not be used by you or anyone else receiving this data through or from you for any purpose other than as a convenience. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to Lionakis. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against Lionakis, Lionakis' officers, directors, employees, agents or sub-consultants that may arise out of or in connection with your use of the BIM.

Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold Lionakis harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from your use of the BIM.

This BIM is not a construction document. Differences may exist between the BIM and corresponding hard-copy construction documents, as-built documents, or record documents. Lionakis makes no representation regarding the accuracy or completeness of the BIM you receive. In the event that a conflict arises between the signed and sealed hard-copy construction documents prepared by Lionakis and the BIM, the signed and sealed hard-copy construction documents shall govern.

You, or any party to which this BIM is distributed, are responsible for determining if conflicts exist. By your use of this BIM, you are not relieved of your duty to fully comply with the construction documents, including, but not limited to, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with the work of others for the Project.

Because information presented in the BIM can be modified, unintentionally or otherwise, Lionakis reserves the right to remove all indications of ownership and/or involvement from the BIM.

Under no circumstances shall delivery of the BIM for use by you be deemed a sale by Lionakis, and Lionakis makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall Lionakis be liable for any loss of profit or any consequential damages as a result of your use or reuse of the BIM. The BIM shall be provided in Revit 20__.

Lionakis will provide you with the following BIM files:

_____

_____

_____

_____

_____

The BIM files will be sent to you after signed acknowledgement of this letter is received by Lionakis.

Accepted By:

Recipient: _____

Company: _____

Address: _____

City, State, ZIP: _____

Recipient's Signature: _____ Date:_____

Printed Name: _____

Title: _____

SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and installation procedures for patching and extending Work.

B. Transitions and adjustments.

C. Repair of damaged surfaces and finishes.

D. Cleaning.

1.2 RELATED SECTIONS

A. Section 01 73 29 – Cutting and Patching.

B. Section 02 41 00 – Demolition.

1.3 ALTERATIONS, CUTTING AND PROTECTION

A. Perform work of this Section under provisions of CBC Chapter 33, CFC Chapters 33 and 35, and NFPA 241.

B. Assign the work of relocating, removal, cutting and patching of products, materials, equipment and systems to trades qualified to perform the work, in a manner to cause the least damage to existing surfaces and provide a means of returning surfaces to the level of quality of new work.

C. Perform cutting and removal work to remove the minimum amount of materials necessary to accommodate new work and in a manner to avoid damage to adjacent work.

1. Cut finish surfaces such as concrete, masonry, drywall, plaster, or metals in a straight line at a natural point of division or where required to perform the specified work.

D. Protect existing finishes, equipment and adjacent work that are scheduled to remain from damage.

1. Close openings in exterior surfaces to protect existing and new work from extremes of temperature.

a. Maintain existing interior work above 60 degrees F and below 85 degrees F.

b. Provide heat and humidity control as needed to prevent damage to existing work and to new work.

E. Provide temporary enclosures to separate work areas within the building and from areas occupied by Owner. Temporary construction barriers shall match the fire rating of the separation barrier being breached. Fire retardant plastic dust barrier shall only be used where there is no fire rating required between the work area and adjacent spaces.

F. 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. When exit routes need to be altered due to construction operations, provide proposed alternate exit route for Owner and DSA review and approval. Proposal shall include, but not be limited to, alternate exit route, temporary directional signage, and personnel to redirect building occupants during entire duration of exit route blockage.

G. Coordinate and obtain Owner's approval of construction activity path of travel from outside of building to the areas of work inside the facility.

H. Hazardous Materials:

1. Existing conditions and Work to be accomplished under this Contract do not deal with the possible or actual existence of hazardous materials (Hazmat), such as asbestos-containing materials, lead-based paint, PCBs, etc.
2. If there is a possibility of disturbing or contacting surfaces or materials containing hazardous materials (Hazmat) during execution of Work under this Contract, Contractor shall suspend Work in that area, immediately inform Owner and Architect, and follow directions and Hazmat-related procedures provided by Owner.

I. Provide not less than five days' notice to Owner of activities that will affect Owner's operations.

1. 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.

PART 2 PRODUCTS

2.1 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. New Materials: As specified in product Sections; match existing products, materials, equipment and systems for patching and extending work.

1. Provide same products, materials or types of construction as that in existing structure as required to patch, extend or match existing work.
2. A product, finish or type of construction that requires patching, extending or matching shall be installed as necessary to complete the Work and match the consistency of adjacent standards of quality.

B. Type and Quality of Existing Products: Determine by inspection and testing of products where necessary, referring to existing Work as a standard.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that demolition is complete and areas are ready for installation of new Work.

B. Beginning of restoration Work means acceptance of existing conditions.

3.2 PREPARATION

A. Cut, move or remove items as necessary for access to alteration and renovation Work at no additional cost to Owner. Replace and restore assemblies at completion to “like new” condition.

B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as required to receive finished Work.

C. Remove all debris and abandoned items from area and from concealed spaces.

D. Remove surface finishes and prepare surfaces for proper installation of new work and finishes.

3.3 INSTALLATION

A. Coordinate alteration and renovation work to expedite completion and to accommodate Owner occupancy. Patch and extend existing work using skilled mechanics that are capable of matching existing quality of workmanship. Quality of patched or extended work shall be not less than that specified for new work.

B. Room Finishes: Complete in all respects including operational electrical work.

C. Remove, cut and patch items as necessary for access to alterations and renovation Work in a manner to minimize damage and to provide a means of restoring products and finishes to specified condition.

D. Refinish visible existing surfaces to remain in renovated rooms and spaces to specified condition for each material with a neat and flush transition to adjacent finishes.

E. In addition to specified replacement of equipment and fixtures, restore existing electrical systems to full operational condition.

F. Install products using procedures specified in individual product Sections to match existing products and finishes.

G. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

3.4 TRANSITIONS

A. Where new Work abuts or aligns with existing, provide a smooth and even transition.

B. Patch Work to match existing adjacent Work in texture and appearance, without breaks, steps or bulkheads.

C. When finished surfaces are cut and a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division. Make transition recommendation to Architect prior to proceeding with the Work.

3.5 ADJUSTMENTS

A. Where change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition to Architect.

1. Where extreme change of plane of 2 inches or more occurs, request from Architect direction for making transition.

B. Trim existing doors as necessary to clear new floor finish. Refinish trimmed area as required to match door finish.

C. All openings for surface penetrations shall be cut uniformly around and sealed and closed tight to penetrating elements.

3.6 REPAIR OF DAMAGED SURFACES

A. Patch or replace portions of existing surfaces that are damaged, lifted, discolored or showing other imperfections at no additional cost to Owner.

B. Repair substrate prior to patching finish.

3.7 FINISHES

A. Finish surfaces as specified in individual product Sections.

B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.8 CLEANING

A. Clean adjacent Owner-occupied areas of work soiled by work of this Contract.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product Delivery Requirements.

C. Product Storage and Handling Requirements.

D. Product Options.

E. Product Substitution Procedures.

1.2 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. All products shall be new, of first class quality, and shall be delivered, installed, connected and finished in every detail, and shall be so selected and arranged as to fit correctly into the proper spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by Architect shall be furnished. Contractor shall provide satisfactory evidence as to the kinds and quality of material and workmanship.

C. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

D. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Delivery of materials to the project site shall be coordinated by and received by Contractor or their representative, and stored in secured areas as agreed upon at the job start meeting.

C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.

D. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

E. Contractor shall take into consideration the available space and location of work site when delivery of materials is necessary.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

B. For exterior storage of fabricated products, place on sloped supports above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation and degradation of products.

E. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

F. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

G. Contractor shall be responsible to provide all new materials in unopened manufacturer's original containers and deliver such items to project site in good condition for use on this project. Contractor shall be responsible to store all new materials received as per manufacturer recommendations. Any and all materials discovered to be improperly stored and/or damaged will be replaced at the sole expense to Contractor. Any requests for delays or extension of the Contract Time due to the above will not be considered.

H. Contractor shall use all means necessary to protect all materials before, during and after installation and to protect the installed work and materials of all other trades and of existing structures. In event of damage, Contractor is to immediately make all repairs and replacements necessary using compatible and like materials.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One Manufacturer and stating “No Substitutions Allowed, Owner’s Standard”: Products of manufacturer named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers without naming a Product, with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

D. Products specified by Naming One or More Manufacturers and Naming Product(s) by the first listed Manufacturer, with a Provision for Substitutions: Submit a request for substitution for any product, by any manufacturer, listed or not listed, other than the product(s) listed.

E. Basis-of-Design Product Specification: Where a specific manufacturer’s product is named and accompanied by the words “Basis-of-Design”, 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 other manufacturers, whether listed or not. Submit a substitution request for any product, by any manufacturer, listed or not listed, other than the product(s) listed as “Basis-of-Design”.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Architect will consider requests for Substitutions only within 35 days after Award of the Contract.

B. Reference to any product, material, equipment, article, system, service or patented process, by trade, catalogue number, name brand product or product manufacturer is for information only and shall not be construed as limiting competition.

C. Substitutions will only be considered when one or more of the following conditions are met:

1. All aspects of the proposed substitution meet or exceed the criteria for the specified product.
2. The proposed changes are in keeping with the general intent of the Contract Documents.
3. The request is fully documented and timely and properly submitted.
4. The specified product cannot be provided within the Contract Time.
5. The request is directly related to an “or equal” clause or similar language in the Contract Documents.
6. The request offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities that Owner must assume. Owner’s additional responsibilities may include, but not be limited to, compensation to Architect for redesign and/or evaluation services and increased cost of other construction by Owner.
7. The specified product becomes unavailable through no fault of Contractor.
8. The specified product cannot receive necessary approvals by governing authorities, and the requested substitution can be approved by governing authorities in a timely manner.
9. It can be demonstrated that the specified product cannot be provided in a manner that is compatible with other materials and Contractor certifies that the proposed substitution will overcome the incompatibility.
10. It can be demonstrated that the specified product cannot be coordinated with other materials and Contractor certifies that the proposed substitution can be coordinated.
11. The specified product cannot provide the warranty required by the Contract Documents and Contractor certifies that the proposed substitution provides the required warranty.

D. Substitutions will not be considered when one or more of the following conditions occur:

1. Acceptance would require revisions to the Contract Documents, Contract Time extensions or an increase in the Contract Sum.
2. They are indicated or implied on shop drawing or product data submittals, without separate written request.
3. When the specified product cannot be provided as a result of failure of Contractor to pursue the Work in a timely manner or properly coordinate construction activities.

E. In those cases where the Specifications designate a product, material, equipment, article, system, service or patented process by specific brand or trade name and there is only one brand or trade name listed, the item involved is:

1. Required to be used since it is a unique or novel product application, or
2. Required to match other products in use by Owner, or

3. Is the only brand or trade name known to Architect.

F. Document each request on Substitution Request Form attached at the end of this Section with complete data substantiating compliance of proposed Substitution with the Contract Documents. The burden of proof as to comparative quality, suitability and performance of proposed product(s), material(s), equipment, article(s), system(s), service(s) or patented process(es) shall be upon Contractor. Architect will be the sole judge of the equality of the proposed substitution versus the specified item(s).

G. A substitution request constitutes a representation that Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same or better warranty for the Substitution as for the specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extensions which may subsequently become apparent.
5. Will reimburse Owner for review services associated with approvals by authorities having jurisdiction.

H. Substitution Submittal Procedure:

1. Submit request for Substitution electronically. Limit each request to one proposed Substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
3. Architect will notify Contractor, in writing, of decision to accept or reject request.
4. Incomplete Substitution Request package will not be reviewed and will be returned to Contractor. Contractor shall then provide the specified item.
5. Only one request for substitution will be allowed. If proposed substitution is not accepted by Architect, Contractor shall provide the specified item.
6. Use of accepted substitutions shall in no way relieve Contractor from responsibility for compliance with Drawings and Specifications.
7. All costs associated with accepted substitutions shall be borne by Contractor including, but not limited to, required changes to the Project's design, architectural and/or engineering design fees, detailing, Agency approvals and fees, and all additional construction costs caused by substitution.
8. All substitutions affecting structural or fire/life safety items will require approval from DSA prior to fabrication and installation on the project.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials furnished shall be new and never been used before, unless specified otherwise, and will satisfy the requirements herein and all specifications referenced by provisions within these specifications. Contractor shall furnish, upon request of Architect, an affidavit from the manufacturer or supplier to the effect that materials furnished shall conform to the General

Conditions, the latest revision of AWWA Specifications, ASTM, and Federal Specifications that pertain. All materials shall be installed in accordance with manufacturer's recommendations and the Standard Drawings and Specifications that pertain. Material for one specific product shall be one manufacturer unless otherwise approved by Architect. All materials shall be subject to inspection after delivery to the site and during installation of the work. Failure of the Inspector or Architect to note faulty material shall not relieve Contractor of the responsibility for removing or replacing any such material at no additional cost to Owner.

B. For the ease of maintenance and parts replacement, to the maximum extent possible use materials of a single manufacturer, delivered in manufacturer's original, unopened containers with labels intact and legible, and in sufficient quantity to allow continuity of work. Deviation from this requirement shall require written approval from Owner and Architect.

C. Architect reserves the right to reject any materials list which contains materials from various manufacturers if suitable materials can be secured from fewer manufacturers and to require that source of materials be unified to maximum extent possible.

PART 3 EXECUTION

Not Used

END OF SECTION

SUBSTITUTION REQUEST FORM

SUBSTITUTION REQUEST NUMBER: _____

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Section	Page	Paragraph	Description
_____	_____	_____	_____

_____

The undersigned requests consideration of the following:

Proposed Substitution (Manufacturer, Model # or Name, Color, Etc.): _____

_____

History: ☐ New Product, ☐ Available 2-5 Years, ☐ Available 6-10 Years, ☐ Available 10+ Years

Provide UL, ITS, WHI, (or other) listing / rating of proposed substitution: _____

Attached data shall include, but not be limited to, product, specification, drawings, performance and test data adequate for evaluation of the request for the proposed substitution product and the specified product, with applicable portions of the proposed substitution and the specified product data clearly identified in a point-by-point direct comparison chart. Incomplete form and attachments will result in rejection of substitution request.

_____

Requestor shall address the following items on this Substitution Request Form. Use a separate attached sheet attached as needed:

1. Reason for not providing specified item:

   _____

   _____

2. Will proposed substitution affect dimensions indicated on Drawings? ◯ (Yes) ◯ (No)

   If yes, how? _____

3. Will proposed substitution affect Electrical, Mechanical, Structural, Architectural, etc.?
   ☐ (Yes) ☐ (No) If yes, explain:

   _____

   _____

4. Is proposed substitution larger or smaller than specified product? ◯ (Yes) ◯ (No)
   If yes, state size of substitute product:

   _____

5. Does proposed substitution weight less/more than specified product? ◯ (Yes) ◯ (No)
   If yes, state weight of substitute product:

   _____

6. Will proposed substitution affect other trades and/or parts of the work? ◯ (Yes) ◯ (No)
   If yes, explain all effects:

   _____

   _____

7. Comparison between proposed substitution and specified product (Similarities / Differences)?

   _____

   _____

8. If Substitution Request is accepted, Owner will receive a credit of $_____. The Contract Sum will be adjusted accordingly.
9. Will proposed substitution affect the Contract Time? ◯ (Yes) ◯ (No)
   If yes, ☐ (Add) ☐ (Deduct) _____ calendar days.

INITIAL	UNDERSIGNED CERTIFIES:
_____	Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
_____	Proposed substitution has same or better warranty as specified product.
_____	Proposed substitution has same or better maintenance service and availability of replacement parts as specified product.
_____	Proposed substitution will not affect or delay the Construction Schedule.
_____	Claims for additional costs related to accepted substitution, which may subsequently become apparent, are hereby waived.
_____	Proposed substitution will not affect dimensions and functional clearances.
_____	Coordination, installation, and changes in the Work as necessary for installation of accepted substitution will be complete in all respects, at no additional cost to Owner.
_____	Contractor will pay for all costs associated with changes to the project's design, including, but not limited to, architectural or engineering design fees, detailing, Agency approvals and construction costs caused by the requested substitution.
_____	The function, appearance and quality of the proposed substitution is equivalent or superior to the specified item.

The undersigned certifies that the above is accurate and correct.

Signature: _____

Company: _____

Address: _____

_____

Date: _____

Telephone: _____

Attachments: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ Other (Describe)

_____

Architect's Review and Action:

_____ Substitution Accepted – Make submittals in accordance with Specification Division 01.

_____ Substitution Accepted as Noted - Make submittals in accordance with Specification Division 01.

_____ Substitution Rejected – Provide specified product.

_____ Substitution Request Received Too Late – Provide specified product.

By: _____ Date:_____

Remarks: _____

_____

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Starting of systems.

D. Demonstration and instructions.

E. Protecting installed construction.

F. Project record documents.

G. Operation and maintenance data.

H. Manual for equipment and systems.

I. Spare parts and maintenance products.

J. Extra materials.

K. Product warranties and product bonds.

L. Maintenance service.

1.2 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.

1.3 CLOSEOUT PROCEDURES

A. Submit written certification that the Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with the Contract Documents and ready for Architect’s review.

B. Provide submittals to Architect and Owner required by DSA.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments and sum remaining due.

D. The submission, by Contractor, of satisfactory evidence that no claim or lien exists against Contractor for labor done or materials furnished under the Contract.

E. The submission, by Contractor to Architect, of two copies of the completed and executed DSA Final Verified Reports.

F. Submit items to Architect or other parties as required by individual sections of the Specifications.

1.4 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

C. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to surface and material being cleaned.

D. Replace filters of operating equipment affected by start-up procedures.

E. Clean site; where work of this Project affects exterior areas, sweep paved areas, rake clean landscaped surfaces.

F. Remove waste and surplus materials, rubbish, and construction facilities from the site.

G. Contractor shall be responsible for restoring the work area and all auxiliary areas utilized during the work to conditions that are equal to or better than existed prior to project commencement. Any damages to interior or exterior building surfaces, walkways, landscaping, utilities, etc., shall be repaired or replaced at the sole expense to Contractor.

H. After completion and final acceptance of the project, Contractor shall immediately remove all equipment, fencing, construction materials and debris from project site.

1.5 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative or Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

1.6 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of final inspection.

B. Demonstrate Project equipment instructed by qualified manufacturer's representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at designated location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.7 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.8 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work:

1. Contract Drawings, all divisions and trades.
2. Specifications.
3. Addenda.
4. Change Orders, Construction Change Documents, and other modifications to the Contract.
5. Reviewed and accepted shop drawings, product data and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product Section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and other modifications to the Contract.

F. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   3. Field changes of dimension and detail.
   4. Details not on the original Contract Drawings.
   5. All changes and clarifications as a result of Change Orders, Requests for Information, Construction Change Directives and Architect's Supplemental Instructions.

G. Contractor shall keep the progress Project Record Documents current. In the event that these documents are not kept current, a portion of the monies due Contractor will be withheld from each Application for Payment until the Project Record Documents are brought up to current status, to the satisfaction of Architect.

H. Submit Project Record Documents to Architect with claim for final Application for Payment.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit complete operation and maintenance information in digital format for all manufactured materials and equipment installed on the Project prior to final inspection.

B. Prepare digital manual with title OPERATION AND MAINTENANCE INSTRUCTIONS, and title of Project.

C. Internally bookmark the digital manual, logically organized, and titled as described below.

D. Contents: Prepare a Table of Contents for digital manual, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification Section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Written operating instructions.
      e. Written maintenance instructions for equipment and systems.
      f. Written maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
    a. Shop drawings and product data.
    b. Certificates.
    c. Photocopies of warranties and bonds.

E. Submit Digital Operation and Maintenance Data in final form 15 days prior to final inspection for Architect review and comment. Revise content of documents as required prior to final submittal.

F. Submit final Digital Operation and Maintenance Data within 10 days after final inspection.

1.10 MANUAL FOR MATERIALS AND FINISHES

A. Submit digital copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review and provide comments on digital preliminary draft.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.

C. Submit digital copy of completed manual 15 days prior to final inspection. Draft digital copy will be reviewed and returned with Architect comments. Revise content of document sets as required prior to final submission.

D. Submit revised final manual within 10 days after final inspection.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

H. Additional Requirements: As specified in individual product specification Sections.

1.11 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit digital copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review and provide comments on digital preliminary draft.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.

C. Submit digital copy of completed manual 15 days prior to final inspection. Draft digital copy will be reviewed and returned with Architect comments. Revise content of document sets as required prior to final submission.

D. Submit revised final manual within 10 days after final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

G. Include color coded wiring diagrams as installed.

H. Operating Procedures: Include start-up and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, and checking instructions.

J. Include servicing schedule.

K. Include manufacturer's written operation and maintenance instructions.

L. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

M. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Additional Requirements: As specified in individual product specification Sections.

1.12 SPARE PARTS AND MAINTENANCE MATERIALS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification Sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.13 EXTRA MATERIALS

A. Where extra materials are required by individual Sections, the quantities of materials specified shall be delivered to the location designated by the Owner. Extra materials are property of the Owner and shall not be used by the Contractor for any reason.

1.14 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form and contain full information.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in digital format.

F. Submit prior to final Application for Payment.

G. Time Of Submittals:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
2. Make other submittals within ten days after Date of Project Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Project Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.15 MAINTENANCE SERVICE

A. Unless indicated otherwise, furnish service and maintenance of components indicated in specification Sections for one year from date of Project Completion.

B. Examine system components at frequency consistent with reliable operation. Clean and adjust as required.

C. Include systematic examination and adjustment of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedural requirements and limitations for cutting and patching work.

B. Patching of existing materials and construction disturbed by Work under this Contract, including repair of damage to existing materials and construction caused by:
   1. Installation of new products, materials, and equipment or systems.
   2. Relocation or reinstallation of existing products, materials, and equipment or systems.

1.2 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.

B. Section 01 35 16 – Alteration Project Procedures: Cutting and patching for alterations work.

C. Section 01 60 00 – Product Requirements: Product options and substitutions.

D. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work, including the following:
   1. Cutting and patching incidental to work of the individual Section.
   2. Advance notification to other Sections of openings required in work of those Sections.
   3. Limitations on cutting structural members.
   4. Patching of fire-rated construction.

1.3 SUBMITTALS

A. Submit written request in advance of cutting or patching which affects:
   1. Integrity of moisture-resistant, water-resistant, and exposed to weather elements.
   2. Utility services and mechanical/electrical systems.
   3. Operational elements.
   4. Visual qualities of sight exposed elements.
   5. Existing structural elements.
   6. Efficiency, maintenance, or safety of element.
   7. Work of Owner or separate contractor.

B. Include in request:
   1. Identification of Project.
   2. Location and description of affected Work.
   3. Necessity for cutting or patching.
   4. Description of proposed Work and products to be used.
   5. Alternatives to cutting and patching.

6. List of services and systems that will be temporarily out of service and length of disruption.
7. List of services and systems that will be relocated.
8. Reinforcement to structural elements, with details and engineering calculations showing integration of reinforcement with original structure.
9. Effect on work of Owner or separate contractor.
10. Written permission of affected separate contractor.
11. Date and time the work will be executed.

C. Architect's, Owner's, and DSA's Approval: Obtain approval of cutting and patching submittals before commencing cutting and patching work. Approval does not waive the right to require removal and replacement of unsatisfactory work.

1.4 DEFINITIONS

A. Cutting: Removal of in-place construction for installation or performance of other Work.

B. Patching: Repair work required for restoration of damaged surfaces to original condition after installation of other Work.

1.5 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. 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 results in increased maintenance or decreased operational life or safety.

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

1.6 WARRANTY

A. Existing Applicable Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by appropriate methods and with suitable materials so that existing applicable warranties are not voided.

PART 2 PRODUCTS

2.1 MATERIALS

A. Primary Products: Those required for original installation.

B. Product Substitution: For any proposed change in materials, submit request for substitution as specified in Section 01 60 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing work, assess conditions affecting performance of Work.

C. Beginning of cutting or patching means acceptance of existing conditions.

D. Identify hazardous substances or conditions exposed during the Work to Architect for decision or remedy.

3.2 PREPARATION

A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering Work.

C. Maintain excavations free of water.

3.3 CUTTING

A. Execute cutting and fitting to complete the Work.

B. Uncover in-place Work to reinstall improperly sequenced Work.

C. Remove and replace defective or non-conforming Work.

D. Obtain material samples of installed Work for testing, when requested.

E. Provide openings in the Work for penetration of mechanical and electrical work.

F. Employ experienced installer to perform cutting of moisture-resistant, water-resistant, exposed to weather elements, and surfaces exposed to view.

G. Cut rigid materials in straight, true, and parallel or perpendicular lines.

H. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

I. Cut masonry and concrete materials using masonry saw or core drill.

J. Pneumatic tools are not allowed without prior approval from Architect and Owner.

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

3.4 PATCHING

A. Execute patching to complement adjacent Work.

B. Fit products together to integrate with other Work.

C. Execute Work by appropriate methods to avoid damage to other Work and to provide surfaces suitable for patching and finishing.

D. Employ experienced installer to perform patching of moisture-resistant, water-resistant, exposed to weather elements, and surfaces exposed to view.

E. Restore Work with new materials and products in accordance with requirements of the Contract Documents.

F. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material to full thickness of the penetrated element. Firestopping shall meet or exceed the fire rating of the assembly in which it is installed.

I. Fire rated assemblies disturbed or damaged during construction shall be repaired to pre-construction condition using like materials.

J. Refinish surfaces to match adjacent finish in all respects (type, texture, thickness, color, etc.). For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

3.5 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Removal of designated construction.

B. Identification of utilities.

C. Demolition requirements.

1.2 RELATED SECTIONS

A. Division 01 Sections, as applicable.

1.3 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Accurately record actual locations of capped utilities and subsurface obstructions.

1.4 REGULATORY REQUIREMENTS

A. Perform work of this Section under provisions of CBC Chapter 33, CFC Chapter 33, and NFPA 241 for demolition work, safety of structure, dust control and safety of occupants.

B. Obtain required permits from authorities.

C. Do not close or obstruct egress width to exits.

D. Do not disable or disrupt building fire or life safety systems without 3-day prior written notice to Owner.

E. Conform to procedures applicable when discovering hazardous or contaminated materials.

1.5 SCHEDULING

A. Schedule work under the provisions of Division 01.

B. Describe demolition removal procedures and schedule.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Provide, erect, and maintain temporary barriers as required.

B. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to adjoining facilities.

C. Protect existing materials and finishes that are not scheduled or otherwise required to be demolished.

D. Mark location of utilities.

3.2 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent and occupied buildings.

B. Maintain protected egress and access to the Work.

3.3 DEMOLITION

A. Refer to Drawings for specific items to be demolished.

B. Disconnect, remove, cap, and identify designated utilities within demolition areas.

C. Demolish in an orderly and careful manner. Protect existing supporting structural members and materials.

D. Except where noted otherwise, remove demolished materials from site. Do not bury or burn materials on site.

E. Remove demolished materials from site as Work progresses. Upon completion of Work, leave areas in clean condition.

F. Remove temporary Work.

END OF SECTION

SECTION 26 05 19

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. This Section includes the following:

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

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Alcan Products Corporation; Alcan Cable Division.
   2. American Insulated Wire Corp.; a Leviton Company.
   3. General Cable Corporation.
   4. Senator Wire & Cable Company.
   5. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW and SO.

D. Multiconductor Cable: Comply with NEMA WC 70 for Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. AFC Cable Systems, Inc.
   2. Hubbell Power Systems, Inc.
   3. O-Z/Gedney; EGS Electrical Group LLC.
   4. 3M; Electrical Products Division.
   5. Tyco Electronics Corp.

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

PART 3 EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway.

G. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

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

I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

J. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

K. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway.

L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

M. Class 1 Control Circuits: Type THHN-THWN, in raceway.

N. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

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

B. 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.

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

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

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification 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 and UL 486B.

B. Make splices 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 and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. 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 cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    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.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 26 05 33

RACEWAY 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. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. NBR: Acrylonitrile-butadiene rubber.

H. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:
    a. Duct entry provisions, including locations and duct sizes.
    b. Frame and cover design.
    c. Grounding details.
    d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For professional engineer and testing agency.

F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 METAL CONDUIT AND TUBING

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

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.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch (1 mm), minimum.

F. EMT: ANSI C80.3.

G. FMC: Zinc-coated steel.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
   2. Fittings for EMT: Steel, compression type.
   3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   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. ENT: NEMA TC 13.

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

D. LFNC: UL 1660.

E. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

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

1. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

B. Description: Comply with UL 2024; flexible type, approved for plenum and general-use installation.

2.4 METAL WIREWAYS

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

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12 or 3R, unless otherwise indicated.

C. Fittings and Accessories: Include 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, Screw-cover type or Flanged-and-gasketed type.

E. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

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

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.

B. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened

with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

D. Fittings and Accessories: Include 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.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Thomas & Betts Corporation.
    b. Walker Systems, Inc.; Wiremold Company (The).
    c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Butler Manufacturing Company; Walker Division.
    b. Enduro Systems, Inc.; Composite Products Division.
    c. Hubbell Incorporated; Wiring Device-Kellems Division.
    d. Lamson & Sessions; Carlon Electrical Products.
    e. Panduit Corp.
    f. Walker Systems, Inc.; Wiremold Company (The).
    g. Wiremold Company (The); Electrical Sales Division.

2.7 BOXES, ENCLOSURES, AND CABINETS

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

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. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, 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: Plastic

H. Cabinets:
1. NEMA 250, Type 1, galvanized-steel 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.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.
1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have open or closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE." as indicated for each service.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

7. Handholes as indictated and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

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

a. Armorcast Products Company.

b. Carson Industries LLC.

c. CDR Systems Corporation.

d. NewBasis.

2.9 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

2.10 SLEEVE SEALS

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

1. Advance Products & Systems, Inc.

2. Calpico, Inc.

3. Metraflex Co.

4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

2. Pressure Plates: Plastic or Carbon steel. Include two for each sealing element.

3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.11 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: Rigid steel conduit, IMC.
   2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC or EMT.
   3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, Stainless Steel.
   6. Application of Handholes and Boxes for Underground Wiring:
      a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
      b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
      c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:
   1. Exposed, Not Subject to Physical Damage: EMT.
   2. Exposed, Not Subject to Severe Physical Damage: EMT.
   3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
      a. Loading dock.
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
      c. Mechanical rooms.
   4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   6. Damp or Wet Locations: Rigid steel conduit or IMC.
   7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway EMT.

8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway Plenum-type, optical fiber/communications cable raceway EMT.

9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel or nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

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 in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) 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. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Change from ENT to PVC coded, rigid steel conduit, or IMC before rising above the floor.

I. 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.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations 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 at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
   d. Attics: 135 deg F (75 deg C) temperature change.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.

3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, 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.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

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 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
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 (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, placing them 24 inches (600 mm) o.c. Align planks along the width and along the centerline of conduit.

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 (12.5-mm) sieve to No. 4 (4.75-mm) 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 (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line, below grade.

E. 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 the enclosure.

F. 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 INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

B. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

C. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials.

K. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the following:

1. Division 07 - Penetration Firestopping

1.2 SUMMARY

A. Section Includes:

1. This section includes the horizontal cabling portion of a structured cabling system (SCS) including:

a. Optical fiber

b. Copper and coaxial cabling

c. Termination and patch cables

B. Provide all horizontal cabling, terminating hardware, adapters, and cross-connecting hardware necessary to interconnect all system equipment including equipment located in communications rooms.

1.3 REFERENCES

A. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.

B. Specific reference in specifications to codes, rules, regulations, standards, manufacturer’s instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect at the date of contract unless the document is shown dated.

C. Codes and Standards:

1. ANSI/TIA-568-C Commercial Building Telecommunications Wiring Standard

2. ANSI/TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces

3. ANSI/TIA-606-A Administration Standard for Commercial Telecommunications Infrastructure

4. ANSI/TIA-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

5. ANSI/TIA-758-A Customer-Owned Outside Plant Telecommunications Infrastructure Standard

6. ANSI/TIA-1179 Healthcare Facility Telecommunications Infrastructure Standard

7. National Electrical Code (NEC), based upon year approval by local codes or AHJ
8. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM), current edition
9. Local, county, state and federal regulations and codes in effect as of date of purchase
10. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage temperature range: -40°F to 149°F (-40°C to 65°C)

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Horizontal Category 6A UTP Cable Plenum-rated
   1. Panduit
   2. Approved alternate

B. Horizontal Category 6 UTP Cable Plenum-rated
   1. Panduit
   2. Approved alternate

C. Information outlet components
   1. Panduit Category 6A Jack -10GMX-02, White, angled.
   2. Panduit Blank – Part Number MX-BL-02. White
   3. Approved alternate

D. 48-Port Patch Panels
   1. Panduit
   2. Approved alternate

E. Faceplate for wall-mount telephones
   1. Panduit
   2. Approved alternate

F. Fiber Horizontal Cable Plenum-rated
   1. Corning
   2. Approved alternate

G. Patch Cords, Copper:
   1. Panduit
   2. All Patch Cords Furnished / Installed by District

3. Approved alternate

2.2 ACCESSORIES

A. The Contractor shall:

1. Mount one laminated full-size hard copy in color of a Record Drawing floor plan designating workstation locations, pathways, and communications room locations. Confirm hard copy size with Owner. Record Drawing floor plan shall be scalable, and shall have an identified standard scale.

2. Install the laminated drawings within a protective Plexiglas encasement on the wall of the servicing communications rooms. To ease accessibility the Plexiglas encasement shall be in either flip-down format or file folder format.

2.3 HORIZONTAL CABLING

A. Recognized cabling for providing the signal medium from the work area to the communications room shall include the following:

1. Four-pair Category 6 UTP cable

B. Category 6 UTP Cable Requirements: High performance Category 6 UTP shall adhere to the following:

1. 23/24 AWG solid bare copper

2. Cable jacket shall comply with NEC Article 800 for use as a plenum cable and shall be UL and c (UL) Listed Type CMP (communications multipurpose plenum).

3. Cable shall terminate on an eight-pin modular jack at each outlet. All horizontal cabling shall meet or exceed the ANSI/EIA/TIA-568-C.2 Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components.

4. Cables shall be marked as UL verified with a minimum of Category 6 rating.

5. The cable shall support Voice, Analog Base band Video/Audio, Fax, Modem, Switched-56, T-1, ISDN, RS-232, RS-422, RS-485, 10BASE-T Ethernet, Token Ring, 100Mbps TP-PMD, 100BASE-T Ethernet, 155 Mbps ATM, AES/EBU Digital Audio, 270 Mbps Digital Video, 622 Mbps 64-CAP ATM and emerging high-bandwidth applications, including 1 Gbps Ethernet, gigabit ATM, as well as all 77 channels (550 MHz) of analog broadband video

6. The maximum horizontal cable length for Category 6 copper cable from the termination of the cable in the communications room to the outlet is 295 feet.

7. Cable shall meet or exceed the following electrical characteristics:

8. Cable shall be specified to 250 MHz and shall meet the manufacturer’s guaranteed electrical performance and physical specifications as follows:

C. Cabling Method:

1. The Contractor shall:

a. Provide cabling in accessible spaces, cable tray, (surface and/or enclosed raceway), conduits, and/or J-Hook cable support system. Within consoles, racks, cabinets, desks, and counters, in accessible ceilings spaces and in gypsum board partitions where open cable method may be used. Use UL or ETL listed plenum rated cable in all spaces.

b. Conceal raceway and cabling except in unfinished spaces as is practical.

c. Utilize conduits/cable tray as indicated on the drawings.

d. Route data and voice cables separately in a neat and orderly fashion. No cable ties or wraps shall be used to secure the cables in the runway outside of the communications rooms. Hook and loop fasteners shall be used for any final cable securing needed. Fasteners shall be rated for the area they are used in, (Plenum as required).

e. Examine pathway elements intended for cable.

f. Check raceways and other elements for compliance with space allocations, installation tolerances, debris, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Application of Media:

1. Horizontal cabling

a. The Contractor shall:

1) Install cable using techniques, practices, and methods that are consistent with specified data cabling and the installed components and that ensure specified performance levels of completed and linked signal paths, end to end.

2) Install cables in continuous lengths from communications outlet to specified patch panels for data and termination blocks for voice.

3) Terminate horizontal voice cables into termination blocks without damaging twisted pairs or jacket.

4) Terminate horizontal data cables onto 8P8C modular patch panels without damaging twisted pairs or jacket.

5) Pull cables in smooth and regular motions using methods that prevent cable kinking.

6) If necessary use approved cable pulling lubricant.

7) Keep all items protected before and after installation with dust and moisture proof barrier materials/envelopes. If wiring is terminated on patch panels, data, voice jacks prior to painting, carpet installation, and general finish clean up, these jacks shall be placed in a protective envelope to ensure dust, debris, moisture, and other foreign material do not settle onto jacks' contacts. Envelope will be removed on final trim out after other trades have completed their finish work. It shall be the Contractor's responsibility to ensure the integrity of these protective measures throughout the life/installation of the project.

8) Do not bind cables tightly together with tie or other wraps. Wraps shall slip loosely around cables. Use Velcro wraps instead of cables ties for all bundling in the communications rooms.

9) Pull cables simultaneously if more than one is being installed in the same raceway/pathway.

10) Use pulling means; including fish tape, cable, rope, and basket weave wire/cable grips that will not damage media or raceway.

11) Install open cabling parallel and perpendicular to surfaces or structural members

following surface contours where possible.

12) Do not bend cable greater than a bend radius of 1.00 inch.

b. Cable bundles brought into the communications rooms shall be routed and dressed in such a manner that prior to termination the cables are not subject to damage and misuse such as installers walking on the bundles that are lying on the floor. Cable pulling force shall not exceed 25 pounds of pulling tension or cable manufacturer's recommended pulling tensions.

c. When exiting runway and/or conduit via a means to ensure support of the cable, shall thereafter be supported with approved materials, and space supporting hardware to maintain performance characteristics, or as listed below.

E. Separation of Wires and Cabling Installation Practices:

1. The Contractor shall:

a. Comply with NEC / TIA rules for separating unshielded copper communication and data-processing equipment cables from potential EMI sources, including electrical power lines and equipment.

b. Maintain a minimum spacing of 18 inches from electrical feeders and/or branch circuit wiring.

c. Maintain a minimum spacing of 12 inches from auxiliary systems cabling.

d. Maintain a 1-inch separation where UTP cables must pass perpendicularly to electrical, plumbing, or other wiring, conduit, or piping systems. Use non-conduit bushings, if necessary to maintain separation, which allow for the addition of a reasonable number of cables in the future.

e. Maintain communications pathways away from electrical apparatus such as motor driven equipment and transformers, minimum separation distance of 10-feet is recommended.

f. Provide all necessary installation materials, hardware, tools and equipment to perform insulation displacement type terminations at all data outlets, patch panels, and voice termination materials.

g. Dress and terminate horizontal cables in consistent consecutive order.

h. Arrange cables on patch panels and voice termination hardware in ascending order of room numbers and outlet numbers within rooms.

i. Provide a 3-foot 6-inch service loop for horizontal cables at I/O's. Locate service loop above or below I/O were vertical cable run transitions to horizontal run.

j. Maintain twists in cable pairs to within .5-inch of termination.

k. Group all specialty cables such as the pay phone cables, elevator line, etc which do not have their own termination hardware, in one group, clearly labeled as to cable number and function, in the last positions on the horizontal cabling blocks in each communications room.

l. Limit cable-bending radius for fiber optic cable to 20 times the cable diameter during installation, and 15 times the cable diameter after installation. Follow manufacturer's requirements for copper cable bending radius.

m. Do not leave cables on the floor unprotected or cable bundles hanging from the ceilings. Coil them up in a temporary manner and protect them from damage.

n. Start numbering at the left of the main door to the room and continue in a clockwise direction around the room.

o. The cables within the room will be terminated starting with the cables located to the left of the main door to the room and continue around the room in a clockwise direction.

2.4 TERMINATION HARDWARE

A. Station Hardware

1. Flush mount jacks shall be mounted in a faceplate with back box.
2. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches without prior Owner approval.
3. 8P8C Jack Pin Assignments - Pin connections for voice and data information outlets and patch panels shall match T-568B termination standard under the EIA/TIA 568- A code.
4. Pin assignments at all voice and data panels or connecting blocks shall match pin assignments at the information outlets.
5. Color designation for UTP / F/UTP inserts:
   a. Data, Voice, Security, Fire Alarm > White (Wall mount and modular furniture)
   b. PICIS > Green
   c. Command Center > Purple
   d. Physiological Monitoring > Blue
   e. Anesthesiologist > Yellow
   f. Refrigerator Monitoring > Red
   g. Robot Jacks > Orange

B. Copper patch panels:

1. Copper patch panels shall be rated to match installed cable plant.
2. Horizontal copper cables shall be terminated in eight position/eight conductor (8P8C) modular patch panels with no distinction between voice and data.
3. The termination block on the patch panel shall support the appropriate applications, including 100 Base-T, 52/155 Mbps ATM, and 1000 BASE-T Gigabit Ethernet, and facilitate cross connection and inter connection using modular patch cords.
4. All Modular jack panels shall be wired to T-568B unless requested otherwise by Owner.
5. The wiring block shall accommodate #23 AWG cable conductors.
6. All modular cross connect panels shall be UL-listed.

C. Work area outlets:

1. 8P8C non-keyed modular outlets for applications up to one Gbps and ANSI/TIA/EIA-568-C compliant for the specified transmission requirements.
2. Part of the UL LAN Certification and Follow-up Program.
3. Universal eight-position jack pin/pair assignments.
4. White in color for data outlets and blue in color for voice outlets.

D. Outlet Faceplates:
   1. Match electrical outlets in color and material type.
   2. Four-position with blanks inserted in unused ports.

2.5 PATCH CABLES

A. Copper
   1. All Patch Cables are Furnished and Installed by the Owner.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify the following before proceeding:
   1. Conduits, cable trays and pull boxes are properly installed following section 270528.
   2. Plywood backboards in communications rooms are properly installed in accordance with section 27 11 00.
   3. Grounding system is properly installed and tested following section 27 05 26.
   4. All high-pair count copper cables are routed properly and attached.
   5. All optical fiber links are terminated and tested.
   6. All backbone cabling service loops are installed and protected.
   7. Liquid-carrying pipes are not installed in or above voice and data system communications rooms. Do not proceed with installation in affected areas until removed.

3.2 INSTALLATION

A. All installation shall be done in conformance with ANSI/TIA/EIA-568-C standards, BICSI methods, industry standards and manufacturer's installation guidelines. The Contractor shall ensure that the maximum pulling tensions of the specified distribution cables are not exceeded and cable bends maintain the proper radius during the placement of the facilities. Failure to follow the appropriate guidelines shall require the Contractor to provide in a timely fashion the additional material and labor necessary to properly rectify the situation. This shall also apply to any and all damages sustained to the cables by the Contractor during the implementation.

B. The Contractor shall:
   1. Provide shall provide a 3-foot service loop above the access ceiling or cable trays unless specified otherwise. All service loops shall be a minimum of 18 inches in diameter and be accessible for maintenance.
   2. Coordinate loop placement and orientation with the technology consultant. This allows for future changes or expansion without installing new cables.

C. Cabling between communications rooms and workstation locations shall be made as individual “home runs”. No intermediate punch down blocks or splices may be installed or utilized between the communications rooms and the information outlets at the workstation location.

D. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connec-

tion points at both ends of the cable. There shall never be more than .5 inches of unsheathed Category 5e or 6 UTP cable at either the wiring closet or the workstation termination locations.

E. All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair equipment's efficient use of their full capacity.

F. Exposed Cable

1. All station cabling shall be installed inside walls or ceiling spaces whenever possible.
2. Exposed station cable will only be run where indicated on the drawings and will only be allowed when no other options exist. Owner must approve all exceptions.
3. The Contractor shall provide a copy of the finalized plan in writing to the Owner’s representative for review and authorization to proceed.

G. All cabling placed above drop ceilings must be supported by cable tray, saddle bags or conduit. The Contractor shall permanently affix cable supports to the building structure or substrates and provide attachment hardware and anchors designed for the structure to which attached and are suitably sized to sustain the weight of the cables to be supported. Attaching cable to pipes or other mechanical items is not permitted. Communication cables shall be routed so as to provide a minimum of 18 inches spacing whenever possible from light fixtures, sources of heat and EMI sources. Cabling shall not be attached to ceiling grid wires. Multiple cables are to be dressed every 5 feet to 7 feet. Maximum cable sag between cable hooks is 3”-6”. Plastic/nylon tie-wraps are not allowed to permanently secure cables inside the Telecommunications Rooms. (Refer to Section 27 05 28 Pathways For Communications Systems).

H. In the Telecommunications Room (TR), cables shall be combed and dressed with Velcro ties in a manner as to prevent twists, “braiding” and crossed cables in the cable bundle from the telecommunication room entrance to the termination point at the rear of the patch panel. Behind the patch panel, the cable bundle shall be attached to the rear cable support bar, and shall drop out each cable in a neat, cascading manner to prevent crossed and/or interwoven cables to each patch panel port termination point.

I. Identification - The Contractor shall:

1. Label cable terminations on designation strips.
2. Label all cable at each terminating point.
3. Label each port of the work area outlet.
4. Cable identification numbers shall not be duplicated.
5. Labeling convention to be coordinated with Owner.
6. Label data patch panels and voice blocks in the communications rooms to match those on the corresponding voice and data outlets. The font shall be at least .125-inch in height.
7. Where a wireless access point is installed above an acoustical ceiling, label the ceiling grid frame below the access point, displaying the data port number and, if applicable, the access point identification number. Coordinate with the Owner for all access point iden-

tification information.

8. All labels shall correspond to Record Drawings and to final test reports.
9. Coordinate with Owner for specifications on labeling of all hardware, cabling, and related equipment prior to any testing.
10. Label each distribution rack, block and other terminating equipment unit and field within that unit within 4 inches from the block or patch panel termination. Keep labels in a neat and orderly lineup.
11. Label each connector and each discrete unit of cable-terminating and connecting hardware within connector fields, in wiring closets and equipment rooms. Where similar jacks and plugs are used for both communication and data-processing equipment, use a different color for jacks and plugs of each service.
12. Post the cable schedule in a prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations.
13. Provide electronic copy of final comprehensive schedules for project in software and format selected by Owner.
14. Refer to the following drawing for faceplate labeling:

J. Documentation:

1. All cable inventory data documentation shall be submitted in format coordinated with and approved by Owner so that data can be incorporated into existing databases.
2. Documentation shall include cable identification number, source and destination, type of cable, length of cable and number of pairs or fibers.
3. Complete cross connect documentation is required. It shall include detailed documentation of each pair of all copper backbone cable and strand of fiber.

3.3 POST-INSTALLATION TESTING FOR CATEGORY 6 CABLE

A. Contractor shall test each Category 6 cable and each fiber strand of every optical fiber cable prior to acceptance.

B. Contractor shall supply all of the required test equipment used to conduct acceptance tests.

C. Contractor shall submit acceptance documentation as defined below. No cabling installation is considered complete until test results have been completed, submitted and approved.

D. Standards Compliance and Test Requirements:

1. Category 6 Copper Backbone Cabling shall meet ANSI/TIA-568-C.2 Category 6 Horizontal cabling requirements.

E. Cable Test Documentation:

1. Cable test documentation shall be submitted in hard copy and electronic formats. If proprietary software is used, disk or CD shall contain any necessary software application required to view test results. If the results are delivered in a standard format like Excel, Access, CSV files, etc., software to read these files is not required. Electronic reports shall be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate shall reference traceable circuit numbers that match the electronic record.
2. Each test record shall contain the cable ID as follows: “MEDIA TYPE – SOURCE ROOM

– DESTINATION ROOM – STRAND/PAIR #", e.g. MM-MC-HC23-001.

3. Copper: Test reports shall include the following information for each cabling element:
   a. Wire map results that indicate that 100% of the cabling has been tested for shorts, opens, miss-wires, splits, polarity reversals, transpositions, presence of AC voltage and end-to-end connectivity.
   b. Length, propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.
   c. For Category 6 cabling: Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT, and PSELFEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification shall be marked as a FAIL. Test shall also include mutual capacitance and characteristic impedance
   d. Cable manufacturer, cable model number/type, and NVP
   e. Tester manufacturer, model, serial number, hardware version, and software version.
   f. Cable ID and project name
   g. Auto-test specification used
   h. Overall pass/fail indication
   i. Date of test
   j. Name of Technician Performing Testing

F. Cable Test Equipment:
   1. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.
      a. Copper: Fluke DTX Cable Analyzer or submitted and Owner-approved equivalent.
      b. Fiber Optic: Fluke DTX Cable Analyzer or submitted and Owner-approved equivalent.
   2. Test equipment for Category 6 UTP shall be UL-verified to meet Level III accuracy as specified in ANSI/TIA/EIA-568-C. The cable installers shall have a copy of this reference in their possession and be familiar with the contents.
   3. Test equipment for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14-A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. The cable installers shall have a copy of these references in their possession and be familiar with the contents
   4. Test equipment for single mode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-7-1998: Optical Power Loss Measurements of Installed Single Mode Fiber Cable Plant-OFSTP-7.
   5. The test instrument shall be within the calibration period recommended by the manufac-

turer.

6. Test instruments shall have the latest software and firmware installed.
7. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.
8. Test adapter cables shall be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.
9. All test tools of a given type shall be from the same manufacturer, and have compatible electronic results output.
10. Test adapter cables must be replaced after 1000 tests to ensure accuracy.
11. Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.
12. Test equipment must be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
13. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
14. Test equipment must be capable of running individual NEXT, return loss, etc measurements in addition to auto tests. Individual tests increase productivity when diagnosing faults.
15. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.
16. Test equipment must be capable of running individual NEXT, return loss, etc measurements in addition to auto tests. Individual tests increase productivity when diagnosing faults.
17. Test equipment must include a library of cable types, sorted by major manufacturer.
18. Test equipment must store at least 1000 Category 6 auto tests in internal memory.
19. Test equipment must be able to internally group auto tests and cables in project folders for good records management.
20. Test equipment must include DSP technology for support of advanced measurements.
21. Test equipment must make swept frequency measurements in compliance with TIA standards.
22. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

3.4 POST-INSTALLATION TESTING FOR OPTICAL FIBER: TESTING SHALL BE PERFORMED ON ALL FIBERS IN THE COMPLETED END-TO-END SYSTEM.

A. Refer to section 27 13 00.

B. Power Meter and Source Loss Reports: Testing shall consist of a bi-directional, dual wave length end to end test. The system loss measurements shall be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for single mode fibers.

C. Optical Time Domain Reflectometer (OTDR) Reports: Testing shall consist of a bi-directional end to end OTDR trace performed per TIA/EIA 455-61. The system loss measurements shall be provided at 850 and 1300 nanometers for multi-mode fibers and 1310 and 1550 for

single mode fibers.

D. The acceptable link attenuation for a multimode horizontal optical fiber cabling system is based on the maximum distance of 295 feet.

E. The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two connector pairs, one pair at the telecommunications outlet/connector and one pair at the horizontal cross-connect, plus 295 feet of optical fiber cable.

F. A horizontal link in a network with a consolidation point may be tested using a fixed upper limit for attenuation of 2.75 dB.

3.5 ACCEPTANCE

A. Once all work has been completed, test documentation has been submitted and approved, and the Owner is satisfied that all work has been completed in accordance with contract documents, the Owner will notify Contractor in writing of formal acceptance of the system.

B. Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified herein.

C. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described above. Tests with the "* PASS" (asterisk) will not be acceptable. These circuits must be repaired to meet "PASS".

END OF SECTION

SECTION 28 31 00

FIRE DETECTION AND ALARM SYSTEM (NOTIFIER)

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Applicable sections of Division 26.

1.2 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

C. The system shall be support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.

D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

E. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994

F. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It’s acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

G. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

H. The installing company shall employ NICET (minimum Level III Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

I. Installation and service company shall be located within 50 miles of campus.

1.3 SCOPE:

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings. System shall be A Notifier NFS2-3030 with voice notification.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
2. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit or as plans show.
4. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
6. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
7. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone which ever is greater.
8. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
9. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.

   Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.

   Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.

   Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
10. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B (Style Y), or two Class A (Style Z) circuits.
11. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:
    a. The digital amplifier shall automatically broadcast the stored audio message.
    b. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
    c. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.

d. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.

e. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.

f. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.

1.4 GUARANTY:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer’s warranty of a minimum of 5 years.

1.5 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.6 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12 Extinguishing Systems (low and high)

No. 12A Halon 1301 Extinguishing Systems

No. 13 Sprinkler Systems

No. 15 Water Spray Systems

No. 16 Foam / Water Deluge and Spray Systems

No. 17 Dry Chemical Extinguishing Systems

No. 17A Wet Chemical Extinguishing Systems

No. 2001 Clean Agent Extinguishing Systems

No. 70 National Electric Code

No. 90A Air Conditioning Systems
No. 92A Smoke Control Systems
No. 92B Smoke Management Systems in Malls, Atria, Large Areas
No. 72 National Fire Alarm Code
No. 101 Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:
No. 268 Smoke Detectors for Fire Protective Signaling Systems
No. 864 Control Units for Fire Protective Signaling Systems
No. 2572 Mass Notification Systems
No. 217 Smoke Detectors, Single and Multiple Station
No. 228 Door Closers - Holders for Fire Protective Signaling Systems
No. 268A Smoke Detectors for Duct Applications
No. 521 Heat Detectors for Fire Protective Signaling Systems
No. 464 Audible Signaling Appliances
No. 38 Manually Actuated Signaling Boxes
No. 1481 Power Supplies for Fire Protective Signaling Systems
No. 346 Waterflow Indicators for Fire Protective Signaling Systems
No. 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971 Visual Notification Appliances
No. 2017 Standard for General-Purpose Signaling Devices and Systems
No.60950 Safety of Information Technology Equipment

D. California Fire Code.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:
UL Underwriters Laboratories, Inc
ULC Underwriters Laboratories Canada
FM Factory Mutual
CSFM California State Fire Marshal

B. The system shall be certified for seismic applications in accordance with the International Building Code (IBC). The basis for qualification of seismic approval shall be via shake table testing.

C. The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the FMM-4-20 monitor module and industry standard 4-20 mA gas detectors.

PART 2 PRODUCTS

2.1 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

A. Main FACP or network node shall be a NOTIFIER Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:

1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.

2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.

3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

2.2 System Capacity and General Operation

A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of installation company.

C. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.

D. The FACP shall be able to provide the following software and hardware features:

1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.

3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.
10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.
11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
16. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.

18. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
19. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result of all cooperating detectors chamber readings.
22. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.
23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
24. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.
25. Security Monitor Points: The system shall provide means to monitor any point as a type security.
26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciator’s can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
27. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.

28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.
29. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
30. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

E. Network Communication

1. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels/nodes per network.

F. Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

G. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.
2. The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

H. Loop (Signaling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.
2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit.
4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

I. Digital Voice Command Center

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
2. Function: The Voice Command Center equipment shall perform the following functions:
   a. Operate as a supervised multi-channel emergency voice communication system.

      Operate as a two-way emergency telephone system control center.

b. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.

c. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.

d. Provide all-call Emergency Paging activities through activation of a single control switch.

e. As required, provide vectored paging control to specific audio zones via dedicated control switches.

f. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.

g. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.

h. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.

i. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.

j. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

J. Power Supply:

1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.

2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.

3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.

4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.

5. The Main Power Supply shall be power-limited per UL864 requirements.

6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunciated and logged to the system alarm history log.

7. Addressable Charger Power Supply: The auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power. . NOTIFIER model # ACPS-610

8. The addressable power supply for the fire detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5

amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.

9. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "A" or Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.
10. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
11. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
12. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
13. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
14. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
15. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
16. The addressable power supply mounts in either the FACP back box or its own dedicated surface mounted back box with cover.
17. Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
18. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
19. When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Steady, March Time, Dual Stage or Temporal.
20. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
21. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
22. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power () for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:
    a. Earth Fault on DAP A (Digital Audio Port A)
    b. Earth Fault on DAP B (Digital Audio Port B)
    c. Audio Amplifier Failure Detected Trouble
    d. Active Alarm Bus input
    e. Audio Detected on Aux Input A
    f. Audio Detected on Aux Input B
    g. Audio Detected on Firefighter's Telephone Riser
    h. Receiving Audio from digital audio riser
    i. Short circuit on speaker circuit 1
    j. Short circuit on speaker circuit 2
    k. Short circuit on speaker circuit 3
    l. Short circuit on speaker circuit 4
    m. Data Transmitted on DAP A
    n. Data Received on DAP A
    o. Data Transmitted on DAP B
    p. Data Received on DAP B
    q. Board failure
    r. Active fiber optic media connection on port A (fiber optic media applications)
    s. Active fiber optic media connection on port B (fiber optic media applications)
    t. Power supply Earth Fault
    u. Power supply 5V present
    v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble
4. The audio amplifier shall provide the following built-in controls:
    a. Amplifier Address Selection Switches
    b. Signal Silence of communication loss annunciation Reset
    c. Level adjustment for background music
    d. Enable/Disable for Earth Fault detection on DAP A
    e. Enable/Disable for Earth Fault detection on DAP A
    f. Switch for 2-wire/4-wire FFT riser
5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.

8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control:
1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:
a. Lamp Test
b. Trouble
c. Off-Line Trouble
d. Microphone Trouble
e. Phone Trouble
f. Busy/Wait
g. Page Inhibited
h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators:
1. Speaker Switches/Indicators
a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.\
2. Emergency Two-Way Telephone Control Switches/Indicators
a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Remote Transmissions:
1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.

3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

O. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. All field defined programs shall be stored in non-volatile memory.

P. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
    a. Device Status.
    b. Device Type.
    c. Custom Device Label.
    d. Software Zone Label.
    e. Device Zone Assignments.
    f. Analog Detector Sensitivity.
    g. All Program Parameters.
4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.

5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

2.3 SYSTEM COMPONENTS:

A. Conventional Aspirating Detection
   1. An optional air aspiration detection system shall be available.
   2. The aspirating system shall support multiple sensitivity settings.
   3. The aspirating system shall operate from 24 VDC.
   4. The aspirating system shall provide alarm and trouble relays used to activate a fire alarm control panel.

B. Aspiration System Interface:
   1. The system shall be capable of supporting Interface Modules for integrating Vesda Aspiration detectors into SLC loop of the fire alarm control panel. The Interface Module shall support up to 19 detectors, each SLC loop shall support one interface module.

C. High Level Aspiration System Interface:
   1. The system shall be capable of supporting a High Level Interface for Vesda Aspirating Detection Systems. The interface shall support up to 100 detectors and allow the fire alarm network to monitor and control events on the aspiration system.

D. Portable Emergency Telephone Handset Jack
   1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on plans. Handset jacks shall be approved for emergency telephone system application.
   2. Insertion of a remote handset plug into a jack shall send a signal to the fire command center which shall audibly and visually indicate the on-line condition, and shall sound a ring indication in the handset.
   3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

E. Fixed Emergency Telephone Handset
   1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.

2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. The two-way emergency telephone system shall support a maximum of seven (7) handsets on line (off hook) without degradation of the signal.

F. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.
1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.
4. Communication shall include vital system status such as:
   a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
   b. Independent Addressable Device Status
   c. AC (Mains) Power Loss
   d. Low Battery and Earth Fault
   e. System Off Normal
   f. 12 and 24 Hour Test Signal
   g. Abnormal Test Signal (per UL requirements)
   h. EIA-485 Communications Failure
   i. Phone Line Failure
5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
6. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
8. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

G. Field Wiring Terminal Blocks

1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

H. Printer

1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.
3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

I. Smoke Control Annunciator to be by Kirkland and controlled by BMS.

1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.4 Gateway & Webserver Options

A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.

B. LEDSIGN Gateway: The system shall support an optional and proprietary LEDSIGN Gateway to interface to LED signs that will automatically display emergency messages. The signs shall be capable of storing up to 100 messages that can be activated via system programming with the ability to be manually overridden. The Sign Gateway shall support up to 10 independent signs, each sign capable of playing an independent message. Multiple LEDSIGN Gateways can be used in network applications. An LEDSIGN gateway shall be available from the fire alarm control panel manufacturer.

C. BACnet Interface Gateway: The system shall be capable of being interfaced with BACNet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.

D. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.

E. Noti-Fire-Net Gateway: The system shall support an IP based gateway to enable the panel or local Noti-Fire-Net to be connected to an ONYXWorks workstation via the Internet or Intranet. This gateway shall also support the ability to integrate the system to an interactive firefighter's display. The Noti-Fire-Net Gateway shall be available from the fire alarm control manufacturer.

F. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.

G. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
2. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
3. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
4. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.

5. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
6. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
7. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
8. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
9. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
11. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
12. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
14. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status;NOTIFIER model # NBG-12LX. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be NOTIFIER model # FSP-851 and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST- series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # DNR(W) and the remote test capable photoelectric smoke detector shall be NOTIFIER model # FSP-851R.

H. IntelliQuad™ Advanced Multi-Criteria Intelligent Detector

1. Intelligent multi-criteria fire detector shall be a NOTIFIER model number see drawings. Smoke detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.
3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.
4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers

or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.

6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.
7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single alarming unit.
8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which is at least 1.5 inches (3.81 cm) deep. Mounting base shall be available to mount to standard junction boxes. Suitable boxes include:
    a. 4.0" (10.16 cm) square box with and without plaster ring.
    b. 4.0" (10.16 cm) octagonal box.
    c. 3.5" (8.89 cm) octagonal box.
    d. Single-gang box.
10. Meets Agency Standards
    a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
    b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
    c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

I. IntelliQuad™ PLUS Advanced Multi-Criteria Intelligent Fire/CO Detector

1. Advanced Multi-Criteria Fire/CO detector shall be NOTIFIER model # FCO see drawings and shall be an addressable advanced multi-criteria smoke detector with a separate signal for carbon monoxide (CO) detection per UL 2075 standards.
2. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.

3. The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.
4. The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.
5. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20 percent of the drift range is remaining, when 100 percent of drift range is used, and when there is a chamber fault to show the unit requires maintenance.
6. The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
7. The detector shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detector shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 159 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
8. The detector shall provide a test means whereby it will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There shall be four test methods: functional magnet, smoke entry aerosol, carbon monoxide aerosol or direct heat method.
9. The detector shall provide two LEDs to provide 360° visibility. The LEDs shall be placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. The detector must be capable of connecting to a sounder base that provides both temporal 3 and temporal 4 patterns for fire and CO alarm.
10. Two LEDs on the sensor shall be controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, shall cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
11. The detector shall be plug-in mounted into a twist-lock base. The detector shall be constructed of off-white, UV-resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. The mounting base shall be mounted on a junction box that is at least 1.5 inches (3.81 cm) deep. The mounting base shall be available to mount to standard junction boxes. Suitable boxes include:
    a. 4.0" (10.16 cm) square box with and without plaster ring.
    b. 4.0" (10.16 cm) octagonal box.

c. 3.5" (8.89 cm) octagonal box.
d. Single-gang box.
e. Double-gang box

12. Meets Agency Standards
    a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
    b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
    c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling
    d. UL 2075 – Gas and Vapor Detector and Sensors – Systems Connected

J. Addressable Dry Contact Monitor Module
    1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class A or B) or FMM-101 (Class B)
    2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
    3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
    4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M.

K. Two Wire Detector Monitor Module
    1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device); NOTIFIER model # FZM-1.
    2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
    3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits; NOTIFIER model # XP6-MA.

L. Addressable Control Module
    1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances; NOTIFIER model # FCM-1
    2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
    3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
    4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits; NOTIFIER model # XP6-C.

M. Addressable Releasing Control Module

1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids; NOTIFIER model # FCM-1-REL.
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.Add FMM-4-20

N. Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display; NOTIFIER model # FMM-4-20.
   1. The module shall support programming of up to five programmable event thresholds.
   2. The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the FMM-4-20 monitor module and industry standard 4-20 mA gas detectors.

O. Addressable Relay Module:
   1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
   2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
   3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
   4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R.

p. Addressable Two-In / Two-Out Monitor/Relay Module:
   1. An addressable Two-In / Two-Out module shall be available; NOTIFIER model # FDRM-1.
   2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

Q. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER model # ISO-X.
   1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
   2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
   3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

R. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciator's, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.
3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.
4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

S. SpectrAlert Advance Speakers

1. The Speaker appliance shall be System Sensor SpectrAlert Advance model _____ Speaker. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

   Ceiling Speaker Wall Speaker

T. SpectrAlert Advance Speaker Strobes

1. The Speaker Strobe appliance shall be System Sensor SpectrAlert Advance model _____ Speaker Strobe. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance speaker strobes and the Sync•Circuit™ Module MDL3 accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the Sync•Circuit Module MDL3, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to 33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.

   Ceiling Speaker Strobe Wall Speaker Strobe

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

PART 3 EXECUTION

3.1. INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciator's shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

E. Any change from specification drawings plans must be submitted by a Registered Electrical Engineer and approved by Engineer of Record.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

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

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

END OF SECTION

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