100% CONSTRUCTION DOCUMENTS

Specifications

Stewart Indian School Welcome Center

SPWD Project No.: 15-P03

State of Nevada Public Work Division
August 19, 2016

SECTION 00 00 01 – PROJECT DIRECTORY

August 19, 2016

OWNER
State of Nevada Public Works Division
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Carson City, NV 89701
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(775) 684-4242 Fax
Contact: Robbie Oxoby, RA

USING AGENCY
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(775) 687-8333
Contact: Sherry L. Rupert,
Executive Officer

PRESERVATION OFFICER
State Historic Preservation Office
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Carson City, NV 89701
(775) 684-3436
Contact: Kristen Brown,
Review & Compliance Architectural Historian

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Contact: Jeff Current,
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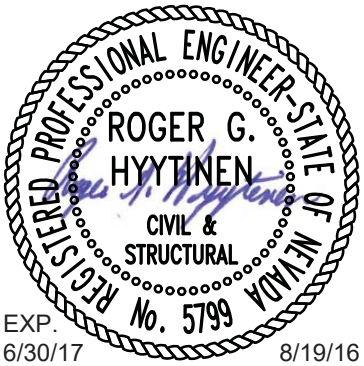
Contact: Jeremy Will, S.E.



EXP.
6/30/17 8/19/16

SECTION 00 00 01 – PROJECT DIRECTORY

June 9, 2016

MECHANICAL
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PE, CEM, LEED AP BD+C

SECTION 00 00 10 - PROJECT MANUAL INDEX

END OF SECTION 000010

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Stewart Indian School Cultural Center.

1. Project Location: State of Nevada Indian Commission, 5366 Snyder Avenue, Building 2, Carson City, Nevada 89701.

B. Owner: State of Nevada Indian Commission.

1. Owner's Representative: State of Nevada Public Works Division, 515 East Musser Street, Room102, Carson City, Nevada 89701-4263

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Selective Demolition of exterior and interior building and site elements including sidewalks, landscaping, concrete slabs, flooring, wood door and frame, and electrical systems. The Work shall include the removal and salvage of historical structural framing and ceilings. The Work shall include the removal of lead containing materials that are present in the existing construction. The Alteration Work shall consist of concrete ramps, retaining walls, slabs, and sidewalks, metal pipe railings and gates, structural reinforced shotcrete, wood framing, architectural wood casework, doors, hardware, historical window reproduction and existing window restoration, flooring, painting, mechanical, and electrical systems.

B. Type of Contract:

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

1.5 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

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

C. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet beyond building perimeter; 10 feet beyond surface walkways, patios, surface parking, and utilities less than 12 inches in diameter; 15 feet beyond primary roadway curbs and main utility branch trenches; and 25 feet beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
2. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.6 WORK RESTRICTIONS

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

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

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6 a.m. to 6 p.m., Monday through Friday, unless otherwise indicated.

C. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

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

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

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

1.7 SPECIFICATION AND DRAWING CONVENTIONS

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

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

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use facsimile of form provided in Project Manual.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions: Substitutions shall be incorporated into the Work in accordance with section 2.5 Substitutions of the General Conditions.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive as described in Section 2.8 of the General Conditions.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.

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

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

2. Submit the schedule of values to the Owner and the Architect within 14 calendar days after the issuance of the Notice to Proceed as required in Section 7.1 of the General Conditions.

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

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

    a. Project name and location.
    b. Contractor's name and address.
    c. Date of submittal.

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

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

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

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

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

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

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

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

1.5 APPLICATIONS FOR PAYMENT

A. Progress Payment Applications shall be formatted and submitted as required in Section 7.2 of the General Conditions.

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

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

C. Application for Payment Forms: Use forms provided by Owner for Applications for Payment. Sample copies are included in Project Manual.

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

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

E. Stored Materials: Payment for materials or equipment not yet incorporated into the Work shall be requested as noted in Section 7.2 of the General Conditions.

F. Transmittal: Submit the quantity agreed upon of signed copies of each Progress Payment Application to Owner by a method ensuring receipt.

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

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

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

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

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

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.

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

1.5 GENERAL COORDINATION PROCEDURES

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

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

1.6 COORDINATION DRAWINGS

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

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

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

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

1. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
2. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
3. Mechanical and Plumbing Work: Show the following:

a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
c. Fire-rated enclosures around ductwork.

4. Electrical Work: Show the following:

a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

5. Fire-Protection System: Show the following:

a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
7. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Request for Information shall be submitted as required in Section 2.3 of the General Conditions.

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

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

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

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.

6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

D. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

    1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 10 working days for Architect's response for each RFI..

    1. The following Contractor-generated RFIs will be returned without action:

        a. Requests for approval of submittals.
        b. Requests for approval of substitutions.
        c. Requests for approval of Contractor's means and methods.
        d. Requests for coordination information already indicated in the Contract Documents.
        e. Requests for adjustments in the Contract Time or the Contract Sum.
        f. Requests for interpretation of Architect's actions on submittals.
        g. Incomplete RFIs or inaccurately prepared RFIs.

    2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
    3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

        a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:

    1. Project name.
    2. Name and address of Contractor.
    3. Name and address of Architect.
    4. RFI number including RFIs that were returned without action or withdrawn.
    5. RFI description.
    6. Date the RFI was submitted.
    7. Date Architect's response was received.

G. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

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

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

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Critical work sequencing and long-lead items.
c. Designation of key personnel and their duties.
d. Lines of communications.
e. Procedures for processing field decisions and Change Orders.
f. Procedures for RFIs.
g. Procedures for testing and inspecting.
h. Procedures for processing Applications for Payment.
i. Submittal procedures.
j. Use of the premises and existing building.
k. Work restrictions.
l. Working hours.
m. Owner's occupancy requirements.
n. Responsibility for temporary facilities and controls.
o. Procedures for moisture and mold control.
p. Procedures for disruptions and shutdowns.
q. Parking availability.
r. Equipment deliveries and priorities.
s. Security.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C.

1. Construction progress meetings shall be held as noted in Section 5.8 of the General Conditions.Progress Meetings: Conduct progress meetings at regular intervals.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Daily construction reports.
3. Site condition reports.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. Daily Construction Reports: Submit at weekly intervals.

D. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Refer to Section 5.7 of the General Conditions for Construction Schedule requirements.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Recovery Schedule: In the event of any failure to adhere to the construction schedule the Contractor shall, within 7 days of written notice from the Owner, provide a recovery schedule for review by the Owner and the Architect. The recovery schedule shall identify how the Contractor proposes, at his sole expense, to overcome the associated delays and complete the Work within the Contract Time. Such notice from the Owner shall not constitute either actual or implied direction for the Contractor to accelerate the Work.

2.2 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Approximate count of personnel at Project site.
3. Equipment at Project site.
4. Material deliveries.
5. High and low temperatures and general weather conditions, including presence of rain or snow.
6. Accidents.
7. Meetings and significant decisions.
8. Stoppages, delays, shortages, and losses.
9. Emergency procedures.
10. Orders and requests of authorities having jurisdiction.
11. Change Orders received and implemented.
12. Construction Change Directives received and implemented.
13. Services connected and disconnected.
14. Equipment or system tests and startups.
15. Partial completions and occupancies.
16. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: The Contractor shall submit a current/updated construction schedule with each Progress Payment Application. Failure by the Contractor to provide a current construction schedule shall be justification for the Owner to withhold approval or reduce the amount of the payment due the Contractor.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules 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 performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
4. Section 024119 "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:

    a. Name of Project.
    b. Date photograph was taken.
    c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

C. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

D. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

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

B. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making

corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 CONTRACTOR'S USE OF ARCHITECT'S DIGITAL FILES

A. General: At Contractor’s written request and Architect’s discretion, copies of Architect’s digital files may be provided to Contractor for Contractor’s use in connection with the project. This use is subject to Contractor signing a release form as provided by Architect.

1. Electronic File Condition Release Form is included at the end of this section.

B. Digital files may be provided if requested for the following uses:

1. Preparation of shop drawings that require Contractor to design and demonstrate the coordinated installation of multiple trades.
2. Preparation of shop drawings and calculations for Contractor provided design-build installation.
3. Preparation of shop drawings for Contractor obtained permits from Authorities Having Jurisdiction (AHJ).

C. Digital Files will not be provided prior to the Notice to Proceed.

D. Contractor use of Digital Files that are prepared by Design Team members other than the Architect are subject to additional requirements beyond those indicated in this section.

E. The following Digital Files are NOT available for Contractor’s use:

1. Door Schedules or Finish Schedules.

2. Individual details or detail sheets – including but not limited to Accessibility Details, Plan Details, Roof Details, Door and Frame Details, Window Details, and Ceiling Details.

1.6 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Submittals shall be provided in accordance with Section 2.4 of the General Conditions.

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

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

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

1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 14 days for review of each resubmittal.

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

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

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

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

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Contractor.
    e. Name of firm or entity that prepared submittal.
    f. Names of subcontractor, manufacturer, and supplier.
    g. Category and type of submittal.

h. Submittal purpose and description.
i. Specification Section number and title.
j. Specification paragraph number or drawing designation and generic name for each of multiple items.
k. Location(s) where product is to be installed, as appropriate.
l. Related physical samples submitted directly.
m. Indication of full or partial submittal.
n. Transmittal number, numbered consecutively.
o. Submittal and transmittal distribution record.
p. Other necessary identification.
q. Remarks.

E. Options: Identify options requiring selection by Architect.

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

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

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

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

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

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

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

a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

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

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.

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

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

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.

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

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

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

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches , but no larger than 30 by 42 inches .
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

    a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure

Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads.

Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

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

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

3.2 ARCHITECT'S ACTION

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

1. Reviewed, No Exceptions Noted..
2. Reviewed, Exceptions Noted - No Resubmittal Required.
3. Reviewed, Exceptions Noted - Resubmittal Required.
4. Rejected - Resubmittal Required.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

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

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

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

SECTION 013591 - HISTORIC TREATMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Historic removal and dismantling.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
2. Section 080152 “Historic Treatment of Wood Windows” for wood window repair, reglazing, and window refinishing.

1.3 DEFINITIONS

A. Consolidate: To strengthen loose or deteriorated materials in place.

B. Dismantle: To disassemble and detach items by hand from existing construction to the limits indicated, using small hand tools and small one-hand power tools, so as to protect nearby historic surfaces; and legally dispose of dismantled items off-site, unless indicated to be salvaged or reinstalled.

C. Existing to Remain: Existing items that are not to be removed or dismantled.

D. Historic: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance which are important to the successful preservation, rehabilitation, restoration, and reconstruction as determined by Architect. Designated historic spaces, areas, and surfaces are scheduled in this Section.

1. Restoration Zone: The northern portions of the First Floor where wood ceilings are to be restored.

2. Alteration Zone: The southern portion of the First Floor where gypsum ceilings are to be removed and replaced.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Reconstruct: To remove existing item, replicate damaged or missing components, and reinstall in original position.

G. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

H. Reinstall: To protect removed or dismantled item, repair and clean it as indicated for reuse, and reinstall it in original position, or where indicated.

I. Remove: Specifically for historic spaces, areas, rooms, and surfaces, the term means to detach an item from existing construction to the limits indicated, using hand tools and hand-operated power equipment, and legally dispose of it off-site, unless indicated to be salvaged or reinstalled.

J. Repair: To correct damage and defects, retaining existing materials, features, and finishes while employing as little new material as possible. Includes patching, piecingin, splicing, consolidating, or otherwise reinforcing or upgrading materials.

K. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

L. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

M. Reproduce: To fabricate a new item, accurate in detail to the original, and in either the same or a similar material as the original, unless otherwise indicated.

N. Restore: To consolidate, replicate, reproduce, repair, and refinish as required to achieve the indicated results.

O. Retain: To keep existing items that are not to be removed or dismantled.

P. Reversible: New construction work, treatments, or processes that can be removed or undone in the future without damaging historic materials unless otherwise indicated.

Q. Salvage: To protect removed or dismantled items and deliver them to Owner ready for reuse.

R. Stabilize: To provide structural reinforcement of unsafe or deteriorated items while maintaining the essential form as it exists at present; also, to reestablish a weather-resistant enclosure.

S. Strip: To remove existing finish down to base material unless otherwise indicated

1.4 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during removal and dismantling work remain Owner's property. Carefully dismantle and salvage each item or object.

B. Coordinate with Architect, who will establish special procedures for dismantling and salvage.

1.5 INFORMATIONAL SUBMITTALS

A. Construction Schedule for Historic Treatments: Indicate for entire Project the following for each activity to be performed in historic spaces, areas, and rooms, and on historic surfaces:

1. Detailed sequence of historic treatment work, with starting and ending dates, coordinated with Owner's continuing operations and other known work in progress.
2. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
3. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use. Do not use such equipment without Contractor's professional engineer's certification that the structure can support the imposed loadings without damage.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's historic treatment operations.

C. Historic Treatment Program: Submit before work begins.

D. Fire-Prevention Plan: Submit before work begins.

E. Inventory of Salvaged Items: After removal or dismantling work is complete, submit a list of items that have been salvaged.

1.6 QUALITY ASSURANCE

A. Historic Treatment Specialist Qualifications: An experienced firm regularly engaged in historic treatments similar in nature, materials, design, and extent to this work as specified in each section, and that has completed a minimum of three recent projects with a record of successful in-service performance that demonstrate the firm's qualifications to perform this work.

1. Field Supervisor Qualifications: Full-time supervisors experienced in historic treatment work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on Project site during times that historic treatment work is in progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
2. Worker Qualification: Persons who are experienced in historic treatment work of types they will be performing.

B. Historic Removal and Dismantling Specialist Qualifications: A qualified historic treatment specialist. General selective demolition experience is not sufficient experience for historic removal and dismantling work.

C. Historic Treatment Program: Prepare a written plan for historic treatment for whole Project, including each phase or process and protection of surrounding materials during operations. Describe in detail materials, methods, and equipment to be used for each phase of work. Show compliance with indicated methods and procedures specified in this and other Sections.

1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

D. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fireprevention devices during each phase or process. Coordinate plan with Owner's fireprotection equipment and requirements. Include each fire watch's training, duties, and authority to enforce fire safety.

E. Mockups: Prepare mockups of specific historic treatment procedures specified in this Section to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Typical Dismantling Work: Dismantle typical plaster medallion from existing plaster ceiling as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

F. Regulatory Requirements: Comply with notification regulations of authorities having jurisdiction before beginning removal and dismantling work. Comply with hauling and disposal regulations of authorities having jurisdiction.

G. Standards: Comply with ANSI/ASSE A10.6.

H. Historic Treatment Preconstruction Conference: Conduct conference at Project site.

1. General: Review methods and procedures related to historic treatment including, but not limited to, the following:

a. Review manufacturer's written instructions for precautions and effects of historic treatment procedures on materials, components, and vegetation.
b. Review and finalize historic treatment construction schedule; verify availability of materials, equipment, and facilities needed to make progress and avoid delays.
c. Review qualifications of personnel assigned to the work and assign duties.
d. Review material application, work sequencing, tolerances, and required clearances.
e. Review areas where existing construction is to remain and requires protection.

2. Removal and Dismantling:

a. Inspect and discuss condition of construction to be removed or dismantled.
b. Review requirements of other work that relies on substrates exposed by removal and dismantling work.

1.7 STORAGE AND PROTECTION OF HISTORIC MATERIALS

A. Salvaged Historic Materials:

1. Clean only loose debris from salvaged historic items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Historic Materials for Reinstallation:

1. Repair and clean historic items as indicated and to functional condition for reuse.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make item functional for use indicated.

C. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after historic treatment and construction work in the vicinity is complete.

D. Storage and Protection: When taken from their existing locations, catalog and store historic items within a weathertight enclosure where they are protected from wetting by rain, snow, condensation, or ground water, and from freezing temperatures.

1. Identify each item with a nonpermanent mark to document its original location. Indicate original locations on plans elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.

1.8 PROJECT CONDITIONS

A. General Size Limitation in Historic Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

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

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

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

1. Hazardous materials will be removed by Owner before start of the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

a. In the case of asbestos, stop work in the area of potential hazard, shut off fans and other airhandlers ventilating the area, and rope off area until the questionable material is identified. Re-assign workers to continue work in unaffected areas. Resume work in the area of concern after safe working conditions are verified.

E. Storage or sale of removed or dismantled items on-site is not permitted unless otherwise indicated.

1.9 COORDINATION

A. Coordinate historic treatment procedures in this Section with public circulation patterns at Project site. Some work is near public circulation patterns. Public circulation patterns cannot be closed off entirely, and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 HISTORIC REMOVAL AND DISMANTLING EQUIPMENT

A. Removal Equipment: Use only hand-held tools except as follows or unless otherwise approved by Architect on a case-by-case basis:

1. Light jackhammers are allowed subject to Architect's approval.
2. Large air hammers are not permitted.

B. Dismantling Equipment: Use manual, hand-held tools, except as follows or otherwise approved by Architect on a case-by-case basis:

1. Hand-held power tools and cutting torches are permitted only as submitted in the historic treatment program. They must be adjustable so as to penetrate or cut only the thickness of material being removed.
2. Pry bars more than 18 inches (450 mm) long and hammers weighing more than 2 lb (0.9 kg) are not permitted for dismantling work.

3.2 EXAMINATION

A. Preparation for Removal and Dismantling: Examine construction to be removed or dismantled to determine best methods to safely and effectively perform removal and dismantling work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed or dismantled and location of utilities and services to remain that may be hidden by construction that is to be removed or dismantled.

1. Verify that affected utilities have been disconnected and capped.
2. Inventory and record the condition of items to be removed and dismantled for reinstallation or salvage.
3. Before removal or dismantling of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
4. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures as a result of removal and dismantling work.

B. Perform surveys as the Work progresses to detect hazards resulting from historic treatment procedures.

3.3 PROTECTION, GENERAL

A. Ensure that supervisory personnel are on-site and on duty when historic treatment work begins and during its progress.

B. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from historic treatment procedures.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide barricades, barriers, and temporary directional signage to exclude public from areas where historic treatment work is being performed.
3. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of historic treatment work.
4. Contain dust and debris generated by removal and dismantling work and prevent it from reaching the public or adjacent surfaces.
5. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
6. Protect floors and other surfaces along haul routes from damage, wear, and staining.
7. Provide supplemental sound-control treatment to isolate removal and dismantling work from other areas of the building.

C. Temporary Protection of Historic Materials:

1. Protect existing historic materials with temporary protections and construction. Do not deface or remove existing materials.
2. Do not attach temporary protection to historic surfaces except as indicated as part of the historic treatment program and approved by Architect.

D. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

E. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by the historic treatment work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for the historic treatment work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

F. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.

1. Prevent solids such as stone or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from historic treatment work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

G. Existing Roofing: Prior to the start of work in an area, install roofing protection.

3.4 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following.

1. Comply with NFPA 241 requirements unless otherwise indicated.
2. Remove and keep area free of combustibles including, rubbish, paper, waste, and chemicals, except to the degree necessary for the immediate work.

    a. If combustible material cannot be removed, provide fire blankets to cover such materials.
3. Prohibit smoking by all persons within Project work and staging areas.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or highly combustible materials, including welding, torch-cutting, soldering, brazing, paint removal with heat, or other operations where open flames or implements utilizing high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practical, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other hightemperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or highly combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows.

    a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    d. Have fire watch perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work at each area of Project site to detect hidden or smoldering fires and to ensure that proper fireprevention is maintained.
    e. Maintain fire-watch personnel at each area of Project site until 60 minutes after conclusion of daily work.

C. Fire Extinguishers, Fire Blankets, and Rag Buckets: Maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire watch is trained in fire-extinguisher and blanket operation.

3.5 GENERAL HISTORIC TREATMENT

A. Ensure that supervisory personnel are present when historic treatment work begins and during its progress.

B. Halt the process of deterioration and stabilize conditions unless otherwise indicated. Perform work as indicated on Drawings. Follow the procedures in subparagraphs below and procedures approved in historic treatment program:

1. Retain as much existing material as possible; repair and consolidate rather than replace.
2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
3. Use reversible processes wherever possible.
4. Use historically accurate repair and replacement materials and techniques unless otherwise indicated.
5. Record existing work before each procedure (preconstruction) and progress during the work with digital preconstruction documentation photographs. Comply with requirements in Section 013233 "Photographic Documentation."

C. Notify Architect of visible changes in the integrity of material or components whether due to environmental causes including biological attack, UV degradation, freezing, or thawing; or due to structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

D. Where missing features are indicated to be repaired or replaced, provide features whose designs are based on accurate duplications rather than on conjectural designs, subject to approval of Architect.

E. Where Work requires existing features to be removed or dismantled and reinstalled, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.

F. Identify new and replacement materials and features with permanent marks hidden in the completed work to distinguish them from original materials. Record a legend of identification marks and the locations of the items on record Drawings.

3.6 HISTORIC REMOVAL AND DISMANTLING

A. General: Have removal and dismantling work performed by a qualified historic removal and dismantling specialist. Ensure that historic removal and dismantling specialist's field supervisors are present when removal and dismantling work begins and during its progress.

B. Perform work according to the historic treatment program and approved mockups.

1. Provide supports or reinforcement for existing construction that becomes temporarily weakened by the work, until the work is completed.
2. Perform cutting by hand or with small power tools wherever possible. Cut holes and slots neatly to size required, with minimum disturbance of adjacent work.
3. Do not operate air compressors inside building, unless approved by Architect in each case.
4. Do not drill or cut columns, beams, joints, girders, structural slabs, or other structural supporting elements, without having Contractor's professional engineer's written approval for each location before such work is begun.
5. Do not use explosives.

C. Water-Mist Sprinkling: Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment that ensure that such water will not create a hazard or adversely affect other building areas or materials.

D. Unacceptable Equipment: Keep equipment that is not permitted for historic removal or dismantling work away from the vicinity where such work is being performed.

E. Removing and Dismantling Items on or near Historic Surfaces:

1. Use only dismantling tools and procedures within 12 inches (300 mm) of historic surface. Do not use pry bars. Protect historic surface from contact with or damage by tools.
2. Unfasten items to be removed, in the opposite order from which they were installed.
3. Support each item as it becomes loosened to prevent stress and damage to the historic surface.
4. Dismantle anchorages.

F. Masonry Walls:

1. Remove masonry carefully and erect temporary bracing and supports as needed to prevent collapse of materials being removed.
2. Dismantle top edge and sides before removing wall. Stop removal work and immediately inform Architect if any structural elements above or adjacent to the work show signs of distress or dislocation during any phase of removal work.
3. Remove wall in easily managed pieces.
4. During removal, Contractor is responsible for the stability of the partially remaining wall. Notify Architect of the condition of temporary bracing for wall if work is temporarily stopped during the wall's removal.

G. Loose Plaster: Identify loose, non-historic plaster and separate it from its substrate by tapping with a hammer and prying with a chisel or screwdriver. Do not use pry bars. Leave sound, firmly adhered plaster in place. Do not damage, remove, or dismantle historic plasterwork except where indicated or where it is an immediate hazard to personnel and as approved by Architect.

H. Anchorages:

1. Remove anchorages associated with removed items.
2. Dismantle anchorages associated with dismantled items.
3. In non-historic surfaces, patch holes created by anchorage removal or dismantling according to the requirements for new work.
4. In historic surfaces, patch or repair holes created by anchorage removal or dismantling according to Section specific to the historic surface being patched.

END OF SECTION 013591

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

C. See General Conditions, Section 5.20 - Materials Testing, for materials testing requirements and responsibilities.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of [**five**]<**Insert number**> previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

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

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

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. The Contractor shall develop and implement an appropriate quality assurance/quality control program for the Project. A detailed description of the program shall be furnished to the Owner and the Architect for review prior to submitting the first progress payment application.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Testing of construction materials delivered to the job site shall be carried out by the Owner unless otherwise required in the Construction Documents. Refer to Section 5.20 of the General Conditions.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

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

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

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

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

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

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

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

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

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

1.3 INDUSTRY STANDARDS

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

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

1.4 ABBREVIATIONS AND ACRONYMS

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

1. ICC - International Code Council; www.iccsafe.org.
2. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

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

1. DOE - Department of Energy; www.energy.gov.
2. DOI - Department of Interior; https://www.doi.gov/
3. EPA - Environmental Protection Agency; www.epa.gov.
4. OSHA - Occupational Safety & Health Administration; www.osha.gov.

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

D.

1. SPWD - Nevada State Public Works Division; www.http://publicworks.nv.gov/
2. NIC -State of Nevada Indian Commission; http://nic.nv.gov/
3. SHPO - State Historic Preservation Office; http://shpo.nv.gov/State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. The Contractor shall pay all costs related to temporary utilities, including, but not limited to, applications, fees, permits, engineering, and any other costs that may be required to acquire temporary utilities.

B. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

C. Temporary utilities may be connected to the Owner's existing metered utilities only with the Owner's and utility company's written authorization.

D. Any connection to the Owner's existing utilities shall be separately metered to allow for proper allocation of utility costs, unless another arrangement is specifically agreed to and authorized by the Owner in writing. Temporary meters shall be removed upon completion of the Work.

E. The Contractor shall be solely responsible for providing temporary heating, cooling, and/or ventilation as required to prevent degradation or damage to the Work. The permanent heating, cooling and air handling systems shall not be utilized for the purpose of temporary heating, cooling or ventilation until the Owner approves of such use in writing. In no case shall the permanent heating, cooling, or air handling systems be operated until they are complete, including formal start-up, check out, and testing and balancing. Utilization of any of the permanent heating, cooling, or air handling systems prior to Substantial Completion shall not impact the specified warranty for such equipment which shall begin on the date of Substantial Completion in accordance with the General Conditions of the Contract.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch , 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts.

B. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches .

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 8 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F .
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

F. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide construction sign in location as directed by Owner. This sign shall be the only sign displayed on the Project site. Sign requirements are as follows:

a. Size: 8’ x 4’.
b. Lettering: Roman Style.
c. Lettering Color: Black.

d. Background Color: White.
e. Lettering Size: 1/4” minimum to 2 3/4” maximum.
f. Sign Format: Project Title Completion Date Contractor Name Architect Name Design Consultant Names

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

E. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

G. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of

exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.
2. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

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

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

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

1.4 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 14 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

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

1.5 QUALITY ASSURANCE

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

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

4. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
5. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

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

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

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

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. See other Sections for specific content requirements and particular requirements for submitting special warranties.

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

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

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

B. Product Selection Procedures:

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

    a. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

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

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

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

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

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

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

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

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

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

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

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Air or smoke barriers.
    c. Fire-suppression systems.
    d. Mechanical systems piping and ducts.
    e. Control systems.
    f. Communication systems.
    g. Fire-detection and -alarm systems.
    h. Electrical wiring systems.

3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

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

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

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

3.2 PREPARATION

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

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

fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

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

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

E.

3.3 CONSTRUCTION LAYOUT

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

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

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

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

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

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of [**two**]<**Insert number**> permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

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

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

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

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

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

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

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

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

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

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

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

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

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

3.6 CUTTING AND PATCHING

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

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

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

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

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

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

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

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

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

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

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

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

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

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

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

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

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

3.7 PROGRESS CLEANING

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

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

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

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

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

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

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

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

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

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

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

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

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

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

3.8 STARTING AND ADJUSTING

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

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

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

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

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

3.9 PROTECTION OF INSTALLED CONSTRUCTION

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

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

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
2. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
3. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

D. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 6 inches or more.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.3 RECYCLING DEMOLITION and CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Clean and stack undamaged, whole masonry units on wood pallets.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

G. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

H. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

    a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Requirements:

1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 017300 "Execution" for progress cleaning of Project site.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

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

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

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Refer to General Conditions of the Contract, Section 3.4 for Substantial Completion

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

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

1.6 FINAL COMPLETION PROCEDURES

A. See General Conditions of the Contract, Section 3.5, for Final Completion.

1.7 SUBMITTAL OF PROJECT WARRANTIES

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

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

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

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

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

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

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

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

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

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

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

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

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

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

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

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

1.4 CLOSEOUT SUBMITTALS

A. Prior to substantial completion of the Project, the Contractor shall submit to the Architect, a sample of each operation and maintenance manual for equipment and/or materials incorporated into the Work.

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

C. Final Manual Submittal: Upon approval of the sample submittal by the Architect, the Contractor shall furnish to the Owner, three bound and indexed copies of the approved operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

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

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

B. Title Page: Include the following information:

1. Name and address of Project.
2. Name and address of Owner.
3. Date of submittal.
4. Name and contact information for Contractor.

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

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

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

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

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

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

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

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

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

1. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

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

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.

B. Related Requirements:

1. Section 017300 "Execution" for final property survey.
2. Section 017700 "Closeout Procedures" for general closeout procedures.
3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up record prints.

B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued. <Record Prints shall be maintained as noted in Section 2.6 of the General Conditions of the Contract>.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.

c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as paper copy.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

C. Upon completion or termination of the project, the set of record documents shall be delivered to the Architect as noted in Section 2.6 of the General Conditions of the Contract.

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

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

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 013591 "Historic Treatment Procedures" for historic removal and dismantling.
3. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

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

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

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

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

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

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

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

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

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

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

1. Interruption of utility services. Indicate how long utility services will be interrupted.
2. Coordination for shutoff, capping, and continuation of utility services.

C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

D. Predemolition Photographs: Submit before Work begins.

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

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

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

1. Before selective demolition, Owner will remove the following items:

a. Existing furniture, selving, and loose items intended for salvage..

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

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

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 6 inches or more.

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

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

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

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

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

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

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

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

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

1. Arrange to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

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

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

3.4 SELECTIVE DEMOLITION, GENERAL

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

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Work in Historic Areas: Selective demolition may be performed only in areas of the Project that are not designated as historic. In historic spaces, areas, and rooms or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 013591 "Historic Treatment Procedures."

C. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

D. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

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

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

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

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

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

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

E. Wood Framing and Sheathing: Remove nails and connectors between items to be removed and those that remain in a manner that avoids damage to items that remain. Where cutting is required, do not overcut into portions of the structure that are to remain or be reinstalled.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

END OF SECTION 024119

SECTION 024126 – SELECTIVE ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.
2. Disposal of materials.
3. Storage of removed materials.
4. Identification of utilities.
5. Salvaged items.
6. Protection of items to remain as indicated on Drawings.
7. Relocate existing equipment to accommodate construction.

B. Related Sections:
1. Section 02 41 16 - Structure Demolition: Demolition of utilities and other underground items.
2. Section 02 41 19 - Selective Structure Demolition: Removal of designated building equipment and construction.
3. Section 08 31 13 - Access Doors and Frames: Execution requirements for access doors and panels specified by this section.

1.2 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work. Describe demolition removal procedures and schedule.

1.3 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of capped utilities, conduits and equipment abandoned in place.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State of Nevada Public Work's standard.

1.5 PRE-INSTALLATION MEETINGS

A. General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.6 SEQUENCING

A. General Conditions: Requirements for sequencing.

B. Sequence as requested for project.

1.7 SCHEDULING

A. General Conditions: Requirements for scheduling.

B. Schedule work to coincide with new construction or remodeled/ renovation area.

C. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.8 COORDINATION

A. General Conditions: Requirements for coordination.

B. Conduct demolition to minimize interference with adjacent and occupied building areas.

C. Coordinate demolition work with General Contractor.

D. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

E. Shut-down Periods:
1. Arrange timing of shut-down periods of in service panels with Owner. Do not shut down any utility without prior written approval.
2. Keep shut-down period to minimum or use intermittent period as directed by Owner.
3. Maintain life-safety systems in full operation in occupied facilities, or provide notice minimum 3 days in advance.

F. Identify salvage items in cooperation with Owner.

1.9 CONTRACTOR'S USE OF PREMISES

A. Confine operations at site to areas and limits permitted by law, ordinances, permits; contract documents and general conditions.

B. Protection and safekeeping of products stored on premises is responsibility of contractor supplying product.

C. Deliveries and unloading shall be scheduled to prevent traffic congestion blocking of access or interference with work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

D. Contractor shall pay for, or satisfactorily repair, all damages incident to their work, to sidewalks, streets, other public or private property, or to any public utilities occurring during period of work under this contract.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Verification of existing conditions before starting work.

B. Visit site and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference shall be reported immediately to the consultant.

C. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

D. Verify termination points for demolished services.

3.2 PREPARATION

A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

B. Temporary egress signage and emergency lighting

3.3 DEMOLITION

A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect/Engineer before disturbing existing installation. Demolish existing electrical work, including auxiliary systems, in areas of existing building shown reworked. Coordinate removal of electrical systems with General Contractor and Owner.

B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

C. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

D. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

E. Reconnect equipment being disturbed by renovation work and required for continue service to nearest available panel.

F. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.

G. Install temporary wiring and connections to maintain existing systems in service during construction.

H. Perform work on energized equipment or circuits with experienced and trained personnel.

I. Remove, relocate, and extend existing installations to accommodate new construction.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.

L. Clean and repair existing equipment to remain or to be reinstalled.

M. Protect and retain power to existing active equipment remaining.

N. Cap abandoned empty conduit at both ends.

O. In reworked areas, remove all electrical equipment; i.e.: Light fixtures, panelboards, switches, receptacles, auxiliary system devices, telephone outlets, etc.; unless otherwise noted. Remove existing branch circuits (conduit, wire, outlet boxes and supports) serving equipment to be removed. Abandon circuits concealed in concrete. Remove conductors from abandoned conduits. Leave existing branch circuits and feeders which run through reworked areas and serve existing equipment to remain in service, continuous and uninterrupted. Repair, re-terminate, re-support, etc., any damaged circuits, feeders or supports.

P. Abandon outlets in existing masonry and brick walls: provide blank stainless steel cover plates.

Q. Cut off abandoned conduits concealed in slab one inch below top of base floor slab and patch slab or floor to match existing.

3.4 EXISTING PANELBOARDS

A. Remove panelboards in its entirety.

B. Remove existing wire no longer in use from panel to equipment.

3.5 SALVAGE ITEMS

A. Electrical equipment, wiring, etc., removed and not required to be part of new electrical installation is classed as salvage.

B. The Contractor shall submit a list of salvageable equipment and/or parts identified below that are to be removed. Provide list to Owner for review.

C. The list shall contain the following:
1. type of equipment
2. quantity
3. manufacturer
4. model #
5. condition (with explanation if needed)

D. Once the list has been reviewed the Contractor will be notified of any equipment deemed reusable by the Owner.

E. Salvageable equipment not selected to be retained by the Owner becomes property of Contractor. Remove from job site.

3.6 REUSABLE ELECTRICAL EQUIPMENT

A. Carefully remove equipment, materials, or fixtures which are to be reused.

B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

C. Relocate existing lighting fixtures as indicated on Drawings. Clean fixtures and re-lamp. Test fixture to see if it is in good working condition before installation at new location.

3.7 CUTTING AND REPAIRING

A. Cut and repair walls floors, roof, etc., as required for installation of work in this Division. Employ professional installers of repair materials where repair work is major or aesthetics are of primary importance.

B. Do not pierce exterior walls below grade with hanger bolts. Do not cut building structural members except where accepted by Engineer. Do not use core drilling as a cutting method above telephone, electrical or data equipment. Use hammer drill only (size limited). Contain water below floor at any location of core drilling. Locate final holes to avoid cutting existing rebar as much as possible.

C. Repair work shall be comparable with work cut. New finishes shall match adjacent finishes. Engineer will review repaired work and may reject unsuitable work.

3.8 HAZARDOUS MATERIALS

A. Submit Material Safety Data Sheets for all materials furnished in this project defined as hazardous by NFPA. All requirements of the Material Safety Data Sheets shall be implemented and followed judiciously when hazardous materials are installed or otherwise used.

B. All hazardous materials shall be stored and used (mixed, applied, etc.) in strict accordance with the OSHA Standards, and Safety Data Sheets.

3.9 WELDING AND CUTTING

A. Special precautions shall be taken to reduce fire hazards where electric or gas welding or cutting work or soldering is done and suitable fire extinguishing equipment shall be maintained near such operations.

3.10 CLEANING

A. General Conditions: Requirements for cleaning.

B. Remove demolished materials as work progresses. Legally dispose.

C. Keep workplace neat.

3.11 PROTECTION OF FINISHED WORK

A. General Conditions: Requirements for protecting finished Work.

B. Do not permit traffic over unprotected floor surface.

3.12 DISPOSAL PROCEDURES (FLUORESCENT BULBS, BALLASTS & LIGHT FIXTURES)

A. These materials do not require special training to remove or package.

B. The Contractor shall contract with Waste Management LampTracker to recycle the lamps (fluorescent bulbs) and ballasts removed during the project. The costs to recycle these materials is the responsibility of the contractor. The disposal and costs of non-regulated materials (light fixtures) is the responsibility of the Contractor. The Contractor is required to recycle as much material as possible.

C. LAMPS

1. The lamps contain mercury and are required to be properly recycled. If the lamps were crushed they would no longer be classified as regulated waste but would be hazardous waste which is not permitted.
2. The removed lamps are to be placed into boxes obtained from LampTracker for recycling. The box is to be closed with clear packing tape. The box is required to also meet the following additional requirements.
   a. Each box is to be properly closed with clear tape.
   b. The boxes are to be placed on a pallet and shrink-wrapped.
   c. 4 foot lamps boxes are not to be stacked higher than 66 inches.
   d. 8 foot lambs boxes are not to be stacked higher than 48 inches.
   e. Each box is to be properly labeled per the labeling section in this document.
3. The Contractor is required to protect the boxes from the weather. If the boxes become wet for any reason, the Contractor is required to replace the boxes at no cost to State of Nevada.
4. The recycling facility will not take boxes that have indications that they may have leaked materials. Water stained boxes cannot be accepted.
5. The Contractor is required to use proper packing and arrange for picking by Waste Management.

D. BROKEN LAMPS

1. The Contractor is to minimize lamp breakage. However, if breakage does occur and the majority (75%) of the bulb is still intact, place this portion in the lamp boxes for recycling. The smaller pieces are to be swept up and placed into a sealable 5 gallon bucket. The pieces are not to be vacuumed.
2. Broken lamp buckets are required to be labeled per the Labeling Section in this document.

E. BALLAST RECYCLING

1. The Contractor is to separate the ballasts into two types: ballasts with the “NO PCBs” label, and ballast that do not contain the label. Contractor shall order the appropriate size containers depending on the quantity of ballasts. The Contractor properly package and arrange for pickup by Waste Management. The containers are required to be properly labeled, placed on pallets, shrink wrapped and cannot exceed 700 pounds.

F. LABELING

1. The Contractor is required to place a label on all containers/boxes. The label must be accurate and visible once placed on the pallet for shipping. The labels can be pre-printed by the Contractor with the date and number of units in each container marked in the field. If the number of units is not correct and the recycling facility determines that the shipment is not acceptable and returns delivery, the Contractor is responsible for all charges to correct.
2. The following are the requirements for all labels.
   a. Lamps
      Universal Waste/Used Mercury Lamps for Recycling
      Date: _____ Number of Units: _____

Location: Building Name: Street Address, City and State

b. Broken Lamps
Broken Universal Waste/Used Mercury Lamps for Recycling
Date: _____ Number of Units: _____
Location: Building Name: Street Address, City and State

c. Non-PCB Ballast
Non-PCB Ballast for Recycling
Date: _____ Number of Units: _____
Location: Building Name: Street Address, City and State

d. PCB Ballast
PCB Ballast for Recycling
Date: _____ Number of Units: _____
Location: Building Name: Street Address, City and State

END OF SECTION 024126

SECTION 031000 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Requirements:

1. Drawings and general provisions of the Contract Documents including General, Special and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. General Scope of Work:

1. Provide formwork and accessories in accordance with provisions of this Section for cast-in-place concrete shown on the Drawings or required by other Sections of these Specifications.

C. Related work:

1. Section 032000: Concrete reinforcement.
2. Section 033000: Cast-in-place concrete.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Design of formwork is the Contractor's responsibility.

C. Standards:

1. Concrete work shall comply with the requirements of ACI 301, “Specifications for Structural Concrete for Buildings”, latest edition.
2. Items not otherwise specified shall comply with ACI Standard 347, “Recommended Practice for Concrete Formwork”, latest edition.

D. Allowable Tolerances in Formwork:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347.
2. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
3. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.
4. Refer to Structural Drawings for additional requirements.

E. Inspections:

1. See drawings and general provisions of the Contract Documents including General, Special and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

2. See requirements for inspection as stated in Part 3 of this section.

1.3 SUBMITTALS

A. Submit manufacturer’s specifications and installation instructions for products specified. Include manufacturer’s certification as may be required to show compliance with these specifications.

1.4 JOB CONDITIONS

A. LOADING STRUCTURES

1. Protect all in-place structures from excessive loading.
2. Shore and brace as necessary to prevent all damage.

B. SCHEDULING

1. Contractor shall provide and erect sufficient forms so that the work of placing concrete will proceed at a rate to insure maintaining a schedule so that the time of the inspector shall be as continuous as practicable.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL

1. Except for metal forms, use new materials. Materials may be re-used during progress of the Work, provided they are completely cleaned and reconditioned, recoated for each use, and capable of producing formwork of the required quality.

B. EARTH FORMS

1. Side forms for footings may be omitted, and concrete may be placed directly against excavation, only when requested by Contractor and approved by Architect, in writing. The Architect shall be the sole authority for making this approval.
2. When omission of forms is accepted, provide additional concrete 1” on each side of the minimum design profiles and dimensions shown on Structural Drawings.

C. FORM MATERIALS

1. Plywood:

a. APA Exterior “B-B” “Plyform” grade Douglas Fir veneer panel with medium density overlaid one side grade; sound, undamaged sheets with clean, true edges; conform to Product Standard PS 1. Use for all exposed concrete surfaces.
b. Panel thickness and placing as required to support concrete in accordance with referenced standards; minimum ¾” thickness.
c. All panels edge sealed; Both faces of general use panels shall be factory sealed with colorless coating which will not affect application of applied finishes or protective coatings; form oil not permitted.

2. Lumber for Forms:
   a. For concealed concrete surfaces including footings and foundations, use “Standard” or better grade Douglas Fir, T&G or shiplap, surface 1 side, 2 edges, not wider than 8”, secured to wood or steel stakes, substantially constructed to shapes indicated and to support the required loads.
   b. For studs, wales, and supports, use S4S surfaced “Standard” or better grade Douglas Fir lumber, dimensions as required to support the loads, but not less than 2x4 inch size.
3. Flat Steel Forms:
   a. Approved type steel forms may be used in lieu of wood and plywood, at the Contractor’s option.
4. Tube Forms:
   a. For round columns furnish fiber, fiberglass, or metal tube forms of diameters required, capable of withstanding continuous pour full height and providing a finished surface free of spiral markings.

D. ACCESSORIES

1. Form Ties:
   a. Removable form bolts with coil ties, or snap ties.
   b. Either system shall have cone spreaders and tie metal shall be ¾” minimum back of concrete face.
   c. As manufactured by Superior Concrete Accessories, Burke, Richmond, or approved equal.
2. Screed Chairs:
   a. Approved type for slab screeds.
3. Chamfer Strips:
   a. Wood or PVC strips, ¾ x ¾ inch size of maximum possible lengths.
4. Control Joints:
   a. For interior slabs, where not otherwise provided by saw cutting, furnish Greenstreak Plastic Products “Zipcap Control-joint Former:, or approved, minimum 10-foot lengths, 1” depth for installation in new interior slabs.
5. Expansion Joints:
   a. For Interior Slabs: Meadows “Seal Tight” self-expanding cork, ½” thick by depth of slab less ¼”, conforming to ASTM D1752, Type 3 (AASHTO M153-Type II), or approved equal.
6. Waterstops:
   a. Polyvinyl chloride, minimum 1,750 psi tensile strength, minimum 50° F to plus 175° F working temperature range, 4” wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing; manufactured by Greenstreak, or approved equal.
7. Nails, Spikes, Lag Bolts, Thru-Bolts, Anchorages:
   a. Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
8. Joint Sealant:

a. As specified in Section 033000.

E. TREATMENT OF FORMS

1. Furnish W. R. Meadows, Inc. “Sealtight Duogard”, Nox-crete Chemical “Nox-crete Form Coating”, Sternson Ltd. “CRA”, or Old North Mfg. Co. Inc. or Sonneborn-Contech or Metalcrete Industries equivalent chemical release agent, as approved, guaranteed as non-staining and not impairing bond of paints or other coatings.
2. Form release agent may be factory-applied provided release agent conforms to these requirements; form oil not permitted.

2.2 DESIGN OF FORMWORK

A. General:

1. Design formwork so it will safely support vertical and lateral loads that might be applied. Design forms and falsework to include factors pertinent to safety of the structure during construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Drawings.

B. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General:

1. Install concrete work in accordance with ACI 301 except as amended by this Section.

B. Earth Forms:

1. Where permitted, hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

C. Construction - Formwork:

1. General:
   a. Construct formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 347. Construct so concrete members and structures are of correct sizes, shapes, lines, and dimensions shown, and as

required to obtain accurate alignment, location, grades, level, and plumb work in the finished structure.

b. Make reasonably tight to prevent excess leakage of cement paste during concrete placement. Solidly butt joints, and provide backup material at joints as required to prevent leakage and prevent fins. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over-stressing by construction loads.

c. Set form board and plywood for walls horizontally; keep form joints to a minimum.

d. Provide for openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features as required.

e. Remove debris and clean out forms before pouring any concrete.

f. Keep forms moist prior to pour to prevent shrinkage and warping.

g. Do not damage concrete during stripping. Permit removal of remaining principal shores.

2. Fabrication:

a. Fabricate forms for easy removal without hammering or prying against concrete surfaces.

b. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces.

c. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

d. Locate studs and joists not farther apart than 12 inches o.c. Horizontal form wales spaced not to exceed 2 feet o.c.

3. Form Ties:

a. Hold inner and outer forms for vertical concrete together with combination steel ties and spreaders as approved by Architect.

b. Space wall form ties not over 4 feet apart horizontally and 2 feet apart vertically. Space ties symmetrically in tiers and rows, each tier plumb from top to bottom and each row level. Form tie placement in formed walls where wall surface will be left exposed in the finished work, shall be uniformly spaced and aligned within the following tolerance:

> Tie alignment, horizontally and vertically along each wall plane, shall occur no more than ¼” from a straight line measured between first and last tie along any line, and no more than ¼” variance in alignment between any to adjacent ties.

c. At horizontal pour lines, locate ties not more than 6” below the pour lines. Tighten after concrete has set and before the next pour is made.

d. For exposed concrete surfaces, install form ties of removable type with she-bolts equipped with permanent plugs and a system approved by Architect for fixing the plug in place.

4. Forms for Exposed Concrete:

a. Drill forms to suit ties being used, and to prevent leakage of cement paste around the holes. Do not splinter forms by driving ties through improperly prepared holes.

b. Provide sharp clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.

c. Use extra studs, wales, and bracing to prevent objectionable bowing of forms between studs, and to avoid bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.

5. Column Forms:

a. For square or rectangular columns, use 2” thick planks or joists, surfaced one side and two edges; or use metal forms.

b. For round columns, use tube forms as specified above, which will impart a smooth architectural finish as directed and approved by Architect.

c. Construct column forms with tight joints and securely clamped together with steel clamps.

6. Corner treatment:
   a. Chamfer salient corners in exposed concrete unless otherwise noted or where flush with adjacent surfaces. Unless shown otherwise, form chamfers with 3/4" x 3/4" strips, accurately formed and surfaced to produce uniformly straight lines and tight edges.
   b. Extend terminal edges to required limit, and miter the chamfer strips at changes in direction.
7. Provisions for Other Trades:
   a. Provide openings in concrete formwork to accommodate work of other trades.
   b. Verify size and location of openings, recesses, and chases with the trade requiring such items.
   c. Accurately place and securely support items to be built into the concrete.
8. Re-use of Plywood:
   a. Plywood forms may be reused provided damaged edges are removed, imperfections in faces are repaired and holes filled and plywood is cleaned to obtain concrete surfaces equal to that obtained by new plywood.

D. TREATMENT OF FORMS

1. Before placing the concrete, the contact surfaces of forms shall be coated with a suitable non-staining form coating compound or shall be given two coats of nitrocellulose lacquer. Mineral oil shall not be used on forms.
2. Excess coating shall be removed by wiping with cloths. Re-used forms shall have the contact surfaces cleaned thoroughly, those which have been coated shall be given an additional application of the coating.
3. Apply form coating material in strict accordance with manufacturer’s recommendations.

E. MISCELLANEOUS EMBEDDED ITEMS

1. Anchor Bolts:
   a. Set as required on the drawings.
2. Inserts, Sleeves, Conduit and Similar:
   a. Allow all trades time and facilities to install.
   b. Conform to Section 503 of ACI Building Code and the International Building Code.
   c. General Contractor shall furnish and install all sleeves and frames for openings shown on drawings or required for equipment, except those sleeves specified under the Mechanical and Electrical Work.
3. Bolt Inserts:
   a. Shall be of threaded type to receive standard machine bolt.
   b. Size 5/8” unless larger size is indicated on the drawings.
4. All Other Miscellaneous Items:
   a. Build-in items specified in other Sections exactly where shown.
   b. Verify locations which may be critical.

F. JOINTS AND STOPPAGES

1. Construction Joints:
   a. Install in accordance with Paragraph 1906.4 of the International Building Code and as specified herein. Located where indicated or otherwise required and approved as to not impair strength of structure.

b. Provide nominal ¾" x 2-1/2" key at construction joints, unless otherwise shown on drawings, or as directed by Structural Engineer.
c. Make joints perpendicular to principal reinforcement. Continue half reinforcement and mesh across joints except at isolation joints; provide longitudinal keys at least 1-1/2" deep at all joints in walls and between walls and slabs or footings.
d. Remove key-forming wood inserts and thoroughly clean surface of concrete at all joints, removing all laitance, before placing next lift.
e. Immediately prior to placing next lift and/or adjacent slab, dampen hardened concrete of joint surface and coat with neat cement mortar of similar proportions to mortar in concrete.

2. Expansion Joints:
   a. Do not extend reinforcement through where bonded on both sides of joint; smooth dowels may extend through joint. Position accurately and support against displacement in locations listed hereinafter.
   b. Interior Work:
      1) Install isolation/expansion joints between interior ground-supported slabs and building foundation walls when shown on Drawings, and at other locations where specifically shown or noted.
      2) Install joints with top surface recessed below finish elevation ¼", and fill with joint sealer as specified in Section 03300, finished flush with slab surface.
   c. Exterior Work:
      1) Install as required in new walks and slabs in locations and/or spacings shown, elsewhere not more than 10 feet apart. Coordinate exact locations and alignment with Architect.
      2) Install expansion joints between concrete walks/slabs and vertical building walls and retaining walls.
      3) Install at all other locations indicated.
      4) Install joints with top surface recessed below finish elevation ¼", and fill with joint sealer as specified in Section 03300, finished flush with slab surface.
3. Control Joints:
   a. Provide as detailed and in locations indicated, accurately placed to true straight lines and supported against displacement.
   b. For exterior work, form with edging tool as specified in Section 03300.
   c. For interior work, build control strips into forms or diamond-saw cut joints 1/8" wide by 1/5 the depth of the slab.
      1) If saw cut method is used, saw cutting shall be performed as soon as the concrete hardens sufficiently to prevent raveling of the concrete at the edges and before the concrete temperature is permitted to fall; perform cuts 4 – 8 hours after concrete is placed, as soon as the freshly placed concrete can be walked on.
      2) Contractor shall have at least one spare saw available during the saw cutting operation.

G. REMOVING FORMS AND SHORING

Conform to the following, unless specified otherwise in Structural Notes.

1. Ties:
   a. Remove 4 days after pour. Fill holes with dry pack cement mortar as specified in Section 033000.
2. Forms:
   a. Remove only after concrete has thoroughly hardened. Vertical forms may be removed 24 hours after pour where structure is supported on shores. Remove other forms no sooner than 7 days.

3. Shoring:
    a. Remove shoring only on approval of Engineer but not before 28 days.
    b. Shoring is required for any reinforced concrete structural component, except concrete slabs supported by structural steel framing.
    c. Shoring for beams and slabs shall remain in place at all ties until all concrete work over has been completed; if necessary to remove any shoring in order to remove plywood forms, shoring so removed shall immediately be reinstalled to support all loads.
4. Finished Surfaces:
    a. Exercise care in removing forms from finished concrete surfaces so that surfaces are not marred or gouged, and that corners are true, sharp, and unbroken.
    b. Release sleeve nuts or clamps, and pull the form ties neatly.
    c. Do not permit steel spreaders, form ties, or other metal to project from, or be visible on, any concrete surface except where so shown on Drawings.

3.3 FIELD QUALITY CONTROL

A. INSPECTIONS

1. Testing will be performed as required by International Building Code, as adopted by local jurisdiction, and these Specifications.
2. Inspections of formwork shall include configuration, form, and steel cleanliness.
3. Inspect erected formwork for conformance with approved drawings, for design and seal of form joints, and for type and location of form ties.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. Related work:

1. Section 031000: Concrete formwork.
2. Section 033000: Cast-in-place concrete.

1.2 QUALITY ASSURANCE

A. Comply with the pertinent provisions of the latest edition of the following, except as may be modified herein.

1. ACI 318 “Building Code Requirements for Reinforced Concrete”, hereinafter called “ACI 318”.
2. ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”, hereinafter called “ACI 315”.
3. Concrete Reinforcing Steel Institute (CRSI) “Manual of Standard Practice”.

B. Inspections: Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1.

C. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work in this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. BAR REINFORCING STEEL

1. Unless otherwise specifically noted in Structural Notes, furnish deformed bars meeting requirements set forth in ASTM A615, Grade 60 minimum. Bars shall be unpainted, uncoated, and free from rust, dirt and loose scale.
2. Where reinforcing requires welded connections, furnish weldable reinforcing bars which meet the chemical requirements of ASTM A706 (Grade 60 ksi) with a minimum carbon equivalent of .55 percent.

B. WELDED STEEL WIRE FABRIC

1. Furnish welded wire fabric meeting requirements set forth in ASTM A185 and A82, Fy=65 ksi.

C. FIBROUS SECONDARY REINFORCEMENT

1. General:
   a. Use in all lightweight concrete topping slabs placed over metal decking, and all standard weight concrete mixes for interior and exterior slabs on grade.
   b. Acceptable fibrous secondary reinforcement for slabs shall be filamentized nylon or polypropylene fiber which is inert to alkali and chemical attack; fiberglass fibers are not acceptable.
2. Length:
   a. As recommended by fibrous reinforcing manufacturer; ranging between ½" to ¾".
3. Acceptable Products/Manufacturers:
   a. "Nycon" as manufactured by Nycon Inc.
   b. "Fibermesh" as manufactured by Fibermesh Co.
   c. "Microfiber" as manufactured by W. R. Grace.

D. ACCESSORIES

1. General:
   a. Use wire bar type supports complying with CRSI recommendations, unless otherwise shown on Drawings. Do not use wood, brick, or other non-complying material.
   b. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
   c. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized, plastic-protected legs, or stainless steel. In addition, portions of all accessories within ¾" of the concrete surface for painted or unpainted exposed concrete surfaces shall be stainless steel and bars shall be tied with stainless steel wire, whether for exterior or interior exposure.
2. Tie Wire:
   a. 16 gauge or heavier, double annealed wire.
3. Spacer Bars for Wall Reinforcing:
   a. No. 3 bars, "U" shaped. Stock items of equivalent function may be submitted for approval.
4. Mortar Blocks:
   a. Furnish as required for use as spacers in placing reinforcement; shall be 2" square (maximum).
   b. Mortar blocks shall be constructed of mortar mixed with the same proportions of sand and cement used in concrete, and develop a minimum compressive strength of 4,000 psi at 28 days.
   c. Mortar blocks shall have a tie wire embedded and the protruding ends to be tied to the reinforcing steel to hold the mortar blocks in place; mortar blocks with a grooved top may be used for supporting steel in slabs.
   d. Do not use wood, brick, or other non-complying material.
5. Metal Chair Supports:
   a. In lieu of mortar blocks, furnish approved heavy-duty plastic-type chair supports, sized to support all slab steel to proper height and with cushioned pads to prevent vapor barrier membrane penetration.

2.2 FABRICATION

A. General:

1. Fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with the CRSI Manual.
2. In case of fabricating errors, do not straighten or rebend reinforcement in a manner that will weaken or injure the material.
3. Reinforcement with any of the following defects will not be acceptable.
   a. Bar lengths, depths, and/or bends exceeding the specified fabrication tolerances;
   b. Bends or kinks not shown on the Drawings;
   c. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Hooks & Bends:

1. Minimum Bend Diameter: The diameter of bend measured on the inside of the bar for standard hooks, other than stirrup and tie hooks, not less than:

Bar Size	Minimum Diameter
#3 through #8	6 bar diameters
#9 through #11	8 bar diameters

2. Field bending of reinforcing bars, unless specifically noted on the Plans, will not be allowed. If bars are found to be field bent, especially brittle grade 60 bars, the Contractor will be responsible to provide corrective measures as directed by the Architect.

B. Cleaning Reinforcement:

1. Clean reinforcement, at time concrete is placed, free of mud, oil, or other materials that will reduce the bond. Conform to ACI 318, Par. 7.4 and IBC, Section 1907.

C. Placing & Fastening Reinforcement:

1. General:
   a. Conform to IBC, Section 1907.5.
   b. Prevent water from softening soil under reinforcing during steel placing.
   c. Conform to ACI 318, Par. 7.5 for placing, supports, tolerances, and draped fabric, unless noted otherwise on Drawings.
2. Placement:
   a. Place reinforcement as shown on Drawings.
   b. Accurately position in accordance with shop drawings; support and tie intersections in accordance with best practices and as necessary to secure reinforcement and prevent displacement by formwork, construction, or concrete placement operations.

c. Locate and support reinforcing by metal chairs or mortar blocks as required; wood or foam supports are not acceptable.
d. Reinforcing bars may be relocated as necessary to avoid interference with other reinforcement, conduit, or other embedded items.
e. If any reinforcing bar is moved a distance exceeding one bar diameter of the specified placing tolerance, the resulting rearrangement of the reinforcement shall be subject to acceptance by the Structural Engineer.
f. Reinforcement to maintain minimum concrete coverage as shown.

3. Fastening:
   a. Securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement.
   b. Set wire so that ends are directed into the concrete.
   c. Wire tie stirrups and ties to main reinforcement.
4. Supports:
   a. General: Provide sufficient number of supports and of strength to carry the reinforcement. Do not place reinforcing bars more than 2 inches beyond last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
   b. On ground: Use concrete block.
   c. Over Formwork: In unexposed areas use concrete block or metal chairs. In exposed slabs and similar conditions use approved “invisible” metal chairs, hot-dip galvanized or approved plastic type.

D. SPACING OF BARS

1. Space reinforcing bars to comply with ACI 318, Par. 7.6 unless otherwise noted on Drawings. In conformance with placement requirements specified above, reinforcing bars may be relocated as necessary to avoid interference with other reinforcement, conduit, or other embedded items.

E. SPLICES IN REINFORCEMENT

1. CRSI standard by lapping ends, placing bars in contact, and tightly wire tying or by welding in an approved manner, except as noted otherwise. Do not splice bars except at locations shown on Drawings, except as otherwise specifically approved by Structural Engineer.
2. All welding to conform to “Recommended Practice for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete” of the American Welding Society (AWS D 12.1), performed in accordance with AWS D1.4.
3. All reinforcing bars requiring hooks: The minimum “Standard Hook” and leg extension, except as otherwise noted.
4. Splice in a manner developing at least 125% of the yielding strength of the bar.

F. SHRINKAGE & TEMPERATURE REINFORCEMENT

1. Conform to ACI 315, Par. 7.12 for reinforcement for shrinkage and temperature stresses normal to principal reinforcement where same is placed in one direction only.

G. CONCRETE PROTECTION FOR REINFORCEMENT

1. Conform to Structural Drawings and ACI 318, Par. 7.7.

H. STEEL DOWELS

1. Provide dowel bars where shown or required for connecting to in-place or subsequent work as shown.

I. PLACING WELDED WIRE FABRIC

1. Install in all concrete slabs on grade, except slabs where bar reinforcing is indicated; provide sizes specified herein or otherwise indicated, and with minimum coverages indicated for concrete protection.
2. Install welded wire fabric in as long of lengths as practical.
3. Lap adjoining pieces at least 12” or one full mesh spacing plus 2”, whichever is greater, and lace splices with 16 gauge wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
4. Do not carry through expansion joints.

J. FIBROUS SECONDARD REINFORCEMENT

1. For all standard weight slabs on grade and lightweight topping slabs as specified above, add fibrous reinforcing to concrete mix at the batch plant, at manufacturer’s recommended rate per cubic yard of standard weight and lightweight concrete mixes, and in strict accordance with fiber manufacturer’s printed instructions.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. WORK INCLUDED: Drawings and general provisions of the Contract Documents including General, Supplementary and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. RELATED WORK

1. Section 031000: Concrete formwork.
2. Section 032000: Concrete reinforcement.
3. Section 033450: Concrete finishing.

C. COORDINATION

1. Coordinate all installation under this Section with work of other trades.

1.2 QUALITY ASSURANCE

A. GENERAL

1. Concrete shall conform to all provisions of the latest edition of the (ASTM) American Society for Testing and Materials and the (ACI) American Concrete Institute noted within this specification, except as modified by the Supplemental Requirements contained herein.
2. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
3. Preinstallation (or Preconstruction) Conference: Conduct conference at Project site to comply with requirements in Division 1 Section “Project Management and Coordination”.

B. STANDARD SPECIFICATIONS

1. Conform to ACI Specifications for Structural Concrete for Buildings (ACI 301-2002) hereinafter called “ACI 301”.
2. Conform to ACI 302 “Guide for Concrete Floor and Slab Construction”.
3. Conform to ACI 304 “Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete”.
4. Conform to ACI 306R “Recommended Practice for Cold Weather Concreting”; conform to ACI 305R “Recommended Practice for Hot Weather Concreting”.
5. Conform to ACI 308 “Standard Practice for Curing Concrete”.
6. Conform to ACI 318 “Building Code Requirements for Reinforced Concrete”.
7. Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute Standard ACI 347, “Recommended Practice for Concrete Formwork”.

C. QUALITY CONTROL

1. Do not commence placement of concrete until mix designs have been reviewed and approved by the Architect and all governmental agencies having jurisdiction, and until copies are at the job site, and the batch plant. Also, no concrete shall be placed until the Contractor has secured the Architect's approval of the completed reinforcement placement.
2. See drawings and general provisions of the Contract Documents including General, Supplementary, and other Conditions and Division 1. Also see other requirements for testing as stated in Part 3 of this Section; conform to requirements, therefore, and furnish materials for tests. Give inspector full cooperation.

D. NOTICE OF INTENTION TO PLACE CONCRETE

1. Notify Architect, Structural Engineer, and Special Inspector at least 48 hours prior to an intended pour.

1.3 SUBMITTALS

A. SUBMIT

1. Submit list of all items proposed to be provided under this Section together with manufacturer’s product data and installation instructions for all such proprietary materials.
2. Submit product data and manufacturer’s instructions for all required products.

B. Provide the following submittals in accordance with ACI-301:

1. Admixture certification. Chloride ion content must be included.
2. Aggregate certification.
3. Concrete mix design. Submit a mix design for each strength and type of concrete. Clearly indicate where each mix design will be used.
4. Construction and control joints not shown on drawings.
5. Materials and methods for curing (per Section 033450).
6. Laboratory tests on concrete.

1.4 JOB CONDITIONS

A. WINTER CONCRETING

1. Provide adequate equipment for heating materials and protecting concrete during freezing or near-freezing weather.
2. Keep all materials, reinforcement, forms, and ground in contact with concrete, free from frost; use no materials containing ice.

B. HOT WEATHER CONCRETING

1. Take steps to reduce concrete temperature and water evaporation by proper attention to ingredients, production methods, handling, placing, protecting and curing.

C. LOADING STRUCTURES

1. Protect all in-place structures from excessive loading. Shore and brace as necessary to prevent all damage.

D. FIELD REFERENCE MANUAL

1. A copy of ACI SP-15 “Field Reference Manual” which includes ACI 301 shall be kept in the Contractor’s Field Office at all times.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Provide in accordance with Section 031000 for all work of this Section.

2.2 CONCRETE MATERIALS

A. PORTLAND CEMENT

1. Provide a standard brand of Portland cement complying with ASTM C150, Type II, low alkali. Do not change the brand of cement during progress of the Work except as approved in writing by the Architect.

B. AGGREGATE

1. General
   a. Provide hardrock aggregate complying with ASTM C33, with additional attributes specified herein.
   b. For making grading tests of fine and coarse aggregate, use square mesh wire cloth complying with ASTM E11.
2. Fine aggregate
   a. Provide washed natural sand having strong, hard, durable particles, and containing not more than 2% by weight of deleterious matter such as clay lumps, mica, shale, or schist.
   b. Grade from coarse to fine within the following limits:

Sieve size:	Percentage by weight passing sieve: Minimum:	Maximum:
3/8"	100	---
No. 4	95	100
No. 8	65	95
No. 16	45	75
No. 30	30	50
No. 50	10	22
No. 100	2	8

3. Coarse aggregate
   a. Provide coarse aggregate consisting of clean, hard, fine grained, sound crushed rock or washed gravel, or a combination of both, containing not more than 5% by weight of flat, chip-like, thin, elongated, friable, or laminated pieces, nor more than 2% by weight of shale or cherty material. Any piece having a length in excess of five times the average thickness shall be considered flat or elongated.

b. Use coarse aggregate of the largest practicable size for each condition of placement, subject to the following maximum size limitations: Do not exceed 3/4 of the clear distance between reinforcing bars 1/5 of the narrowest dimension between sides of forms, or 1/3 the depth of any slab section.

c. Grade combined aggregates within the following limits:

Sieve size or size in inches:	Percentage by weight passing sieve: 1-1/2" aggregate: Min:	Max:	1" aggregate: Min:	Max:	3/4" aggregate: Min:	Max:
1-1/2"	95	---	---	---	---	---
1"	75	90	90	100	---	---
3/4"	55	77	70	90	90	100
3/8"	40	55	45	65	60	80
No. 4	30	40	31	47	40	60
No. 8	22	35	23	40	30	45
No. 16	16	30	17	35	20	35
No. 30	10	20	10	23	13	23
No. 50	2	8	2	10	5	15
No. 100	0	3	0	3	0	5

C. WATER

1. Use only water which is clean and free from deleterious amounts of acid, alkali, salt, and organic materials.

2.3 ADMIXTURES

A. Use only standard brands of admixtures for concrete, approved by the Architect, meeting or exceeding the following requirements.

1. Air entraining admixtures shall conform to "Specifications for air-entraining admixtures for Concrete" ASTM C-260.
2. Water Reducing Admixture: "Eucon WR-75" by The Euclid Chemical Co., "Pozzolith 200N" by Master Builders, "Plastocrete 161" by Sika Corporation, and WRDA-64 by W.R. Grace. The admixture shall conform to ASTM C-494, Type A and not contain more chloride ions than are present in municipal drinking water.
3. Water Reducing, Retarding Admixture: "Eucon Retarder-75" by The Euclid Chemical Co., "Pozzolith 100XR" by Master Builders, DARATARD-17 by W.R. Grace, or "Plastocrete 161MR" by Sika Corporation. The admixture shall conform to ASTM C-494, Type D and not contain more chloride ions than are present in municipal drinking water.
4. Mid-Range Water Reducing Admixture: "Daracem-55" as manufactured by W.R. Grace, "Sikament HP" as manufactured by Sika Corporation, or approved equal. The admixture shall not contain calcium chloride, and shall conform to ASTM C-494, Type A.
5. High Range Water Reducing/Retarding Admixture (Superplasticizer): "ECON 537" by The Euclid Chemical Co., DARACEM 100 by W.R. Grace, or "Sikament 320" by Sika Corporation. Admixture shall conform to ASTM C-494, Type G, and not contain more chloride ions than are present in municipal drinking water.
6. High Range Water Reducing Admixture (Superplasticizer): "Eucon 37" by The Euclid Chemical Co., WRDA-19 by W.R. Grace, or "Sikament 86" by Sika Corporation. The admixture shall conform to ASTM C-494, Type F, and not contain more chloride ions than are present in municipal drinking water.
7. Non-Corrosive, Non-Chloride Accelerator: "Accelguard 80" by The Euclid Chemical Co., DARASET by W.R. Grace, "Plastocrete 161FL" by Sika Corporation, or approved equal.

The admixture shall conform to ASTM C-494, Type C or E, and not contain more chloride ions than are present in municipal drinking water.

8. Concrete Corrosion Inhibitor: DCI Corrosion Inhibitor by W.R. Grace & Co., "Armatec 2000" by Sika Corporation or approved equal. The admixture shall conform to ASTM C-494 Type C. When this is specifically noted to be used, it shall be used at a dosage rate of 2 gallons per cubic yard (Armatec 2000 by Sika Corporation at 1/2 gallon per cubic yard).
9. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than 0.05% ions by weight of cement are not permitted.
10. Certification: Written conformance to the above mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Architect.

2.4 ACCESSORY MATERIALS

A. Expansion joint filler: Provide preformed strips, non-extruding and resilient bituminous type, of thickness indicated, complying with ASTM D1751, ("Fibre Expansion Joint" by W.R. Meadows or approved equal).

B. Curing and Sealing Compound: (Meeting ASTM C-309) The compound shall be a clear styrene acrylate type, 30% solids content minimum, and have test data from an independent testing laboratory indicating a maximum loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon. Compound shall be "Super Rez Seal" by The Euclid Chemical Co., "Vulkem 2101" by Mameco International, Inc., "Masterkure 30" by Master Builders, or "Sealtight CS-309" by W.R. Meadows. Manufacturer's Certification required. (Sodium Silicate Compounds are prohibited.)

C. Dissipating Resin Curing Compound: (Meeting ASTM C-309) The compound shall be a dissipating resin type compound, "Kurez DR" by The Euclid Chemical Co., "Vulkem 2100" by Mameco International, "Sealtight 3100" by W.R. Meadows, or approved equal. The film must chemically break down in a two-to-four week period. (To be used where a dissipating curing compound is required.)

D. Bonding Materials: The compound shall be a polyvinyl acetate, rewettable type, "Euco Weld" by The Euclid Chemical Company or "Weld-crete" by The Larsen Company. Use only in areas not subject to moisture.

E. Bonding Admixture: The compound shall be a latex, non-wettable type, "SBR Latex" or "Flex-Con" by The Euclid Chemical Company, or "Daraweld C" by W.R. Grace.

F. Structural Bonding Epoxy Adhesive: The compound shall meet ASTM C-881 and shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces, "Euco Epoxy #452 MV or #620" by The Euclid Chemical Company, "Sikadur Hi-Mood or Sikadur 32 Hi-Mod LPL" by Sika Chemical Corporation.

G. Patching Mortar: "Verticoat" by The Euclid Chemical Co. or "Sika Repair 223" by Sika Chemical Corporation. The compound shall be epoxy type, 100% solids, suitable for use on dry or damp surfaces.

H. Patching Compound: Free-flowing, polymer-modified cementitious repair mortar, "Euco Thin Top Supreme" by The Euclid Chemical Co., "SikaTop 121" or "SikaTop 122" by Sika Corporation.

I. Epoxy Joint Filler: Shall be a multi component, 100% solids compound with a minimum shore D hardness of 50, "Euco Epoxy #700" by The Euclid Chemical Company or "Sikadur 51 NS/SL" by Sika Chemical Corporation. When and where this is specifically noted to be used, this shall be applied as late as possible after the concrete floor slab is poured, preferably at least 6 months, but not earlier than 2 months after the concrete floor slab is poured. **Use in all interior slab joint locations, where concrete slab is to be left exposed.**

J. Non-shrink Grout: The grout shall conform to CRD C-621-83, "Corps of Engineers Specification for Non-shrink Grout". The grout shall be “Hi-Mod” (non-catalyzed metallic) or "Euco N-S" (non-metallic) by the Euclid Chemical Company, or “Embeco 636” (non-catalyzed metallic), "Masterflow 713" (non-metallic) by Master Builders, or “Sealtight 588 Grout”, by W.R. Meadows.

K. Abrasive Aggregate for Non-slip Aggregate Finish: "Non-Slip" by The Euclid Chemical Company, "Alundum" by North Company or approved equal.

L. Evaporation Retarder: The compound shall be "SikaFilm" by Sika Corporation, "Confilm" by Master Builders, or “Eucobar” by Euclid Chemical Company.

M. Joint Sealant: Shall be "Eucolastic I" by The Euclid Chemical Company, or "SikaFlex Ia" by Sika Corporation. The sealant shall be a one part urethane sealant requiring no primer and conforming to ASTM C-920, Type S, grade NS., class 25. Use in exterior slab joint locations, where specifically noted.

N. Concrete Fibers: Concrete fibers for all designated areas shall be 100% virgin polypropylene material. Fibers shall be 1/2" or 3/4" in length such as Grace "Microfiber" by W.R. Grace, "Fibermesh" by Fibermesh Co., or approved equal. Fibers shall be used at a minimum dosage rate of 1-1/2 lbs. per cubic yard, unless otherwise specified. Grace "Microfiber" shall be used at a rate of 1 lb. per cubic yard.

O. V.O.C. Curing and Sealing Compounds: When curing and sealing compounds must meet V.O.C. regulations (or under such conditions where proper ventilation for safety is not possible), the curing and sealing compounds shall meet ASTM C-309 and shall be "Sealtight Vocomp 25" water-base acrylic cure and sealing compound by W.R. Meadows, or approved equal. Dissipating resin curing compounds shall be "Sealtight 1100" by W.R. Meadows, or approved equal. All curing and sealing compounds shall be coordinated with any floor coverings to insure that no conflict exists with the required adhesives.

P. Chemical Floor Hardener: "Sealtight Pena-lith" by W.R. Meadows, or approved equal.

Q. Waterstops: "Sealtight PVC Waterstops" by W.R. Meadows, or approved equal. All waterstops shall comply with the Corps of Engineers CRD-C 572.

2.5 EQUIPMENT FOR MIXING & PLACING

A. CONVEYING EQUIPMENT

1. Use crane bucket, wheelbarrow, pumps, or buggies to deliver concrete to placing location.
2. Chuting permitted only by methods to insure a practically continuous flow of concrete at delivery and to prevent material separation.
3. If pumping is employed, secure prior approval of equipment, procedures and mix design. No aluminum pipes or chutes will be permitted for pumping, chuting or tremie operations.

B. COMPACTION EQUIPMENT

1. Use internal mechanical vibrators with 7000 rpm minimum frequency.

2.6 CONCRETE MIXES

A. Provide a mix design prepared by the approved testing agency, based on strengths of the approved materials, and meeting the requirements stated on the Drawings.

B. Proportions for concrete mixes shall be in accordance with ACI 301, Section 3.9. All mixes must be approved by the Architect prior to use on the job. No deviations from the approved mixes will be permitted without written prior approval of the Architect.

C. Where the concrete production facility can establish the uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a basis for determining mix design proportions shall exceed the specified design strength by the requirements of ACI-318, Section 4.3 or ACI-301, Section 3.9.

D. When a concrete production facility does not have field test records for calculation of standard deviation, the required average strength shall be at least 1200 psi greater than the specified design strength.

E. Secure the Architect's approval of each mix design, including new mix designs required to be prepared should there occur a change in materials being used.

F. All concrete shall contain the specified water-reducing or water-reducing retarding admixture and/or mid-range or high-range water-reducing admixture (superplasticizer). All concrete slabs, placed at air temperatures below 40° F shall contain the specified non-corrosive non-chloride accelerator. All concrete required to be air entrained shall contain an approved air-entraining admixture. All pumped concrete, concrete for industrial slabs, architectural concrete, concrete required to be watertight, and concrete with a water-cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer). All concrete slabs and flatwork, both interior and exterior, shall contain the specified concrete fibers.

G. All concrete containing the high-range water-reducing admixture (superplasticizer) shall have a maximum slump of 8" unless otherwise approved by the Architect. The concrete shall arrive at the job site at a 3" max. slump, be verified, then the high-range water-reducing admixture added to increase the slump to the approved level. All other concrete shall have a maximum slump of 3" for slabs and 4" for other members. This maximum slump may not be exceeded except by the job-site addition of the specified high-range water-reducing admixture, (Superplasticizer). In those portions of the structures where member dimensions and/or congestion due to reinforcing steel prevent the proper placement and consolidation of the concrete at the maximum slump specified, superplasticizer shall be used by the Contractor in lieu of increasing the slump of non-superplasticized concrete by the addition of water.

H. Hardrock concrete

1. Achieve a weight of approximately 145 pcf and an ultimate compressive strength as listed in the following table.

Concrete Types

Location	Req'd. 28 day Compressive Strength	Maximum Water Cement Ratio	Air Content
Footings and all other below grade	3000	0.50	3% ± 1%
Interior slabs on grade, and Interior walls	4000	0.45	3% ± 1%
Concrete subjected to freezing and thawing	4000	0.45	4.5% - 7.5%
Exterior slabs subjected to deicers	4000	0.45	4.5% - 7.5%

I. Do not retemper mix by adding water in field.

PART 3 - EXECUTION

3.1 PREPARATION

A. SURFACE CONDITIONS

1. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. CLEANING FORMS

1. Before placing concrete, clean spaces within forms of all refuse, debris and dirt. Provide cleaning holes for removal of foreign matter; after cleaning, replace forms at openings and brace to prevent form failure.

C. MIXING & PLACING

1. Conform to the requirements of ACI 301, Chapters 7 and 8.
2. Clean free of all foreign matter and ice, all mixing and transporting equipment, subgrade and forms to receive concrete.
3. Clean reinforcement of deleterious coatings and ice.

D. EMBEDMENT FOR GENERAL WORK IN OTHER SECTIONS

1. Allow other trades time and facilities to install necessary embedded items such as nailers, hangers, inserts and sleeves; and other items as noted herein.

E. EMBEDMENT FOR MECHANICAL & ELECTRICAL WORK

1. Cooperate with and allow time for and access to forms for embedment of pipes and conduits in slabs.
2. Place sleeves and core forms as required for mechanical and electrical work, sizes and locations as shown as directed by cognizant trades.

3.2 INSTALLATION OF FORMWORK

A. In accordance with Section 031000.

3.3 CONCRETE MIXING

A. Concrete for minor work, when approved by the Architect, may be mixed at the site in a power mixer when the mixer has a capacity not less than one full sack batch.

B. Unless otherwise approved by the Architect, use ready mixed concrete complying with ASTM C94.

1. Mixing
   a. Mix each batch of concrete not less than 15 minutes, five minutes of which shall be at the site.
   b. Rotate the drum at the rate specified by the manufacturer of the mixer as "mixing speed."
   c. Whenever there is a delay in unloading, rotate the drum slowly at intervals to prevent incipient set of concrete.
2. Addition of water:
   a. Normally, do not deliver concrete with total permissible amount of water incorporated therein.
   b. After water is added, at least five minutes of mixing time shall be immediately prior to discharge.
   c. Concrete will be rejected if not placed in final position within 1-1/2 hours after water is first added to the batch.
3. Concrete at time of placing shall be in such condition that it can be placed properly.
4. Discharge all wash water from the mixing drum before the truck reloads at the batching plant.
5. Mixing equipment shall not be charged beyond its rated capacity.

C. Concrete consistency

1. Use the amount of water established by the approved mix design.
   a. Do not exceed the maximum quantity specified for the grade of concrete.
   b. Use the minimum amount of water necessary to produce concrete of the workability required by the Architect.
   c. Do not supplement the predetermined amount of water with additional water for any reason.
2. Measure concrete consistency by ASTM C143 method.
3. Provide maximum slumps of concrete as follows:
   a. Footings and slabs on soil: 3", (+1", -1").
   b. Other concrete: 4".

D. Cement grout and dry-pack grout

1. Mix at the site, in composition of one volume of portland cement to 2-1/2 volumes of fine aggregate.
2. Mix the materials dry; then add sufficient water to make the mixture flow under its own weight.
3. When grout is used as dry-pack concrete, add sufficient water to make a stiff mixture which can be molded into a sphere.

E. Miscellaneous provisions

1. Provide strengths of concrete as shown on the Drawings and the table herein.
2. Provide concrete dense and free from honeycomb and other defects.
3. Place and finish members to conform to the shapes and dimensions indicated, with all surfaces true to line, plumb, and level.

3.4 INSERTS, ANCHORS, AND EMBEDDED ITEMS

A. Reglets, Reveals, and Rebates

1. Form reglets, reveals and rebates as required to receive frames, flashing, and other equipment, and as shown on the Drawings.
2. Verify the dimensions and positions of required reglets, reveals, and rebates with the Architect and with trades whose work is related to or contingent upon such dimensions and positions.

B. Embedded Piping, and Rough Hardware

1. Coordinate the various trades who are required to fasten work to the structure, or are required to insert therein any sleeve, box, bolt, anchor, insert, or other rough hardware.
2. Provide every facility for setting all required items accurately in the forms.
3. Be responsible for changes in position of such items after they have been set.
4. Provide in the forms for all sleeves, boxes, bolts, anchors, inserts, strap anchors, for frames, and other rough hardware required for the Work, and which are shown or required to be embedded in the concrete.
5. Conduits and sleeves
   a. Locate so as not to reduce the strength of construction. Do not place pipes, except conduits, in a slab of less than 4" thickness.
   b. In placing conduits at slabs on earth, place below the reinforcement, and encase in concrete by increasing the thickness of the slab locally to at least 3" of concrete around the conduit on all sides. In placing conduits at slabs on metal deck, use 1” Ø maximum size, space at last 6” o.c., and place under welded wire fabric maintaining at least 1-1/2” coverage.

3.5 CONVEYING AND PLACING CONCRETE

A. Before placing concrete, thoroughly clean forms, wash out with water, and make tight.

B. Time of placing

1. Do not place concrete until reinforcement, conduits, outlet boxes, anchors, sleeves, hangers, bolts, and other embedded materials are securely and properly fastened in their correct positions.
2. Secure the Architect's approval of reinforcement before commencing placement of concrete.

C. Preparation

1. Before new concrete is deposited upon or against concrete that has taken its initial set or has hardened, remove all incrustations from forms and reinforcement.
2. Remove all laitance, oil, and loose particles from concrete and concrete surfaces, and thoroughly clean the forms with water under stiff pressure.
3. Remove all laitance after concrete has hardened partially (not less than two hours nor more than four hours after placing) by brushing with stiff bristles, or by directing a stream of water from a 1/4" nozzle, or by other methods approved by the Architect, to expose the clean top surface of the coarse aggregate.
4. Where cleaning is not satisfactory to the Architect, sandblast the surface and then wash again.

D. Method of placing

1. Place concrete only under the degree of inspection described elsewhere in these Specifications, and as required by governmental agencies having jurisdiction.
2. Do not place concrete outside of regular working hours unless required inspection authorities have been notified properly and are present.
3. Spouts, pipes, troughs, belts, chain buckets, and other equipment may be used in conveying concrete, but the manner and method used shall be only as approved by the Architect.
4. Do not permit concrete to free drop more than 4'-0".
5. Deposit concrete direct into conveyances, and direct from conveyances to final points of repose, except where troughs, buckets, or the like are used, in which case dump concrete into hoppers and then into the conveyances.
6. Where tremies are used, or where the free drop is 4'-0" or more, and through reinforcement, use a dumping box or board, moving the concrete from there by shovels or hoes.
7. Deposit concrete so that the surface is kept level throughout, a minimum being permitted to flow from one position to another, and place as rapidly as practicable after mixing.
8. Do not use in this Work any concrete not placed within 30 minutes after leaving the mixer.

E. Tamping and conveying

1. Thoroughly work concrete around reinforcement and embedded fixtures, and into corners of forms, during placing operations.
2. Completely compact and vibrate all concrete including floor slabs with tamping poles, mechanical vibrators and by tapping forms until the concrete is thoroughly compact and without voids. Determine the number of tampers and vibrators needed by the amount and method of placing concrete.
3. Exercise care to tamp and vibrate concrete vigorously and thoroughly to obtain maximum density.
4. Use manual tampers as well as mechanical vibrators.
5. Exercise care to direct the quick handling of vibrators from one position to another.
6. Do not over-vibrate concrete.
7. Do not move concrete by use of vibrator.
8. Have at least one spare vibrator on site during all concrete pours.

F. Stoppages

1. Stop concrete placing only when and where approved by the Architect.
2. Maintain flow surfaces of freshly placed concrete as level whenever a pour is stopped, providing tight dams to accomplish this.
3. Make horizontal construction joints only where shown on the Drawings or specifically approved by the Architect.
4. Provide keys and dowels at construction joints where indicated on the Drawings, and where concrete placement is interrupted.

3.6 STEPS, SLABS, WALK, AND PAVING ON EARTH

A. Preparation for slabs on earth

1. Prepare the subgrade and base as specified in other Sections.
2. Dampen the subgrade for exterior slabs and paving if necessary prior to placing concrete.

B. Placing and finishing

1. Mechanically vibrate and then tamp the freshly placed concrete, using a heavy tamper, or similar means, until at least 3/8" of mortar is brought to the surface.
2. Use tampers having a face consisting essentially of a grid of parallel metal bars.
3. Tamp with a light tamper, and screed with heavy straightedge, until depressions and irregularities are worked out and the surfaces are true to finish grades and elevations.
4. Remove excess water and debris worked to the surface in compaction and screeding.
5. Remove laitance as described previously.
6. When concrete has hardened sufficiently, float to a compact and smooth surface.

C. In Slabs-On-Grade Provide

1. Contraction (control) joints in interior work.
   a. By use of tooled control joints or at Contractor's option by sawcutting to 1/5 slab depth.
   b. Where not otherwise shown on Drawings, provide control joints at column centerlines and/or at the following maximum spacing:
      4" slab max. spacing = 10 ft. each way.
      5" slab max. spacing = 10 ft. each way.
      6" slab max. spacing = 12 ft. each way.
      7" slab max. spacing = 14 ft. each way.
      8" slab max. spacing = 14 ft. each way.
   c. Provide close coordination with the Architectural joint layout, pattern and spacing for all exposed to view floor slabs. This layout shall be verified prior to pouring concrete.
2. Joints in Exterior Work
   a. Provide contraction joints in exterior work where shown by means of 1" deep tooled joints with edges rounded and tool marks removed. If the layout of the contraction joints is not shown on the plans, then the Contractor shall submit a proposed layout to the Architect for approval with joints at a maximum of 5’-0” o.c.
3. At all construction joints of slabs on grade, discontinue slab reinforcement, and provide smooth, greased dowels.
4. Provide isolation joints where shown at contacts between slabs and vertical surfaces. Form with 15# felt paper for interior work and expansion joint filler for exterior work.

5. Seal exterior expansion and contraction joints where shown with the here-in specified joint sealing compound.
6. Provide the finish surfaces shown on the Drawings or otherwise directed by the Architect, in accordance with pertinent provisions of Section 033450 of these Specifications.
7. Cure and protect concrete in accordance with pertinent provisions of Section 033450 of these Specifications, and ACI 302.

3.7 SODA AND ACID WASH

A. At concrete surfaces to receive plaster, paint, or other finish, and which have been formed by oil-coated forms, scrub with a solution of 1-1/2 lbs caustic soda to one gal. of water.

B. On surfaces where smooth wood or waste molds have been used, scrub with a solution of 20% muriatic acid or hydro-chloric acid.

C. After the surfaces have been scrubbed, wash with clean water as soon as possible.

3.8 DEFECTIVE CONCRETE

A. The following concrete will be deemed to be defective, and shall be removed promptly from the job site.

1. Concrete which is not formed as indicated, is not true to intended alignment, is not plumb or level where so intended, is not true to intended grades and levels.
2. Has voids or honeycombs that have been cut, resurfaced, or filled, unless with the approval of the Architect.
3. Has sawdust, shavings, wood, or embedded debris.
4. Does not have the specified finish, or reveals.
5. Has cracking which is more than minor hairline cracks, and which are unacceptable to the Architect.
6. Has slab joints which have experienced slab curling to an extent which is unacceptable to the Architect.
7. Or does not conform fully to the provisions of the Contract Documents.

B. Repairs and Replacements

1. Defective concrete may be cut out and repaired with gunite, or other approved methods, when and as directed by the Architect.
2. Where defective concrete is found after removal of the forms, cut out the defective concrete, if necessary, and make the surfaces match adjacent surfaces.
3. Repair of Surface Defects. All voids, damaged places, fins, projections, honeycomb areas, and tierod holes shall be removed down to sound concrete and shall be repaired immediately after form removal and after a concrete curing compound is applied. The specified bonding agent shall be used for all patching and the specified epoxy adhesive and/or epoxy mortar shall be used for all structural repairs. All patching and repairs shall have prior approval of the Architect as to method and procedure. Any concrete which has not been formed as shown on the contract drawings, is out of alignment or level or indicated a defective surface or unsoundness of any nature shall be removed and replaced to the limits required by the Architect unless he grants permission to patch or otherwise correct the defective work. Permission to patch or attempt the correction shall not be construed to be a waive of the Architect's right to require complete removal of defective work.

4. Work uneven surfaces and angles of concrete to a surface matching adjacent concrete surfaces.

3.9 GROUTING AND CEMENT POINTING

A. All column base plates, equipment bases, and other locations noted on the structural drawings shall be grouted with the specified non-shrink grout. All exposed grout shall be the specified non-metallic type.

3.10 INSPECTIONS & TESTING

A. The required testing services of Section 16.3 and 16.4 of ACI-301 shall be performed by an independent testing laboratory approved by the Architect and paid for by the Owner. The testing services required in Section 16.5 shall be performed by the same testing laboratory and paid for by the General Contractor.

B. The testing laboratory representative shall be present during the placement of all concrete unless this requirement is waived by the Architect. The testing laboratory shall conduct the tests specified in 16.3 and in addition shall inspect the reinforcing steel placement (including grade of steel) prior to the beginning of placement. The Contractor shall provide ample notice to the testing laboratory and shall make available to the testing laboratory, shop drawings of the reinforcing steel placement bearing the shop drawing review stamp of the Architect.

C. When requested the testing agency shall provide evidence of recent inspection (within the last three years) of its facilities by the Cement and Concrete Reference Laboratory of the National Bureau of Standards. Evidence shall be presented to indicate that deficiencies mentioned in the report of that inspection have been corrected.

D. Standard slump and cylinder samples (3) must be taken after addition of water. The method of measuring water and the person(s) authorized to add water and make samples must be mutually responsible for cost of additional sampling and testing costs related to discharging concrete in conflict with Contract Documents. All concrete requiring a slump change of more than 2", except when the HRWR admixture is being used, will be rejected.

E. Compression test specimen: ASTM C 31-80, one set of 3 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required. Test one cylinder at seven days, one at 28 days, and hold the third cylinder until needed.

F. Slump and compressive strength tests: ASTM C 39-81 - one set for each 50 cu. yd. or fraction thereof, of each class of concrete placed in any one day or for each 5000 sq. ft. of surface area placed: one specimen tested at 7 days, one specimen tested at 28 days and one specimen retained in reserve at the laboratory for later testing if required.

G. Determine air content of normal-weight concrete for each strength test. In addition, for all exterior flat-work concrete, determine air content per ASTM C 231-82 for each 20 cu. yd. placed.

H. When concrete fails to meet the acceptance criteria specified in ACI-301, Section 17.2, the Architect may order further testing of concrete in place in accordance with Section 17.3. When such tests are ordered, cost of testing shall be paid by the Contractor.

I. The Contractor shall bear all cost of correcting rejected work, including the cost of the Architect's additional services thereby made necessary.

END OF SECTION 033000

SECTION 033450 - CONCRETE FINISHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Drawings and general provisions of the Contract Documents including General, Supplementary and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. Related work:

1. Section 033000: Cast-in-place concrete.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Except as may be modified herein or otherwise directed by the Architect, comply with ACI 301, "Specifications for Structural Concrete for Buildings."

C. STANDARD SPECIFICATIONS

1. Refer to Section 033000 for same and conform thereto as they apply to concrete curing and finishing work of this Section.

E. DEFECTIVE WORK

1. Contractor shall remove and replace at his own expense all defective work as adjudged by the Architect.

1.3 SUBMITTALS

A. Submit:

1. Submit manufacturer's product data and installation instructions for proprietary materials including curing agents, sealers, hardeners, and the like.

1.4 JOB CONDITIONS

A. Refer to Section 033000 for same and conform thereto as they apply to concrete curing and finishing work of this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete materials: Comply with pertinent provisions of Section 033000, except as may be modified herein.

B. Curing Compound for Curing Exterior Slabs:

1. Furnish liquid membrane-forming curing compound conforming to ASTM C309, Type I clear. Compound shall be a clear styrene acrylate type, 30% solids content minimum, and have test data from an independent testing laboratory indicating a maximum loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon.
2. Compound shall be “Super Rez Seal” by The Euclid Chemical Co., “Vulkem 2101” by Mameco International, Inc., “Masterkure 30” by Master Builders, or “Sealtight CS-309” by W. R. Meadows.
3. Manufacturer’s Certification required. (Sodium Silicate Compounds are prohibited.)

C. Curing Compounds for Curing Interior Slabs

1. For Slabs to Receive Floor Coverings: Furnish clear liquid curing compound, compatible with respective floor covering adhesives; W. R. Meadows “SealTight Med-Cure” concrete curing compound, or equivalent, as approved. Curing compound shall be fully compatible with all resilient flooring and carpet adhesives which will be used on the Project and guaranteed by the manufacturer, in writing, not to impair bonding adhesive.

2. For Interior Slabs to be Left Exposed and Sealed: Furnish liquid membrane-forming acrylic polymer, water-based curing and sealing compound conforming to ASTM C309, Type I, Class B clear, non-yellowing; W. R. Meadows “VOCOMP-25” or equivalent, compatible with sealer specified below.

D. Sealer

1. For interior slabs to receive sealed finish furnish acrylic polymer, water-based sealer conforming to ASTM C309, Type I, Class B clear, non-yellowing; W. R. Meadows “VOCOMP-25”, or approved equivalent.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 FINISHING OF FORMED SURFACES – REPAIR OF SURFACE DEFECTS

A. General:

1. After removal of forms, give the concrete surfaces one or more of the finishes specified below where so indicated on the Drawings, or directed by the Architect.

2. Immediately after form removal, patch all tie holes and repairable defective areas.
3. Revise the finishes as needed to secure the approval of the Architect.

B. Formed Surfaces to be Concealed in the Finished Work:

1. Leave surfaces with the texture imparted by forms, except patch tie holes and defects.
2. Remove fins exceeding 1/4" in height.

C. Formed Surfaces to be Left Exposes in the Finished Work: All exposed concrete not otherwise specified and excluding wall surfaces in mechanical rooms and the like, shall be treated as follows:

1. Fin Removal:
   a. Completely remove all surface fins by hand or power grinding with carborundum stone or power grinder to approved smoothness on surfaces to be left exposed.
2. Voids, Gravel Pockets and Similar:
   a. Cut out defective areas 1” deep; vertical edges.
   b. Wet cavities and adjacent area.
   c. Cement mortar to match adjacent areas, use as little water as possible.
   d. Retemper after 1 to 2 hours for shrinkage, as required.
   e. Thoroughly fill voids and finish off, match adjacent surface in exposed work.
   f. Finish with “Sacked Finish” as specified below.
   g. Keep patched and finished areas damp for 7 days.
3. Tie Holes:
   a. Clean and thoroughly dampen; fill solid with patching mortar as specified above for voids and pockets.

D. Sacked Finish

1. General:
   a. Provide sacked finish as specified below on all exposed surfaces of building walls and other dominant exposed surfaces.
2. Sacked Finish:
   a. Pre-dampen concrete while still green and apply matching color slurry of patching material specified above for minor defective areas and apply with burlap or sponge float.
   b. Remove any surplus, then rub with clean burlap; cure in approved manner.
   c. All sacked finish surfaces shall be smooth and uniform in appearance, pinhole free, with all imperfections completely concealed.

E. Wall & Curb Tops, Horizontal Offsets, Other Unformed Surfaces

1. In general, strike smooth after placing concrete, float to continued uniform surface and to texture reasonably consistent with adjacent formed surfaces, as approved.

3.3 FINISHING SLABS

A. Finishing Slabs – General

1. All floor surfaces shall be within ±1/2" of finished floor elevations designated on plans. If variations greater than this exist, the Architect may direct the Contractor to grind the surfaces to bring them within the requirements. Patching of low spots shall not be permitted. Grinding shall be done as soon as possible, preferably within 3 days, but not until the concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

2. Floor Flatness/Leveling Tolerances: F_F defines the maximum floor curvature allowed over 24 in. computed on the basis of successive 12 in. (300 mm) elevation differentials, F_F is commonly referred to as the "Flatness F-Number".

   F_F = _____4.57_____
   Maximum difference in elevation, in decimals of inches, between successive 12" elevation differences.

   F_L defines the relative conformity of the floor surface to a horizontal plane as measured over a 10 ft. (3.5 m) distance. F_L is commonly referred to as the "levelness F-Number".

   F_L = _____12.5_____
   Maximum difference in elevation, in decimals in inches, between two points separated by 10 ft.

   All floors shall be measured in accordance with ASTM E-1155 " Standard Test Method for Determining Floor Flatness and Levelness Using the "F-Number" System (Inch-Pound Units).

   All float finishes shall achieve an F_F 20/F_L 17 tolerance.

   Unless otherwise noted, all troweled slabs shall achieve an F_F 35 (Differences in elevation in successive 12 in. measurements shall not exceed 0.131 in.) / F_L 33 (Differences in elevation between two points shall not exceed 0.375" in 10 ft.).
3. Slab Curling: Acknowledging that there will be a strong possibility of having at least some slab curling at slab edges, the Contractor shall take reasonable means to keep this curling to a minimum. In the event that curling occurs to an extent and at locations which will be detrimental to the service and Architectural qualities needed for the final slab finish, the Contractor shall, at his expense, provide edge grinding or other means as necessary to bring the slab surface to a finish surface acceptable to the Architect.

B. Slab Finishes

1. Unless otherwise shown, scheduled or specified hereinafter, use the following finishes, as applicable:
   a. Furnish smooth troweled finish for all floors to receive resilient floor coverings and carpeting.
   b. Furnish smooth troweled finish for all interior floors to remain as walking surfaces.
   c. Furnish broomed float finish for interior recessed slabs to receive ceramic floor tile finishes and associated setting beds.
   d. Furnish broomed trowel finish for all exterior walks, ramps, stairs and miscellaneous slab surfaces not otherwise specified to receive smooth trowel or exposed aggregate finishes.
   e. Furnish “tactile” diamond pattern finish, in addition to broom finish, at handicap ramp cur-cut slab areas indicated to receive “tactile warning surface”.
   f. Furnish “non-slip” finish for cast-in-place curbs and associated gutters, as applicable, integral with sidewalks.
2. Before finishing work begins, place, strike off, consolidate and level and/or slope, as applicable, concrete to condition ready for finishing.
3. Consolidate placed concrete preferably with power driven floats of impact type except for thin joist slabs; use wood or cork-faced hand floats for surfaces inaccessible to power floats.
4. Replace slabs with excessive shrinkage cracks and those not properly sloped and finished to floor flatness and leveling tolerances specified above, as approved, without additional cost to Owner.

C. Float Finish:

1. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further until ready for floating.
2. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
3. During or after the first floating, check the planeness of the surface with a ten foot straightedge applied at not less than two different angles.
4. Cut down high spots and fill low spots.
5. Refloat the slab immediately to a uniform sandy texture.

D. Broomed Float Finish:

1. Provide a floated finish as described above. After floating, draw a broom across surface to a light scored texture finish, as approved.

E. Troweled Finish:

1. Provide a floated finish as described above, followed by a power troweling and then a hand troweling.
   a. Produce an initial surface which is relatively free from defects, but which still may show some trowel marks.
   b. Provide hand troweling when a ringing sound is produced as the trowel is moved over the surface.
   c. Thoroughly consolidate the surface by hand troweling.
2. Provide a finished surface essentially free from trowel marks, uniform in texture and appearance.
3. On surfaces intended to support floor coverings, use grinding or other means as necessary and remove all defects of such magnitude as would show through the floor covering.

F. Broomed Trowel Finish:

1. Power float to trueness within the specified tolerance, and provide one-pass steel troweling. After troweling, draw a broom across surface to a light transverse scored texture, as approved.

G. “Tactile” Finish:

1. After floating and applying broom finish, imprint surface of handicap curb cuts with a diamond pattern texture using an expanded metal grate imprinting tool, as approved.

H. Non-Slip Finish:

1. After troweling, obtain finish by dragging a strip of clean, wet burlap across the slab and curb surfaces to produce a fine, granular, or sandy textured surface without disfiguring marks.
2. Round edges and joints in curbs with an edger having a radius of ¼”.

I. Exterior Control Joint & Slab Edge Treatment:

1. Steel tool all control joints, all exposed perimeter edges, and edges of expansion joints, prior to filling with sealant, to a smooth bullnose form, using an edger having a radius of ¼”, as approved.

2. Form control joints in uniform straight lines, spaced no greater than 5 feet apart. Coordinate exact locations and alignment with Architect.

3.4 CURING AND PROTECTION

A. The Contractor shall use all necessary precautions to keep cracking of all concrete work to an absolute minimum. Beginning immediately after placement, protect concrete from premature drying, excessively hot and cold temperatures, and mechanical injury.

1. Maintain curing procedures used for seven (7) days at minimum temperature of 50° F; if mean daily temperature drops below 40° F during this period, extend curing period an equal number of days or provide temporary heat or additional protection to maintain specified minimum temperature of air in contact with concrete.

B. Temperature, wind, and humidity;

1. When concrete slab placements are subjected to high temperatures, wind and/or low humidity the Architect may require the use of the specified evaporation retarder to minimize plastic cracking. The compound may be required to be applied one or more times during the finishing operation. The initial application is usually made after the strike-off operation.
2. Cold weather:
   a. When the mean daily temperature outdoors is less than 40° F, maintain the temperature of the concrete between 50° F and 70° F for the required curing period.
   b. When necessary, provide a proper and adequate heating system capable of maintaining the required heat without injury due to concentration of heat.
   c. Do not use combustion heaters during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
   d. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   e. Only the specified non-corrosive non-chloride accelerator shall be used. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.
3. Hot weather:
   a. When necessary, provide wind breaks, fog spraying, shading, sprinkling, ponding, or wet covering with a light colored material, applying as quickly as concrete hardening and finishing operations will allow.
4. Rate of temperature change:
   a. Keep the temperature of the air immediately adjacent to the concrete during and immediately following the curing period as uniform as possible and not exceeding a change of 5° F in any one hour period, or 50° F in any 24 hour period.

C. Curing Walls & Formed Surfaces:

1. Where forms are exposed to the sun, minimize moisture loss by keeping the forms wet until they can be removed safely.
2. In hot weather, immediately after forms have been removed, cure by continuous sprinkling or covering with absorptive mat or fabric kept continuously wet or use vapor mist bath.
3. In freezing weather, protect in accordance with ACI 301.

D. Curing Exterior Slabs:

1. Spray slabs with liquid membrane-forming compound specified above for exterior slabs, applied at not less than the manufacturer's specified and recommended rate.

E. Curing Interior Slabs:

1. For Slabs to Receive Resilient and Carpet Floor Coverings:
   a. Spray new slab surfaces with liquid curing compound specified above, applied at not less than the manufacturer's specified and recommended rate and in accordance with manufacturer's written instructions.
   b. In addition, all floor slabs shall be covered with blankets for a minimum of 72 hours after pouring.
3. For Slabs to be Left Exposed and Sealed:
   a. Spray new slab surfaces with liquid membrane-forming curing and sealing compound specified above, applied at not less than the manufacturer's specified and recommended rate and in accordance with manufacturer's written instructions.
   b. In addition, all floor slabs shall be covered with blankets for a minimum of 72 hours after pouring.
   c. After curing compound has fully dried per manufacturer's recommendations, Contractor shall cover such slab surfaces with protective sheeting as necessary to avoid damage due to subsequent construction work and prior to final finishing of such floor surfaces as specified below.

F. Protection from mechanical injury:

1. During the curing period, protect all concrete during period from damaging mechanical disturbances, more especially load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from damage from construction equipment, materials and methods, from application of curing procedures, and from rain and running water.
3. Do not load self-supporting structures in such a way as to overstress the concrete.

END OF SECTION 033450

SECTION 033610 - SHOTCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide shotcrete where "shotcrete" or "gunite" is called for on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. In addition to complying with pertinent regulations of governmental agencies having jurisdiction, comply with pertinent provisions of ACI 506.2, "Specifications for Materials, Proportioning, and Application of Shotcrete," except as may be modified herein.

C. Do not commence placement of shotcrete until required mix designs have been reviewed and approved by the Architect and all governmental agencies having jurisdiction.

D. Provide access for, and cooperate with, the inspector and testing laboratory.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement:

1. For shotcrete where mix designs are required to be submitted, use the type of portland cement upon which the approved mix design is based.

2. For shotcrete where no mix design is required to be submitted, use portland cement complying with ASTM C150, type I or II, or use blended hydraulic cement complying with ASTM C595, type IS, IS-A, IP, or IP-A.

B. Aggregates:

1. For normal weight shotcrete, provide normal weight aggregate complying with ASTM C33, with the combined gradation of fine and coarse aggregate conforming to Table 2.2.1 of ACI 506.2, and as recommended in the approved mix design where mix designs are required to be submitted.

2. For lightweight, shotcrete, and where lightweight aggregate is required or permitted, comply with ASTM C330.

C. Use water which is clean, fresh, and potable.

D. Admixtures:

1. Use only those admixtures recommended in the approved mix design, and approved by the governmental agencies having jurisdiction.

2.2 SHOTCRETE MIX DESIGNS

A. Provide a mix design prepared by the approved testing agency, based on strength of the specified materials, and meeting the requirements stated in the Contract Documents.

1. Secure the Architect's approval of each mix design, including new mix designs required to be prepared should there occur a change in materials being used.

B. Produce the compressive strengths called for on the Drawings.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 BATCHING AND MIXING

A. Control mix proportions by weight batching, or by volume batching complying with ASTM C685.

1. If permitted, other volume batching procedures may be used, provided a minimum of one weight batching check is made every four hours for control purposes.
2. Assure that the specified mix design is achieved.

B. Use batching and mixing equipment capable of proportioning and mixing all ingredients (except water in the case of dry-mix equipment) at a rate that will provide adequate production, and with an accuracy that will assure uniformity of batches.

1. Use weighing equipment capable of batching with the accuracy specified in ASTM C94.
2. For volummetric equipment, be capable of batching with the accuracy specified in ASTM C685.

C. Ready-mixed concrete (if used):

1. Comply with ASTM C94; except the materials may be delivered to the shotcrete equipment in the dry state if that equipment is capable of adding the water and mixing it satisfactorily with the dry ingredients; or
2. Comply with ASTM C685, in which case deliver the ingredients dry and proportioned, and mix at the site.

3.3 PREPARATION OF SURFACES

A. Earth surfaces:

1. Compact and trim to line and grade before placing the work of this Section.

2. Do not place shotcrete on frozen surfaces.

3. Dampen surfaces to receive shotcrete.

B. Existing concrete or masonry surfaces:

1. Remove all unsound material before applying shotcrete.

2. Chip or scarify areas to be repaired, and remove off-sets which would cause an abrupt change in thickness without suitable reinforcement.

3. Taper the edges, and leave no square shoulders at the perimeter of the cavity.

4. Remove all loose material from areas receiving shotcrete.

5. Exposed masonry and concrete surfaces to receive shotcrete shall be presaturated with clean water and allowed to dry to a saturated surface dry (SSD) condition immediately prior to shotcrete application. Maintain SSD condition as required during application.

C. Steel surfaces:

1. Remove rust, oil, scale, and previously applied paint from surfaces receiving shotcrete.

2. Comply with Specification SSPC-SP6 of the Steel Structures Painting Council.

D. Rock surfaces:

1. Clean rock surfaces of loose material, mud, and other foreign matter that will prevent bond of the shotcrete.

E. Forms:

1. Use form-coating material on removable forms to prevent absorption of moisture and to prevent bond with the shotcrete.

2. Use a non-stain material for surfaces exposed to view when construction is completed.

3. Do not use form-coating material that will interfere with subsequent bonding to the shotcrete when such bonding is required.

3.4 PLACEMENT OF SHOTCRETE

A. Place shotcrete using suitable delivery equipment and procedures that will result in shotcrete in place meeting the specified requirements.

B. Placement thicknesses:

1. Control thickness, method of support, air pressure, and/or water content of shotcrete to preclude sagging and sloughing off.

2. Discontinue shotcreting, or provide suitable means to screen the nozzle stream, if wind or air currents cause separation of the nozzle stream during placement.

3. Dampen absorptive substrate surfaces prior to placement of shotcrete to facilitate bond and to reduce the possibility of shrinkage cracking developing from premature loss of water.

4. Broom or scarify the surface of freshly placed shotcrete to which, after hardening, additional layers of shotcrete are to be bonded. Dampen surface just prior to application of succeeding layers.

5. First, fill with sound material all corners and areas where rebound cannot escape or be blown free. Complete the corners between the web and flanges of structural steel before application to the flat areas.

6. Provide a supply of clean, dry air adequate for maintaining sufficient nozzle velocity for all parts of the work and, if required, for simultaneous operation of a suitable blow pipe for clearing away rebound.

C. Placement around reinforcement:

1. Hold the nozzle at such distance and angle to place material behind reinforcement before any material is allowed to accumulate on its face.

2. In the dry-mix process, additional water may be added to the mix when encasing reinforcement, to facilitate a smooth flow of material behind the bars.

3. Do not place shotcrete through more than one layer of reinforcing steel rods or mesh in one application, unless demonstrated by preconstruction tests that steel becomes encased properly.

4. Test to ascertain if any voids or sand pockets have developed around or behind reinforcement by probing with an awl or other pointed tool after the shotcrete has achieved its initial set; by removal of randomly selected bars; or by coring or other suitable means.

D. Cover of reinforcement:

1. Place shotcrete to provide the following minimum cover over reinforcement.

   a. For shotcrete used as linings or coatings: 3/4" for fine aggregate shotcrete, and 1 1/2" for coarse aggregate shotcrete.

   b. For principal reinforcement in beams, girders, and columns: 1 1/2".

   c. For reinforcement in slabs and walls: 3/4" for fine aggregate shotcrete and 1 1/2" for coarse aggregate shotcrete.

2. Do not decrease the above minimums except as specifically approved in writing by the Architect.

E. Line and thickness control:

1. Use adequate ground wires or other accepted means to establish the thickness, surface planes, and finish lines of the shotcrete.

2. Maintain specified tolerances by keeping ground wires secure and taut.

F. Placement precautions:

1. Do not place shotcrete if drying or stiffening of the mix takes place at any time prior to delivery to the nozzle.

2. Do not use rebound or previously expended material in the shotcrete mix.

3. Remove all overspray and rebound prior to final set and before placement of shotcrete material on such adjacent surfaces.

3.5 REPAIR OF SURFACE DEFECTS

A. Remove shotcrete which lacks uniformity, exhibits segregation, honeycombing, or lamination, or which contains any dry patches, slugs, voids, or sand pockets.

B. Repair defective areas by preparing as specified above for existing concrete and masonry surfaces, and by applying new shotcrete meeting the specified requirements.

1. Repair core holes in accordance with Chapter 9 of ACI 301.

2. Do not fill core holes with shotcrete.

3.6 FINISHING

A. Unless otherwise specified or directed by the Architect, provide a troweled finish throughout.

B. In other finishing operations, avoid troweling of thin sections of shotcrete unless both troweling and commencement of moisture curing take place within a relatively short period after placement of shotcrete.

C. Do not, in any case, scrape or cut to remove high spots until the shotcrete has become stiff enough to withstand pull of the cutting devices.

3.7 JOINTS

A. Make joints in accordance with Paragraph 3.6 of ACI 506.2, as approved by the Architect, and in compliance with pertinent requirements of governmental agencies having jurisdiction.

3.8 CURING AND PROTECTION

A. Cure and protect the in-place shotcrete in accordance with pertinent provisions of Paragraph 3.7 of ACI 506.2, except as may be directed otherwise by the Architect.

END OF SECTION 033610

SECTION 042110 - MASONRY REPAIR AND REPOINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section involves repair of existing stone masonry, as shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

PART 2 - PRODUCTS

2.1 REPOINTING MORTAR

A. Ingredients:

1. Portland cement: Comply with ASTM C150, Type II.

2. Lime: Comply with ASTM C207, Type S.

3. Aggregate:

a. Provide clean, rounded or natural salt-free sand, well graded, free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter, and complying with ASTM C144;

b. Match the existing mortar as closely as possible in current surface color.

4. Do not use admixtures unless specifically approved in advance by the Architect.

5. Provide water free from deleterious amounts of acids, alkalis, and organic materials.

6. Mortar color pigment:

a. Provide concentrated mortar color pigments, in shade or shades approved by the Architect. Provide high purity, chemically inert, unfading, alkali-fast mineral oxides, finely ground and especially prepared for mortar, in color and pointing technique selected by the Architect;

b. Match the existing mortar surface color as closely as possible.

B. Mixing:

1. Except as otherwise approved in advance by the Architect, mix as necessary to obtain Type "S" mortar as approved by the Architect.

2. Prepare a sample of the proposed mix and allow it to cure.

   a. Break open the sample and compare to the broken surface of the existing mortar.

   b. Adjust the mix as required to exactly match the existing mortar in color and texture.

   c. Permit the Architect to retain the approved sample for use as a standard for mortar quality to be provided for the Work.

2.2 STRUCTURAL REPAIR MORTAR

A. Structural repair mortar shall be Planitop XS with Planicrete AC additive by Mapei, or approved equal.

2.3 STONE

A. Prior to bidding, carefully inspect the area where work of this Section will be performed and determine the number of existing stones that must be replaced.

B. At no additional cost to the Owner, provide replacement stone masonry matching the existing in color, texture, and dimensions to the approval of the Architect.

2.4 CRACK ADHESIVE

A. Adhesive crack filler shall be Aboweld 55-1 by Abatron, Inc. or approved equal and shall be applied per the manufacturers recommendations.

2.4 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Areas which require repair are indicated on the plans. The Contractor shall field verify the extent of the damages at all masonry walls. The Architect shall be notified of any areas which have damages similar to the areas shown on the plans.

3.2 PREPARATION

A. Thoroughly inspect all existing masonry and, with the Engineer present and approving, review all areas of existing masonry to be repointed, or repaired and provide a plan on how this work will be performed.

B. Removal of defective areas:

1. Use extreme care in removing existing mortar and stone, avoiding damage to the existing masonry units.

2. Take care to avoid damaging existing masonry or enlarging width of joints.

3. Remove and repair existing damaged masonry and replace with new stone masonry of the type approved for that location by the Architect.

3.3 INSTALLATION

A. Repointing and Patching Architecturally Exposed Masonry

1. Do all repointing and patching with mortar only; do not use bituminous materials.

2. Add only enough water to dry mix ingredients to produce a damp, workable mortar mix.

3. Keep mortar in a dampened condition for one to two hours, and then add only sufficient water to bring it to a proper consistency.

4. Application:

a. Fill mortar joints in layers not more than 1" thick.

b. Apply each layer with pressure as soon as previous layer has partially dried.

c. Do not tool each layer smooth, but leave surface of the layer rough to enhance bonding of subsequent layers.

d. Compress the final layer as much as possible to completely fill the joint.

e. Compact joints solidly before final tooling.

5. Tooling:

a. Tool all joints to a dense, smooth, concave pattern as directed and approved by the Architect, to match the existing joints.

b. Do not spread mortar over stone masonry or other exposed surfaces.

c. Do not featheredge mortar.

6. Perform final tooling when mortar is thumb-print hard, tooling the joints to a dense, smooth, concave pattern.

B. Structural Masonry Repairs at Unfinished and Unexposed Locations

1. Use the specified repair mortar.

2. Remove loose material from area to be repaired.

3. Clean and prepare substrate in accord with the repair mortar manufacturer’s requirements.

4. Apply and cure repair mortar in accord with the repair mortar manufacturer’s requirements.

3.4 CLEANING

A. Clean the face of the masonry one to two hours after mortar has set.

1. Use plain stiff bristle brush.

2. If mortar has become too hard, use brush and plain water, augmented by use of wooden paddle or (only if necessary) a chisel.

3. If harsher cleaning methods are required, allow mortar to cure 30 days before commencing.

END OF SECTION 042110

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Drawings and general provisions of the Contract Documents including General, Supplemental and other Conditions and Division 1, “General Requirements” Sections, apply to the work specified in this Section.

B. The extent of the miscellaneous metal work is indicated on the drawings, which includes, whether specifically specified herein or not, all items fabricated from iron and steel shapes, plates, bars, strips and pipes which are not a part of other metal systems in other sections of these specifications.

C. Related Sections

1. Division 3 Section “Cast-in-Place Concrete” for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Coordinate with all applicable sections of these specifications for related work where miscellaneous metals work is to be used.

1.2 QUALITY ASSURANCE

A. Standard Specifications: Comply with the provisions of the following codes, standards and specifications, except as otherwise shown or specified:

1. AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings”, and including “Commentary of the AISC Specifications”.
2. AISC “Specification for the Design of Cold-Formed Steel Structural Members”.
3. AWS “Structural Welding Code”.

B. Qualifications for Welding Work

1. Qualify welding processes and welding operators in accordance with the AWS “Standard Qualification Procedure”.

1.3 SUBMITTALS

A. Manufacturer’s Data

1. Submit manufacturer’s specifications, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of miscellaneous metal work, including paint products.

1.4 JOB CONDITIONS

A. Field Measurements

1. Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

B. Inserts & Anchorages

1. Furnish inserts and anchoring devices which must be set in concrete and/or welded to building components for the installation of miscellaneous metal work. Coordinate delivery with other work to avoid delay.

C. Shop Assembly

1. Pre-assemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site.
2. Disassemble units only to the extent necessary for shipping and handling limitations.
3. Clearly mark units for re-assembly and coordinated installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials – General

1. Metal Surfaces, General: For the fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coatings.
2. Steel Plates, Shapes and Bars: ASTM A36.
3. Steel Plates to be Bent or Cold-Formed: ASTM A283, Grade C.
4. Cold-Finished Steel Bars: ASTM A108, grade as selected by fabricator.
5. Hot-Rolled Carbon Steel Sheets and Strips: ASTM A568 and ASTM A569; pickled and oiled.
6. Cold-Rolled Carbon Steel Sheets: ASTM A 366.
7. Galvanized Carbon Steel Sheets: ASTM A653, with hot-dip galvanized coat complying with ASTM A924, G90.
8. Steel Pipe: ASTM A53, type as selected; Grade A; black finish; standard weight (schedule 40), except where otherwise shown or specified as stronger.
9. Steel Tubing: ASTM A500, Grade B.
10. Stainless Steel: Type 304, ASTM A167, with AISI 2D finish, deal soft, fully annealed.
11. Aluminum: Furnish extruded shapes of 6061-T6 alloy, of gauges, shapes and sizes required, unless otherwise specifically specified herein.

B. Anchors

1. Threaded-Type Concrete Inserts: Galvanized ferrous castings, internally threaded to receive machine bolts; malleable iron ASTM A27; hot-dip galvanized.
2. Wedge-Type Concrete Inserts: Box-type ferrous castings, designed to accept bolts having special wedge-shaped heads; malleable iron ASTM A47, or cast steel ASTM A27; hot-dip galvanized.
3. Slotted-Type Concrete Inserts: 1/8" thick pressed steel plate, ASTM A283; box-type welded construction with slot design to receive square head bolt and with knockout cover; hot-dip galvanized.

C. Fasteners

1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls.
2. Standard Bolts and Nuts: ASTM A307, Grade A, regular hexagon head.
3. Lag Bolts: Hex head type complying with Federal Spec FF-B-561.
4. Machine Screws: Cadmium plated steel complying with Federal Spec FF-S-111.
5. Plain Washers: Round, general assembly grade carbon steel complying with Federal Spec FF-W-92.
6. Lock Washers: Helical spring type carbon steel complying with Federal Spec FF-W-84.

D. Zinc Coating

1. Except as further specified below, where noted in this Section that ferrous metal items are to be zinc-coated or galvanized, provide by the "hot-dip" method, in accordance with ASTM A123, of the following coating weight per square foot of actual surface:

Steel under 1/16"	:	1.1 oz. average, 1.8 oz. min.
Steel 1/16" to under 1/8":		1.5 oz. average, 1.8 oz. min.
Steel 1/8" to under 1/4"	:	2.0 oz. average, 1.8 oz. min.
Steel 1/4" and heavier:		2.3 oz. average, 2.0 oz. min.

2. Galvanize bolts and similar threaded fasteners in accordance with ASTM A153, Class A, B, C and D, as applicable.
3. Steel pipe shall be galvanized in accordance with ASTM A53.
4. Steel sheet in coils and cut lengths shall be galvanized in accordance with ASTM A924, G-60 or G-90 specifications, as applicable.
5. Furnish certificate from plating firm attesting to conformance with Specifications for steel plates and shapes.

E. Metal Primer Paint

1. Zinc-Coated (Galvanized) Material: Not required, except furnish zinc-rich primer for re-galvanizing welds in galvanized steel, complying with Steel Structures Painting Council (SSPC) Painting System Guide PS12.01.
2. All Other Ferrous Metals - Concealed in the Completed Work: Furnish Tnemec Company, Inc. "FD88 Azeron Primer", or approved equal, lead-free, high solids primer, meeting or exceeding performance requirements of Federal Specification TT-P-86G, Type I. At fabricator's option, primer as specified below for 'exposed' applications may be used for 'concealed' work.
3. All Other Ferrous Metals - Exposed in the Completed Work: Furnish Tnemec "Series 37 Chem-Prime" or Sherwin Williams "Kem Kromik Universal Metal Primer", or approved equal, chromate-free rust inhibitive universal alkyd-phenolic primer compatible with high performance primer and finish coats as specified.

F. Grout for Installation of Metal Fabrication

1. For general use, furnish Master Builders "Masterflow 928 Grout", or approved equal, "flowable" consistency, with a minimum compressive strength in 28 days of 7000 psi.

2.2 FABRICATION - GENERAL

A. General

1. Use materials of the size and thicknesses shown or, if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work.

2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work; punch and shear leaving clean and true surfaces.
3. Weld corners and seams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.
4. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown or, if not shown, use Phillips flathead (countersunk) screws or bolts.
5. Provide holes, cuts and connections, where shown, for work of other trades. Provide for anchorage of the type shown, coordinated with the supporting structure and the progress schedule. Fabricate and space anchoring devices as shown and as required to provide adequate support for the intended use of the work.
6. Use hot-rolled steel bars for work fabricated from bar stock, unless work is indicated to be fabricated from cold-finished or cold-rolled stock.
7. Detail joints and fastenings for ample strength and stiffness as shown or approved; conceal fastenings wherever possible.
8. Form joints to exclude water, where exposed to elements.

B. Shop Painting

1. Zinc-coated (galvanized) material: Not required.
2. All other ferrous metals:
   a. Remove all mill scale, rust, loose rust, oil, grease, dirt and foreign matter. Clean and prepare surfaces in exterior work in accordance with SSPC Specification SP6. Clean and prepare surfaces in interior work in accordance with SSPC Specification SP3.
   b. Apply one brush or airless spray coat primer coating of applicable type as specified above, as applicable, applied to all exposed surfaces after fabrication, dry film thickness as specified above.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction. Coordinate the delivery of such items to the project site.

3.2 SURFACE CONDITIONS

A. Prior to installation of work in this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where installation of the work of this Section may properly commence

B. Verify that miscellaneous metal items have been fabricated for installation in strict accordance with the original design and the approved shop drawings.

C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation of miscellaneous metal items in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 MANUFACTURED ITEMS

A. Immediately after erection, clean the field welds, bolted connections, and abraded areas of shop rimming. Paint the exposed areas with same material used for shop priming, to the same required thickness.

3.4 INSTALLATION – FABRICATED ITEMS

A. Installation - General

1. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal item to in-place construction; including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts and other connectors as required.
2. Cutting, fitting & placement:
   a. Perform all cutting, drilling, and fitting required for installation of the miscellaneous metal items. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
   b. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
   c. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
   d. Grind joint smooth and touch-up shop paint coat.
   e. Do not weld, cut or abrade the surfaces of units which have been hot-dip galvanized after fabrication, and are intended for bolted field connections.

B. Other Fabricated Items

1. Install all other steel items as specified above and as otherwise shown on Drawings and not classed as structural steel.
2. Install as detailed or required for rigidity and permanence.
3. Grind all welds smooth in fabrication work to be left exposed in completed work.

C. Touch-Up Painting

1. Cleaning and touch-up painting of field welds, bolted connections and abraded areas of the shop paint on miscellaneous metal items are specified in other sections of these specifications.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

B. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F , ambient; 180 deg F .

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL AND IRON

A. Tubing: ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 , Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form Changes in Direction as Follows:

1. By bending.

J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

O. Toe Plates: Where indicated, provide toe plates at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet .
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet .

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

3.4 ATTACHING RAILINGS

A. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Provide wood, nails, bolts, screws, framing anchors and other rough hardware, and other items needed, and perform rough carpentry for the construction shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Codes and standards:

1. In addition to complying with the pertinent codes and regulations of governmental agencies having jurisdiction, unless otherwise specifically directed or permitted by the Architect, comply with:
   a. "Product Use Manual" of the Western Wood Products Association for selection and use of products included in that manual;
   b. "Plywood Specification and Grade Guide" of the American Plywood Association;
   c. "Standard Specifications for Grades of California Redwood Lumber" of the Redwood Inspection Bureau for Redwood, when used.
   d. “National Design Specifications for Wood Construction (NDS)” of the American Forest and Paper Association.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protection:

1. Deliver the materials to the job site and store, in a safe area, out of the way of traffic, and shored up off the ground surface.
2. Identify framing lumber as to grades, and store each grade separately from other grades.
3. Protect metals with adequate waterproof outer wrapping.
4. Use extreme care in off loading of lumber to prevent damage, splitting, and breaking of materials.

PART 2 - PRODUCTS

2.1 GRADE STAMPS

A. Identify framing lumber by the grade stamp of the West Coast Lumber Inspection Bureau, or such other grade stamp as is approved in advance by the Architect.

B. Identify plywood as to species, grade, and glue type by the stamp of the American Plywood Association.

C. Identify other materials of this Section by the Appropriate stamp of the agency approved in advance by the Architect.

2.2 MATERIALS

A. Provide materials in the quantities needed for the Work shown on the Drawings, and meeting or exceeding the following standards of quality, unless otherwise noted on the drawings:

1. Horizontal framing members: Douglas Fir-Larch, NDS Table 4A or 4D, No. 1 or better for members larger than 2x10; NDS Table 4A or 4D, No. 2 or better for 2x10 and smaller members.
2. Vertical framing members: Douglas Fir-Larch, NDS Table 4A or 4D, No. 2, or better. Posts shall be Douglas Fir No. 1, or better.
3. Plates shall be Douglas Fir-Larch, NDS 4A or 4D, No. 1, or better. Nailers, bridging, and blocking: Douglas Fir-Larch NDS Table 4A, No. 2, or better.
4. Moisture content of framing lumber shall not exceed 19% by weight at time of installation.
5. Plywood: (PS-1 plywood bearing the APA trademark of the American Plywood Association.)
    a. Sheathing: Plywood or Oriented-Strand-Board sheathing with exterior glue, grades and sizes as shown on the Drawings.
    b. Backboard: 3/4" thick A/D, group 1, interior.
6. Wood Preservative: Ammoniacal copper arsenite, or 5% solution of pentachlorophenol. All wood in contact with earth, with concrete slabs on grade, and with concrete or masonry foundations shall be pressure preservatively treated Douglas Fir, or foundation grade redwood. All hangars and connections shall be nailed for maximum capacity. All framing anchors, connections, nails, etc. that are attached to pressure treated wood shall have the proper protective finish as required for that pressure treated material.
7. Rough hardware:
    a. Steel items:
        1) Comply with ASTM A7 or ASTM A36.
        2) Use galvanized at exterior locations.
    b. Machine bolts: Comply with ASTM A307.
    c. Lag bolts: Comply with Fed Spec FF-B-561.
    d. Nails:
        1) Use common of the gage and size noted in NDS Table No. 12.3B.
        2) Comply with Fed Spec FF-N-1.
        3) Use galvanized at exterior locations.
    e. Joist hangers: Simpson, Silver, or equal as approved by the Architect, having ICC approval.
    f. All framing anchors, connections, nails, etc. that are attached to pressure treated wood shall have the proper protective finish as required for that pressure treated material.

8. Microlams: Microlam members shall be minimum 1.9E D.F. "MICRO-LAM" as manufactured by Trus Joist MacMillan, or approved equal, having ICC approval.
9. Parallel Strand Lumber: Parallam members shall be minimum 2.0E “Parallam” as manufactured by Trus Joist MacMillian, or approved equal, having ICC approval.
10. Glue-laminated Beams: Provide glue-laminated beams of the types and dimensions shown on the Drawings, "Architectural" appearance grade where exposed, "Industrial" appearance grade where concealed using exterior glue, meeting the requirements of combination DF/DF 24F-V4 at simple spans, combination DF/DF 24F-V8 where continuous over supports, for dry condition of service, and complying with AITC 117-2001, with each unit bearing the AITC stamp of quality inspection. Seal the ends of the beams after manufacture.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which all work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 DELIVERIES

A. Stockpile materials sufficiently in advance of need to assure their availability in a timely manner for this Work.

B. Make as many trips to the job site as are needed to deliver materials of this Section in a timely manner to ensure orderly progress of the Work.

3.3 COMPLIANCE

A. Do not permit materials not complying with the provisions of this Section to be brought onto or to be stored at the job site.

B. Promptly remove non-complying materials from the job site and replace with materials meeting the requirements of this Section.

3.4 WORKMANSHIP

A. Produce joints which are tight, true, and well nailed, with members assembled in accordance with the Drawings and with pertinent codes and regulations.

B. Selection of lumber pieces:

1. Carefully select the members.
2. Select individual pieces so that knots and obvious defects will not interfere with placing bolts or proper nailing, and will allow making of proper connections.
3. Cut out and discard defects which render a piece unable to serve its intended function.
4. Lumber may be rejected by the Architect, whether or not it has been installed, for excessive knots, splits, warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

C. Do not shim any framing component.

3.5 GENERAL FRAMING

A. General:

1. In addition to framing operations normal to the fabrication and erection indicated on the Drawings, install wood blocking and backing required for the work of other trades.
2. Set horizontal and sloped members with crown up.
3. Do not notch, cut, or bore members for pipes, ducts, or conduits, or for other reasons except as shown on the Drawings or as specifically approved in advance by the Architect. Cutting or notching of wood studs per IBC 2308.9.10 and 2308.9.11 will not be allowed.

B. Bearings:

1. Make bearings full unless otherwise indicated on the Drawings.
2. Finish bearing surfaces on which structural members are to rest so as to give sure and even support.
3. Where framing members slope, cut or notch the ends as required to give uniform bearing surface.

3.6 BLOCKING AND BRIDGING

A. Install blocking as required to support items of finish and to cut off concealed draft openings, both vertical and horizontal, between ceiling and floor areas. Also provide blocking at all unsupported wall sheathing edges, at edges of all roof and wall openings, and as required for a complete and proper installation.

B. Bridging:

1. Install wood cross bridging (not less than 2" X 3" nominal), metal cross bridging of equal strength, or solid blocking between joists where shown.
2. Cross bridging may be omitted for roof and ceiling joists where the omission is permitted by code, except where otherwise indicated on the Drawings.
3. Install solid blocking between joists at points of support, and where shown on the Drawings. Blocking may be omitted where joists are supported on metal hangers, unless shown otherwise on the Drawings.

3.7 ALIGNMENT

A. On framing members to receive a finished surface, align the finish subsurface to vary not more than 1/8" from the plane of surfaces of adjacent furring and framing members.

3.8 INSTALLATION OF PLYWOOD SHEATHING

A. Placement:

1. Place horizontal plywood with face grain perpendicular to supports and continuously over at least two supports, except where otherwise shown on the Drawings. Place vertical plywood with face grain parallel to supports with supports or blocking at all plywood edges.
2. Center joints accurately over supports, unless otherwise shown on the Drawings.

B. Protect plywood from moisture by use of waterproof coverings until the plywood in turn has been covered with the next succeeding component or finish.

3.9 FASTENING

A. Nailing:

1. Use only common wire nails or spikes of the dimensions shown on the Drawings and the IBC Nailing Schedule, except where otherwise specifically noted. Use deformed shank nails on all plywood wall sheathing receiving plaster.
2. For conditions not covered in the Nailing Schedule provide penetration into the piece receiving the point of not less than 1/2 the length of the nail or spike, provided, however, that 16d nails may be used to connect two pieces of 2" (nominal) thickness.
3. Nail without splitting wood.
4. Prebore as required.
5. Remove split members and replace with members complying with the specified requirements.
6. Care shall be taken to ensure proper placing and nailing of all plywood for walls and roofs. Comply with the recommendations of the American Plywood Association, and as noted herein. Unless otherwise noted, provide 1/8" and 1/8" spacing for plywood sheathing at the end and edge joints respectively. Start nailing sheets of plywood at the end or side closest to the plywood sheet previously installed, and then progress with the nailing across the panel, from the initial side to the opposite side or end. Do not nail the four corners of the panel initially and then nail the field.

B. Bolting:

1. Drill holes 1/16" larger in diameter than the bolts being used.
2. Drill straight and true from one side only.
3. Do not bear bolt heads on wood, but use washers under head and nut where both bear on wood, and use washers under all nuts.

C. Screws:

1. For lag screws and wood screws, prebore holes same diameter as root of threads, enlarging holes to shank diameter for length of shank.

END OF SECTION 061000

SECTION 061950 - PREFABRICATED WOOD BEAMS & JOISTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide prefabricated wood beams and joists where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 SUBMITTALS

A. Submit:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for acceptance or rejection of actual installation procedures used on the Work.

1.3 QUALITY ASSURANCE

A. Deliver materials of this Section to the job site in bundles banded together for handling and shipping.

PART 2 - PRODUCTS

2.1 PREFABRICATED WOOD MEMBERS

A. Design is based on products of Trus Joist MacMillan Corporation, and nomenclature of that manufacturer is used herein. Equal products of other manufacturers having ICC approval will be acceptable only when approved in advance by the Architect.

B. General:

1. Size and detail the work of this Section to fit the dimensions and loads indicated on the Drawings.

2. Design in accordance with allowable values and section properties assigned and approved by the governmental agencies having jurisdiction.

C. Plywood web joists:

1. Provide "TJI" units, factory made with structural grade plywood, "Micro-Lam" or machine stress related lumber flanges, and utilizing waterproof type glues.

D. Wood Chord and Metal Web Joists:

1. Provide wood chord metal joists, factory made with tubular steel webs, structural wood chords, and true pin connections located at intersections of the centroids of web and chord members, of types shown on the Drawings.

E. Parallel Strand Lumber: Provide Parallam E2.0 (PSL) units.

F. Laminated Veneer Lumber: Provide Microllam E1.9 (LVL) Units

G. Laminated Strand Lumber: Provide Timberstran E1.55 (LSL) Units

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install the work of this Section in strict accordance with the Shop Drawings and manufacturer's recommendations as approved by the Architect.

B. Procedures:

1. Do not impose temporary construction loads which cause stress beyond design limits.

2. Erect bracing and bridging as required to maintain the units straight and plumb.

3. Assure adequate lateral support until the sheathing material has been applied.

END OF SECTION 061950

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior trim.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.3 ACTION SUBMITTALS

A. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:

1. NHLA: National Hardwood Lumber Association, "Rules for the Measurement and Inspection of Hardwood & Cypress."

B. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.2 INTERIOR TRIM

A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: White maple; Clear; NHLA.
2. Maximum Moisture Content: 9 percent.
3. Gluing for Width: Use for lumber trim wider than 6 inches.
4. Veneered Material: Not allowed.
5. Face Surface: Surfaced (smooth).
6. Matching: Selected for compatible grain and color.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.4 FABRICATION

A. Back out or kerf backs of the following members except those with ends exposed in finished work:

1. Interior standing and running trim except shoe and crown molds.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope or miter at returns as indicated on Drawings, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.

1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.

2. Install trim after gypsum-board joint finishing operations are completed.
3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 064600 - WOOD TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior standing and running trim.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, and shims required for installing wood trim and concealed within other construction before wood trim installation.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.4 FIELD CONDITIONS

A. Weather Limitations for Exterior Work: Proceed with installation of exterior wood trim only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

1.5 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.2 EXTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Wood Species: Western red cedar.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content for Exterior Materials: 7 to 12 percent.

2.4 MISCELLANEOUS MATERIALS

A. Nails for Exterior Use: hot-dip galvanized.

2.5 FABRICATION

A. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch .

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches .

D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches .

F. Touch up finishing work specified in this Section after installation of wood trim. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

G. Refer to Section 099300 "Staining and Transparent Finishing" for final finishing of installed wood trim.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.

B. Clean wood trim on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064600

SECTION 064800 - WOOD FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior frames and jambs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including and fire-retardant-treated materials.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of concealed blocking and reinforcement specified in other Sections.
3. Apply WI Certified Compliance Program label to Shop Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product.

B. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood frames until operations that could damage wood frames have been completed in installation areas. If wood frames must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Weather Limitations for Exterior Work: Proceed with installation of exterior wood frames only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

B. Environmental Limitations for Interior Work: Do not deliver or install interior wood frames until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

C. Environmental Limitations for Interior Work: Do not deliver or install interior wood frames until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

D. Field Measurements: Where wood frames are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support wood frames by field measurements before being enclosed, and indicate measurements on Shop Drawings.

E. Established Dimensions: Where wood frames are indicated to fit to other construction, establish dimensions for areas where wood frames are to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood frames can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 WOOD FRAMES, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood frames indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.2 EXTERIOR FRAMES AND JAMBS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Wood Species: Western red cedar.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood frame and quality grade specified unless otherwise indicated.

1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
2. Wood Moisture Content for Exterior Materials: 7 to 12 percent.
3. Wood Moisture Content for Interior Materials: 4 to 9 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of wood frame and quality grade specified unless otherwise indicated.

C. Water-Repellent Preservative Treated Materials: Comply with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment) for exterior wood frames indicated to receive water-repellent preservative treatment.

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with an insecticide containing chloropyrifos (CPF).
2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
3. Extent of Water-Repellent Preservative Treatment: Treat all exterior wood frames unless otherwise indicated.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln dry lumber after treatment to a maximum moisture content of 19 percent.

2.5 MISCELLANEOUS MATERIALS

A. Exterior Blocking, Shims, and Nailers: Softwood or hardwood lumber, fire-retardant treated, kiln dried to less than 15 percent moisture content.

1. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b.

a. Kiln dry lumber after treatment to a maximum moisture content of 19 percent.
b. Preservative Chemicals: Acceptable to authorities having jurisdiction.
c. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

B. Interior Blocking, Shims, and Nailers: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

C. Nails for Exterior Use: stainless steel.

D. Screws for Exterior Use: stainless steel.

E. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.6 FABRICATION

A. Fabricate wood frames to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

2.7 SHOP PRIMING

A. Exterior Wood Frames for Opaque Finish: Shop prime with one coat of wood primer specified in Section 099113 "Exterior Painting."

B. Interior Wood Frames for Opaque Finish: Shop prime with one coat of wood primer specified in Section 099123 "Interior Painting."

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood frames, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood frames to average prevailing humidity conditions in installation areas.

B. Before installing wood frames, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install wood frames to comply with same grade as item to be installed.

B. Assemble wood frames and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install wood frames level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut wood frames to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor wood frames to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. For shop-finished items, use filler matching finish of items being installed.

G. Refer to Section 099123 "Interior Painting" for final finishing of installed wood frames.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective wood frames, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood frames. Adjust joinery for uniform appearance.

END OF SECTION 064800

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.

B. Related Sections:

1. Section 092300 "Gypsum Plastering" for installation in wood- and metal-framed assemblies of insulation specified by referencing this Section.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

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

1. CertainTeed Corporation.
2. Johns Manville; a Berkshire Hathaway company.

3. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

E. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
    b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.

3. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
4. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F .
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following:

1. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; 890FTS/TXTR.
b. Tremco Incorporated; Spectrem 1.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Sika Corporation; Joint Sealants; Sikaflex 15LM.

2.4 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Corporation; Construction Systems.
b. Pecora Corporation; AC-20.
c. Tremco Incorporated; Tremflex 834.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

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

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Glass.
    b. Porcelain enamel.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces - JS-1.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.

2. Joint Sealant: Urethane, S, NS, 100/50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces - JS-2.

1. Joint Locations:

a. Joints between different materials on exterior building envelope.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, Nonstaining, S, NS, 100/50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces - JS-3.

1. Joint Locations:

a. Other joints as indicated on Drawings.

2. Joint Sealant: Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF..
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 080152 - HISTORIC TREATMENT OF WOOD WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Wood window repair.
2. Wood window reconstruction.
3. Reglazing.

B. Related Section:

1. Section 099123 "Interior Painting" for painting of wood windows.
2. Section 099300 "Staining and Transparent Finishing" for exterior finishing of wood windows.

1.3 DEFINITIONS

A. General: See Section 013591 "Historic Treatment Procedures" for other definitions.

B. Wood Window Component Terminology: As identified in AWI's "Architectural Woodwork Quality Standards." Wood window components for historic treatment work include the following classifications:

1. Frame Components: Head, jamb, and sill.
2. Sash Components: Stile and rails, parting bead, stop, and muntins.
3. Exterior Trim: Exterior casing, brick mould, and drip cap.
4. Interior Trim: Casing, stool, and apron.

C. Glazing: Includes glass, glazing points, glazing tapes, glazing sealants, and glazing compounds.

D. Window: Includes window frame, sash, storm window, shutters, and louvered blinds unless otherwise indicated by the context.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for application and use. Include test data substantiating that products comply with requirements.

B. Shop Drawings: For repair and replacement of historic wood windows and components. Show location and extent of replacement work, with enlarged details of replacement parts indicating materials, profiles, joinery, reinforcing, method of splicing into or attaching to existing wood window, accessory items, and finishes. Include field-verified dimensions and the following:

1. Full-size shapes and profiles with complete dimensions for new wood window components and their jointing, showing relation of existing to new components.
2. Component numbers and corresponding window locations in the building on annotated plans and elevations.
3. Provisions for sealant joints as required for location.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include Samples of hardware and accessories involving color selection.

D. Samples for Verification: For the following items of size indicated below, finished as required for use in the Work:

1. Replacement Members: 12 inches long for each replacement member; including parts of frame, sash, exterior trim, and interior trim.

a. Architect reserves the right to require additional Samples of replacement members that show fabrication techniques, materials, and finishes.

2. Repaired and Refinished Wood Window Members: Prepare Samples using existing wood window members removed from site, repaired, and refinished.
3. Weather Stripping: 12-inch-long sections.

1.5 INFORMATIONAL SUBMITTALS

A. Historic Treatment Program: Submit before work begins.

1.6 QUALITY ASSURANCE

A. Historic Treatment Program: Prepare a written plan for historic treatment of wood windows, including each phase or process, protection of surrounding materials during operations, and control of spills during on-site repair and other processes. Describe, in detail, materials, methods, and equipment to be used for each phase of work. Show compliance with indicated methods and procedures related to historic treatment of wood windows specified in this and other Sections.

B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution and for fabrication and installation. Prepare mockups so they are inconspicuous or reversible.

1. Locate mockups on the building where directed by Architect.
2. Wood Window Repair: Prepare one entire window unit to serve as mockup to demonstrate sample repairs of wood window members including frame, sash, glazing, and hardware.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. WI Quality Standard: Comply with WI's "Manual of Millwork" for construction, finishes, grades of wood windows, and other requirements.

D. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to historic treatment of wood windows including, but not limited to, the following:

a. Construction Schedule: Verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
b. Materials, material application, sequencing, tolerances, and required clearances.
c. Review mock-up with Owner's Repesentative, SHPO Repesentative, and Architect..

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with historic treatment of wood windows only when existing and forecasted weather conditions are within the environmental limits set by each manufacturer's written instructions and specified requirements.

B. Concealed and undocumented historic items, relics, and similar objects encountered during historic treatment remain Owner's property. Carefully dismantle and salvage each item or object.

1. Coordinate with Owner's historical adviser, who will establish special procedures for dismantling and salvaging.

1.8 SEQUENCING AND SCHEDULING

A. Perform historic treatment of wood windows in the following sequence:

1. Stamp each window frame with permanent opening-identification number in inconspicuous location.
2. Tag existing window sash, storm windows, shutters, and, louvered blinds with opening-identification numbers and remove for on-site or off-site shop repair. Indicate on tags the locations on window of these components such as top sash, bottom sash, left shutter, and right shutter.
3. Allow installation of temporary protection and security at window openings according to Section 015000 "Temporary Facilities and Controls."
4. Remove window, dismantle hardware, and tag hardware with window opening-identification numbers.
5. In the shop, stamp each sash, storm window, shutter, and louvered blind unit with permanent opening-identification number in inconspicuous location and remove site-applied tags.
6. Sort units by condition, separating those that need extensive repair.
7. Clean surfaces.
8. General Wood-Repair Sequence:

a. Remove paint to bare wood according to Section 099123 "Interior Painting" or 099300 "Staining and Transparent Finishing."
b. Rack frames slightly; inject adhesive into mortise and tenon joints.

c. If thicker than original glass is required, rout muntins to required rebate size.
d. Repair wood by consolidation, member replacement, partial member replacement, and patching.
e. Sand, prime, fill, sand again, and prime surfaces again for refinishing according to Section 099123 "Interior Painting" or 099300 "Staining and Transparent Finishing."

9. Repair, refinish, and replace hardware if required. Reinstall essential operating hardware.
10. Install glazing.
11. Allow removal of temporary protection and security at window openings according to Section 015000 "Temporary Facilities and Controls."
12. Reinstall units.
13. Apply finish coats according to Section 099123 "Interior Painting" or 099300 "Staining and Transparent Finishing."
14. Install remaining hardware and weather stripping.

PART 2 - PRODUCTS

2.1 REPLACEMENT WOOD MATERIALS

A. Wood: Clear fine-grained lumber; kiln dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide.

1. Species: Match species of each existing type of wood product.

2.2 WOOD REPAIR MATERIALS

A. Wood Consolidant: Ready-to-use product designed to penetrate, consolidate, and strengthen soft fibers of wood materials that have deteriorated due to weathering and decay and designed specifically to enhance the bond of wood-patching compound to existing wood.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Abatron, Inc; LiquidWood.
b. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100.
c. Wood Care Systems; ROTFIX.

B. Wood-Patching Compound: Two-part epoxy-resin wood-patching compound; knife-grade formulation as recommended by manufacturer for type of wood repair indicated, tooling time required for the detail of work, and site conditions. Compound shall be designed for filling voids in damaged wood materials that have deteriorated due to weathering and decay. Compound shall be capable of filling deep holes and spreading to feather edge.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Abatron, Inc; LiquidWood with WoodEpox.
b. ConServ Epoxy LLC; Flexible Epoxy Consolidant 100 with Flexible Epoxy Patch 200.
c. Wood Care Systems; ROTFIX with SCULPWOOD.

2.3 GLAZING MATERIALS

A. Glass: Uncoated clear float-glass units according to Section 088000 "Glazing."

B. Glazing Systems:

1. Single Glass Units: Primer as recommended by glazing material manufacturer, with oil-based glazing putty or glazing compound and glazing points, tape glazing, or sealant glazing according to Section 088000 "Glazing."

2.4 WEATHER STRIPPING

A. Compression-Type Weather Stripping: Compressible weather stripping designed for permanently resilient sealing under bumper or wiper action; completely concealed when window is closed.

1. Weather-Stripping Material: Match existing materials and profiles as much as possible unless otherwise indicated.

a. Cellular Elastomeric Gaskets: Preformed; complying with ASTM C 509.
b. Dense Elastomeric Gaskets: Preformed; complying with ASTM C 864.

2.5 MISCELLANEOUS MATERIALS

A. Cleaning Materials:

1. Detergent Solution: Solution prepared by mixing 2 cups of tetrasodium polyphosphate, 1/2 cup of laundry detergent that contains no ammonia, 5 quarts of 5 percent sodium hypochlorite bleach, and 15 quarts of warm water for each 5 gal. of solution required.
2. Mildewcide: Provide commercial proprietary mildewcide or a solution prepared by mixing 1/3 cup of household detergent that contains no ammonia, 1 quart of 5 percent sodium hypochlorite bleach, and 3 quarts of warm water.

B. Adhesives: Wood adhesives for exterior exposure, with minimum 15- to 45-minute cure at 70 deg F , in gunnable and liquid formulations as recommended by adhesive manufacturer for each type of repair.

C. Fasteners: Fasteners of same basic metal as fastened metal unless otherwise indicated. Use metals that are noncorrosive and compatible with each material joined.

1. Match existing fasteners in material and type of fastener unless otherwise indicated.
2. Use concealed fasteners for interconnecting wood components.

D. Anchors, Clips, and Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel complying with requirements in ASTM B 633 for SC 3 (Severe) service condition.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect adjacent materials from damage by historic treatment of wood windows.

B. Clean existing wood windows of mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. After cleaning, rinse thoroughly with fresh water. Allow to dry before repairing or painting.

C. Condition replacement wood members and replacement windows to prevailing conditions at installation areas before installing.

3.2 HISTORIC TREATMENT PROCEDURES, GENERAL

A. General: Have historic treatment of wood windows directed and performed by a qualified historic treatment specialist. Ensure that historic treatment specialist's field supervisors are present when historic treatment of wood windows begins and during its progress. In treating historic items, disturb them as minimally as possible and as follows:

1. Follow the historic treatment sequence in "Sequencing and Scheduling" Article.
2. Apply each product according to manufacturer's written instructions unless otherwise indicated.
3. Stabilize and repair wood windows to reestablish structural integrity and weather resistance while maintaining the existing form of each item.
4. Stop the progress of deterioration by removing coatings and applying borate preservative treatment before repair.
5. Repair items in place where possible and retain as much original material as possible.
6. Replace or reproduce historic items where indicated or scheduled.
7. Make historic treatment of materials reversible whenever possible.
8. Install temporary protective measures to protect wood window work that is indicated to be completed later.

B. Mechanical Abrasion: Where mechanical abrasion is needed for the work, use only the gentlest mechanical methods, such as scraping and natural-fiber bristle brushing, that will not abrade wood substrate, reducing clarity of detail. Do not use abrasive methods such as sanding, wire brushing, or power tools except as indicated as part of the historic treatment program and as approved by Architect.

C. Repair and Refinish Existing Hardware: Dismantle window hardware; repair and refinish it to match finish samples.

D. Repair Wood Windows: Match existing materials and features, retaining as much original material as possible to perform repairs.

1. Unless otherwise indicated, repair wood windows by consolidating, patching, splicing, or otherwise reinforcing wood with new wood matching existing wood or with salvaged, sound, original wood.
2. Where indicated, repair wood windows by limited replacement matching existing material.

E. Protection of Openings: Where sash or windows are indicated for removal, cover resultant openings with temporary enclosures so that openings are weathertight during repair period.

F. Identify removed windows, sash, and members with numbering system corresponding to window locations to ensure reinstallation in same location. Key windows, sash, and members to Drawings showing location of each removed unit. Permanently stamp units in a location that will be concealed after reinstallation.

3.3 GLAZING

A. Remove cracked and damaged glass and glazing materials from openings and prepare surfaces for reglazing.

B. Remove existing glass and glazing where indicated on Drawings and prepare surfaces for reglazing.

C. Remove glass and glazing from openings and prepare surfaces for reglazing.

D. Install new glass with indicated glazing system and according to Section 088000 "Glazing."

E. Disposal of Removed Glass: Remove from Owner's property and legally dispose of it unless indicated to be reinstalled.

3.4 WOOD WINDOW PATCH-TYPE REPAIR

A. General: Patch wood members that are damaged and exhibit depressions, holes, or similar voids, and that have limited rotted or decayed wood.

1. Verify that surfaces are sufficiently clean and free of paint residue prior to patching.
2. Treat wood members with wood consolidant prior to application of patching compound. Coat wood surfaces by brushing, applying multiple coats until wood is saturated and refuses to absorb more. Allow treatment to harden before filling void with patching compound.
3. Remove rotted or decayed wood down to sound wood.

B. Apply wood-patching compound to fill depressions, nicks, cracks, and other voids created by removed or missing wood.

1. Prime patch area with application of wood consolidant or manufacturer's recommended primer.
2. Mix only as much patching compound as can be applied according to manufacturer's written instructions.
3. Apply patching compound in layers as recommended by manufacturer until the void is completely filled.
4. Finish patch surface to match contour of adjacent wood member. Sand patching compound smooth and flush, matching contour of existing wood member.
5. Clean spilled compound from adjacent materials immediately.

3.5 WOOD WINDOW MEMBER-REPLACEMENT REPAIR

A. General: Replace parts of or entire wood window members at locations where damage is too extensive to patch.

1. Verify that surfaces are sufficiently clean and free of paint residue prior to repair.
2. Remove broken, rotted, and decayed wood down to sound wood.
3. Custom fabricate new wood to replace missing wood; either replace entire wood member or splice new wood part into existing member. Fabricate replacement members according to WI Section 7 requirements for Custom Grade.
4. Secure new wood using finger joints or multiple dowels with adhesive and nailing to ensure maximum structural integrity at each splice. Use only concealed fasteners. Fill nail holes and patch surface to match surrounding wood.

B. Repair remaining depressions, holes, or similar voids with patch-type repairs.

C. Clean spilled materials from adjacent surfaces immediately.

D. Glazing: Reglaze units prior to reinstallation.

1. Mill new and existing glazed members to accommodate new glass thickness.
2. Provide glazing stops to match contour of sash frames.

E. Reinstall units removed for repair into original openings.

F. Weather Stripping: Replace nonfunctioning and install missing weather stripping to ensure full-perimeter and meeting rail weather stripping for each operable sash.

3.6 ADJUSTMENT

A. Adjust existing and replacement operating sash, screens, hardware, weather stripping, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.7 CLEANING AND PROTECTION

A. Protect window surfaces from contact with contaminating substances resulting from construction operations. Monitor window surfaces adjacent to and below exterior concrete and masonry during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances contact window surfaces, remove contaminants immediately according to glass manufacturer's written recommendations.

B. Clean exposed surfaces immediately after historic treatment of wood windows. Avoid damage to coatings and finishes. Remove excess sealants, glazing and patching materials, dirt, and other substances.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 080152

SECTION 081433 - WOOD PLANK DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Exterior wood plank doors.
2. Fitting wood plank doors to frames and machining for hardware.
3. Prehanging doors in frames.

B. Related Requirements:

1. Section 099113 "Exterior Painting" for field finishing stile and rail doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include details of construction and glazing.
2. Include factory-finishing specifications.

B. Shop Drawings: For stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data, including the following:

1. Dimensions of doors for factory fitting.
2. Locations and dimensions of mortises and holes for hardware.
3. Requirements for veneer matching.
4. Doors to be factory finished and finish requirements.
5. Fire-protection ratings for fire-rated doors.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of door, from manufacturer.

B. Sample Warranty: For special warranty.

C. Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is a licensee of WI's Certified Compliance Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in opaque plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 17 and 50 percent during remainder of construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, within specified warranty period.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time from date of Substantial Completion:

a. Exterior Doors: Five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of stile and rail wood door from single manufacturer.

2.2 MATERIALS

A. General: Use only materials that comply with referenced standards and other requirements specified.

1. Assemble exterior doors and sidelites, including components, with wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
2. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.

B. Panel Products: Any of the following unless otherwise indicated:

1. Particleboard made from wood particles, complying with ANSI A208.1, Grade M-2.
2. Medium-density fiberboard made from wood fiber, complying with ANSI A208.2, Grade 130.
3. Hardboard complying with ANSI A135.4.
4. Veneer-core plywood.

2.3 EXTERIOR WOOD PLANK DOORS

A. Exterior Stile and Rail Wood Doors: Exterior custom doors complying with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards," and with other requirements specified.

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

    a. Harring Doors.
    b. Pella Corporation.
    c. Woodtech Trading Company.
    d. Therma Tru Doors.

2. Grade: Premium.
3. Finish: Sanded unfinished.
4. Wood Species and Cut for Transparent Finish: Douglas fir or western hemlock, quarter sawed/sliced (vertical grain).
5. Door Construction for Transparent Finish:

    a. Wood Plank Construction: Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.

6. Provide WI Certified Compliance Labels indicating that doors comply with requirements of grades specified.
7. Mark, label, or otherwise identify stile and rail wood doors as complying with WDMA I.S.6A and grade specified.

2.4 WOOD PLANK DOOR FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels unless otherwise indicated:

1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/2 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide not more than 3/8 inch from bottom of door to top of threshold.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Exterior Doors: Factory treat exterior doors after fabrication with water-repellent preservative to comply with WDMA I.S.4. Flash top of outswinging doors with manufacturer's standard metal flashing.

D. Prehung Doors: Provide stile and rail doors complete with frames, weather stripping, and hardware.

1. Provide wood door frames that comply with Section 064800 "Wood Frames."
2. Provide hardware, including weather stripping, that complies with Section 087100 "Door Hardware."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081433

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

a. Swinging doors.
b. Sliding doors.
c. Folding doors.

2. Cylinders for door hardware specified in other Sections.

B. Related Sections:

1. Section 081433 "Stile and Rail Wood Doors" for astragals and integral intumescent seals provided as part of labeled fire-rated assemblies.

C. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.

1. Weather stripping, and lock cylinders to be installed under other Sections.
2. Permanent lock cores to be installed by Owner.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
d. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.
2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
4) Fastenings and other pertinent information.
5) Explanation of abbreviations, symbols, and codes contained in schedule.
6) Mounting locations for door hardware.
7) List of related door devices specified in other Sections for each door and frame.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

B. Warranty: Special warranty specified in this Section.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

C. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf .
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.8 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.
c. Concealed Floor Closers: 25 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide twelve months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

A. Hinges: BHMA A156.1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. Don-Jo Mfg., Inc.
    b. Hager Companies.
    c. Stanley Commercial Hardware; a division of Stanley Security Solutions; Div. of The Stanley Works.

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
2. Deadbolts: Minimum 1.25-inch bolt throw.

C. Lock Backset: 2-3/4 inches , unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated on Drawings.
2. Levers: Cast.
3. Knobs: Cast.
4. Escutcheons (Roses): Cast.
5. Dummy Trim: Match lever lock trim and escutcheons.
6. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

    a. Best Access Systems, Stanley Security Systems, Inc.

2.4 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.5 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Master Key System: Change keys and a master key operate cylinders.
2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: "DO NOT DUPLICATE."

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Master Keys: Five.

2.6 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Pemko Manufacturing Co.

2.7 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Fire-Rated Applications:

    a. Wood or Machine Screws: For the following:

        1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
        2) Strike plates to frames.
        3) Closers to doors and frames.

    b. Steel Through Bolts: For the following unless door blocking is provided:

        1) Surface hinges to doors.
        2) Closers to doors and frames.
        3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.8 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.
2. Furnish permanent cores to Owner for installation.

E. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

G. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.7 DOOR HARDWARE SCHEDULE

Door Hardware Set No. 1

No.	Item	Description	Manufacturer	Finish
1.5 Pair	Hanging Device	800	HAG	US26D
1	Securing Device	9K37AB15KSTK	BAS	626
1	Perimeter Gasket	316PK	Pemko	
1	Door Shoe	210SNV	Pemko	SN

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:

1. Glass for windows.
2. Glazing sealants and accessories.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and glass testing agency.

B. Product Certificates: For glass.

C. Preconstruction adhesion and compatibility test report.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Install glazing in mockups specified in Section 080152 “Historic Treatment of Wood Windows” to match glazing systems required for Project, including glazing methods.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

a. Wind Design Data: As indicated on Drawings.

2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch , whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

2.2 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.

C. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.3 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

2.4 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.5 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.6 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches .

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.6 MONOLITHIC GLASS SCHEDULE

A. Glass Type - G1: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.

END OF SECTION 088000

SECTION 092300 - GYPSUM PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Gypsum plastering on expanded-metal lath.
2. Gypsum plastering on monolithic concrete.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockups for each substrate and finish texture indicated for gypsum plastering, including accessories.

    a. Size: 100 sq. ft. in surface area.

2. Simulate finished lighting conditions for review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, contamination, corrosion, construction traffic, and other causes.

1.5 FIELD CONDITIONS

A. Comply with ASTM C 842 requirements or gypsum plaster manufacturer's written recommendations, whichever are more stringent.

B. Room Temperatures: Maintain temperatures at not less than 55 deg F or greater than 80 deg F for at least seven days before application of gypsum plaster, continuously during application, and for seven days after plaster has set or until plaster has dried.

C. Avoid conditions that result in gypsum plaster drying out too quickly.

1. Distribute heat evenly; prevent concentrated or uneven heat on plaster.
2. Maintain relative humidity levels for prevailing ambient temperature that produce normal drying conditions.
3. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during plaster application and until plaster is dry.

PART 2 - PRODUCTS

2.1 EXPANDED-METAL LATH

A. Expanded-Metal Lath: ASTM C 847, cold-rolled carbon-steel sheet with ASTM A 653/A 653M, G60 , hot-dip galvanized-zinc coating.

1. Diamond-Mesh Lath:

a. Type: Self-furring.
b. Weight: 2.5 lb/sq. yd. .

2.2 ACCESSORIES

A. General: Comply with ASTM C 841, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Cornerite: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 , hot-dip galvanized-zinc coating.
2. Striplath: Fabricated from expanded-metal lath with ASTM A 653/A 653M, G60 , hot-dip galvanized-zinc coating.
3. Cornerbeads: Fabricated from zinc-coated (galvanized) steel.

a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.

4. Casing Beads: Fabricated from zinc-coated (galvanized) steel; square-edged style; with expanded flanges.

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Bonding Compound: ASTM C 631.

C. Fasteners for Attaching Metal Lath to Substrates: ASTM C 841.

D. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch diameter unless otherwise indicated.

2.4 BASE-COAT PLASTER MATERIALS

A. Gypsum Neat Plaster: ASTM C 28/C 28M, for use with job-mixed aggregates.

B. Aggregates for Base-Coat Plasters: ASTM C 35, sand and perlite.

2.5 FINISH-COAT PLASTER MATERIALS

A. Gypsum Ready-Mixed Finish Plaster: Manufacturer's standard, mill-mixed, gaged, interior finish.

2.6 PLASTER MIXES

A. Mixing: Comply with ASTM C 842 and manufacturer's written instructions for applications indicated.

B. Mix Additives: Use accelerators and retarders, if required by Project conditions, according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

3.3 INSTALLING EXPANDED-METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C 841.

1. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

3.4 INSTALLING ACCESSORIES

A. General: Install according to ASTM C 841.

B. Cornerbeads: Install at external corners.

C. Casing Beads: Install at terminations of plasterwork, except where plaster passes behind and is concealed by other work and where metal screeds, bases, or frames act as casing beads.

3.5 PLASTER APPLICATION

A. General: Comply with ASTM C 842.

1. Do not deviate more than plus or minus 1/8 inch in 10 feet from a true plane in finished plaster surfaces when measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not

terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on concrete substrates for direct application of plaster.

C. Base-Coat Plaster:

1. Over Expanded-Metal Lath:

a. Scratch Coat: Gypsum neat plaster with job-mixed sand.
b. Brown Coat: Gypsum neat plaster with job-mixed sand.

2. Over Monolithic Concrete: Gypsum neat plaster with job-mixed sand.

D. Finish Coats:

1. Smooth-Troweled Finishes:

a. Materials: Gypsum ready-mixed finish plaster.
b. Locations: Provide smooth-troweled finish unless otherwise indicated.

3.6 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.7 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 092300

SECTION 096543 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes linoleum sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of linoleum flooring indicated.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of sheet flooring installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for flooring installation.

1. Engage an installer who employs workers for this Project who are trained or certified by flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F or more than 90 deg F .

1. Sheet Flooring: Store rolls upright.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring during the following time periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LINOLEUM SHEET FLOORING

A. Linoleum Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing.

1. Roll Size: In manufacturer's standard length but not less than 78 inches wide.

B. Thickness: 0.010 inch .

C. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by linoleum flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests recommended by linoleum flooring manufacturer, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install flooring until it is the same temperature as space where it is to be installed.

1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 LINOLEUM SHEET FLOORING INSTALLATION

A. Unroll linoleum sheet flooring and allow it to stabilize before cutting and fitting.

B. Lay out linoleum sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.
5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from linoleum flooring before applying liquid floor polish.

1. Apply three coat(s).

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 096543

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Galvanized metal.
2. Wood.

B. Related Requirements:

1. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
2. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.

2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Kelly-Moore Paint Company Inc.
2. M.A.B. Paints.
3. Sherwin-Williams Company (The)

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

D. Colors: Match existing.

1. 100 percent of surface area will be painted with deep tones.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

F. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

G. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint entire exposed surface of window frames and sashes.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:

1. Alkyd System MPI EXT 5.3B:

a. Prime Coat: Primer, galvanized, cementitious, MPI #26.
b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
c. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), MPI #94.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Gypsum board.
2. Plaster.

B. Related Requirements:

1. Section 099113 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
2. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of topcoat product.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Kelly-Moore Paint Company Inc.
2. M.A.B. Paints.
3. Sherwin-Williams Company

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. Colors: As selected by Architect from manufacturer's full range.

2.3 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior: MPI #50.

B. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.

C. Primer, Latex, for Interior Wood: MPI #39.

2.4 WATER-BASED PAINTS

A. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 2): MPI #144.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.
2. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

    a. Equipment, including panelboards.

2. Paint the following work where exposed in occupied spaces:

    a. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Gypsum Board and Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2), MPI #144.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:

1. Interior Substrates:

a. Dressed lumber (finish carpentry or woodwork).
b. Wood-based panel products.

B. Related Requirements:

1. Section 099123 "Interior Painting" for stains and transparent finishes on concrete floors.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Initial Selection: For each type of product.

C. Samples for Verification: For each type of finish system and in each color and gloss of finish required.

1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F .

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Dulux (formerly ICI Paints North America)
2. Sherwin-Williams Company, The.
3. Zinsser; Rust-Oleum Corporation.

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in wood finish systems schedules for the product category indicated.

2.2 MATERIALS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

1. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
2. Shellacs, Clear: VOC not more than 730 g/L.
3. Stains: VOC not more than 250 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.

D. Stain Colors: Match existing..

2.3 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 10 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
3. Sand surfaces exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

A. Interior Wood Substrates: Wood trim and doors.

1. Polyurethane Varnish over Stain System MPI INT 6.3E:

a. Stain Coat: Stain, semitransparent, for interior wood, MPI #90.
b. First Intermediate Coat: Polyurethane varnish matching topcoat.
c. Second Intermediate Coat: Polyurethane varnish matching topcoat.
d. Topcoat: Varnish, interior, polyurethane, oil modified, satin (MPI Gloss Level 4), MPI #57.

B. Exterior Wood Substrates: Wood framing, trim, and shingles.

1. Stain, Exterior, Water Based, Solid Hide MPI 16:

a. Stain Prep: Stain prep product for wood exterior surfaces.
b. First Intermediate Coat: Water Based, Solid Hide, Exterior Stain matching topcoat.
c. Second Intermediate Coat: Water Based, Solid Hide, Exterior Stain topcoat.
d. Topcoat: Stain, Exterior, Water Based, Solid Hide, MPI #16.

END OF SECTION 099300

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Failure of hydrostatic test according to NFPA 10.
    b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc. ; Slimline Single Rollers or comparable product by one of the following:

1. Hunter Douglas Contract.
2. Insolroll Window Shading Systems
3. Nysan Solar Control Inc.; a Hunter Douglas company

C. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Nickel-plated metal.

a. Loop Length: As indicated on Drawings.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, sill mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of inside face of shade.
2. Direction of Shadeband Roll: Regular, from back of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

a. Type: Exposed with endcaps.
b. Color and Finish: As selected by Architect from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Product: MechoShade Systems Inc; EuroVeil Basket Weave 5300 Series (or equal).Light-Filtering Fabric: Woven fabric, stain and fade resistant.
2. Source: Roller-shade manufacturer.
3. Type: PVC-coated polyester.
4. Weave: Basketweave.
5. Thickness: 0.025 inches.
6. Roll Width: As indicated on Drawings.
7. Openness Factor: 5 percent.
8. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F :

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch . Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123661 - SIMULATED STONE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

C. Samples for Initial Selection: For each type of material exposed to view.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.5 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOPS

A. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top.

B. Countertops: 3/4-inch- thick, quartz agglomerate with front edge built up with same material.

C. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.

2.2 COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with the "Physical Characteristics of Materials" Article of ANSI SS1.

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

a. E. I. du Pont de Nemours and Company.
b. LG Chemical, Ltd.
c. Samsung Chemical USA, Inc.

2. Colors and Patterns: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

END OF SECTION 123661

SECTION 220503 - PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Equipment drains and over flows.

B. REFERENCES

   1. American Society of Mechanical Engineers:
      a. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
      b. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
      c. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
      d. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
      e. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
   2. ASTM International:
      a. ASTM B32 - Standard Specification for Solder Metal.
      b. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
      c. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.
      d. ASTM B75 - Standard Specification for Seamless Copper Tube.
      e. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
      f. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
      g. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
      h. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

1.2 SUBMITTALS

A. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.4 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.6 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type M, hard drawn.

B. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.

C. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F. “T-Drill” type fittings not allowed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - ABOVE GROUND PIPING

A. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

B. Group piping whenever practical at common elevations.

C. Sleeve pipe passing through partitions, walls and floors. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

E. Provide access where valves and fittings are not accessible.

F. Install non-conducting dielectric connections wherever jointing dissimilar metals.

G. Establish invert elevations, slopes for drainage to minimum 1/4 for waste piping and 1/8 inch per foot for storm water. Maintain gradients.

H. Slope piping and arrange systems to drain at low points.

I. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

END OF SECTION 220503

SECTION 230553 - IDENTIFICATION FOR MECHANICAL PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Stencils.
4. Pipe markers.
5. Ceiling tacks.
6. Labels.
7. Lockout devices.

1.2 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog literature for each product required.

B. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

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

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Marking Services, Inc.
4. Panduit Corporation.
5. Seton Identification Products.
6. Substitutions: Section 01 25 00 - Product Requirements.

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

A. Plastic Tags:

1. Manufacturers:
   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Marking Services, Inc.
   d. Panduit Corporation.
   e. Seton Identification Products.
   f. Substitutions: Refer to Section 01 25 00 - Product Requirements.

B. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter or square.

C. Metal Tags:

1. Manufacturers:

a. Brady Corporation.
b. Brimar Industries, Inc.
c. Marking Services, Inc.
d. Panduit Corporation.
e. Seton Identification Products.
f. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2. Brass, Aluminum or Stainless Steel with stamped letters; tag size minimum 1-1/2 inches diameter or square with finished edges.

D. Information Tags:

1. Manufacturers:
a. Brady Corporation.
b. Brimar Industries, Inc.
c. Marking Services, Inc.
d. Panduit Corporation.
e. Seton Identification Products.
f. Substitutions: Refer to Section 01 60 00 - Product Requirements.
2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

E. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
4. Ductwork and Equipment: 1-3/4 inches high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Manufacturers:
a. Brady Corporation.
b. Brimar Industries, Inc.
c. Marking Services, Inc.
d. Panduit Corporation.
e. Seton Identification Products.
f. Substitutions: Refer to Section 01 25 00 - Product Requirements.
2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:

1. Manufacturers:
   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Marking Services, Inc.
   d. Panduit Corporation.
   e. Seton Identification Products.
   f. Substitutions: Refer to Section 01 25 00 - Product Requirements Not permitted.
2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:

1. Manufacturers:
   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Marking Services, Inc.
   d. Panduit Corporation.
   e. Seton Identification Products.
   f. Substitutions: Refer to Section 01 25 00 - Product Requirements Not permitted.
2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Identify new equipment with plastic nameplates.

F. Identify piping, concealed or exposed in mechanical and service spaces, with plastic pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 40 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Omit pipe marking in exposed finished spaces.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, adjusting, and balancing of air systems.
2. Testing, adjusting, and balancing of hydronic systems.
3. Measurement of final operating condition of HVAC systems.

1.2 REFERENCES

A. Associated Air Balance Council:

1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

1.3 SUBMITTALS

A. Prior to commencing Work, submit proof of latest calibration date of each instrument.

B. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms.

C. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

D. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty.

E. Submit draft copies of report for review prior to final acceptance of Project.

F. Furnish reports in soft cover, letter size, 3-ring or comb style binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience certified by AABC.

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.8 SEQUENCING

A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 13 - Administrative Requirements: Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Air coil fins are cleaned and combed.
8. Access doors are closed and duct end caps are in place.
9. Air outlets are installed and connected.
10. Duct system leakage is minimized.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Fan Coil: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

D. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

E. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

F. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

G. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

3.6 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
1. Terminal Units.
2. Air Inlets and Outlets.

B. Report Forms

1. Title Page:
   a. Name of Testing, Adjusting, and Balancing Agency
   b. Address of Testing, Adjusting, and Balancing Agency
   c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
   d. Project name
   e. Project location
   f. Project Architect
   g. Project Engineer
   h. Project Contractor
   i. Project altitude
   j. Report date
2. Summary Comments:
   a. Design versus final performance
   b. Notable characteristics of system
   c. Description of systems operation sequence
   d. Summary of outdoor and exhaust flows to indicate building pressurization
   e. Nomenclature used throughout report
   f. Test conditions
3. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Range
   f. Calibration date
4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
   c. HP/BHP and kW
   d. Phase, voltage, amperage; nameplate, actual, no load
   e. RPM
   f. Service factor
   g. Starter size, rating, heater elements
   h. Sheave Make/Size/Bore
5. Cooling Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Entering air DB temperature, design and actual
   g. Entering air WB temperature, design and actual
   h. Leaving air DB temperature, design and actual
   i. Leaving air WB temperature, design and actual
   j. Saturated suction temperature, design and actual
   k. Air pressure drop, design and actual
6. Air Moving Equipment:
   a. Location

b. Manufacturer
c. Model number
d. Serial number
e. Arrangement/Class/Discharge
f. Air flow, specified and actual
g. Return air flow, specified and actual
h. Total static pressure (total external), specified and actual
i. Inlet pressure
j. Discharge pressure
k. Sheave Make/Size/Bore
l. Number of Belts/Make/Size
m. Fan RPM

7. Return Air Data:
   a. Identification/location
   b. Design air flow
   c. Actual air flow
   d. Design return air flow
   e. Actual return air flow
   f. Return air temperature
   g. Actual mixed air temperature
   h. Design outside/return air ratio
   i. Actual outside/return air ratio
   j. Maximum allowable leakage duct capacity times leak factor
   k. Test apparatus
      1) Blower
      2) Orifice, tube size
      3) Orifice size
      4) Calibrated
   l. Test static pressure
   m. Test orifice differential pressure
   n. Leakage
8. Air Distribution Test Sheet:
   a. Air terminal number
   b. Room number/location
   c. Terminal type
   d. Terminal size
   e. Area factor
   f. Design velocity
   g. Design air flow
   h. Test (final) velocity
   i. Test (final) air flow
   j. Percent of design air flow

END OF SECTION 230593

SECTION 230700 -MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior piping insulation, insulation jackets, equipment insulation, covering, thermal insulation for piping systems including vapor retarders, jackets and accessories.

B. Related Sections:
   1. Section 23 05 53 – Mechanical Identification: Product requirements for mechanical identification for placement by this section.

1.2 REFERENCES

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate).

B. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).

C. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

F. NAIMA (North American Insulation Manufacturers Association) - National Insulation Standards.

G. SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.

1.3 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics and list of materials and thickness for each service, and locations.

B. Manufacturer's Installation Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation outside ambient conditions required by manufacturer of each product.

B. Maintain temperature during and after installation for minimum period of 24 hours.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Provide five-year manufacturer warranty for manmade fiber.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:

1. CertainTeed Corporation.
2. Knauf Fiber Glass.
3. Johns Manville Corporation.
4. Owens-Corning.
5. Manson Insulation, Inc.
6. Substitutions: Section 01630 - Product Options and Substitutions.

B. Manufacturers; Closed Cell Elastomeric Insulation:

1. Armoflex USA, Inc.
2. Armacell LCC
3. Nomaco Insulation
4. K-Flex USACertainTeed Corporation.
5. Substitutions: Section 01630 - Product Options and Substitutions.

2.2 PIPING INSULATION

A. TYPE P-9: Flexible, closed cell elastomeric insulation, tubular; ‘k’ value of 0.28 as 74 degrees F (‘ksi’ value of 0,04 at 24 degrees C); with integral adhesive lap seal.

2.3 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:

1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

B. Aluminum Pipe Jacket:

1. ASTM B209.
2. Thickness: 0.025 inch thick sheet.
3. Finish: Embossed.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
6. Metal Jacket Bands: 1/2 inch wide; 0.015 inch thick aluminum. or 0.010 inch thick stainless steel.

C. Stainless Steel Pipe Jacket:

1. ASTM A167 Type 304 stainless steel.
2. Thickness: 0.016 inch thick.
3. Finish: Corrugated.
4. Metal Jacket Bands: 1/2 inch wide; 0.010 inch thick stainless steel.

2.4 DUCTWORK INSULATION

A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.

1. Thermal Conductivity: 0.30 0.27 0.25 at 75 degrees F.
2. Maximum Operating Temperature: 250 degrees F.
3. Density: 1.0 pound per cubic foot.

B. TYPE D-2: ASTM C1071, Type II, rigid, glass fiber duct liner with coated air side.

1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Density: 3.0 pound per cubic foot.
3. Maximum Operating Temperature: 250 degrees F.
4. Maximum Air Velocity: 4,000 feet per minute.

2.5 DUCTWORK INSULATION ACCESSORIES

A. Vapor Retarder Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

B. Vapor Retarder Lap Adhesive: Compatible with insulation.

C. Adhesive: Waterproof, ASTM E162 fire-retardant type.

D. Liner Fasteners: Galvanized steel, welded with press-on head.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

A. Install in accordance with NAIMA National Insulation Standards.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

D. Continue insulation through penetrations of building assemblies or portions of assemblies having a fire resistance rating of one hour or less. Provide intumescent fire stopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions.

E. Exterior Applications Exposed Refrigerant Piping: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at the 3 or 9 o'clock position on the side of horizontal piping with the overlap facing down to shed water or on the bottom side of horizontal equipment.

F. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

G. Finish insulation at supports, protrusions, and interruptions.

H. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

I. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.3 INSTALLATION - DUCTWORK SYSTEMS

A. Duct dimensions indicated on Drawings are finished inside dimensions.

B. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor retarder jackets.
2. Finish with tape and vapor retarder jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor retarder jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. External Glass Fiber Duct Insulation:

1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
2. Secure insulation without vapor retarder with staples, tape, or wires.
3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

E. Duct Liner:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.

F. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.

3.4 SCHEDULES

A. Cooling Services Piping Insulation Schedule:

Piping	Insulation Type	Pipe Size Inch	Thickness Inch
Equipment drain piping and condensate drains- inside building	P-9	All	0.5
Refrigerant Liquid	P-9	All	0.5
Refrigerant Suction	P-9	All	0.5
Refrigerant Hot Gas	P-9	All	0.5

B. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches
Supply Plenums – All Rectangular (internally insulated)	D-2	1.0
Return Plenums– All Rectangular (internally insulated)	D-2	1.0

END OF SECTION 230700

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Refrigerant piping.
2. Unions, flanges, and couplings.
3. Pipe hangers and supports.
4. Refrigerant moisture and liquid indicators.
5. Valves.
6. Refrigerant strainers.
7. Refrigerant pressure regulators.
8. Refrigerant pressure relief valves.
9. Refrigerant filter-driers.

1.2 REFERENCES

A. Air-Conditioning and Refrigeration Institute:

1. ARI 495 - Refrigerant Liquid Receivers.
2. ARI 710 - Liquid-Line Driers.
3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

C. American Society of Mechanical Engineers:

1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
3. ASME B31.5 - Refrigeration Piping.
4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

D. ASTM International:

1. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
2. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
3. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

G. Underwriters Laboratories Inc.:

1. UL 429 - Electrically Operated Valves.

1.3 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.

B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.

C. Provide pipe hangers and supports in accordance with ASME B31.5.

D. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

1.4 SUBMITTALS

A. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:
   a. Refrigerant moisture and liquid indicators.
   b. Refrigerant strainers.
   c. Refrigerant pressure regulators.
   d. Refrigerant pressure relief valves.
   e. Refrigerant filter-driers.
   f. Refrigerant solenoid valves.

C. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Test Reports: Indicate results of refrigerant leak test.

E. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.

F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Coordinate routing of all refrigerant piping with other trades and with roofing consultant.

1.9 WARRANTY

A. Furnish five year manufacturer warranty for valves excluding packing.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

A. Copper Tubing: ASR - ASTM B280, drawn.

1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 UNIONS, FLANGES, AND COUPLINGS

A. 2 inches and Smaller:

1. Copper Pipe: Bronze, brazed joints.

B. 2-1/2 inches and Larger:

1. Copper Piping: Bronze brazed joints.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 REFRIGERANT MOISTURE AND LIQUID INDICATORS

A. Manufacturers:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.

B. Indicators:

1. Port: Double, UL listed.
2. Body: Copper or brass, flared or solder ends.
3. Sight glass: Color-coded paper moisture indicator with removable element cartridge and plastic cap.
4. Maximum working pressure: 500 psig
5. Maximum working temperature: 200 degrees F

2.4 VALVES

A. Manufacturers:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.

B. Diaphragm Packless Valves:

1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
2. Phosphor bronze and stainless steel diaphragms, rising stem and hand wheel.
3. Stainless steel spring, nylon seats, disc with positive back seating.
4. Maximum working pressure: 500 psig.
5. Maximum working temperature: 275 degrees F.

C. Packed Angle Valves:

1. Forged brass or nickel-plated forged steel, solder or flared ends.
2. Forged brass seal caps with copper gasket, rising stem and seat with back seating, molded stem packing.
3. Maximum working pressure: 500 psig.
4. Maximum working temperature: 275 degrees F.

D. Ball Valves:

1. Two-piece bolted forged brass body with Teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered or threaded ends.
2. Maximum working pressure: 500 psig.
3. Maximum working temperature: 300 degrees F.

E. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
2. Maximum working pressure: 500 psig.

F. Refrigerant Check Valves:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.
4. Globe Type:
   a. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, Teflon seat disc.
   b. Maximum working pressure: 425 psig. Maximum working temperature: 300 degrees F.
5. Straight Through Type:
   a. Spring, neoprene seat.
   b. Maximum working pressure: 500 psig.
   c. Maximum working temperature: 200 degrees F.

2.5 REFRIGERANT STRAINERS

A. Manufacturers:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.

B. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass.
2. Maximum working pressure: 430 psig.

C. Straight Line, Non-Cleanable Type:

1. Steel shell, copper plated fittings, stainless steel wire screen.
2. Maximum working pressure 300 psig.

2.6 REFRIGERANT PRESSURE REGULATORS

A. Manufacturers:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.

2.7 REFRIGERANT PRESSURE RELIEF VALVES

A. Manufacturers:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; for standard 300 psig setting; selected to ASHRAE 15.

2.8 REFRIGERANT FILTER-DRIERS

A. Manufacturers:

1. Alco Controls Div, Emerson Electric Co.
2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
3. Sporlan Valve Co.

B. Replaceable Cartridge Angle Type:

1. Shell: ARI 710, UL listed, brass, removable cap, for maximum working pressure of 350 psig.
2. Filter Cartridge: Pleated media with integral end rings, stainless steel support, ARI 730 rating for 75 tons.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Route piping parallel to building structure and maintain gradient.

B. Install piping to conserve building space, and not interfere with use of space.

C. Group piping whenever practical at common elevations.

D. Install pipe identification in accordance with Section 220553.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.

G. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Flood refrigerant piping system with nitrogen when brazing.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

J. Install valves with stems upright or horizontal, not inverted.

K. Insulate piping; refer to Section 220700.

L. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.

M. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

N. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

O. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

P. Provide electrical connection to solenoid valves.

Q. Fully charge completed system with refrigerant after testing.

R. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

S. Install refrigerant piping in accordance with ASME B31.5.

3.4 EVACUATION AND CHARGING

A. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

B. Make an initial test of completed refrigerant piping system with 150 psi charge of nitrogen after first isolation of any controls, etc., which are not rated for 150 psi. Test all joints with a soap solution.

C. Make evacuation and leak tests in the presence of Owner's representative and/or Engineer after completing refrigerant piping system installation. A positive pressure test will not be acceptable as a substitution for required evacuation procedures.

D. Do not use cooling compressor to evacuate the system or operate it at any time prior to completing the specified evacuation procedures.

E. Draw a vacuum on each entire system with a vacuum pump to 200 microns using a vacuum gauge calibrated in microns. First vacuum shall hold for a minimum of one hour at 200 microns.

F. Break vacuum with refrigerant to be used and re-establish vacuum test. This second vacuum test shall hold for a minimum of 8 hours at 200 microns.

G. Conduct tests at minimum of 60°F ambient or above. If ambient temperatures are consistently below 60°F, contact the Engineer immediately for an alternative procedure and/or alternative scheduling.

H. After passing all tests, fully charge each system with refrigerant, and then conduct a leak test of the entire system with and electronic leak detector. Make all final adjustments to refrigerant system as required.

I. Insulate complete system as specified.

3.5 INSTALLATION - REFRIGERANT SPECIALTIES

A. Refrigerant Liquid Indicators:

1. Install line size liquid indicators in main liquid line downstream of condenser.
2. When receiver is provided, install line size liquid indicators in liquid line downstream of receiver.
3. Install line size liquid indicators downstream of liquid solenoid valves.

B. Refrigerant Valves:

1. Install service valves on compressor suction and discharge.
2. Install gage taps at compressor inlet and outlet.
3. Install gage taps at hot gas bypass regulators, inlet and outlet.
4. Install check valves on compressor discharge.
5. Install check valves on condenser liquid lines on multiple condenser systems.
6. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.

C. Strainers:

1. Install line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, install single main liquid-line strainer.
3. Install shut-off valves on each side of strainer.

D. Install pressure relief valves on ASME receivers. Install relief valve discharge piping to terminate outdoors.

E. Filter-Dryers:

1. Install permanent filter-dryers in low temperature systems.
2. Install permanent filter-dryer in systems containing hermetic compressors.
3. Install replaceable cartridge filter-dryer vertically in liquid line adjacent to receivers.
4. Install replaceable cartridge filter-dryer upstream of each solenoid valve.

F. Solenoid Valves:

1. Install in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Install in liquid line of single or multiple evaporator systems.
3. Install in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

3.6 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

B. Pressure test refrigeration system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using electronic leak detector.

C. Repair leaks.

D. Retest until no leaks are detected.

END OF SECTION 232300

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Low pressure ducts.

1.2 RELATED WORK

A. Section 23 07 00 - HVAC Insulation.

B. Section 23 33 00 – Air Duct Accessories.

C. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.3 REFERENCES

A. ASHRAE - Handbook 2005 Fundamentals; Chapter 35 - Duct Design.

B. ASHRAE - Handbook 1983 Systems and Equipment; Chapter 16 - Duct Construction.

C. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

D. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

E. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

F. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

G. ASTM B209 - Aluminum and Aluminum Alloy Sheet and Plate.

H. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

I. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooling Equipment.

J. SMACNA – HVAC Duct Construction Standards – Metal and Flexible.

K. UL 181 - Factory-Made Air Ducts and Connectors.

1.4 DEFINITIONS

A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain listed sizes inside lining.

1.5 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A and NFPA 96 standards.

1.6 SUBMITTALS

A. Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for low pressure and kitchen hood exhaust.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Non-combustible or conforming to requirements for Class 1 air duct materials, or UL 181.

B. Steel Ducts (concealed): ASTM A525 or ASTM A527 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per sq ft (382 g/sq m) for each side in conformance with ASTM A90.

C. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 degrees F (0.034 KSI at 24 degrees C).

D. Fasteners: Rivets, bolts, or sheet metal screws.

E. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

F. Hanger Rod: Steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK

A. Fabricate and support square and round ducts in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible, and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for pressure classifications as indicated below for round duct.

B. Round ducts for downstream of Fan Coils, exhaust and single zone application shall be shall be insulated flexible duct.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times the width of duct on centerline. Bends and elbows in round ducts larger than 22 inches diameter routed through structural trusses may have a radius equal to the width of the duct where necessary. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Round elbows shall be one piece stamped or welded segmented type. Adjustable elbows are not acceptable.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

F. Provide easements where low pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.

G. Connect flexible ducts to metal ducts with draw bands and adhesive plus sheet metal screws.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 23 33 00 for incidental ductwork requirements.

B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect diffusers or grilles to low pressure ducts with rigid elbow and 5 feet (1.5 m) maximum length of insulated flexible duct. Hold in place with mastic and strap or clamp.

E. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 ADJUSTING AND CLEANING

A. If proper measures are not taken to keep ductwork clean prior to substantial completion, at the discretion of the Architect/Engineer, clean duct systems with high power vacuum machines. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION 233100

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Volume control dampers.

B. Flexible duct connections.

C. Duct test holes.

1.2 RELATED WORK

A. Section 23 31 00 – HVAC Ducts and Casings.

1.3 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. SMACNA - Duct Construction Standards.

1.4 SUBMITTALS

A. Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers duct access doors. Provide product data for hardware used.

B. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.

C. Volume control dampers.

D. Duct test holes.

PART 2 - PRODUCTS

2.1 VOLUME CONTROL DAMPERS.

A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.

B. Fabricate single blade dampers for duct sizes to 12 x 48 inch.

C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch (300 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

E. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

F. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.2 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install dampers with quadrant regulator on side or bottom of duct.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

END OF SECTION 233300

SECTION 238126 - SPLIT SYSTEM HEAT PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Outdoor condensing units.

B. Indoor ducted fan coils

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. None.

1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. None.

1.4 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

B. ADC 1062 - Air Distribution and Control Device Test Code.

1.5 SUBMITTALS

A. Submit product data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings which indicate simultaneous heating and cooling capabilities for individual indoor units.

B. Submit manufacturer's installation instructions.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience.

1.8 WARRANTY

A. Provide one year manufacturer's warranty under provisions of Section 01 70 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. LG.

B. Daikin.

C. Lennox.

D. Sanyo.

E. Substitutions: Under provisions of Division 01.

2.2 SINGLE ZONE HEAT PUMP SYSTEM

A. General.

1. The air conditioning and heating system shall be an inverter compressor driven heat pump as manufactured by LG Electronics, Inc. (LG) and shall be pre-charged with R-410A refrigerant. The system shall consist of a single phase, horizontal discharge outdoor unit and a ducted indoor unit and controls engineered and provided by the equipment manufacturer.

2.3 OUTDOOR UNIT

A. The outdoor unit shall be used with components of the same manufacturer consisting of the outdoor unit, indoor unit and controls.

B. System components shall be of the same manufacturer or as recommended by the manufacturer of the equipment.

C. Unit control boards shall perform all functions required to effectively and efficiently operate the system and allow communication from a wired controller.

D. The outdoor unit shall be completely factory assembled, piped and wired.

E. Each outdoor unit shall be run tested at the factory.

F. The outdoor unit capacity must be equal to the indoor unit capacity to ensure the system will have sufficient capacity to handle the building space loads at peak design.

G. The outdoor unit shall have a tested sound rating no higher than 58 dB(A) tested per KSA0701.

H. All refrigerant lines from the outdoor unit to the indoor unit shall be field installed and insulated separately.

I. The outdoor unit shall have an accumulator.

J. The outdoor unit shall have over-current protection.

K. The outdoor unit shall have the ability to operate with an elevation difference of up to 98 feet above or below the indoor unit.

L. The maximum length from the outdoor unit to indoor unit shall be up to 246 feet.

M. The outdoor unit shall be capable of operating in heating mode from 75°F down to 5°F (LUU247HV/LUU427HV down to 0°F; LSU---HYV and LAU---HVP down to 14°F; LSU---HE down to 34°F) ambient wet bulb without additional low ambient controls.

N. The outdoor unit shall be capable of operating in cooling mode down to 14°F and up to 118°F ambient dry bulb without additional low ambient controls. An optional low ambient wind baffle kit shall be furnished to allow the outdoor unit to operate in cooling mode down to 0°F.

O. The system shall have a single refrigerant circuit and use R-410A refrigerant.

P. All 208/230V 1 phase outdoor units shall be equipped with an electronic controlled expansion valve (EEV).

Q. Frame:

1. Outdoor unit casing shall be constructed of pre-coated metal. An easily removable front panel shall be provided to allow access to major components and control devices.
2. Outdoor unit base legs shall be provided to secure the unit during installation.
3. Outdoor unit casings shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 480 hours.

R. Compressor:

1. All 208/230V 1 phase outdoor units shall be equipped with a single digitally controlled, inverter driven rotary compressor.
2. All 208/230V 1 phase outdoor unit compressors shall have an inverter to modulate capacity. The frequency of the inverter compressor shall be variable from 25Hz to 107Hz or 10Hz to 100Hz.
3. The compressor shall be equipped with internal over-current protection.
4. The compressor shall be mounted to avoid the transmission of vibration.

S. Fan:

1. All outdoor unit frames shall be furnished with direct drive propeller type fans. All 208/230V 1 phase outdoor unit fans shall be driven by a digitally controlled inverter that varies the fan speed from zero to maximum design speed.
2. The fan motor shall be designed and built by the unit manufacturer. The motor shall be brushless digitally controlled (DC) design and shall have inherent overload protection, have permanently lubricated bearings and have a maximum speed up to 950 rpm.
3. Fan blades shall be statically and dynamically balanced propeller fans made of durable Lupos (ABS) plastic
4. All fans shall be provided with a raised fan guard to limit contact with moving Articles. Fan guards shall be fabricated of MSWR8 mild steel wire rods.
5. The outdoor unit shall have horizontal discharge airflow.

T. Coil:

1. The outdoor unit coil shall be of nonferrous construction with stamped aluminum louvered fins for improved heat transfer capability on copper tubing with inner grooves and shall be a minimum of two rows.
2. The coil fins shall have a factory applied corrosion resistant GoldFin™ material with hydrophilic coating. Coil coating shall be tested in accordance with ASTM B-117 salt spray test procedure for a minimum of 1000 hours.
3. Coils shall be pressure tested at the factory.
4. The outdoor coil shall be protected with a pre-coated metal guard.

U. Electrical:

1. The outdoor unit electrical power shall be 208/230V, 1 phase, 60Hz
2. The outdoor unit shall be capable of operation within voltage limits of +/- 10% rated voltage.
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indo or unit and the outdoor unit shall be 24VDC completed using a 2-conductor, stranded, shielded cable.

2.4 INDOOR UNIT DUCTED – HIGH STATIC

A. General:

1. Unit shall be factory assembled, wired, piped and run tested.
2. Unit shall be designed to be installed for indoor application.
3. Unit shall be designed to mount fully concealed above the finished ceiling.
4. Unit shall have opening to supply air from front horizontal and a dedicated rear horizontal return.
5. The supply air shall be flanged for field installed ductwork that shall not exceed the external static pressure limitation of the unit.
6. Unit shall be capable to be installed with heat pump or heat recovery or cooling VRF system.

B. Casing/Panel

1. Unit case shall be manufactured using galvanized steel plate.
2. The cold surfaces of the unit shall be covered internally with a coated polystyrene insulating material.
3. The cold surfaces of the unit shall be covered externally with sheet insulation made of Ethylene Propylene Diene Monomer (M-Class) (EPDM)
4. The external insulation shall be plenum rated and conform to ASTM Standard D-1418.
5. Unit shall be provided with hanger brackets designed to support the unit weight on four corners.
6. Hanger brackets shall have pre-punched holes designed to accept field supplied, all thread rod hangers.

C. Cabinet Assembly:

1. Unit shall have supply air discharge outlets horizontal and a return air inlet horizontal.
2. Unit shall be equipped with factory installed temperature thermistors for:
   a. Return air
   b. Refrigerant entering coil
   c. Refrigerant leaving coil

3. Unit shall have a factory assembled, piped and wired electronic expansion valve (EEV) for refrigerant control.
4. Unit shall have a built-in control panel to communicate with other indoor units and to the outdoor unit.
5. Unit shall have the following functions as standard:
   a. Self-diagnostic function
   b. Auto addressing
   c. Auto restart function
   d. Auto changeover function (Heat Recovery system only)
   e. Auto operation function
   f. Child lock function
   g. Forced operation
   h. Dual thermistor control
   i. Sleep mode
   j. External static pressure (ESP) control
   k. Dual setpoint control
   l. Multiple aux heater applications
   m. Filter life and power consumption display

D. Fan Assembly:

1. The unit shall have two direct drive Sirocco fans made of high strength ABS GP-2200 polymeric resin.
2. The fan impeller shall be statically and dynamically balanced.
3. The fans shall be mounted on a common shaft.
4. The fan motor is Brushless Digitally controlled (BLDC) with permanently lubricated and sealed ball bearings.
5. The fan motor shall include thermal, overcurrent and low RPM protection.
6. The fan/motor assembly shall be mounted on vibration attenuating rubber grommets.
7. The fan speed shall be controlled using microprocessor based direct digitally controlled algorithm.
8. In cooling mode, the indoor fan shall have the following settings: Low, Med, High, Power Cool, and Auto.
9. In heating mode, the indoor fan shall have the following settings: Low, Med, High, and Auto.
10. Each of the settings can be field adjusted from the factory setting (RPM/ESP).
11. Unit shall be designed for high speed air volume against an external static pressure of up to 0.98” water gauge.

E. Filter Assembly:

1. The return air inlet shall have a factory supplied removable, washable filter with antifungal treatment.
2. The filter access shall be from the rear of the unit.

F. Coil Assembly:

1. Unit shall have a factory built coil comprised of aluminum fins mechanically bonded on copper tubing.
2. The copper tubing shall have inner grooves for high efficiency heat exchanger.
3. Unit shall have a minimum 2-3 row coil, 19-21 fins per inch.
4. Unit shall have a factory supplied condensate drain pan below the coil constructed of HIPS (high impact polystyrene resin).

5. Unit shall include an installed and wired condensate drain pump capable of providing minimum 27.5 inch lift from bottom surface of the unit.
6. The drain pump shall have a safety switch to shut off the unit if condensate rises too high in the drain pan.
7. Unit shall have provision of 45° flare refrigerant pipe connections.
8. The coil shall be factory pressure tested at a minimum of 551 psig.
9. All refrigerant piping from outdoor unit to indoor unit shall be field insulated.

G. Microprocessor Control:

1. The unit shall have a factory installed microprocessor controller capable of performing functions necessary to operate the system.
2. The unit shall be able to communicate with other indoor units and the outdoor unit using a field supplied minimum of 18 AWG, 2 core, stranded and shielded communication cable.
3. The unit controls shall operate the indoor unit using one of the five operating modes:
   a. Auto changeover (Heat Recovery System only)
   b. Heating
   c. Cooling
   d. Dry
   e. Fan only

H. Electrical:

1. The unit electrical power shall be 208-230/1/60 (V/Ph/Hz)
2. The unit shall be capable of operating within voltage limits of +/- 10% of the rated voltage.

I. Controls:

1. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS485 daisy chain.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Installing contractor must be certified by the equipment manufacturer to properly install all components of the system. Only trained installers shall install all refrigerant piping per manufacturer’s installation instructions.

C. Install refrigerant piping purge and charge with R410A refrigerant.

D. Field-insulate refrigerant piping.

E. Install and connect all controls wiring.

F. Coordinate power wiring and connections with Division 26.

3.2 TERMINAL UNIT SCHEDULE: As shown on drawings.

END OF SECTION 238126

SECTION 260001 – ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General provisions of the Contract including the "General Conditions", "Supplementary Conditions", and "General Requirements" of the Contract as written and referred to here are adopted and made part of Division 26.

B. The Contract Agreement, Bidding documents, and all Addenda issued prior to Contract Agreement execution form a part of these specifications and apply to all Contracts or Subcontracts relating to the electrical systems.

1.2 SUMMARY

A. The work under this Division shall consist of all labor, materials, equipment, services and related accessories, etc., necessary and required to complete all work as shown or inferred on the Drawings and in the Specifications (Contract Documents).

B. Provide fixed electrical equipment, except where specifically noted otherwise.

C. Provide portable electrical equipment for the complete system(s).

D. Provide equipment and/or wiring normally furnished or required for complete electrical systems but not specifically specified on the drawings and/or in specifications, as though specified by both.

E. All equipment and wiring shall be new, except where specifically shown or specified otherwise.

F. Provide flexible electrical conduit and conductors having a slack, 90-degree bend or loop in any plane between connections at all vibration isolated equipment and the first attachment to building structure or cabinets, panels or boxes mounted thereon.

1.3 WORK INCLUDED IN THIS DIVISION

A. Electrical work includes, but is not limited to
1. Arranging and coordinating with State owned utility services required as shown or specified.
2. Removal or relocation of electrical services and electrical work located on or crossing through project property, above or below grade, obstructing construction of project or conflicting with completed project or any applicable code.
3. Alterations and additions to existing electrical systems.
4. Provide panelboards, circuit breakers, power outlets, convenience outlets, switches, and/or other equipment forming part of system.
5. Complete lighting system.
6. Complete communication system.
7. Connection of all appliances and equipment including Owner furnished equipment.
8. Complete grounding system.
9. Complete temporary facilities for construction power.

1.4 WORK NOT INCLUDED IN THIS DIVISION (REFER TO OTHER DIVISIONS OF THESE SPECIFICATIONS)

A. Flashing of conduits into roofs and outside walls. Inform General Contractor of number and size of roof penetrations prior to bidding.

B. Furring of building structure or finishes for conduit and equipment.

C. Finish painting of conduit and equipment except for factory applied prime or finish painting specified for equipment, fixtures, devices or materials furnished under this section.

D. Installation of motors except where specifically noted. See Division 23.

E. Control wiring for mechanical systems, except where specifically indicated to be provided by Electrical Contractor. See Division 23.

1.5 RELATED WORK SPECIFIED ELSEWHERE

A. Classification of Excavation: Division 02 – Site work.

B. Concrete Work: Division 03.

C. Painting: Division 09.

D. Firestopping: Division 07.

1.6 REFERENCES

NEC:	National Electrical Code (latest edition adopted by local authorities unless otherwise noted).
NFPA:	National Fire Protection Association.
OSHA:	Occupational Safety and Health Administration.
UL:	Underwriters Laboratories, Inc.
NEMA:	National Electrical Manufacturer's Association.
IEEE:	Institute of Electrical and Electronic Engineers.
ACI:	American Concrete Institute.
ADA:	American Disabilities Act.
ANSI:	American National Standards Institutes.
ASTM:	American Society for Testing Materials.
AWS:	American Welding Society.
FM:	Factory Mutual Insurance Association.
IBC:	International Building Code
IES:	Illumination Engineering Society.
ISA:	Instrument Society of America.
LPI	Lightning Protection Institute.
NACE:	National Association of Corrosion Engineers.
NETA:	International Electrical Testing Association.
UL:	Underwriters Laboratories.
NECA:	National Electrical Contractors Association
NETA:	National Electrical Testing Association.

1.7 ADOPTED CODES

A. 2012 International Building Code (IBC) Published by the International Code Council (ICC).

B. 2011 National Electrical Code (NEC) published by the National Fire Protection Association (NFPA)

C. 2012 International Fire Code (IFC) published by the International Code Council.

D. National Fire Codes (NFPA Standards) published by the National Fire Protection Association (NFPA) as referenced in the 2012 International Fire Code.

E. 2012 International Energy Conservation Code (IECC) published by the International Code Council. ASHRAE/IESNA Standard 90.1-2004 is incorporated by reference.

F. All applicable provisions of the Nevada Revised Statutes (NRS) and the Nevada Administrative Code (NAC), including those listed below.

G. The most current regulations of the State Fire Marshal, Nevada Department of Public Safety, Carson City, Nevada (NAC Chapter 477, State Fire Marshal).

H. The most current edition of the Americans with Disabilities Act (ADA) published by the United States Department of Justice including the Americans with Disabilities Act Accessibility Guidelines (ADAAG)

I. Other codes, regulations, and standards referenced in the body of this document.

J. Local codes and ordinances do not apply to projects constructed on state-owned land, except for zoning requirements pursuant to Nevada Revised Statutes Section 278.580.

1.8 DEFINITIONS

Provide:	Furnish, install, connect and test until complete.
Wire:	Furnish all necessary wiring, connect and test until complete.
Install:	Furnish, set in place, wire and test until complete.
Work:	Materials completely installed, connected, and tested until complete.
AWG:	American Wire Gage.
Equal:	Acceptable equal as determined by the Engineer.

1.9 REQUIREMENTS OF REGULATORY AGENCIES

A. Obtain and pay for all permits and inspections required for the work. Comply with all ordinances pertaining to work described herein. Pay all expenses arising from the procurement of these certificates and include in the base Contract Price.

B. Install work under this Division per drawings, specifications, latest adopted edition of the National Electrical Code, (NFPA-70) including local amendments and interpretations, Local adopted Building Codes, and any special codes having jurisdiction over specific portions of work within complete installation. In event of conflict, install work per most stringent code requirements determined by Engineer. This does not relieve the Contractor from furnishing and installing work shown or specified which may exceed the requirements of such ordinances, laws, regulations and codes.

C. All materials, products, devices, fixtures, forms or types of construction included in this project shall meet or exceed the published requirements of National Electrical Code (NEC), American National Standards Institute (ANSI), Institute of Electrical and

Electronics Engineers (IEEE) and National Electrical Manufacturers Associations (NEMA). All equipment shall bear the Underwriter's Laboratories (UL) label or equivalent from approved independent testing laboratory.

D. Arrange, pay fees for and complete work to pass required tests by agencies having authority over work. Deliver to Engineer copies of the Certificates of Inspection and approval issued by authorities and provide original copy of each certificate to Owner.

E. When required by law or regulations, the governmental agency having jurisdiction for inspections shall be given reasonable notice and opportunity to inspect the work. Any work that is enclosed or covered up before such inspection and test shall be uncovered at the Contractor's expense; after it has been inspected, the Contractor shall restore the work to its original condition at his own expense.

1.10 INSURANCE

A. The Contractor shall procure and maintain, at his expense, such insurance as required by law and/or specified in the General Conditions.

1.11 DRAWINGS AND SPECIFICATIONS

A. Drawings and specifications are complementary. Work called for by one is binding as if called for by both. Any discrepancies between drawings and specifications shall be brought to the attention of the Engineer for clarification during the bidding period. No allowance shall subsequently be made to the Contractor by reason of his failure to have brought said discrepancies to the attention of the Consultant during the bidding period or by reason of any error on the Contractor's part.

B. Drawings are schematic and diagramatic in nature. Drawings show general run of circuits and approximate location of equipment. The contractor shall review drawings of all trades to assure coordination prior to placement of work. Right is reserved to change location of equipment and devices, and routing of conduits within 10 feet, without extra cost to Owner (prior to rough-in).

C. Use dimensions in figures, shop drawings, etc. and actual site measurements in preference to scaled dimensions. Do not scale drawings for exact sizes or locations – use dimensioned details or actual field conditions. Verify item mounting heights as required by project conditions prior to rough-in.

D. The architectural drawings shall take precedence over all other drawings in matters of dimensions. Discrepancies between different drawings or between drawings and specifications, or regulations and codes governing the installation shall be brought to the attention of the Engineer in writing for determination.

E. Layout equipment as shown on drawings as close as possible. Verify access requirements for equipment actually furnished, and adjust layout to comply with NEC 110. Right is reserved to change layout within 10 feet without additional cost (prior to rough-in).

F. All devices, light fixtures, etc. located in ceiling tiles shall be located in the center of the ceiling tile UNLESS specifically noted or approved to do otherwise.

G. The Contractor is responsible to field measure and confirm the mounting heights and location of electrical equipment with respect to counters, doorways, and other architectural, mechanical or structural work. Do not scale distances off the electrical drawings: Use actual building dimensions.

H. Execution of Contract is evidence that Contractor has examined all existing conditions, drawings and specifications related to work, and is informed to extent and character of

work. Later claims for labor and materials required due to difficulties encountered, which could have been foreseen had examination been made, will not be recognized.

I. All work called for in this Section of the plans and specifications shall be performed under this Section, regardless of whether such work may also have been called for in other Section(s). Discrepancies in or conflicts among the various parts of the contract drawings shall not relieve Contractor of his obligation to perform.

J. No attempt has been made to establish the required sections or splits of equipment relative to the size of access into the space, building, etc. Contractor shall establish all said splits, sections, etc. necessary to install equipment complete without undue disassembly of equipment or demolition of building parts at site of work.

K. Charges for extra work are not allowed unless work is authorized by written order from the Owner's Representative approving charges for work.

L. Check all door swings so light switches are not located behind doors. Relocate switches as required with the Engineer's review.

1.12 SEISMIC QUALIFICATIONS & REQUIREMENTS

A. Equipment Seismic Qualification
Major equipment and components shall be suitable for and certified to meet all applicable seismic requirements of the California Building Code (CBC) through zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, CBC: a peak of 2.15g's and a ZPA of 0.86g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

B. Structural Design Requirements
1. Include in the bid, hiring of a structural engineer, registered in the state of Nevada, to provide calculations and details for equipment pads and mounting and bracing of all major equipment. Attach equipment according to those calculations.
2. Major equipment and components include:
   a) Conduit racks and supports.
   b) Transformers.
   c) Panelboards.
   d) Service and Distribution switchboards.
3. Equipment anchoring and bracing shall be designed to conform to IBC 2012 and NRS 341.143.

C. See Spec Section 26 05 30 Seismic Protection for Electrical Equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All material shall be new, and have a UL label where available. If UL label is not available, material shall be manufactured in accordance with applicable NEMA, IEEE and Federal Standards. Use UL labeled components in assemblies that do not have overall UL label. All equipment shall comply with the terms "listed and labeled" as defined in the NEC 70, Article 100. Submit letter stating compliance with these requirements.

B. Utilize one of the manufacturers listed to furnish all of the major equipment (i.e., transformers, bus duct, switchgear, circuit breakers, etc.) required for this project.

PART 3 - EXECUTION

3.1 VISIT TO SITE

A. Visit site, and survey existing conditions affecting work prior to bid. Include necessary materials and labor to accomplish the electrical work, including relocation of existing services and utilities on building site in bid. No consideration shall be given to future claims due to existing conditions. Any discrepancies or interference's shall be reported immediately to the Engineer.

3.2 WORKMANSHIP

A. All work performed shall be first class work in every aspect. The work shall be performed by mechanics skilled in their respective trades, who shall at all times be under the supervision of competent persons. All work shall be installed to comply with NECA's "Standard of Installation."

B. Work under this Division shall be first class with emphasis on neatness and workmanship. All work shall be installed square and plumb and concealed where possible. Work that is deficient, defective, poorly laid out, not perfectly aligned, or that is not consistent with the requirements generally accepted in the trade for "first class work" will not be acceptable.

C. In addition to the materials specified elsewhere, furnish and install all other miscellaneous items necessary for the completion of the work to the extent that all systems are complete and operative.

D. All work under this Section shall be performed in cooperation with the work performed under all other Sections of the Specifications for the Project in order to avoid interference with other work and to secure the proper installation of all work. Refer the Drawings and Specifications covering the work to be performed under all Sections, so that the relation and extent of the work of this Section with respect to the work of all other Sections is understood. Give right of way to raceways and piping systems installed at a required slope.

E. Install work using competent mechanics, under supervision of foreman, all duly certified by local authorities. The installation shall be subject to the Engineer's observation, and final acceptance. The Engineer may reject unsuitable work.

E. Conduit systems must be complete prior to installation of wiring.

3.3 CHANGE ORDERS

A. Additional work may be required on the project which is outside the scope of the contract. Such additional work will be described in Supplemental Instructions and/or Clarifications, to be estimated and priced by the Contractor, and accepted by the Owner, prior to commencing work. Proposals shall include a list of quantities of all material being used with unit costs broken down into material and labor costs per unit.

B. Material costs and labor units shall not exceed the latest edition of RS Means Electrical Cost Data.

C. See the General Conditions of the Specifications for acceptable charges.

3.4 GUARANTEE

A. Furnish the Owner a written guarantee, stating that if workmanship and/or material executed under this Division is proven defective within one (1) year after final acceptance

by the Owner, such defects and other work damaged will be repaired and/or replaced. Submit with Operations and Maintenance Manuals.

B. Obtain from the various manufacturers or vendors guarantees or warranties for their particular equipment or components, and deliver them to the Owner. All guarantees and warranties provided shall be referenced to this project.

C. In event that systems are placed in operation in several phases at the Owner's request, guarantee will begin on date each system or item of equipment is accepted for service by the Owner. Provide O&M manuals for all equipment when equipment is accepted for service by the Owner.

D. All guarantees and warranties shall include labor and material at the site of installation for the duration of the guarantee period.

3.5 OBSERVATIONS OF WORK AND DEMONSTRATION OF OPERATION (ACCEPTANCE)

A. At all observations of work, open panel covers, junction box covers, pull box covers, device covers, and other equipment with removable plates for observation. Provide sufficient personnel to expedite cover removal and replacement.

B. Contractor to demonstrate operation of new equipment and/or systems to satisfaction of Owner/Engineer. Contractor to have manufacturer available for demonstration of equipment and/or systems where requested by Owner/Engineer. Furnish affidavit signed by Owner's representative indicating that demonstration of operation has been performed.

3.6 COOPERATION AND COORDINATION

A. Carefully coordinate work with other contractors and subcontractors. Refer conflicts between trades to Engineer. Provide necessary information to other trades for such coordination. Such information shall include Shop Drawings, Product Data and all other required data.

B. Provide a system erection/coordination drawing showing electrical, HVAC, plumbing and architectural for installation in congested areas. Drawings shall be in plan view for work above the ceilings and also sections shall be provided showing the elevations of conduit racks and routing and the coordination with mechanical piping and ductwork.

C. Whenever such information is not provided in a timely manner or whenever such information is incorrect, this contractor shall bear all costs for providing or correcting affected work of related trades with no change to the Contract Price or Construction Schedule.

D. Work to be installed as progress of project will allow. Schedule of work determined by General Contractor, Owner, and/or Architect/Engineer.

3.7 COORDINATION OF UTILITY SERVICES

A. Drawings indicate proposed service layouts. The Contractor shall provide all concrete structures, pullboxes, vaults, trenching, raceways, protective bollards, etc., as required per NV Energy standards, even though the distribution system is owned by State of Nevada.

3.8 HVAC CONTROL WIRING

A. Control Wiring including low voltage and line voltage interlock wiring will be furnished and installed under Division 23, except where specifically shown otherwise. Carefully coordinate power and control wiring interface.

B. This Contractor shall obtain from Division 23 all wiring diagrams associated with the HVAC work and furnish all power and 120V control wiring, disconnects and starters for equipment not already packaged with these items. The Contractor shall include in his bid connections, disconnects and circuiting for all added and relocated equipment as directed by the Temperature Controls Contractor even if it is not shown on the bid documents. All wiring and conduit associated with the HVAC Temperature Control System is included under Division 23. Wiring and conduit shall comply with Division 26. All electrical work associated with the HVAC system shall be done under the supervision of Division 23.

3.9 STARTERS

A. Separately mounted starters are furnished and installed under Division 26 unless specifically shown otherwise. All power wiring, fuses, thermal overloads, and disconnect switches and connection of all motors is under this division. Provide the proper feeders and connections as recommended by the manufacturer of the equipment.

3.10 PROTECTING

A. Provide warning lights, bracing, shoring, rails, guards and covers necessary to prevent damage or injury. All persons working around electrical equipment shall have electrical shock and flash protection per OSHA 1910.301-309 & 331-335.

B. Do not leave exposed or unprotected, electrical items carrying current. Protect visitors and workers from exposure to contact with electrically energized surfaces, parts, etc. in accordance with OSHA standards.

3.11 DELIVERY, STORAGE AND HANDLING

A. Deliver equipment and materials to job site in original, unopened, labeled container. Products shall be properly identified with names, model numbers, types, grades, compliance labels and other information needed for identification. Store to prevent damage and injury. Store materials to prevent corroding. Store finished materials and equipment to prevent staining and discoloring. Store materials affected by condensation in warm dry areas. Provide heaters. Contractor shall verify the availability of on site storage space, if no on site storage space is available then the contractor shall cover the cost for off site storage. Materials stored at the project site that becomes soiled with construction dirt, concrete, or moisture shall be removed from the site and replaced with new. Do not install soiled material.

B. Protect work and materials from damage by weather, entrance of water or dirt. Cap and mark conduit during installation.

C. Avoid damage to materials and equipment in place. Repair, or remove and replace damaged work and materials.

D. Protection and safekeeping of products stored on premises is responsibility of Contractor supplying products.

E. Schedule of deliveries and unloading to prevent traffic congestion blocking of access or interference with work. Arrange deliveries to avoid larger accumulations of materials than can be suitably stored at site.

F. Install equipment per manufacturer's recommendations. Conflicts between contract documents and these recommendations shall be referred to Engineer for remedy.

G. Electrical or electronic equipment that has been damaged, exposed to weather or is, in the opinion of the Engineer or Architect, otherwise unsuitable because of improper fabrication, storage or installation shall be removed and replaced by this Contractor at his expense.

3.12 ANCHORS

A. Provide anchors for all equipment, raceways, hangers, etc. to safely support weight of item involved plus 100% for dead loads. Live loads shall be considered in addition to dead loads.

B. Anchors to consist of expansion type devices similar to "Redhead" or lead expansion anchors. Plastic anchors are not acceptable.

C. Use preset anchor steel inserts in concrete slabs. Provide preset anchor size and type for anticipated or specified rod/bolt size and live/dead load.

3.13 CLEANING AND PAINTING

A. Clean equipment furnished in this Division after completion of work. Clean wipe the interior of all conduit, pullboxes, junction boxes, outlet boxes, and panelboard backboxes, soiled with dirt and debris prior to installation of wiring.

B. Touch-up or re-paint damaged painted finishes as determined by the Engineer.

C. Remove debris, packing cartons, scrap, etc., from site daily.

3.14 SPARE PARTS

A. Where spare parts are specified in the Technical Sections, furnish spare parts to Owner with itemized receipt. Contractor is responsible to deliver parts and have receipt signed by Owner's representative. Turn over receipt with as-built documents.

3.15 HOUSEKEEPING PADS

A. Furnish 2500 # concrete pads, 4” high (interior locations) or 6” high (exterior locations) unless otherwise noted, for all freestanding equipment, i.e.: switchboards, panels, control panels, motor control centers, transformers, etc. Pads shall have 1" x 45° chamfered edges, and shall extend 2” to 4" beyond equipment mountings.

3.16 TRAINING

A. Training for operation and maintenance of new systems or modifications to existing systems is specified in Technical sections. Contractor shall submit with record documents an itemized receipt signed by Owner’s representative that all specified training has been received.

3.17 ACCESS PANELS

A. The contractor shall furnish all access panels for walls, partitions, etc., and shall give access panel to the General Contractor for installation at locations as directed by the Electrical Contractor. It shall be the responsibility of the Electrical Contractor that access panels are provided for access to all boxes, bus joints, equipment, etc., which may be concealed by building construction to comply with the NEC and NFPA. Access panels shall be installed so as not to interfere with lighting arrangements.

END OF SECTION 260001

SECTION 260002 – ELECTRICAL SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION OF SUBMITTAL CATEGORIES

A. The required submittals are defined below and specified in each section.

1. Requests for substitutions are written requests to use materials, equipment, etc., different from that specified.
2. Shop Drawings include fabrication, layout, wiring diagrams, erection, setting, coordination, drawings and diagrams and performance data.
3. Samples are units of work, materials or equipment items, showing the workmanship, pattern, trim and similar qualities proposed.
4. Manufacturer's Data is standard printed product information concerning the standard portions of the manufacturer's products.
5. Certifications are written statements, executed specifically for the project application by an authorized officer of the contracting firm, manufacturer, or other firm as designated, certifying to compliance with the specified requirements.
6. Test Reports are specific reports prepared by independent testing laboratories, showing the results of specified testing.
7. Industry Standards are printed copies of the current standards in the industry.
8. Manufacturer's Product Warranties are manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed by the manufacturer if the product fails under certain conditions and times limits.
9. Operating Instructions are the written instructions by the manufacturer, fabricator or installer of equipment or systems, detailing the procedures to be followed by the Owner’s in operation, control and shut-down.
10. Maintenance Manuals are the compiled information provided for the Owner’s maintenance of each system of operating equipment.
11. Maintenance Materials (spare parts) are extra stock of parts or materials for the Owner's initial use in maintaining the equipment and systems in operation.
12. Record Drawings are accurate representations of the installed systems and wiring as recorded on a daily “as-installed” basis.
13. Guarantees are signed commitments to the Owner that certain acts of restitution will be performed if certain portions of work fail within certain conditions and time limits.
14. Product Data includes manufacturer's data pertaining to the products, materials and equipment of the work.
15. Method of Procedures are detailed sequences of work required during interruption of service and/or connection to energized parts of systems requiring special sequences or protections.
16. Training – Materials and sign-off of completion.
17. Identification nomenclature – See section 26 05 53.

PART 2 - PRODUCTS

2.1 PROPOSED MATERIAL MANUFACTURERS

A. Submit to Consultant within 30 days after award of contract a complete list of proposed material manufacturers. List does not preclude submission of shop drawings. Acceptance of manufacturer on list does not constitute acceptance of specific material or

equipment. If shop drawings are submitted with non approved substitutions, the contractor will pay the expense incurred by the consultant to review the shop drawings of any re-submittal.

PART 3 - EXECUTION

3.1 SUBSTITUTIONS

A. See General Conditions of the specifications for information regarding substitutions. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples if requested by Engineer are provided. Alternate products shall meet or exceed design criteria.

3.2 SUBMITTAL FORM AND PROCEDURES

A. Shop and Erection Drawings
1. Submit shop drawings for material and equipment furnished under Division 26 of specifications, to Consultant for review within 30 days after award of contract. Shop drawings shall be submitted on timely basis to allow adequate lead time for review, re-submission if necessary, manufacture and delivery to allow access of material to project at correct time based on schedule established by Consultant/Contractor. Provide index with thumb tabs collated with Table of Contents for sections. Include complete descriptive data with dimensions, operating data and weight for each item of equipment. Carefully examine shop drawings to assure compliance with drawings and specifications prior to submittal to Consultant. **Shop drawings and submittals shall bear the stamp of approval of the Electrical Contractor as evidence that they have checked the drawings.** Drawing submitted without this stamp of approval will not be considered and will be returned for proper re-submission. All shop drawings shall be submitted as a single one time complete package. Partial packages shall not be reviewed.
2. Submit minimum 8 copies. Architect/Engineer will retain minimum 3 copies and return balance to Contractor. Electronic copies are acceptable. Coordinate required number of copies and submittal requirements with General Conditions.
3. Clearly mark each shop drawing item to correspond to drawings and specifications. Any drawings not clearly marked will be rejected.
4. Review of shop drawings does not relieve Contractor of responsibility for errors and omissions in shop drawings. Contractor is responsible for dimensions and sizes of equipment. Inform Engineer in writing of equipment differing from that specified.

B. "Record" Drawings
1. One complete set of prints will be furnished to the Contractor to indicate actual location of conduit systems, outlets, and equipment. Keep set of prints on job and record day to day changes to Contract drawings with red pencil. Provide “Record" drawings as specified in the General Conditions or Division 01 of the specifications at the completion of job.

C. Maintenance Materials
1. Submit a list of all warranties and guarantees.
2. Submit with final close out documents a signed receipt for all maintenance materials (spare parts) specified. See Technical Sections for required materials.

D. Product Warranties and Guarantees
1. Submit fully executed Product Warranties and Contractor Guarantees to the Owner with final close out documents.

E. Maintenance Manuals
1. Submit to Consultant three (3) sets of data prepared by manufacturer for each item and/or device of electrical equipment furnished in this contract completely describing and identifying equipment. Data to include serial numbers, catalog/model numbers, parts lists, description of operation, final shop drawings, wiring diagrams, all electrical ratings, set-up and maintenance procedures and other literature required for maintenance of equipment. See Technical Sections for other required information. Electronic copies are acceptable.

F. Summary of Project Closeout Items for Owner
1. Certificates of inspection and approval from authorities having jurisdiction.
2. Executed Guarantees and Product Warranties.
3. “Record” drawings.
4. Final shop drawings.
5. Final Erection drawings.
6. Receipt for maintenance materials (spare parts).
7. Maintenance manuals.
8. Receipt for keys.
9. Completed test reports.
10. Signed off observation and punch lists.
11. Lien waivers.

3.3 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop Drawings shall include, but not be limited to the following:
1. Shall be drawn to accurate scale except where diagrammatic representations are specifically indicated.
2. Shall show clearance dimensions of critical locations and show dimensions of spaces required for operation and maintenance of equipment.
3. Shall show conduit and conductor connections and other service connections.
4. Shall show interfaces with other work including structural support.
5. Shall include complete descriptive data, with dimensions, operating data and weight.
6. Shall indicate deviation from the contract documents.
7. Shall explain deviations.
8. Shall show short circuit current ratings for all electrical equipment.
9. Shall show how deviations coordinate with portions of the work, currently or previously submitted.

B. Review of shop drawings shall not relieve Contractor of responsibility for errors or omissions in shop drawings. Any equipment that will not fit into space shown on drawings shall be called to the attention of the Engineer in writing.

C. Samples: Submit samples where requested by Engineer. Engineer’s review of sample submittals
1. Shall be limited to general type, pattern and finish.
2. Shall not include testing and inspection of the submitted samples.
3. Shall not indicate complete compliance with specified requirements. Complete compliance with specifications is the exclusive responsibility of the Contractor.

D. Manufacturer's Data
1. Where pre-printed data covers more than one distinct item, mark copy to *clearly* indicate which item is to be provided.
2. Contractor shall delete portions of data not applicable.
3. Contractor shall mark data showing portion of operating range required for project application.

4. Elaboration of standard data describing a non-standard product shall be processed as a shop drawing.
5. For each product Contractor shall include the following information summarized into a single sheet document for each product
   a) Manufacturer's production specifications including catalog/model number.
   b) Manufacturer's Serial Number.
   c) Installation or fabrication instructions.
   d) Source of supply.
   e) Sizes, weights, speeds and operating capacities.
   f) All electrical ratings, including temperature rating of terminals.
   g) Conduit and wire connection sizes and locations.
   h) All thermal ratings.
   i) Statements of compliance with required standard and governing regulations.
   j) Cooling requirements and makeup and/or ventilating air requirements.
   k) Performance data, where applicable.
   l) All sound ratings.
   m) Other information needed to confirm compliance.
   n) Manufacturers recommended parts list.
   o) Other information required by Technical Sections.

E. Source Codes: Provide Source Code in both electronic and paper format and Source Code Licenses for all equipment that is computer driven. Provide Development licenses so Source Code can be examined, modified, and maintained. These Development Licenses, along with all software licenses shall become property of the Owner. At the discretion of the owner, third parties will be allowed to use the software as necessary, for the life of the work in this project. No encryption or other obfuscation will be allowed.

F. Certifications: Contractor shall submit with notarized execution.

G. Test Reports: Submit notarized test reports signed and dated by firm performing test.

H. Manufacturer's Product Warranties: Contractor shall submit product warranties in accordance with the technical sections. Where published warranty includes deviation from required warranty, product is disqualified from use on project, unless manufacturer issues a specific project warranty.

I. Operating Instructions required
1. Submit manufacturer's operating instructions for each item of electrical equipment.
2. Submit supplement with additional project application instructions where necessary.
3. Submit specific operating instructions for each electrical system that involves multiple items of equipment.
4. Submit instructions for charging, start-up, control or sequencing of operation, phase or seasonal variations, shut-down, safety and similar operations.
5. All operating instructions shall be typewritten in completely explained and easily understood English language.

J. Maintenance Manual Requirements
1. Provide emergency instructions including addresses and telephone numbers for service sources.
2. Provide regular system maintenance procedures.
3. Indicate proper use of tools and accessories.
4. Provide wiring and control diagram for each system.
5. Provide manufacturer's data for each operational item in each system.

6. Provide source code submittal for all software controlled equipment.
7. Provide manufacturer's product warranties, and guarantee relating to the system and equipment items in the system.
8. Provide Final Shop and Erection drawings relating to the system.
9. Bind each operating and maintenance manual in one or more vinyl-covered, 2” 3-ring binders, plus pocket-folders for folded drawings. Index with thumb tab collated with Table of Contents for sections. Mark the back spine and front cover of each binder with system identification and volume number.

K. Maintenance Materials: Deliver all materials to the Owner in fully identified containers or packages suitable for storage. Obtain receipt for all delivered materials signed by the Owner’s Representative.

L. Guarantees: Where indicated as "Certified", provide guarantee which, in addition to execution by an authorized officer of each guarantor, is attested to by the Secretary of each guarantor and bears the corporate seal. Submit draft of each guarantee prior to execution.

END OF SECTION 260002

SECTION 260503 – EQUIPMENT WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:
   1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
   2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
   1. NEMA WD 1 - General Requirements for Wiring Devices.
   2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Submittal procedures.

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

A. General Conditions: Coordination and project conditions.

B. Obtain and review shop drawings, product data, manufacturer’s wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS

2.1 CORD AND PLUGS

A. Attachment Plug Construction: Conform to NEMA WD 1.

B. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

C. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 EXISTING WORK

A. Remove exposed abandoned equipment wiring connections, including abandoned connections above accessible ceiling finishes.

B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.

3.3 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations and to motors.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.4 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION 260503

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building wire and cable and wiring connectors and connections.

B. Related Sections:
   1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.
   2. Section 31 23 17 - Trenching: Execution requirements for trenching required by this section.
   3. Section 31 23 23 - Fill: Requirements for backfill to be placed by this section.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.
   2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:
   1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
   2. Solid conductors for feeders and branch circuits 8 AWG and larger.
   3. Stranded conductors for control circuits.
   4. Conductor not smaller than 12 AWG for power and lighting circuits.
   5. Conductor not smaller than 16 AWG for control circuits.
   6. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.

B. Wiring Methods: Provide the following wiring methods:
   1. All Locations Unless Noted Otherwise: Use only building wire, Type THHN/THWN or XHHW insulation, in raceway.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper.

1.5 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit for building wire.

C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.

D. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

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

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

A. General Conditions: Requirements for coordination.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Product Description: Single conductor insulated wire.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 90 degrees C.

E. Insulation Material: Thermoplastic.

2.2 ARMORED CABLE

A. Type AC Cable may not be used on this project.

2.3 METAL CLAD CABLE

A. Type MC Cable may not be used on this project and is strictly prohibited.

2.4 CONNECTORS AND SPLICES

A. Provide UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, type and class for application and for service indicated. Select connectors to comply with Project's installation requirements and as specified in Part 3 "Applications" of this Article.

B. For Conductors #10 AWG and Smaller: Wire and cable connectors shall be solderless, twist on, 600 volts, 105°C., shall comply with UL 486A/C standards. Connectors coded for easy selection compatible with wiring to be spliced. Install connectors as recommended by manufacturer. Use proper crimping tool where crimp sleeves are used.
   1. Acceptable Connector Manufacturers
      a) 3M- "Scotchlock"
      b) Buchanan - "B Cap"
      c) Thomas & Betts - "Stak-On"
      d) Ideal - "Wing Nuts"

C. Compression Splices: Splice conductors #8 and larger with solid copper barrel, type fittings applied with an appropriate hydraulic tool. Splices used only where approved. Splice fittings: Burndy "Hydent". Insulate splices with 600 volt, 105°C, "heat shrink", "cold shrink" covers, or taped insulation consisting of rubber, friction and vinyl tapes applied per manufacturer for 600 volt, 105°C covering to 150 percent of installation rating of conductor.
   1. Acceptable Splice and Tape Manufacturers
      a) Burndy
      b) Thomas & Betts
      c) Ilsco
      d) Anderson
      e) Blackburn
      f) Oz/Gedney

D. Connectors and/or Terminations for Conductors #6 AWG and larger: Tin plated, 98% copper, dual crimp long barrel compression lugs with two bolt holes, insulated with molded covers to accommodate 1/2" bolts. Apply with hydraulic tool recommended by manufacturer.
   1. Acceptable Manufacturers and Products
      a) O-Z Gedney
      b) Burndy Engineering Company "Hylugs"
      c) Thomas and Betts, "Color Keyed"
      d) Anderson

E. Use pulling lubricant which will not be detrimental to insulation of conductors indicated by published user information.
   1. Acceptable Manufacturers of Lubricant
      a) Ideal Industries
      b) Panduit Corp.
      c) OZ/Gedney
      d) Plymouth/Bishop
      e) American Polywater Corp.
      f) Thomas & Betts

F. Insulate all live joints to 600 volts with strip rubber, friction tape, and electrical vinyl tape installed in accordance with manufacturers recommendations.
   1. Acceptable Tape Manufacturers
      a) 3M
      b) Plymouth

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 EXISTING WORK

A. Remove exposed abandoned wire and cable, including abandoned wire and cable above accessible ceiling finishes. Patch surfaces where removed cables pass through building finishes.

B. Disconnect abandoned circuits and remove circuit wire and cable. Remove abandoned boxes when wire and cable servicing boxes is abandoned and removed. Install black cover for abandoned boxes not removed.

3.4 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 16075. Identify each conductor with its circuit number or other designation indicated.

D. Install wiring complete with connections to equipment.

E. Install wiring so conductors are not in tension in completed system.

F. Form wiring neatly and group in circuit. Tie grouped conductors with nylon ties, T&B "Tyrap" or approved equivalent.

G. Each conduit run shall be run complete end to end before conductors are installed.

H. Use pulling lubricant to decrease pulling tension for all feeder cables, and all difficult cable pulls of any type or size. Pull all conductors into raceway at the same time.

I. Provide cable supports, at locations required by NEC and/or as shown. Supports with malleable screwed conduit fitting and non-conductive wedges drilled for the size conductors installed. Provide supports rated for all types of insulation and all voltage. Cable supports shall be O.Z./Gedney type "R" or accepted equivalent. Furnish pullbox, sized per NEC for each cable support.

J. Bond circuit ground wires where installed to all devices, equipment, outlet and junction boxes, and grounding bushings (where provided) with a full size conductor and lugged type connection.

K. Securely fasten non-ferrous identifying tapes, pressure sensitive labels or engraved nameplates to all cables, feeders and power cables exposed in vaults, inside pull boxes, exposed in manholes, exposed in switchboard, termination compartments, etc. See Section 26 05 53 for nameplates and labels.

L. Join and terminate copper conductors individually. Do not mix voltages in the same raceway.

M. Provide lugs where not furnished as part of equipment - furnish as specified above, to connect all conductors.

N. Furnish lugs for conductors #1/0 and larger with two bolt tongue or accepted equivalent single bolt tongue with anti-turn devices.

O. Mark all branch circuit conductors at panel terminations including neutrals with pressure sensitive numbers to correspond to circuit numbers connected. See Section 16040 for labels.

P. Connect circuits and feeders as shown on drawings. Drawings are diagrammatic and do not show every detail required in the wiring system. Detail wiring accomplished per NEC.

Q. All conductors making up parallel feeders to be same size, same type, and same insulation, all cut same length. Bond each group of conductors making up a phase or neutral at both ends in an approved manner. Parallel conductors shall not be run in the same raceway.

R. DO NOT COMBINE CIRCUITS into more than three circuits per homerun unless specifically approved by the Consultant.

S. Neutral conductors shall not be used for equipment grounding.

T. Circuitry shall not be run in elevator shafts and hoistways.

U. Provide a separate neutral and grounding conductor for all GFI circuits or GFI devices to ensure an adequate ground-fault return path.

V. Use #10 AWG for all 20 amp, 120 volt homerun circuits that exceed 75 feet from center of load and 150 feet for 277 volt circuits.

W. Panelboards may not be used as raceways.

X. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

Y. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.

Z. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

AA. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

BB. Clean conductor surfaces before installing lugs and connectors.

CC. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3.5 WIRE COLOR

A. General:
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Brown, orange, and yellow for circuits at 277/480 volts single or three phase.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
      a. Black and red for single phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts single or three phase.
      c. Brown, orange, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.6 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 260519

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rod electrodes.
2. Wire.
3. Grounding well components.
4. Mechanical connectors.
5. Exothermic connections.

B. Related Sections:
1. Section 03 20 00 - Concrete Reinforcing: Bonding or welding bars when reinforcing steel is used for electrodes.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.

B. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

1.3 SYSTEM DESCRIPTION

A. Grounding systems use the following elements as grounding electrodes:

1. Existing Metal underground water pipe.
2. Concrete-encased electrode.
3. Rod electrode.
4. Plate electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit data on grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

D. Manufacturer's Installation Instructions: Submit for active electrodes.

E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

B. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

D. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

1.11 COORDINATION

A. General Conditions: Requirements for coordination.

B. Complete grounding and bonding of building reinforcing steel prior concrete placement.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES

A. Product Description:
1. Material: Copper-clad steel.
2. Diameter: 3/4 inch (19 mm).
3. Length: 8 feet(2.4 m).

B. Connector: Connector for exothermic welded connection.

2.2 WIRE

A. Material: Stranded copper.

B. Foundation Electrodes: As shown on drawings.

C. Grounding Electrode Conductor: Copper conductor bare.

D. Bonding Conductor: Copper conductor bare.

2.3 GROUNDING WELL COMPONENTS

A. Well Pipe: 8 inches NPS (DN200) by 18 inches (600 mm) long concrete pipe with belled end.

B. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2.4 MECHANICAL CONNECTORS

A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.5 EXOTHERMIC CONNECTIONS

A. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Verification of existing conditions before starting work.

B. Verify final backfill and compaction has been completed before driving rod electrodes.

3.2 PREPARATION

A. Remove paint, rust, mill oils, surface contaminants at connection points.

3.3 EXISTING WORK

A. Modify existing grounding system to maintain continuity to accommodate renovations.

B. Extend existing grounding system using materials and methods as specified.

3.4 INSTALLATION

A. Install in accordance with IEEE 142.

B. Install grounding and bonding conductors concealed from view.

C. Install grounding well pipe with cover at each rod location. Install well pipe top flush with finished grade.

D. Install grounding electrode conductor and connect to reinforcing steel in foundation footing as indicated on Drawings. Electrically bond steel together.

E. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

F. Install continuous grounding using underground cold water system and building steel as grounding electrode. Where water piping is not available, install artificial station ground by means of driven rods or buried electrodes.

G. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

H. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.

I. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

J. Grounding electrical system using continuous metal raceway system enclosing circuit conductors in accordance with NEC.

K. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.5 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground resistance testing in accordance with IEEE 142.

E. Perform continuity testing in accordance with IEEE 142.

F. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION 260526

SECTION 260530 – SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

PART 1 – GENERAL

1.1 SUMMARY

A. Structural design and calculations for major equipment anchoring, conduit support, and bracing details.

1.2 RELATED SECTIONS

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

1.3 REFERENCES

A. International Building Code, 2012

1.4 CODE INFORMATION

A. This project is subject to the seismic bracing requirements of the International Building Code, 2012 edition. The following criteria are applicable to this project.

1. Seismic Use Group: II
2. Site Class Category: B
3. Seismic Design Category: D
4. See Architectural cover Sheet Code Analysis for additional information.

B. It is recommended that the contractor enlist the services of a qualified seismic bracing vendor/supplier. Provide bracing for identified equipment and system.

C. Resistance to lateral forces induced by earthquakes shall be accomplished with consideration of friction resulting from gravity loads. The following companies are listed as resources for the Contractor to consider for obtaining competent assistance regarding the seismic bracing of mechanical piping and equipment. Since seismic constraint is not a common mechanical requirement for projects, and considering that the requirements are specific and include technical expertise, this information may be helpful.

1. Amber Booth
2. Cooper B-Line
3. Mason Industries
4. Tolco (Division of Nibco)

1.5 SUBMITTALS

A. Shop Drawings: Detail drawings along with catalog cuts, templates, and erection and installation details, as appropriate, for the items listed. Submittals shall be complete in detail; shall indicate thickness, type, grade, class of metal, and dimensions; and shall show construction details, reinforcement, anchorage, and installation with relation to the building construction.

1. Lighting Fixtures in Buildings.

2. Equipment Requirements.

B. Product Data:

1. Copies of the design calculations with the detail drawings. Calculations shall be stamped by a registered engineer in the State of Nevada and shall verify the capability of structural members to which bracing are attached for carrying the load from the brace. Structural seismic calculations for equipment anchorage for major equipment shall be included.

2. Contractor Designed Bracing: Copies of the Design Calculations with the Drawings. Calculations shall be approved, certified, stamped and signed by a Registered Professional Engineer. Calculations shall verify the capability of structural members to which bracing are attached for carrying the load from the brace.

C. Include Seismic Certification for major equipment.

1. Light Fixtures.
2. Switchboards.
3. Panelboards.
4. LV Padmounted transformer.

1.6 QUALIFICATION

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five years. When requested by the engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic qualified equipment as follows:
The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the 2012 International Building Code (IBC) Site Classification D. The site coefficients Fa=1.0, and spectral response accelerations of Ss=1.334g, S1=0.53g are used. The test response spectrum shall be based upon a 5% damping factor, and a peak (Sds) of at least 2.15g's (3-12 Hz) applied at the base of the equipment in the horizontal direction. The forces in the vertical

direction shall be at least 66% if those in the horizontal direction. The tests shall cover a frequency range from 1 to 100Hz. Guidelines for the installation consistent with these requirements shall be provided by the equipment manufacturer and based upon testing of representative equipment. Equipment certification acceptance criteria shall be based upon the ability for the equipment to be returned to service immediately after a seismic event within the above requirements without the need for repairs.

1.7 SYSTEM DESCRIPTION

A. The requirements for seismic protection measures described in this section shall be applied to the electrical equipment and systems listed below.

B. Electrical Equipment: Electrical equipment shall include the following items to the extent required on the Drawings or in other sections of these specifications:

1. Light Fixtures.
2. Switchboards.
3. Panelboards.
4. LV Padmounted transformer and switch.

C. Electrical Systems: The following electrical systems shall be seismically protected in accordance with this specification: Lighting, power, security, communications and fire alarm.

D. Conduits Requiring No Special Seismic Restraints: Seismic restraints may be omitted from electrical conduit less than 2-1/2 inches trade size. All other interior conduit, shall be seismically protected as specified.

1.8 EQUIPMENT REQUIREMENTS

A. Rigidly Mounted Equipment: Constructed and assembled to withstand the seismic forces in accordance with IBC 2012. Each item of rigid electrical equipment shall be entirely located and rigidly attached on one side only of a building expansion joint. Piping, electrical conduit, etc., which cross the expansion joint shall be provided with flexible joints that are capable of accommodating displacements equal to the full width if the joint in both orthogonal directions.

PART 2 – PRODUCTS

2.1 LIGHTING FIXTURE SUPPORTS

A. Lighting fixtures and supports shall conform to UL 1570, UL 1571, UL1572, UL1573 or UL1574 as applicable.

PART 3 – EXECUTION

3.1 SWAY BRACES FOR CONDUIT

A. Sway bracing materials shall consist of rods, plates, angles, etc.

3.2 LIGHTING FIXTURES IN BUILDINGS

A. Pendant Fixtures: Per manufacturer's mounting requirements and details on plans. Provide sway bracing for all pendant fixtures that will hit something if they sway less than 45 degrees.

1. Pendent fixtures must be able to sway 45 degrees from vertical without hitting ductwork, piping, walls, soffits, etc. Where this is not possible provide sway bracing per detail on plans.

B. Ceiling Attached Fixtures:

1. Recessed Fluorescent Fixtures: Recessed fluorescent individual or continuous-row mounted fixtures shall be supported be a seismic-resistant suspended ceiling support system built in accordance with the ASTM E 580. Recessed lighting fixtures not over 56 pounds in weight may be supported be and attached directly to the ceiling seismic design. Fixture accessories, including louvers, diffusers, and lenses shall have lock or screw attachments.

2. Surface-Mounted Fluorescent Fixtures: Surface-mounted fluorescent individual or continuous-row fixtures shall be attached to a seismic-restraint ceiling support system built in accordance with ASTM E 580.

C. Assembly Mounted on Outlet Box: A supporting assembly, that is intended to be mounted on an outlet box, shall be designed to accommodate mounting features on 4-inch boxes, plaster rings, and fixture studs.

D. Wall-Mounted Emergency Light Unit: Attachments for wall-mounted emergency light units shall be designed and secured for the worst expected seismic disturbance at the site.

3.3 ANCHOR BOLTS

A. Cast-In-Place: Floor or pad mounted equipment shall use cast-in-place anchor bolts or Hilti HDA anchors as indicated. One nut shall be provided on each bolt. Anchor bolts shall conform to ASTM F 1554, Grade 36. Anchor bolts shall have an embedded straight length equal to at least 12 times nominal diameter of the bolt. Anchor bolts that exceed the normal depth of equipment foundation piers or pads shall either extend into concrete floor or the foundation shall be increased in depth to accommodate bolt lengths.

B. Expansion or Chemically Bonded Anchors: Expansion or chemically bonded anchors shall not be used unless test data in accordance with ASTM E 488 has been provided verify the adequacy of the specific anchor and application. Expansion of chemically bonded anchors shall not be used to resist pull-out in overhead and wall installations.

3.4 RESILIENT VIBRATION ISOLATION DEVICES

A. Where the need for these devices is determined, based on the magnitude of the design seismic forces, selection of anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations shall follow the same procedure as in paragraph ANCHOR BOLTS, except that an equipment weight equal to three times the actual equipment weight shall be used.

3.5 SWAY BRACES FOR CONDUIT 2-1/2" TRADESIZE AND GREATER

A. Sway braces shall be provided to prevent movement of the conduits under seismic loading. Braces shall be provided in both the longitudinal and transverse directions, relative to the axis of the pipe. The bracing shall not interfere with thermal expansion requirements for the pipes as described in other sections of these specifications.

B. Transverse Sway Bracing: Install transverse sway bracing for steel and conduit. All runs (length of pipe between end joints) shall have a minimum of two transverse braces.

C. Longitudinal Sway Bracing: Longitudinal sway bracing shall be provided at 40 foot intervals unless otherwise indicated. A;; runs (length of conduit between end joints) shall have one longitudinal brace minimum. Branch lines, walls, or floors shall not be used as sway braces.

D. Vertical Runs: Run is defined as length of pipe between end joints. Vertical runs of conduit shall be braced at not more than 10-foot vertical intervals. Braces for vertical runs shall be above the center of gravity of the segment being braces. Sway braces shall not be used as sway braces.

E. Clamps and Hangers: Clamps or hangers in conduits shall be applied directly to conduit.

F. Anchor Rods, Angles, and Bars: Anchor rods, angles, and bars shall be bolted to either pipe clamps or pipe flanges at one end and cast-in-place concrete or masonry insert or clip angles bolted to the steel structure in the other end. Rods shall be solid metal or pipe as specified below. Anchor rods, angles, and bars shall not exceed lengths given in the tabulation below.

3.6 EQUIPMENT SWAY BRACING

A. Suspended Equipment: Equipment sway bracing shall be provided for items supported from overhead structural systems. Braces shall consist of angles, rods, bars, or pipes and secured at both ends with not less than ½-inch bolts. Sufficient braces shall be provided for equipment to resist a horizontal force equal to three times the weight of equipment without exceeding safe working stress of bracing components. Details of equipment bracing shall be submitted for acceptance. In lieu of bracing with vertical supports, these items may be supported and braced with hangers inclined at 45 degrees directed up and radially away from equipment and oriented symmetrically in 90-degree intervals on the horizontal plane, bisecting the angles of each corner of the equipment, provided that supporting members are properly sized to support operating weight of equipment when hangers are inclined at a 45-degree angle.

B. Floor or Pad Mounted Equipment:

1. Shear Resistance: Floor mounted equipment shall be bolted to the floor. Requirements for the number and installation of bolts to resist shear forces shall be in accordance with paragraph ANCHOR BOLTS.

2. Overturning Resistance: The ratio of the overturning moment from seismic forces to the resisting moment due to gravity loads shall be used to determine if overturning forces need to be considered in the sizing of anchor bolts. Calculations shall be provided to verify the adequacy of the anchor bolts for combined shear and overturning.

END OF SECTION 260530

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:
1. Section 26 05 03 - Equipment Wiring Connections.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 26 05 53 - Identification for Electrical Systems.
5. Section 26 27 26 - Wiring Devices.
6. Section 27 05 28 – Interior Communications Pathways.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.

B. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground: Provide schedule 40 PVC. Provide pre-cast concrete or nonmetallic handholes, vaults or manholes.

C. Under Slab on Grade within the Building Perimeter: Provide schedule 40 PVC. Refer to Section 26 05 34.

D. Outdoor Locations, Above Grade: Provide electrical metallic tubing. Where exposed to physical damage and heavy moisture (including roof tops) use rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. In Slab on grade or elevated slabs: Not Permitted.

F. Interior Wet Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

G. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

H. Exposed Dry Locations: Provide electrical metallic tubing, except where exposed to physical damage; provide rigid steel conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: ¾ inch (19mm) unless otherwise specified. Comply with NEC for minimum size conduit and installation requirements. Minimum size ¾ inch diameter for branch circuits, minimum size 3/4 inch diameter for homeruns. Minimum size for PVC conduit shall be 3/4 inch in diameter. Conduits shall be installed complete end-to-end prior to installing conductors.

1.5 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit for the following:
1. Flexible metal conduit.
2. Liquidtight flexible metal conduit.
3. Nonmetallic conduit.
4. Flexible nonmetallic conduit.
5. Nonmetallic tubing.
6. Raceway fittings.
7. Conduit bodies.
8. Surface raceway.
9. Wireway.
10. Pull and junction boxes.
11. Handholes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents:
1. Record actual routing of conduits 2” and larger.
2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Product storage and handling requirements.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. General Conditions: Coordination and project conditions.

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Intermediate Metal Conduit (IMC): Rigid steel.

C. Fittings and Conduit Bodies: NEMA FB 1; all steel fittings. Threadless fittings shall not be used.

D. Terminate rigid conduit in dry locations with two steel locknuts, one inside, one outside of the cabinet, junction box or outlet box and an insulated bushing. Bushings shall be malleable iron or steel with smooth insulating ring molded into edge of bushing to prevent damage to cable. Insulated bushings shall be 150 degree C self extinguishing thermoplastic. Provide grounding bushings on 1 ½ inch conduit and larger. Construction of bushings shall be similar to steel bushings described above except provide lugs for grounding connection.

E. Where conduits are installed underground, the threaded joints shall be sealed with a conductive joint sealing compound.

2.2 PVC COATED METAL CONDUIT

A. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil (0.05 mm) thick.

B. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction.

B. Fittings: NEMA FB 1.

C. Connectors and fittings galvanized steel, threadless type with insulated throats, U.L. approved for grounding means.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: Interlocked steel construction with PVC jacket.

B. Fittings: NEMA FB 1.

C. Fitting Assembly – Sealing type, with steel gland, nylon ring and ground cone inside locknut. All fittings with insulated throat, U.L. approved for grounding means.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; use insulated throat galvanized steel, rain tight, compression or set screw type. Compression type must be used in all medical facilities and in damp locations. Provide grounding bushing on 1¼ inch and larger. **Zinc alloy and similar soft metal castings are not allowed.**

2.6 NONMETALLIC CONDUIT

A. Product Description: NEMA TC 2; Schedule 40 PVC. Minimum sizes shall be 3/4 inch by diameter.

B. Fittings and Conduit Bodies: NEMA TC 3.

C. Fittings same material as conduit and installed with watertight joint compound recommended by manufacturer.

2.7 WIREWAY

A. Product Description: NEMA Type 1, General purpose, Oiltight and dust-tight. NEMA Type 3R, raintight type wireway as required to meet project conditions. Open top assembly.

B. Knockouts: NEMA Type 1, Manufacturer's standard. NEMA Type 3R – none.

C. Size: As indicated on Drawings.

D. Cover: NEMA Type 1 – removable hinged cover latches with captive screws. NEMA Type 3R – removable cover with quick release latches and full gaskets.

E. Connector: Slip-in.

F. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.8 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch (13 mm) male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Furnish gasketed cover by box manufacturer.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26.

E. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.9 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4, flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6,inside flanged, recessed cover box for flush mounting:
   1. Material: Galvanized cast iron.
   2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
   3. Cover Legend:["ELECTRIC".

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 EXISTING WORK

A. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces.

B. Remove concealed abandoned raceway to its source.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets when raceway is abandoned and removed. Install blank cover for abandoned outlets not removed.

3.3 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.4 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit in and under slab from point-to-point.

K. Maintain clearance between raceway and piping for maintenance purposes.

L. Maintain 12 inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

P. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Install no more than equivalent of three 90 degree bends (270 degrees total) between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

S. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

T. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

U. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

V. Close ends and unused openings in wireway.

W. Use rigid metal conduit or PVC coated rigid steel conduit on all through slab transitions. Except through slab penetrations terminating at floor mounted equipment, and/or housekeeping pads may be PVC. Use rigid metal conduit elbows 2-lap wrapped with 20mil

3M Scotch wrap or tape or PVC coated rigid steel conduit on all underground/ underslab raceways 2 inches and larger.

X. Use rigid steel conduit for all medium voltage feeders. Medium Voltage feeders located underground outside the building may be PVC encased in concrete per the Electrical Site Plan.

Y. Use rigid steel conduit for all motor circuits where subject to physical damage or below 10' AFF.

Z. Intermediate grade metal conduit, (threaded only), may be used in lieu of rigid steel conduit where allowed by NEC.

AA. Use flexible conduit, "greenfield" for:
1. Connection to vibrating equipment in dry locations between rigid conduit and connection box on equipment.
2. Final connections to equipment in dry locations.
3. Final connections to equipment requiring adjustments.
4. Final connections to recessed lighting fixtures from conduit system.
5. Connection to distribution transformers.
6. Connection to bus duct plug-in switches.
7. Maximum length 6'.

BB. Use Liquidtight flexible conduit in damp or wet locations for same circuit categories listed for flexible conduit above. Engineer will determine "damp or wet" locations if questionable.

CC. EMT shall not be installed underground and shall not be encased in concrete.

DD. Conduit must be installed high enough above lay in ceiling to permit removal of ceiling panels and light fixtures.

EE. In concrete slab on grade or elevated slabs: Conduit may penetrate slabs but will **NOT** be allowed to run in slabs on grade or elevated slabs.

FF. Run conduit below the roofing assembly. In accordance with NEC 300.4 conduit may not be run exposed across roof.

GG. Due to the corrosive nature of the soil all metal conduit, couplings, elbows and fittings in contact with the soil or buried below grade shall be factory coated with PVC or two-lap wrapped with 20 mil 3M Scotchwrap with Pipe Primer applied as recommended by Manufacturer. Make underground conduit fittings watertight using conductive compound tape. Do not use split couplings and similar fittings underground and exposed to moisture.

HH. Route underground conduits minimum 24" below grade.

II. Paint conduit threads exposed to moisture with exterior grade, rust preventive silver paint after installation.

JJ. Where conduit crosses expansion joints, install expansion type fittings with bonding jumper. Use expansion joint with lateral conduit movement of 4" or 8" as indicated. When both vertical and lateral movement is expected the joint shall be a 1" braided flexible coupling allowing both directional movements.

KK. For vertical conduit runs from the first floor to upper floors, each floor deck shall be considered an expansion joint. Provide expansion type fittings to allow for up to 2" movement in addition to any thermal expansion or contraction expected to occur.

LL. Make connections to equipment away from wall with rigid or IMC conduit extensions exposed from ceiling to floor, anchored with floor flange and/or angle frame as required. Make connections to equipment with flexible conduit from tee conduit body in conduit riser.

MM. Vibrating equipment and equipment requiring adjustment, i.e.: motors, transformers, etc: make final connections with liquid-tight flexible metal conduit.

NN. Isolate conduit connections to equipment on roof from roof penetration of conduit with short section of liquid-tight flexible conduit between roof penetration and equipment to prevent leak in roof penetration due to equipment vibration.

OO. Supports shall be installed in accordance with Seismic standards. Provide necessary side braces and swing joints as required. See Spec Section 26 05 30 Seismic Protection for Electrical Equipment.

3.5 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches (150 mm) separation. Install with minimum 24 inches (600 mm) separation in rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

P. Seal boxes during construction to prevent entrance of construction debris.

Q. Paint wiring connections in ground mounted outlets or floor outlets in wet locations with “Scotchkote” and fill box with “Duxseal”.

R. Where outlet boxes are installed in unfinished concrete walls or columns, provide 1” deep plaster ring with box and ring set in position before the concrete in poured so concrete will fill around the ring and cover plate can be installed flush with the unfinished surface. In case of brick walls, follow same procedure with mason filling around the plaster ring with mortar.

S. Install all outlets located on columns or walls, provide 6” x 6” x 3” deep wood box placed in the forms before concrete in poured. Remove wood box before waterproofing is applied. General Contractor will waterproof wall and opening, after which Electrical Contractor will install outlet box. General Contractor will grout around box. Set boxes carefully so that cover plates will be flush with the surface and square.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.7 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.8 CLEANING

A. General Conditions: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION 260533

SECTION 260553 – ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide and install required identification for the systems and equipment shown on the drawings and/or specified. The extent of identification is specified herein and in individual technical sections of work.

B. Coordinate with Consultant and Owner for proper equipment identification nomenclature. Nameplates must be approved by Consultant prior to ordering and installation.

C. Types of electrical identification include:
1. Conduit labeling.
2. Buried cable and conduit warnings.
3. Cable/conductor identification.
4. Operational instructions and warnings.
5. Danger signs.
6. Equipment/system identification labels and signs.
7. Device plate labeling.
8. Junction box labeling.

1.2 RELATED WORK

A. Painting of conduit and color coded painting of conduit if required. See Division 9.

1.3 SUBMITTALS

A. Manufacturer's Data
1. Product specifications and installation instructions for each material and device.

B. Samples
1. Provide for each color, lettering style and other graphic representation.

C. Labels
1. Provide a list of labels with actual designations as they will be printed.

PART 2 - PRODUCTS

2.1 ELECTRICAL IDENTIFICATION MATERIAL

Conform to ANSI A13.1, Table 3 for minimum size of legend letters and minimum length of color field for each raceway or cable size. Use colors prescribed by ANSI A13.7, NFPA 70 and these specifications.

A. Color-Coded Conduit Markers
1. Manufacturer's standard preprinted, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits. Attach with adhesive, adhesive lap joint of marker, matching adhesive plastic tape at each end of marker, or pre-tensioned snap-on. Lettering to indicate voltage, function of conductors in conduit and shall be 8" minimum length (i.e. ac power, dc power, fire alarm).

B. Color-Coded Plastic Tape

1. Manufacturer's standard self-adhesive vinyl tape, minimum 3 mils thick by 1-1/2" wide.
2. Color: Orange.

C. Underground Plastic Line Marker
1. Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, for direct-burial service; minimum 4" wide x 4 mils thick. Printing to indicate type service of cable; with large (minimum 2-1/2") high letters.

D. Cable/Conductor Identification Bands
1. Manufacturer's standard vinyl self-adhesive self laminating cable/conductor markers, wrap-around type; pre-numbered plastic coated, or write-on type with clear plastic self-adhesive cover flap, lettered to show circuit identification. Similar to Panduit "Instacode" or accepted equivalent by T&B, or Tyton. Refer to Section 26 05 19 Low Voltage Electrical Power Conductors and Cables.

E. Self-Adhesive Plastic Signs
1. Manufacturer's standard, self-adhesive, pre-printed, flexible vinyl signs for operational instructions or warnings. Sizes suitable for application and visibility, with proper wording for application.
2. Color: Orange or Yellow with black lettering.

F. Danger Signs
1. Manufacturer's standard "DANGER" signs, baked enamel finish on 20 gage steel; standard red, black and white graphics; 14" x 10" unless 10" x 7" is largest which can be applied, or where larger size is needed for visibility use recognized explanation wording (as examples: HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH, DANGER-STARTS AUTOMATICALLY).

G. Engraved Signs (Nameplates)
1. Use 1/8" thick melamine plastic laminate, complying with FS LP-387, sizes as indicated, engrave with standard letter style of sizes and wording indicated (1/4" letters minimum).
2. Color: Black field with white letters for normal power service;
Red field, white letters for emergency/standby service;
Orange field, white letters for UPS service
3. Fasteners: Self adhesive backing or double stick tape.

H. Permanent Polyester Tape:
1. Use Permanent Metalized Polyester Tapes for Industrial purposes that are resistant to oil, solvents and chemicals, these durable tapes adhere to all surface.
2. DYMO #18485, Black on Silver, 3/8” wide, or equivalent.

I. Lettering and Graphics
1. Coordinate names, abbreviations and other designations used with those shown or specified. Provide numbers, lettering, and wording as indicated or required for identification and operation/maintenance.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements
1. Install after completion of painting.
2. Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. Conduit Identification

1 Use adhesive marking tape labels, Brother or Kroy labels 1" high x 12" long (min.), at 20 foot intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible. Labels for multiple conduits shall be aligned. Use the following colors:

a. Above 600 Volts: Conduit 2” and larger - Black letters on orange background indicating feeder identification and voltage. Feeders within walls: provide identification on wall surfaces directly external to the conduits. Alternate identification labels with "DANGER - HIGH VOLTAGE" warning signs of the same color.

b. 600 Volt and Below Normal: Conduit 2” and larger - White letters on black background indicating feeder identification and voltage. Not required unless otherwise noted.

c. 600 Volt and Below Emergency: All conduit - White or black letters on red background indicating feeder identification and voltage. Not required unless otherwise noted

d. 600 Volt and Below UPS: All conduit - Black letters on yellow background indicating feeder identifications, circuit number and voltage. Not required unless otherwise noted

e. Fire Alarm: All conduit shall be manufactured red.

f. Temperature Control: White or black letters on blue background indicating "TEMP. CONTROL"

g. Ground: All conduit - White or black letters on green background

h. Network Fiber: All conduit - Black letters on white background indicating "NETWORK FIBER."

2. Where conduits enter or exit a panelboard, pull or junction box, switchboard, or other distribution equipment, conduit labels shall include circuit number in addition to feeder identification and voltage.

3. For overhead conduits, place identification such that it can be read standing on the floor below.

C. Underground Cable Identification

1. During back-filling of underground cable, install continuous underground marker, directly over buried line 6" to 8" below finished grade. Where multiple lines are buried in common trench not exceeding 24" width, install a single line marker. Install additional line markers for each increment of 24” width, i.e., 36” wide trench - 2 markers; 54” wide trench, 3 markers. Install multiple markers evenly spaced.

2. Install line marker for every buried ductbank and/or conduits 3" diameter or larger.

3. Electric Lines: Use red colored tape with lettering stating “CAUTION BURIED ELECTRIC LINE BELOW”.

4. Communication Lines: Use orange colored tape with lettering stating “CAUTION COMMUNICATION LINE BELOW”.

D. Operational Identification and Warnings

1. Provide operational signs for:

a. Switchgear

b. Automated breakers

c. Transfer switches

d. Large motor starters

e. Engine-generator

f. All rotating equipment

g. Decommissioned equipment to read "Retired in Place."

E. Danger Signs

1. Provide for medium voltage switchgear, sectionalizing loop switches, etc., as shown and described herein.
2. Provide for engine generators and other automatic equipment, i.e.: “Danger-Starts Automatically”.
3. Provide as required by codes.

F. Engraved Plastic Laminated Signs
1. Install on each major unit of electrical equipment in the building. Provide single line of text, 1/4" high lettering on 1" high sign (1-1/2" high where 2 lines required). Matching terminology and numbering as indicated in contract documents.
2. Provide signs for each unit of the following categories:
   a. Electrical cabinets and enclosures: Indicate cabinet designation, voltage, phase and feeder origin.
   b. Access panel/doors to electrical facilities: Indicate room name and use.
   c. Major electrical switchgear: Indicate equipment designation, voltage, phase and feeder origin.
   d. Electrical substations: Indicate equipment designation, voltage, phase and feeder origin.
   e. Safety switches, circuit breakers and portable engine disconnects: Indicate equipment designation, voltage, phase, feeder origin and circuit number.
   f. Transformers: Indicate transformer designation, voltages, phases, feeder origin, circuit number and equipment served.
   g. Feeder cables inside pull and junction boxes and inside all switchgear at terminals indicating source and destination: Fasten with nylon ties.
   h. All equipment furnished in this Division of the specifications: Indicate equipment designation, voltage, phase, feeder origin and circuit number.

G. Install signs where indicated or most visible. Secure with at least two cadmium-plated screws. Where substrate cannot receive screws, use industrial epoxy cement to secure signs. Self-adhesive or double stick tape is acceptable. Secure with cadmium plated screws on porous surfaces.

H. Identify all conduits installed for future use.

I. Junction, Pull and Connection boxes. Identification of systems and circuits shall indicate system voltage and identity of contained circuits on outside of box cover. Color code shall be same as conduits for pressure sensitive labels. Use self-adhesive marking tape labels at exposed locations and indelible black marker at concealed boxes. All fire alarm boxes shall have red covers. All temperature control boxes shall have blue covers.

J. Branch Circuit Conductors shall be identified in each junction box and pull box with wire markers as manufactured by T & B, Panduit, 3M or Ideal to indicate panel/circuit number.

K. Junction Boxes in branch circuit wiring shall be labeled with panel and circuit numbers. Junction boxes for special systems shall be labeled with system name and other identification as directed; for example, “fire alarm-zone 1”. Where boxes are installed flush mounted in finished areas or surface mounted in unfinished areas, labeling shall be with engraved plastic nameplate as specified herein. Where boxes are installed above accessible ceilings, labeling may be neat hand written lettering with indelible marker.

L. Device Plates – switches and receptacles. Identify the panelboard and branch circuit number from which served on the front of the device plate with Permanent Polyester Clear Tape with black letters. Locate all labels at the bottom of the plate in the same location throughout.

END OF SECTION 260553

SECTION 260573 – OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes short circuit and protective device coordination study encompassing portions of electrical distribution system from normal power source or sources up to and including breakers in service entrance switchboard, fuses in service entrance switchboard, main breaker in sub-distribution panels, fuses in sub-distribution panels and main breaker in each panelboard.

B. Related Sections:
   1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
   2. Section 26 24 16 - Panelboards.
   3. Section 26 28 19 - Enclosed Switches.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers:
   1. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).

B. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

1.3 DESIGN REQUIREMENTS

A. Complete Short Circuit and Protective Device Coordination Study to meet requirements of NFPA 70 and NEC 700.27 for selective coordination.

B. Report Preparation:
   1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
   2. Perform study with aid of computer software program.
   3. Obtain actual settings for packaged chiller and motor characteristics and for equipment incorporated into Work.
   4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
      a. Utility supply bus.
      b. Medium voltage air interrupter switchgear.
      c. Switchboards.
      d. Distribution panelboards.
      e. Branch circuit panelboards.
      f. Each other significant equipment location throughout system.
   5. Starting point for study shall be at 10 milliseconds.

C. Report Contents:
   1. Include the following:
      a. Calculation methods and assumptions.
      b. Base per unit value selected.

c. One-line diagram.
d. Source impedance data including power company system available power and characteristics.
e. Typical calculations.
   1) Fault impedance.
   2) X to R ratios.
   3) Asymmetry factors.
   4) Motor fault contribution.
   5) Short circuit kVA.
   6) Symmetrical and asymmetrical phase-to-phase and phase-to-ground fault currents.
   7) Tabulations of calculation quantities and results.
f. One-line diagram revised by adding actual instantaneous short circuits available.
g. State conclusions and recommendations.

2. Prepare time-current device coordination curves graphically indicating coordination proposed for system, centered on conventional, full-size, log-log forms.
3. Prepare with each time-curve sheet complete title and one-line diagram with legend identifying specific portion of system covered by that particular curve sheet.
4. Prepare detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
5. Plot device characteristic curves at point reflecting maximum symmetrical fault current to which device is exposed. Include on curve sheets the following:
   a. Power company relay characteristics.
   b. Power company fuse characteristics.
   c. Medium voltage equipment protective relay characteristics.
   d. Medium voltage equipment protective fuse characteristics.
   e. Low voltage equipment circuit breaker trip device characteristics.
   f. Low voltage equipment fuse characteristics.
   g. Cable damage point characteristics.
   h. Pertinent transformer characteristics including:
      1) Transformer full load current.
      2) Transformer magnetizing inrush.
      3) ANSI transformer withstand parameters.
      4) Significant symmetrical fault current.
   i. Pertinent motor characteristics.
   j. Transfer switch characteristics.
   k. Other system load protective device characteristics.

1.4 ARC FLASH HAZARDS ANALYSIS STUDIES

A. Scope of Study
Determine the short-circuit current available at the designated point of contact and perform the following to provide adequate protection:
1. Calculate the flash protection boundary
2. Calculate the arc-flash incident energy.
3. Confirm the required labeling.
4. Confirm the required personal protective equipment with arc rating to provide adequate protection for personnel working on or near energized conductors or components.

B. Procedure

The actual short-circuit available current is to be determined from a recent short circuit study. If the actual short-circuit is not known, calculate incident energy using the nearest transformer that would supply the fault current. The flash protection boundary will be calculated in accordance with NFPA 70E. The arc-flash incident energy is to be calculated using the equations in NFPA 70E.

Provide Warning Labels on all switchboards, panelboards and motor control centers for "Arc Flash and Shock Hazard Appropriate PPE Required" listing the following:

1. Available 3 phase Short-Circuit Current
2. Flash Protection Boundary
3. Incident energy at 18" expressed in cal/cm2
4. PPE required
5. Voltage shock hazard
6. Limited shock approach boundary
7. Restricted shock approach boundary
8. Prohibited shock approach boundary

1.5 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Qualifications Data: Submit the following for review prior to starting study.
   1. Submit qualifications and background of firm.
   2. Submit qualifications of Professional Engineer performing study.

C. Software: Submit for review information on software proposed to be used in performing study.

D. Product Data: Submit the following:
   1. Report: Summarize results of study in report format including the following:
      a. Descriptions, purpose, basis, and scope of study.
      b. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short-circuit duties, and commentary regarding same.
      c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.
      d. Fault current calculations including definition of terms and guide for interpretation of computer printout.

E. Submit copies of final report signed by professional engineer. Make additions or changes required by review comments.

1.6 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

B. Use commercially available software, designed specifically for short circuit and protective device coordination studies with minimum of 5 years documented availability approved by Architect/Engineer.

C. Perform study in accordance with IEEE 242.

1.7 QUALIFICATIONS

A. Study Preparer: Company specializing in performing work of this section with minimum 5 years documented experience.

B. Perform study under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Nevada with minimum of five years experience in power system analysis.

C. Demonstrate company performing study has capability and experience to provide assistance during system start up.

1.8 PRE-INSTALLATION MEETINGS

A. General Conditions: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.9 SEQUENCING

A. General Conditions: Requirements for sequencing.

B. Allow for review of completed study by Architect/Engineer.

C. Submit short circuit and protective device coordination study to Architect/Engineer prior to receiving final approval of distribution equipment shop drawings and prior to releasing equipment for manufacturing.

D. When formal completion of study will cause delay in equipment manufacturing, obtain approval from Architect/Engineer for preliminary submittal of study data sufficient in scope to ensure selection of device ratings and characteristics will be satisfactory.

1.10 SCHEDULING

A. General Conditions: Requirements for scheduling.

B. Schedule work to expedite collection of data to ensure completion of study for final approval of distribution equipment shop drawings prior to release of equipment for manufacturing.

1.11 COORDINATION

A. General Conditions: Requirements for coordination.

B. Coordinate work with local power company.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Provide assistance to electrical distribution system equipment manufacturer during start up of electrical system and equipment.

C. Select each primary protective device for delta-wye connected transformer so device's characteristic or operating band is within transformer characteristics, including point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection.

D. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by 16 percent current margin to provide proper coordination and protection in event of secondary line-to-line faults.

E. Separate medium-voltage relay characteristic curves from curves for other devices by at least 0.4 second time margin.

3.2 ADJUSTING

A. General Conditions: Requirements for starting and adjusting.

B. Perform field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Adjust settings in accordance with approved short circuit and protective device coordination study.

END OF SECTION 260573

SECTION 262416 – PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Distribution and branch circuit panelboards.
2. Electronic grade branch circuit panelboards.

B. Related Requirements:
1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers:
1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:
1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
5. NEMA PB 1 - Panelboards.
6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:
1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc.:
1. UL 50 - Cabinets and Boxes
2. UL 67 - Safety for Panelboards.
3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
4. UL 1283 - Electromagnetic Interference Filters.
5. UL 1449 - Transient Voltage Surge Suppressors.
6. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Product Data: Submit catalog data showing specified features of standard products.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

D. Source Quality control submittals: Indicate results of factory tests and inspections.

E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Requirements for submittals.

B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.

C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. General Conditions: Requirements for maintenance products.

B. Extra Stock Materials:
1. Furnish two of each panelboard key. Panelboards keyed alike.

1.6 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.1 BRANCH CIRCUIT PANELBOARDS

A. Manufacturer List:

Manufacturer	Lighting Panels rated 240V	Lighting Panels rated 480/277V	Distribution Panels rated 600V
Milbank	NQOD CP3A		
Cooper GE	CMP		

B. Substitution Limitations:
1. General Conditions: Requirements for substitutions for other manufacturers and products.

C. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

D. Materials:
1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

2. For non-linear load applications subject to harmonics furnish 200 percent rated, plated copper, solid neutral.
3. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.
4. Molded Case Circuit Breakers: UL 489, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Provide UL class 760 arc-fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
5. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.
6. Surge Suppresser: Integrated in panelboard, refer to Section 26 35 56.
7. Enclosure: NEMA PB 1, Type 1 or Type 3R as required to meet service conditions.
8. Split solid neutral shall be plated and located in the main compartment up to 225 amperes so incoming neutral cable may be of the same length. UL listed paneboards with 200% rated solid neutral shall be plated copper for non-linear load applications. Panelboards shall be marked for non-linear load applications.
9. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twist-outs covering unused mounting space.
10. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL listed for reverse connection without restrictive line or load markings. Circuit breaker handle accessories shall provide provisions for locking handle in the OFF position.

E. Cabinet Front: Door-in-door Flush or Surface cabinet front as indicated on drawings with concealed trim clamps, concealed hinge, plastic directory card holder, and flush lock keyed alike. Front shall have cylindrical tumbler type lock with catch and spring-loaded door pull. All lock assemblies shall be keyed alike. Finishes:
   1. Finish in manufacturer's standard gray enamel.

2.2 SOURCE QUALITY CONTROL

A. General Conditions: Testing, inspection and analysis requirements.

B. Independently test integral surge suppressers with category C3 high exposure waveform (20 kV-1.2/50us, 10kA-8/20 us) per IEEE C62.41.

PART 3 EXECUTION

3.1 DEMOLITION

A. Disconnect abandoned panelboards and load centers. Remove abandoned panelboards and load centers.

3.2 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1.

B. Install panelboards plumb.

C. Install recessed panelboards flush with wall finishes.

D. Height: 6 feet (1800 mm) to top of panelboard install panelboards taller than 6 feet (1800 mm) with bottom no more than 4 inches (100 mm) above floor.

E. Install filler plates for unused spaces in panelboards.

F. Provide typed circuit directory for each branch circuit panelboard [and load center]. Revise directory to reflect circuiting changes to balance phase loads. Identify each circuit as to its clear, evident and specific purpose of use.

G. Install engraved plastic nameplates in accordance with Section 26 05 53.

H. Install spare conduits out of each recessed panelboard to accessible location above ceiling and below slab not on grade. Minimum spare conduits: 5 empty 1 inch (DN27) (above and below). Identify each as SPARE.

I. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

J. Provide each panelboard with nameplate showing panel designation, voltage rating and phase. Indicate source of power (feeder origin) and feeder size (awg/mils and conduit).

K. Label shall be engraved laminated-plastic nameplate. Nameplates shall be black with white letters (normal power) or red with white letters (emergency power).

L. Mount panelboards securely to building structure with 3/8" minimum diameter galvanized bolts and inserts number as required for size of panel, but not less than 4. Mount panelboards with centerline 4'-6" approximately above finished floor with the top a maximum of 74” AFF. Where panels of different heights are mounted adjacent, install top of panel trim at same height above floor. Close all unused openings.

M. Mount feeder panelboards taller than 66" on 4" high 2500# concrete pad and bolt to wall and pad with 1/2" diameter bolts and inserts .Breaker handles in the “ON” position shall not be higher than 6-7” to centerline from the Finished Floor when panelboards are installed on concrete pads

N. Where two sets of feeder cables are required in panel gutter space, run one set in each side of panel.

O. When connecting a panelboard to a transformer, connected conductors shall include a slack 90-degrees bend in flexible conduit between the transformer and any subsequent rigid connection to building structure. Use stranded, flexible conductors to maintain as much flexibility as practical. Do not permit flexible conductors to contact or drape against floor or wall surfaces. The first panelboard, cabinet or switch connected to a transformer shall be resiliently supported from structure by affixing with bolts through holes with grommets (wall supported; equal to Kinetics Model TG Isolation Grommet) or by being set on ¾” thick Neoprene isolation pads (equal to Kinetics Type RSP) sized so that the supported load deflects pads approximately 0.12”, or in the upper half of the manufacturer’s recommended loading range in pounds per square inch. Pad type isolators should use load spreading steel plates to avoid damaging the pad by narrow base rails or sections, as required.

P. Provide seismic bracing in accordance with the manufacturer's recommendations and in compliance with the seismic zone requirements for the zone in which the equipment is located.

Q. Connect only one wire/cable to each breaker terminal.

3.3 FIELD QUALITY CONTROL

A. General Conditions: Requirements for testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.

E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.4 ADJUSTING

A. General Conditions: Requirements for starting and adjusting.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.5 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean existing panelboards to remain or to be reinstalled.

END OF SECTION 262416

SECTION 262726 – WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall switches; wall dimmers; wall and ceiling occupancy sensors; receptacles; multioutlet assembly; and device plates and decorative box covers.

B. Related Sections:
1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.
2. Section 26 09 23 – Lighting Control Devices; Wall and ceiling occupancy sensors.

1.2 REFERENCES

A. National Electrical Manufacturers Association:
1. NEMA WD 1 - General Requirements for Wiring Devices.
2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALIFICATIONS

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

1.5 EXTRA MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish two of each style, size, or switch, receptacle type and finish wall plate.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Manufacturers:
1. Cooper Wiring Devices.
2. Harvey Hubbell, Inc.
3. Leviton Manufacturing Company.
4. P&S.
5. Substitutions: Not permitted.

B. Product Description: NEMA WD 1, Heavy-Duty,AC only general-use Decora switch.

C. Body and Handle: white plastic with Decora Rocker.

D. Ratings:

E. Voltage:
1. 120-277 volts, AC.
2. Current: 20 amperes.

2.2 WALL DIMMERS

A. Manufacturers:
1. Eagle.
2. Hubbell Wiring Devices.
3. Leviton.
4. Lutron.
5. P&S.
6. Substitutions: Not Permitted.

B. Product Description: NEMA WD 1; Semiconductor dimmer for the following load types.
1. Dimmers shall provide full range, continuously variable control of light intensity.
2. Controls shall provide preset single pole, 3-way, or multi-location control from the dimmer location regardless of the position of the other 3-way switch location.
3. Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.
4. Operate at the rated capacity across the full ambient temperature range including modified capacities for ganging configurations with require the removal of fins.
5. Control should be designed to not interfere with audio, video, or radio equipment.
6. Utilize air gap off, activated when user selects “off” at any control to disconnect the load from line supply eliminating any leakage current.
7. Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption.
8. Designed and tested with withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.
9. Design and test dimmers to withstand line-side surges without impairment to performance when subjected to surges of 6,000 volts, 200 amps per ANSI/ IEEE C62.41C.
10. Capable of operating at the rated capacity; this includes modified capacities for ganging configurations which require the removal of fins. Operation at rated capacity shall be possible across the full ambient temperature range, without shortening design lifetime.

C. Load Specific Requirements: Within rated capacity, dimmers shall be available for direct control of the following loads.
1. Dimming Compact Fluorescent Lamps (CFL):
   a. Contain circuitry specifically designed to control dimmable self ballasted CFL loads.
   b. Provide with lower dimming range adjustment.
   c. Listed to UL 172.
2. Dimming LED Lamps:
   a. Contain circuitry specifically designed to control dimmable self ballasted CFL loads.
   b. Provide with lower dimming range adjustment.
   c. Listed to UL 172.

d. LED dimmers shall have been tested with the specific fixtures.

3. Electronic Flourescent dimming ballasts including 0-10V, Mark 10, Hi-Lume, and Eco10 (Eco Series) Techologies:
   a. Shall provide direct control of fluorescent dimming ballasts up to the manufacturer's specified rating.
   b. Shall provide leads for connection based on dimming technology and manufacturer's requirements.
4. Remote Dimming Modules:
   a. Provide high power module and wall dimmer from a single manufacturer.
   b. High power module listed to UL 508 for control of incandescent/ halogen, magnetic low voltage, electronic low voltage, fluorescent, and neon/cold cathode loads. Provide high power modules as defined on project drawings.

D. Body and Handle: White Nylon with linear slide.

E. Voltage: 120 or 277 volts.

F. Power Rating: Match load shown on drawings; 600 watts minimum.

G. Accessory Wall Switch: Match dimmer appearance.

2.3 OCCUPANCY SENSORS

A. Occupancy Sensors
   1. Wall sensors.
   2. Dual technology sensors shall:
      a. Either corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas
      b. Passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
   3. Ultrasonic sensors shall:
      a. Utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.
      b. Have an ultrasonic operating frequency that is crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
   4. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
   5. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
   6. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
   7. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
   8. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

B. Products
   1. Wall Mounted Single Level Motion Sensor Switch.

2. Wall Mounted Bi-Level Motion Sensor Switch.
3. Ceiling Mounted Dual Technology Occupancy Sensor with Power Pack.

C. Circuit Control Hardware – (Power Packs)
1. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
2. Provide power packs as required. Power Pack shall be installed in jbox.
3. Relay Contacts shall have ratings of:
   a. 13A - 120 VAC Tungsten
   b. 20A - 120 VAC Ballast
   c. 20A - 277 VAC Ballast
   d. 20A – 347 VAC Ballast

D. Control wiring between sensors and control units shall be Class II, 18-20 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
1. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

E. Mount switches and occupancy sensors as indicated on Drawings and by manufacturer's requirements.

CONTROL TYPE	**COMMISSIONING AND CALIBRATION**
Occupancy sensors	Ensure that the sensor is correctly placed and oriented per the specifications and/ or construction drawings. If unanticipated obstructions are present, it may be necessary to adjust the sensor location and orientation.
Occupancy sensors	Adjust the sensitivity and time delay of the occupancy sensor, and test to ensure it provides appropriate response. For optimal user acceptance, energy savings and lamp life, set the time delay initially for a minimum of 15 minutes (NEMA recommendation).
Manual dimming	Ensure correct placement of the dimmer per the construction drawings. Adjust the upper limit of the dimming range according to the task being performed, and set the lower limit of the range so that the minimum light level meets the use/application of the space.

2.3 RECEPTACLES

A. Manufacturers:
1. Cooper Wiring Devices.
2. Harvey Hubbell, Inc.
3. Leviton Manufacturing Company.
4. P&S.
5. Substitutions: Not permitted.

B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.

C. Device Body: White nylon. Decora style.

D. Configuration: NEMA WD 6, type as indicated on Drawings.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.4 WALL PLATES

A. Manufacturers:
1. Cooper Wiring Devices.
2. Harvey Hubbell, Inc.
3. Leviton Manufacturing Company.
4. P&S.
5. Substitutions: Not permitted.

B. Decorative Cover Plate: White. Provide red cover/plate for red receptacle unless noted otherwise.

C. Jumbo Cover Plate: White.

D. Weatherproof Cover Plate: Gasketed cast metal plate with hinged, gasketed, and lockable device cover. System shall be weatherproof while in use.

E. Wall plates for devices in laboratories, kitchen areas, mechanical rooms, and other similar areas shall be beveled edge stainless steel plates, single or multi-gang as required by the outlet. Wall plates for devices in surface boxes, unless specified otherwise, shall be beveled edge satin finish stainless steel plates, single or multi-gang as required by the outlet. Blank plates shall be furnished and installed on all empty, blanked or unused outlets. Device plates manufactured by device manufacturer where available. Wall Plates shall be single and combination types that mate and match with corresponding devices.

PART 3 EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and project conditions.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install devices plumb and level.

B. Install switches with OFF position down.

C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Install receptacles with grounding pole on bottom.

F. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

G. Install wall plates on flush mounted switches, receptacles, and blank outlets.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Connect wiring devices by wrapping solid conductor around screw terminal. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

J. Use jumbo size plates for outlets installed in masonry walls.

K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

L. Match devices to plug connectors for Owner-furnished equipment. Verify type, configuration, etc., prior to providing devices. Including all such costs in bid submission.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified and as indicated on drawings.

B. Install wall switch 42 inches above finished floor.

C. Install convenience receptacle 24 inches above finished floor. Unless noted otherwise.
1. Baseboard monted receptacles with architectural prior to rotation.

D. Install convenience receptacle 6 inches above back splash of counter or as directed by Architect.

E. Install dimmer 42 inches above finished floor.

F. Coordinate installation of wiring devices with floor box service fittings per plans.

3.5 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. General Conditions: Final cleaning.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 262819 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fusible.
   2. Nonfusible switches.

B. Related Requirements:
   1. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   2. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:
   1. NEMA FU 1 - Low Voltage Cartridge Fuses.
   2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

B. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

A. General Conditions: Closeout procedures.

B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

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

PART 2 - PRODUCTS

2.1 NONFUSIBLE SWITCH ASSEMBLIES

A. Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.

B. Operation:

1. Switch Ratings
   a. Switch Rating: Horsepower rated for AC or DC as indicated on Drawings.
   b. Short Circuit Current Rating: UL listed for 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600 ampere). [200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200 ampere)].

C. Materials:
   1. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel.
      a. Interior Dry Locations: Type 1.
      b. Exterior Locations: Type 3R.

   2. Service Entrance: Switches identified for use as service equipment are to be labeled for this application. Furnish solid neutral assembly and equipment ground bar.
   3. Furnish switches with entirely copper current carrying parts.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Disconnect and remove abandoned enclosed switches.

3.2 INSTALLATION

A. Install enclosed switches where indicated. Secure switches to building or equipment surface as shown. Where the surface is not adaptable for mounting, provide unistrut P-1000 rack mounted as required to secure switch.

B. Install enclosed switches plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 feet (1500 mm) to operating handle.

D. Install fuses for fusible disconnect switches. Refer to Section 26 28 13 for product requirements.

E. Install engraved plastic nameplates in accordance with Section 26 05 53. Engrave nameplates with the equipment served and the panel and circuit number supplying the switch.

F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

G. Secure switches and circuit breakers to building structure in accordance with seismic zone specified in other sections of this specification.

H. All exterior mounted switches shall comply with NEC 312.2.

I. All switches shall be mounted to comply with NEC 404.8.

3.3 FIELD QUALITY CONTROL

A. General Conditions: Requirements for testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.4 CLEANING

A. General Conditions: Requirements for cleaning.

B. Clean existing enclosed switches to remain or to be reinstalled.

END OF SECTION 262819

SECTION 265100 – LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes interior luminaires, lamps, ballasts, and accessories.

B. **LIGHTING AGENCIES, DISTRIBUTORS, ETC. ARE REQUIRED TO HAVE A COMPLETE FIXTURE SCHEDULE, ALL LIGHTING PLANS, ARCHITECTURAL REFLECTED CEILING PLANS AND SPECIFICATIONS IN ORDER TO BID THE PROJECT. PRICING SHALL NOT BE BASED ON CATALOG NUMBERS ALONE. COORDINATE AND PROVIDE ALL MOUNTING HARDWARE AND ACCESSORIES AS REQUIRED BY ARCHITECTURAL CEILING TYPES AND CEILING TILE CONFIGURATIONS. CHANGE ORDERS WILL NOT BE ALLOWED FOR FAILURE TO USE THE COMPLETE SET OF PLANS FOR BID PURPOSES.**

C. Related Sections:
   1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
   2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
   3. ANSI_NEMA_ANSLG C78.377-2008 Specifications for the Chromaticity of Solid State Lighting Products.

B. Illuminating Engineering Society (IES)
   1. IES LM-79-08
   2. IES LM-80-08

C. US Department of Energy
   1. Lighting Facts

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.

C. Product Data: Submit dimensions, ratings, and performance data.

D. Samples: Submit two color chips 3 x 3 inch (75 x 75 mm) in size illustrating luminaire finish color where indicated in luminaire schedule.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.6 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish two of each plastic lens type.

C. Furnish 10% replacement lamps for each type of lamp installed.

D. Furnish 10% of each type of ballast type.

1.7 SUPPORT AND BRACING

A. All luminaires shall be installed with supports and bracing required for the seismic zone in which the project is located. See Section 26 05 30.

PART 2 PRODUCTS

2.1 INTERIOR LUMINAIRES

A. Product Description: Complete interior luminaire assemblies, with features, options, and accessories as scheduled on drawings.

B. Refer to General Conditions for product options.

2.2 LED LUMINAIRES

A. Shall be tested according to the Illuminating Engineering Society of North America (IESNA) LM-79 and LM-80.
   1. Shall supply third party testing and data in compliance with Commercially Available LED Product Evaluation and Reporting (CALiPER) or National Voluntary Laboratory Accreditation Program (NVLAP).
   2. The testing laboratory must be listed on the U.S. Department of Energy's Solid-State Lighting website as an accredited testing laboratory.
   3. Manufacturers shall provide supporting evidence of lamp life calculation based on junction temperature and drive current upon request.

B. Shall be listed and labeled in accordance with the U.S. Department of Energy Lighting Facts Program.

C. Shall provide independent test laboratories IES photometrics which verify light levels.

D. Correlated Color Temperature (CCT) measured in Kelvin's shall meet Nominal CCTs and tolerances as defined in ANSI_NEMA_ANSLG C78.377-2008.
   1. Nominal CCT: 4000 K: 3985 ± 275 K

E. Minimum CRI > 80

2.6 RECESSED LUMINAIRES

A. Furnish all recessed luminaires in compliance with U.L. Standards for:
1. Thermally Protected Fixture - Non-Type I.C.
a. Where luminaire is installed in a ceiling with the possibility of overheating.
b. Provide IC rated covers when fixture is non- I.C. rated.
2. DC - IC Luminaire - Type I.C.
a. Where luminaire is intended to be installed where direct contact with insulation is expected.

B. Check Architectural drawings, sections and specifications for insulation methods and ceiling types for additional information to determine the correct method to furnish luminaires for U.L. compliance.

2.7 STEMS

A. Not required

2.8 LAMPS

A. LED, Type as shown.

B. Use proper lamp for installed reflector assembly.

C. Acceptable Lamp Manufacturers
1. Osram/Sylvania
2. Philips
3. G.E..

D. **All lamps shall be installed as new immediately prior to final inspection; do not use for construction purposes.**

E. Guarantee lamps as follows: LED lamps, 5 years. Guarantees begin from date of Substantial Completion.

2.9 EXIT LIGHTS

A. Exit lights furnished with 6" high stencil letters. Use green LED's. Verify color used with local codes, if a different color is required, indicate on the shop drawing submittal.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned luminaires, lamps, and accessories.

3.2 INSTALLATION

A. Support of luminaires responsibility of this Section.

B. See Spec Section 260530, Seismic Protection for Electrical Equipment for additional requirements.

C. Fixtures mounted in grid ceilings and in hard ceilings shall be supported independently of the ceiling or ceiling grid. See details on plans. For recessed fixtures in hard ceilings provide one support at each corner of 2' x 4' and larger luminaries and one at each end at opposite corners of 1' x 4' and 2' x 2' luminaries. In hard ceilings, galvanized hanger wires may be used.

D. Provide devices for securing luminaire to ceiling grid to comply with Article 410-16(c) of National Electrical Code. ("Earthquake Clips").

E. Wire luminaires with flexible conduit individually to junction boxes. Do not wire luminaire to luminaire.

F. Support recessed luminaires with 3/4" black iron ceiling channel, one piece on each side of luminaire, anchored to ceiling system. Support large recessed luminaires over 20 pounds independent of furred ceiling system with rods, size as required, anchored to structure.

G. Support surface and pendant luminaires from 3/8" fixture stud in outlet box. Large surface or pendant luminaires (in excess of 20 pounds) with 3/8" rod run through the outlet box to structure and anchored independent of ceiling and conduit systems.

H. Provide plaster frames for recessed luminaries in plaster and concealed spline ceilings supported independent of ceiling construction with 1/4" rod anchored to structure.

I. Individual flexible connections to luminaires shall be made with 2#14 and 1#14 (ground) THHN-2 in 3/8" flexible conduit not to exceed 6'. Bond ground wire at each end. Provide additional wire(s) as required for a/b and similar switching schemes.

J. Stems on linear luminaires shall be installed as follows (except luminaires with slide grip hangers): First and last stem in row shall be installed in first knockout from end of luminaires; one stem shall be installed between each two luminaires connect intermediate stems to center joint where luminaires join and attach by use of "joining plates". Provide adequate number of stems to completely support luminaires and keep luminaires aligned straight and plumb.

K. Connect luminaires in continuous rows other than recessed grid type connected by nipples with locknuts and bushings.

L. Furnish complete manufacturers shop drawing for continuous luminaires showing mounting, ceiling interface and complete luminaire layout.

M. Locate all ceiling luminaires as indicated on Drawings.

N. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

O. Install recessed luminaires to permit removal from below.

P. Install recessed luminaires where installed in rated assemblies using accessories and firestopping materials to meet regulatory requirements for fire rating.

Q. Install wall-mounted luminaires at height as indicated on Drawings.

R. Install accessories furnished with each luminaire.

S. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

T. Install specified lamps in each luminaire.

U. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Aim and adjust luminaires as indicated on Drawings.

3.5 CLEANING

A. General Conditions: Final cleaning.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

A. General Conditions: Protecting finished work.

B. Relamp luminaires having failed lamps at Substantial Completion.

3.7 GUARANTEE

A. All LED luminaires, components, accessories etc., except lamps, shall be LED warranties should be 5 years for LED fixtures guaranteed against defects in materials and workmanship for five (5) year from date of in-service acceptance by owner. Replacement shall include parts and labor at the site of the work for the term of the warranty.

B. LED replacement lamps shall be guaranteed for three (3) years from date of in-service acceptance by owner. Replacement shall include parts and labor at the site of the work for the term of the warranty.

END OF SECTION 265100

SECTION 265600 – LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes exterior luminaries, poles, and accessories.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
   2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
   3. ANSI O5.1 - Wood Poles, Specifications and Dimensions.
   4. ANSI_NEMA_ANSLG C78.377-2008 Specifications for the Chromaticity of Solid State Lighting Products.

B. Illuminating Engineering Society (IES)
   1. IES LM-79-08
   2. IES LM-80-08

C. U.S. Department of Energy
   1. Lighting Facts

1.3 SUBMITTALS

A. General Conditions: Submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.

C. Product Data: Submit dimensions, ratings, and performance data.

D. Samples: Submit two color chips 3 x 3 inch (75 x 75 mm) in size illustrating luminaire finish color where indicated in luminaire schedule.

1.4 QUALIFICATIONS

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. General Conditions: Product storage and handling requirements.

1.6 COORDINATION

A. General Conditions: Coordination and project conditions.

B. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

1.7 MAINTENANCE MATERIALS

A. General Conditions: Spare parts and maintenance products.

B. Furnish 10% of each lamp installed.

C. Furnish two gallons of touch-up paint for each different painted finish and color.

D. Furnish 10% ballasts of each type installed.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.

B. Refer to General Conditions for product options.

2.2 LED LUMINAIRES

A. Shall be tested according to the Illuminating Engineering Society of North America (IESNA) LM-79 and LM-80.
   1. Shall supply third party testing and data in compliance with Commercially Available LED Product Evaluation and Reporting (CALiPER) or National Voluntary Laboratory Accreditation Program (NVLAP).
   2. The testing laboratory must be listed on the U.S. Department of Energy's Solid-State Lighting website as an accredited testing laboratory.
   3. Manufacturers shall provide supporting evidence of lamp life calculation based on junction temperature and drive current upon request.

B. Shall be listed and labeled in accordance with the U.S. Department of Energy Lighting Facts Program.

C. Shall provide independent test laboratories IES photometrics which verify light levels.

D. Correlated Color Temperature (CCT) measured in Kelvin's shall meet Nominal CCTs and tolerances as defined in ANSI_NEMA_ANSLF C78.377-2008.
   1. Nominal CCT: 4000 K: 3985 ± 275K

2.3 LAMPS - GENERAL

A. Minimum Efficacy, Lamps Greater Than 100 Watts: 60 lumens/W, except where otherwise indicated or permitted by applicable code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General Conditions: Coordination and Project conditions.

B. Verify foundations are ready to receive fixtures.

3.2 EXISTING WORK

A. Disconnect and remove abandoned exterior luminaries.

3.3 INSTALLATION

A. Install concrete bases for lighting poles at locations as indicated on Drawings, in accordance with Section 03 30 00.

B. Install poles plumb. Install shims to adjust plumb. Grout around each base.

C. Install lamps in each luminaire.

D. Bond and ground luminaries, metal accessories and metal poles in accordance with Section 26 05 26.

3.4 FIELD QUALITY CONTROL

A. General Conditions: Field inspecting, testing, adjusting, and balancing.

B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

C. Measure illumination levels to verify conformance with performance requirements.

D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.5 ADJUSTING

A. General Conditions: Testing, adjusting, and balancing.

B. Aim and adjust luminaries to provide illumination levels and distribution.

3.6 CLEANING

A. General Conditions: Final cleaning.

B. Clean photometric control surfaces as recommended by manufacturer.

C. Clean finishes and touch up damage.

3.7 PROTECTION OF FINISHED WORK

A. General Conditions: Protecting finished work.

B. Relamp luminaries having failed lamps at Substantial Completion.

3.8 GAURANTEE

A. All LED luminaires, components, accessories etc., except lamps, shall be LED warranties should be 5 years for LED fixtures guaranteed against defects in materials and workmanship for five (5) year from date of in-service acceptance by owner. Replacement shall include parts and labor at the site of the work for the term of the warranty.

END OF SECTION 26 600

SECTION 270100 – BASIC COMMUNICATION REQUIREMENTS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

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

B. Include all labor, materials, tools, transportation, storage costs, excavation, training, equipment, insurance, temporary protection, permits, inspections, taxes and all necessary and related items required to provide a complete and operational telecommunications system as shown on the Drawings and described in the Specifications.

1.2 QUALITY ASSURANCE

A. The Contractor installing communications cabling and termination equipment must have a minimum of (5) years experience installing telecommunications systems of similar size and scope.

B. The Contractor must be licensed by the Nevada State Contractors Board.

C. Formal, written evidence of the following may be requested at any point during the Bid or installation processes:

1. The Contractor, including any subcontractor, must have BICSI® Registered Installers and Technicians on staff and assign them to the current Project. The project shall be staffed at all times by Installers and Technicians who, in the role of lead crafts persons, shall be able to provide leadership and technical resources for the remaining crafts persons on the project.

2. If requested, the Contractor, including any subcontractor, shall show proven expertise in the implementation of cabling projects. This expertise can be illustrated through the inclusion of details of at least three projects involving the design and installation of Category 6 unshielded twisted-pair cabling systems and optical fiber cabling systems within the past two year period. Names, addresses, and telephone numbers of references for the three projects shall be included.

3. The Contractor must be certified by Belden/CDT, CommScope Systimax or approved equal in order to provide a 20 to 25 system warranty for the horizontal Category 6 cabling. The Contractor shall perform all necessary training from the manufacturer to obtain the manufacturer certification.

4. In the event subcontractors are used for any portion of the installation or acceptance testing, the Contractor shall be responsible for any subsequent corrective action required on that portion of the work.

1.3 SUBMITTALS

A. Manufacturer’s Data Sheets

1. Submit minimum 6 copies. Architect/Engineer will retain a minimum of 3 copies and return balance to Contractor.

2. Data sheets must be bound in 3-ring binders. Provide a table of contents for each binder indicating the products submitted. Products listed in the table of contents should be in the same order as they appear in the Specifications.

3. Where pre-printed data covers more than one distinct item, mark data sheet to clearly indicate which item is to be provided. Delete or cross-out non-applicable data.

B. Shop Drawings

1. Submit (1) reproducible and (3) blue lines. Architect/Engineer will retain a minimum of 3 copies and will return the reproducible to the Contractor.

2. Submit shop drawings for conduit routing and telecom room layouts to Consultant for review within 90 days after award of contract. Carefully examine shop drawings to insure compliance with drawings and specifications prior to submittal to Consultant. Shop drawings and submittals shall bear the stamp of approval of the Telecom Contractor as evidence that they have checked the drawings. Drawings submitted without this stamp of approval will not be considered and will be returned for proper resubmission. All shop drawings shall be submitted as a single one time complete package. Partial packages will not be reviewed.

C. Test Reports

1. Submit test reports signed and dated by the firm performing the cable testing.

D. Other Submittals

1. See individual Specification Sections for requirements.

E. Substitutions

1. No material substitutions will be allowed except by written acceptance from the Consultant. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples are provided.

1.4 REGULATIONS AND CODE COMPLIANCE

A. The Contractor will comply with all applicable governmental regulations including Federal, State, City, and local applicable codes and ordinances.

B. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

C. All work and materials shall conform to and be installed, inspected and tested in accordance with the governing rules and regulations of the telecommunications industry, as well as federal, state and local governmental agencies, including, but not limited to the following

1. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises.

2. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard.

3. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunication Cabling and Components Standard.

4. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard.

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

6. ANSI/TIA-570-B – Residential Telecommunications Infrastructure Standard.

7. ANSI/TIA-606-A -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

8. ANSI/TIA-607-B -- Commercial Building Grounding (Earthing) and grounding Requirements for Telecommunications.

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

10. ANSI/TIA-942 – Telecommunications Infrastructure Standard for Data Centers.

11. ANSI/TIA-1005 – Telecommunications Infrastructure Standard for Industrial Premises.

12. ANSI/NFPA-70, 2005 -- National Electrical Code (NEC).

13. Underwriter's Laboratories, Inc. (UL).

14. Federal Communications Commission (FCC).

15. Americans with Disabilities Act (ADA).

1.5 DEFINITIONS

A.	Approved/Approval	Written permission to use a material or system.
B.	As Called For	Materials, equipment including the execution specified/shown in the Specifications.
C.	Code Requirements	Minimum requirements.
D.	Concealed	Work installed in pipe and duct shafts, chases or recesses, inside walls, above ceilings, in slabs or below grade.
E.	Exposed	Work not identified as concealed.
F.	Final Acceptance	Owner acceptance of the project from the Contractor upon certification by the Owner's Representative.

G	Furnish	Supply and deliver to installation location.
H.	Furnished by Others	Receive delivery at job site or where called for and install.
I.	Inspection	Visual observations by Owner or Owner's Representative.
J.	Install	Mount and connect equipment and associated materials ready for use.
K.	Listed	Refers to classification by a standards agency.
L.	Or Approved Equal	Approved equal or equivalent as determined by Owner or Owner's Representative.
M.	Owner's Representative	Design professional or Consultant representing the Owner.
N.	Provide	Furnish, install and connect ready for use.
O.	Relocate	Disassemble, disconnect, and transport equipment to new locations: then clean, test, and install ready for use.
P.	Replace	Remove and provide new item.
Q.	Review	A general contractual conformance check of specified products.
R.	Satisfactory	As specified in Specifications.

1.6 INTENT OF DRAWINGS

A. All drawings are diagrammatic unless otherwise noted as detailed dimensioned drawings. Drawings show approximate locations of equipment and devices. Exact locations are subject to the approval of the Owner or Owner’s Representative. The Contractor shall verify dimensions and shall be responsible for their accuracy

B. Items mentioned in the Specifications and not shown in the Drawings, or shown in the Drawings and not mentioned in the Specifications, shall be of like effect as if shown and mentioned in both. In the case of differences between the Drawings and the Specifications, the stricter provision as determined by the Owner or Owner’s Representative shall govern.

C. Omissions from the Drawings or Specifications, or the incorrect description of details of Work which are necessary to carry out the intent of the Drawings and Specifications, or work which is customarily performed, shall not relieve the Contractor from performing such omitted or incorrectly described work.

D. No exclusion from, or limitations in, the language used in the Project Documents shall be interpreted as meaning that ancillary or accessory items necessary to complete any required system or item of equipment are to be omitted.

1.7 REVIEW OF SPECIFICATIONS

A. The Contractor shall carefully study and compare the Drawings and Specifications and shall at once report to the Owner or Owner's Representative any error, inconsistency or omission discovered. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Specifications without such notice to the Owner or Owner's Representative, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the cost for any correction.

1.8 EXAMINATION OF THE PREMISES

A. The Contractor shall visit the Site to become familiar with the local conditions under which the work is to be performed and correlate his observations with the requirements of the Drawings and Specifications. No allowance will be made for claims of concealed conditions which the Contractor learned or should have learned in exercising due diligence in its observations of the site and review of the local conditions.

B. Before ordering any materials or performing any work, the Contractor shall verify all measurements and be responsible for correctness of same. No extra charge or compensation will be allowed for duplicate work or material required because of an unverified difference between an actual dimension and the measurement indicated in the Drawings. Any discrepancies found shall be submitted in writing to the Owner or Owner's Representative for consideration before proceeding with the work.

1.9 WARRANTY AND SERVICES

A. The horizontal Category 6 voice and data cabling system including cabling, patch panels, jacks and faceplates shall carry a minimum 20-year manufacturer warranty from Belden/CDT, CommScope Systimax or approved equal.

B. The premise and outside plant fiber optic cabling system including fiber optic cabling, termination cabinets and fiber connectors shall carry a minimum 25-year manufacturer warranty from Corning LANscape, AFL Telecommunications or approved equal.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS MINIMUM REQUIREMENTS

A. Electrical equipment and systems shall meet UL Standards and requirements of the National Electric Code. This listing requirement applies to the entire assembly. Any modifications to equipment to suit the intent of the Specifications shall be performed in accordance with these requirements.

B. Equipment shall meet all applicable FCC Regulations.

C. All materials, unless otherwise specified, shall be new and be the standard products of the manufacturer. Used equipment or damaged material will be rejected.

D. The listing of a manufacturer as "acceptable" does not indicate acceptance of a standard or cataloged item of equipment. All equipment and systems must conform to the Specifications.

2.2 WORKMANSHIP, SUBSTITUTIONS, WARRANTY

A. Materials and workmanship shall meet or exceed industry standards and be fully guaranteed for a minimum of one (1) year from the date of final acceptance. Cable

integrity and associated terminations shall be thoroughly inspected, fully tested and guaranteed free from defects, transpositions, open shorts, tight kinks, damaged jacket insulation, etc.

B. Refer to the individual Division 27 Specifications for additional and/or extended warranty requirements.

C. All labor must be thoroughly competent, skilled and trained, and all work shall be executed in strict accordance with the best practice of the trades.

D. The Contractor shall be responsible for and make good, without expense to the Owner, any and all defects arising during this warranty period that are due to imperfect materials, improper installation or poor workmanship.

E. After the Contract is awarded, requests to substitute for specified materials shall be submitted by the Contractor to the Owner or Owner's Representative within thirty (30) days, complete with reasons for the substitution and savings which accrue to the Owner if the substitutions are approved. Substitutions after Contract award will be considered only if the substitutions are equal or superior to the products specified.

F. No material substitutions will be allowed except by written acceptance from the Consultant. Specified catalog numbers are used for description of equipment and standard of quality only. Equivalent material will be given consideration only if adequate comparison data including samples are provided.

G. Approval of alternate or substitute equipment or material in no way voids the Specification requirements.

H. Under no circumstances shall the Owner be required to prove that an item proposed for substitution is not equal to the specified item. It shall be mandatory that the Contractor submit to the Owner or Owner's Representative all evidence to support the contention that the item proposed for substitution is equal to the specified item. The Owner's decision as to the equality of substitution shall be final and without further recourse.

2.3 FACTORY ASSEMBLED PRODUCTS

A. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit need not be products of the same manufacturer.

2. Component parts, which are alike, shall be from a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for the intended service.

4. Components of equipment shall bear the manufacturer's name or trademark model number and serial number on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

B. Major items of equipment that serve the same function must be the same make and model.

C. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that a complete and fully operational system will result.

D. Maximum standardization of components shall be provided to reduce spare part requirements.

PART 3 – EXECUTION

3.1 ROUGH-IN

A. Before construction work commences, the Contractor shall visit the site and identify the exact routing of horizontal and backbone pathways.

B. All equipment locations shall be coordinated with other trades and existing conditions to eliminate interference with required clearances for equipment maintenance and inspections.

C. Coordinate work with other trades and existing conditions to determine exact routing of all raceways and locations of sleeves.

1. Where more than one trade is involved in an area, space or chase, all shall cooperate and install their own work to utilize the space equally between them in proportion to their individual requirements. If, after installation of any equipment, piping, ducts, conduit, and boxes, it is determined that adequate space has not been provided for passage or maintenance, rearrange work. Any changes in the size or location of the material or equipment supplied or proposed, which may be necessary in order to meet field conditions or in order to avoid conflicts between trades, shall be brought to the immediate attention of the Owner's Representative and approval received before such alterations are made.

D. Provide easy, safe and code mandated clearances at equipment racks and enclosures.

3.2 CUTTING AND PATCHING

A. The Contractor shall be responsible for all cutting, patching, coring and associated work to complete the telecommunications cabling system. Patch adjacent work disturbed by installation of new work including insulation, walls and wall covering, ceiling and floor covering or other finished surfaces.

3.3 FIRESTOPPING

A. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

B. Fire stopping References:

1. ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.

2. ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers).

3. 2002 NFPA National Electrical Code, Section 800-52, Paragraph 2(b), Spread of Fire and Products of Combustion.

3.4 CONCEALMENT

A. Horizontal and backbone raceway and cabling shall be concealed above ceilings, in walls, below slabs, and elsewhere throughout building. If concealment is impossible or impractical, or in areas without ceilings, the Owner's Representative shall be notified of the proposed routing prior to starting that portion of the work.

3.5 WATERPROOFING

A. The Contractor shall seal all foundation penetrating conduits and all service entrance conduits and sleeves to eliminate the intrusion of moisture, gases and rodents into the building. This requirement also applies to spare conduits.

B. Spare conduits shall be plugged with expandable plugs.

C. All service entrance conduits shall be sealed or resealed after cable placement.

3.6 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate ordering and installation of all equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

B. Where mounting heights are not dimensioned, install systems, materials and equipment to provide the maximum headroom possible.

C. Set all equipment to accurate line and grade, level all equipment and align all equipment components.

D. Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises.

E. No equipment shall be hidden or covered up prior to inspection by the Owner's Representative. All work that is determined to be unsatisfactory shall be corrected immediately.

F. All work shall be installed level and plumb, parallel and perpendicular to other building systems and components.

G. The Contractor shall replace all ceiling tiles damaged by work performed as part of the telecommunications contract.

H. Storage and security of material and equipment shall be the responsibility of the Contractor.

END OF SECTION 270100

SECTION 270528 – INTERIOR COMMUNICATION PATHWAYS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

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

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete interior communication pathways and to ensure that the pathways are in compliance with requirements stated or reasonably inferred by this Specifications, and the Constructions Drawings.

C. This section includes minimum requirements for communication pathways for horizontal and backbone cabling.

D. This section includes minimum requirements for the following

1. Conduit
2. Sleeves
3. Pull Boxes
4. Velcro Tie Wraps
5. Cable Hangers (J-Hooks)
6. Measuring Tape and Pull String
7. Fire Stop

1.2 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of 27 01 00 1.4 and in particular the following code requirements

1. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises.
2. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard.
4. ANSI/TIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces.
5. ANSI/TIA-606-A -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
6. ANSI/TIA-607-B -- Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
7. ANSI/NFPA-70, 2005 -- National Electrical Code (NEC).
8. Underwriter’s Laboratories, Inc. (UL).

1.3 QUALITY ASSURANCE

A. All pathways and associated equipment shall be installed in a neat and workmanlike manner. Conduit, J-hooks, cable tray and pull boxes shall be installed and properly coordinated with other trades so that they are fully accessible for installation and pulling

of cable. All methods of construction that are not specifically described or indicated in the Specifications shall be subject to the control and approval of the Owner's Representative.

1.4 SUBMITTALS

A. The Contractor shall provide product manufacturers data sheets for the following Items

1. Velcro Tie Wraps
2. Cable Hangers (J-Hooks)
3. Measuring Tape and Pull String
4. Fire Stop

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. Shop drawings indicating the proposed layout and elevation of the following items shall be submitted for review and approval.

1. Cable tray.
2. Conduit 2” and larger.
3. Pull boxes.
4. Main J-Hook runs.
5. Sleeves.

D. As-built drawings shall be submitted at the completion of the project showing the actual routing and location of the following items:

1. Cable Tray.
2. Conduit 2” and larger.
3. Pull boxes.
4. Sleeves
5. Main J-Hook runs.

PART 2 – PRODUCTS

2.1 CONDUITS

A. See Electrical Specifications for additional raceway and j-box products and additional requirements.

B. Install conduit where shown on the drawings.

C. All backbone fiber and copper telecom cabling shall be installed in conduit.

D. Conduit shall be concealed unless otherwise noted on the drawings.

E. Install conduit for horizontal telecom cabling where cable is routed through inaccessible areas including but not limited to walls, floors, chases, above gypboard or plaster ceilings, etc.

F. Install ground bushing on ends of conduit at telecommunication rooms. Install a #6 green insulated ground conductor from the ground bushing to the grounding bar in the telecommunication room.

G. Install a 4” square outlet box and 1” conduit (UON) to an accessible ceiling space at each wall or floor mounted telecom outlet. Where the conduit stubs into an accessible ceiling

space, install a plastic bushing on the end of the conduit to prevent damage to the cable jacket.

H. Where conduit penetrations are exposed in finished areas, install steel, chrome plated split ring escutcheon plates.

2.2 SLEEVES

A. See the Electrical Specifications for acceptable products and additional requirements.

B. Provide 4” vertical steel sleeves where shown on the drawings and to accommodate conduit or cable routing through floor slabs. Sleeves shall extend 6 inches above and below the floor slab and shall be cast into the concrete. Where sleeves are core drilled into the concrete, install firestopping material between the sleeve and the floor slab to maintain the floor rating. Provide plastic or nylon bushings on both sides of sleeves to prevent damage to cabling.

C. Provide 4” horizontal sleeves where shown at telecom rooms or rated walls to accommodate routing of horizontal cabling from the corridors. Sleeves should extend 2” beyond the wall on both sides. Provide plastic or nylon bushings on both sides of sleeves to prevent damage to cabling.

D. Install split sleeves (not shown on the drawings) to accommodate routing of horizontal cabling through non-rated full height gypboard walls. Sleeves shall be sized so as not to exceed a 40% fill rate. Install firestopping between the sleeve and structure, and between the telecom cables and the sleeve to maintain the wall rating.

E. Where sleeve penetrations are exposed, install steel, chrome plated split ring escutcheon plates.

2.3 PULL BOXES

A. See the Electrical Specifications for additional pull box requirements and acceptable manufacturers.

B. Provide pull boxes where shown on the drawings to accommodate copper backbone cable splices.

C. Provide pull boxes in backbone cabling conduit every 100 feet and every 180 degrees of bend (whichever is the more strict provision) to facilitate pulling of backbone cabling.

D. Pull boxes shall be sized so as not to exceed the minimum bend radius of the backbone fiber and copper cabling.

E. Coordinate location of pull boxes with other trades. Provide access doors where required to access pull boxes.

2.4 CABLE HANGERS (J-HOOKS) AND SUPPORTS

A. Provide cable hangers (J-hooks) spaced at 4’’-0” centers to support horizontal cable from the workstation outlet to the cable tray.

B. Hangers shall be prefabricated, zinc coated, carbon steel hangers designed specifically for Category 6 cable installations.

C. Hangers shall have an open top and rolled edges. Hangers shall have a minimum 2” and maximum 4” diameter loop.

D. Hangers shall be supported directly from the building structure. The Contractor shall provide anchors, beam clamps, threaded rod, rod fasteners, flange clips and brackets as needed to support the cable hangers from the building structure. Do not attach hangers to ceiling support wires or other support systems installed by other building trades.

E. J-hooks shall not support more cables than recommended by the manufacturer. J-hooks shall be sized to provide a minimum 20 percent spare capacity.

F. Cable bundles shall not exceed (25) cables and shall be loosely bound with Velcro cable straps.

G. Acceptable Products

1. Erico Caddy CableCat Clips.
2. B-Line Cable Hook System.
3. Panduit J-Pro Cable Support System.
4. Or equal.

2.5 VELCRO CABLE STRAPS

A. Install Velcro cable ties cut to length from a continuous roll to loosely bundle horizontal cabling routed down J-hook lines, on the cable tray and ladder rack.

B. Install Velcro cable ties at 2’-0” intervals outside of the telecom room and 1’-0” intervals inside the telecom room.

C. Do not exceed qty (50) cables per bundle.

D. Provide plenum rated Velcro tie wraps where cable is routed in plenum spaces.

E. Do not use plastic tie wraps.

A. Acceptable Products

1. Panduit HLS-15R6 or HLSP (plenum rated).
2. Leviton 43115-075.
3. Or equal.

2.6 MEASURING TAPE AND PULL STRING

A. Install pull string in all conduit and innerduct. Pull string shall be ½” pre-lubricated high strength woven polyester with sequential foot markings. The tensile strength of the pull string shall be greater than or equal to 1,250 lbs.

B. Pull string shall meet or exceed the requirements of Bellcore GR-356-CORE “Generic Requirements for Optical Cable Innerduct and Accessories”.

C. Acceptable Products

1. Carlon TL145xx.
2. A-D Technologies Bull-Line WP12xx.
3. Or equal.

2.7 INNERDUCT

A. Provide UL Listed innerduct where shown on the drawings and for installation of all fiber optic cabling.

B. Innerduct should be terminated at the fiber optic termination cabinets.

C. Provide 1.25" minimum ID innerduct unless otherwise noted. Innerduct shall be constructed of plenum or riser rated plastic and shall have sequential footage markers at regular intervals. Innerduct shall be orange in color UON.

D. Innerduct couplings shall be used to join segments of innerduct together. Couplings shall be manufactured by the same manufacturer as the innerduct.

E. Acceptable Products

1. Carlon Riser-Gard or Plenum-Gard.
2. Amp Netconnect 1435736-4 (Riser) or 1435737-4 (Plenum).
3. Or equal.

2.8 FIRE STOPPING

A. Provide fire stopping and backing material between sleeves/conduit penetrations through rated partitions or floors. Provide fire stopping in sleeves/conduits after all cables have been installed.

B. The minimum required fire resistance ratings of the wall of floor assembly shall be maintained by the fire stop system. The installation shall provide an air and watertight seal.

C. Fire stopping shall be listed or classified by an approved independent testing laboratory. The system shall meet the requirements of "Fire Tests of Through-Penetration Fire Stops" designated ASTM E814.

D. Manufacturer's recommended installation standards shall be closely followed (i.e. minimum depth of material, use of ceramic fiber and installation procedures).

E. For each firestopping system on the project, submit the page from the UL fire resistance directory showing the firestopping system.

F. Acceptable Manufacturers

1. 3M.
2. Hilti.
3. Nelson.
4. Specified Technology.
5. Or equal.

PART 3 – EXECUTION

3.1 COORDINATION DRAWINGS

A. Provide coordination drawings indicating routing of all tray, conduit, sleeves and pull boxes. Coordinate routing with Mechanical, Electrical, Plumbing and Sprinkler trades.

3.2 COMMUNICATION PATHWAYS

A. Prior to cable installation, the Contractor shall verify that the telecommunications pathways are installed as specified in the Drawings and Specifications. Any variations or violations from these documents shall be immediately reported to the Owner's Representative. No portion of the Structured Cabling System shall be installed in any component of the Telecommunications Pathways and Spaces which deviates from these documents. All cabling designated on the Blueprints as terminating within a specific Telecom Room shall be installed as such unless otherwise specified in writing by the Owner's Representative.

B. Cabling for other trades shall not occupy any pathway utilized for telecommunications cabling.

C. The cable tray shall be installed so that a minimum of 6" clear space is maintained above the top of the tray to facilitate cable installation. The contractor shall coordinate the routing of the cable tray with other trades so that plumbing piping, fire sprinkler piping, ductwork, conduits, etc are not routed within the 6" clear space above the tray.

D. The contractor shall reroute the cable tray and shall provide vertical and horizontal offsets as necessary to coordinate the installation with structure and other trades including HVAC, electrical, plumbing and sprinkler.

E. The drawings are diagrammatic and provide a general routing for conduit, J-hooks and cable tray. The Contractor shall coordinate the exact routing of the communication raceway systems with other trades and the building structure. Pull boxes shall be installed to provide access for cable installation, inspection and maintenance.

F. Install conduit where shown on the drawings or required to route telecom cabling in inaccessible ceiling or wall spaces.

G. Cable pathways including conduit, cable tray, sleeves, and J-hooks shall be sized for 20% fill capacity. Initial fill for all J-hook systems shall not exceed 25 cables (half of 50 cable maximum bundle size).

H. When installing conduit, J-hooks and cable tray, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).

1. 6" clear from power conductors.
2. 12" clear from fluorescent lighting fixtures and ballasts.
3. 36" clear from transformers and motors.

I. Provide all items necessary for the support and seismic bracing of conduit and cable tray including concrete anchors, clamps, brackets, hanger rods, unistrut, splice plates, couplers, expansion joint assemblies, etc.

J. The conduit and cable tray system shall provide a continuous ground path per the National Electrical Code. Conduit and tray shall be bonded to ground at the telecom rooms. All sections of the backbone conduit and tray shall be mechanically fastened and bonding jumpers shall be installed as necessary to provide continuous ground path.

K. In order to maximize floor and wall space in the telecom rooms, all conduit must be stubbed into the room above the ladder rack UON. Conduits shall not be stubbed up through the floor slab unless specifically shown on the drawings.

3.3 SLEEVES

L. Install sleeves through walls and floors as required to route horizontal and backbone cabling. Install firestop pathways where indicated on the drawings.

M. Coordinate layout and installation of concrete wall and floor sleeves prior to concrete pours. Contactor is responsible for providing, installing, securing and covering sleeves. The contractor shall have field personnel on site during concrete pours to ensure that sleeves are not dislodged or moved during concrete pours. Contractor will be responsible for core drilling costs related to missed or improperly located sleeves.

N. Provide sleeves for penetration of all gypboard walls. Layout wall penetrations as directed by the General Contractor and provide split sleeves to the framing contractor for installation.

3.4 CUTTING AND PATCHING

A. Contractor is responsible for core drilling existing walls and floor slabs to accommodate sleeves and conduit. Provide core sizes and layout to the Structural Engineer for approval prior to core drilling. Protect existing finishes from water damage during core drilling and cleanup all related water and debris.

3.5 CABLE HANGERS

A. Secure cable tray and J-hook hanger supports directly to the building structure. Hangers shall not be supported from ceiling supports, electrical conduits, plumbing pipes, sprinkler piping, ductwork, ceiling mounted equipment or their supports unless it is part of engineered system.

B. Install J-hooks on a maximum of 4’-0” centers. Install J-hooks a minimum of 6” above ceiling tiles to facilitate ceiling tile removal and a maximum of 2’-0” above ceiling tiles to facilitate cable installation.

END OF SECTION 270528

SECTION 270543 - EXTERIOR COMMUNICATION PATHWAYS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the exterior communication pathways and to ensure that they are in compliance with requirements stated or reasonably inferred by the Specifications and the Construction Drawings.

B. This section includes requirements for underground conduit and communication vaults as shown on the Electrical Site Plan.

C. Minimum requirements and installation methods are included for the following:

1. Conduit
2. Precast Pull Boxes
3. Pull rope
4. Waterproofing

1.2 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 01 00 1.4 and in particular the following code requirements:

1. ANSI/TIA-569-B – Commercial Building Standard for Telecommunications Pathways and Spaces.
2. ANSI/TIA-758-A -- Customer-Owned Outside Plant Telecommunications Infrastructure Standard.
3. ANSI/NFPA-70, 2005 -- National Electrical Code (NEC).
4. Underwriter’s Laboratories, Inc. (UL).

1.3 SUBMITTALS

A. Manufacturer’s Data Sheets: Provide data sheets for the following products:

1. PVC conduit.
2. Rigid Steel Conduit.
3. Precast Pull Boxes

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

C. As-Built Drawings: Provide as-built drawings for the outside plant conduit and vaults. Drawings must be dimensioned off of building lines or curbs indicating the exact routing of the conduit and location of vaults.

PART 2 – PRODUCTS

2.1 PVC CONDUIT

A. Provide PVC conduit as shown on the Site Plan. Conduit shall be rated for direct burial, ultraviolet resistant, and conforming to UL Standard 651, NEC 347, Federal Specification W-C-1094A, Schedule 40 or Schedule 80 as specified on drawings.

B. PVC fittings shall be the same material as conduit and installed with watertight joint compound recommended by manufacturer.

C. Install spacers as required to maintain proper separation between multiple conduits in a run.

1. Acceptable PVC Conduit manufactured by:

a. Carlon
b. Queen City Plastics
c. Certainteed Corporation
d. Pacific Western Extruded Plastics
e. Georgia Pipe Company
f. Hubbell Incorporation
g. Cantex Incorporation
h. Triangle

2.2 RIGID METAL CONDUIT

A. The PVC conduit shall transition to rigid metal conduit a minimum of 10 feet from the building foundation. Rigid metal conduit shall be routed from that point to the stub up location in the building.

B. Stub ups in the telecom rooms shall be vinyl coated rigid steel.

C. Rigid metal galvanized steel conduit (RMC) shall conform to Federal Specification WW-C-581E, NEC Article 346, ANSI Standard C80.1 and U.L. Standard No. 6 for rigid metallic conduit, except hot dipped galvanized after threading.

D. Fittings, sweeps, couplings, etc., shall be galvanized threaded type meeting above standards. Threadless fittings shall not be used.

1. Acceptable RMC Manufacturers:

a. Allied Tube and Conduit Corporation
b. LTV Steel Tubular Productions Co.
c. Midwest Electric-Cooper Industries
d. Wheatland Tube Company
e. Western Tube and Conduit Corp.
f. Triangle Wire and Cable Inc.

2. Acceptable Bushing Manufacturers:

a. Appleton
b. Thomas & Betts
c. OZ/Gedney
d. Midwest
e. Steel City

2.3 PRECAST PULL BOXES

A. Provide precast utility boxes as shown on the site plan.

B. Provide quantity of pull boxes so as not to exceed 250 feet between pull boxes or 180 degrees of conduit bend, whichever the stricter provision.

C. Pull boxes shall have the following inside dimensions 13” wide x 24” long by 12” deep.

D. Pull boxes shall have a 12” reinforced concrete riser.

E. Provide incidental H-20 rated covers.

F. Acceptable Products:

a. Jensen Precast HN1324-B Box, HN1324-E Extension and HN1324-L02 Lid.
b. Or Approved Equal.

PART 3 – EXECUTION

3.1 UTILITY COORDINATION

A. Contact local utility companies prior to excavation to locate and mark underground utilities.

B. Coordinate conduit routing with existing underground utilities. Reroute conduit as necessary to avoid and to provide necessary clearances from existing utilities.

3.2 CONDUIT

A. OSP conduits shall be installed with a slight drain slope (0.125 inches-per-foot) away from buildings to prevent the accumulation of water in the conduit or ingress to the buildings.

B. Factory-manufactured sweeps which meet ANSI/TIA/EIA569-A bend radius requirements shall be used for all telecommunications conduit. The bend radius of the sweeps must be a minimum of 10-times the internal conduit diameter. Bending conduit in the field using manual or mechanical methods is not acceptable.

C. Any 4" conduit with a sweep of more than 11 degrees is to have a minimum concrete encasement of 4".

D. OSP conduits shall be installed a minimum of 48” below finished grade. Conduits shall be encased in hard-tamped sand a minimum of 6” above and below the conduits. 6” clear space shall be maintained between conduits. Backfill above the conduits shall be installed and compacted to 95% density.

E. OSP conduit and duct bank runs must have a continuous orange colored, metal detectable warning tape installed half the distance between the top of the conduit and the finished grade.

F. All cable shall be installed in the lowest available conduit in a duct bank, working up as additional cables are installed.

G. Prior to installing cables, all new or unused OSP conduits must be cleaned with a brush pulled through the conduit at least two times in the same direction and swabbed with clean rags until the rag comes out of the conduit clean and dry. Conduits shall then be

tested with a mandrel to prove compliance with the sweep radius requirements throughout the conduit run.

H. Spare OSP conduits and innerducts shall be plugged with watertight plugs at both ends to prevent the intrusion of moisture, gasses, and rodents throughout the construction project.

I. All OSP conduits and innerduct shall have a 3/8” nylon pull rope installed. Pull tape shall be re-pulled each time an additional cable is installed.

3.3 PULL BOXES

A. Install pull boxes at finished grade.

B. Conduits shall enter pull boxes from the side. Do not sweep conduits into the bottom of the box.

3.4 CUTTING AND PATCHING

A. Sawcut and remove existing pavement, sidewalks, gutters, etc to accommodate installation of outside plant conduit.

B. Replace sub-base, pavement, sidewalks gutters, etc to match existing.

C. Repair and replace all landscaping and sitework disturbed by excavation including but not limited to irrigation lines, lawns, planting, etc. Resod lawn areas disturbed by excavation.

END OF SECTION 270543

SECTION 270800 – TESTING AND IDENTIFICATON

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

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

B. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the testing, labeling and documentation of the telecom cabling system in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

C. This section includes the minimum requirements for the testing, identification and administration for the telecommunications cabling system, including the following:

1. Testing

    a. Category 6 Cable Test Equipment and Test Procedures.
    b. Cable test reports.

2. Identification

    a. Labeling of work area outlet faceplates and jacks.
    b. Labeling of horizontal data, voice and video cabling.
    c. Labeling of Copper Patch Panels.

3. Administration

    a. As-built drawings.
    b. Materials listing.

1.2 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 01 00 1.4 and in particular the following requirements

1. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises.
2. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunication Cabling and Components Standard.
4. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard.
5. ANSI/TIA-606-A -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
6. Underwriter’s Laboratories, Inc. (UL).

1.3 SUBMITTALS

A. Test Equipment: Submit manufacturers' catalog sheets and specifications for the following cable testers

1. Category 6 cable tester.

B. Calibration Reports: Provide calibration reports for all test equipment to be used on the Project. The calibration must have been performed by a manufacturer certified calibration facility and be dated no more than 60 days prior to the start of testing.

C. Cable Test Reports: Provide bound test reports for all cables signed by the technician performing the cable testing. Include Manufacturers data sheets for the cabling being tested.

D. Labels: Submit manufacturer's data sheets on the type of labels to be used for each labeling application.

E. Sample Cable Termination Spreadsheet: Submit a sample cable termination spreadsheet (in Microsoft Excel format).

PART 2 – PRODUCTS

2.1 HORIZONTAL CATEGORY 6 UNSHIELDED TWISTED-PAIR CABLE TESTER

A. Shall perform all tests necessary to certify the horizontal Category 6 UTP cabling in accordance with ANSI/TIA/EIA 568 B.2-1.

B. Shall be a UL certified Level III test set calibrated by a manufacturer certified calibration facility. The calibration shall be dated no more than 60 days prior to the start of testing.

C. Acceptable Manufacturers

1. Fluke Networks
2. Ideal Industries
3. Agilent Technologies
4. Or equal.

2.2 LABELS

A. Labels shall be laser printed and shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

B. Acceptable manufacturers

1. Brother
2. Ideal
3. Panduit
4. W.H. Brady
5. Or equal

2.3 WORK AREA OUTLET FACEPLATE LABELS

A. Label each port in each faceplate in accordance with Labeling Scheme identified on the Drawings. Label must be machine printed and inserted in the faceplate label window. Labels shall be provided by the faceplate manufacturer (Belden/CDT, CommScope Systimax, or equal).

2.4 HORIZONTAL CABLE SHEATH LABELS

A. Label horizontal cable sheaths at work area outlets and at patch panels with laser printed self laminating wrap around vinyl labels. Labels shall be in accordance with the Labeling Scheme identified on the drawings.

B. Labels shall be white with black type. Label size shall be 1.0” wide by 1.5” high.

C. At the Telecom Room, cable labels will be affixed to cable a minimum of 1 inch from the termination on the patch panel, and placed in such a way as to be clearly visible.

D. At the work area outlet, cable labels shall be affixed to the cable 2 inches from the termination on the jack.

1. Acceptable Manufacturers:

a. Brady.
b. Belden.
c. Hellermann Tyton.
d. Or equal.

2.5 COPPER PATCH PANEL LABELS.

A. Label each patch panel with a single panel ID label in accordance with the labeling scheme identified on the drawings.

B. Labels shall be compatible with the patch panels provided for the Project.

C. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.5” wide by 0.5” high.

1. Acceptable Manufacturers:

a. Brady.
b. Belden.
c. Hellermann Tyton.
d. Or equal.

D. Label each patch panel port with a laser printed label. Label each port with the room number of the room housing the work area outlet.

E. Labels shall be compatible with the patch panels provided for the Project.

F. Label material shall be permanent polyester. Labels shall be white with black type. Label size shall be 0.375” high.

1. Acceptable Manufacturers:

a. Brady.
b. Belden.
c. Hellermann Tyton.
d. Or equal.

PART 3 – EXECUTION

3.1 CABLE TESTING – GENERAL

A. Visually inspect all cables, cable reels, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.

B. Where post-manufacture test data has been provided by the manufacturer on the reel or shipping carton, submit copies to the Owner's Representative as part of the cable test results.

C. The Owner's Representative reserves the right to observe any or all portions of the cable testing process.

D. The Owner's Representative further reserves the right to conduct, using contractors equipment and labor, a random re-test of up to thirty percent (30%) of the cable plant to confirm documented test results.

E. Test results and corrective procedures are to be documented and submitted to the Owner's Representative within five (5) working days of test completion.

3.2 CATEGORY 6 UTP CABLE TESTING

A. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

B. Field test measurements shall be made in accordance with Annex I of ANSI/TIA/EIA-568-B.2 unless otherwise noted.

C. Field test measurements shall be conducted from 1 MHz to 250 MHz.

D. Field testing shall be conducted using a level III tester. The accuracy of the level III tester shall meet or exceed the requirements of Annex B of ANSI/TIA/EIA-568-B.2-1. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

E. Every cabling link shall be tested in accordance with the ANSI/TIA/EIA-568-B.1 Section 11.2: “100-Ohm twisted-pair transmission performance and field test requirements”.

F. The installed twisted-pair horizontal links shall be tested from the patch panel in the telecommunications room to the work area outlet. The cable must pass the “Permanent Link” performance limits specification as defined in ANSI/TIA/EIA-568-B.1.

G. 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned above. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

H. Trained technicians who have successfully attended an appropriate training program shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

I. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall

be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2).

J. The Contractor shall provide Category 6, 250 MHz channel test results on all pairs of cable. The following minimum field test parameters are required:

1. Wire map (including cable shield if present).
2. Length.
3. Insertion loss.
4. Near-end crosstalk (NEXT) loss.
5. Power sum near-end crosstalk (PSNEXT) loss.
6. Equal-level far-end crosstalk (ELFEXT).
7. Power-sum equal-level far-end crosstalk (PSELFEXT).
8. Return loss.
9. Propagation delay.
10. Delay skew.

K. Test results shall be provided in electronic format and printed 8.5” x 11” format signed by the technician performing the testing. The electronic format should be a Microsoft Word .doc file. Along with the above test parameters, the following information must be included for each cable tested:

1. Name of Owner and name of project (building name).
2. Date and time of test.
3. Name of technician performing the field testing.
4. Manufacturer, model number, serial number and software revision of field tester.
5. Cable ID (Telecom Room # - Patch Panel # - Port # / Work Area Room # - Telecom Outlet – Jack #).
6. Overall Pass/Fail result.
7. Manufacturer, category and model number of cable.
8. NVP used to determine cable length.

3.3 IDENTIFICATION AND LABELING

A. The Contractor shall confirm the telecom room and work area room numbers with the Owner or Owner's Representative prior to labeling.

B. Work Area Outlet Face Plates: Label all faceplates in sequential order in a clockwise manner from the main entrance of the room containing the cable drops starting with the number one “1”. This numbering scheme will reset in each room. For example, Telecom Outlet 2 in Room 102 = “102-2”.

C. Work Area Data and Voice Jacks: Each data and voice jack at the work area outlet shall be labeled. The label shall identify the name of the telecom room from which the drop originated, the letter of the patch panel where the drop is terminated and the patch panel port number. For example, Telecom Room “150”, Patch Panel “B”, Patch Panel Port 48 = “150-B-48”.

D. Work Area Horizontal Data, Voice and Video Cable: Horizontal cable should be labeled at both ends within 6” of the point of termination. At the workstation outlet, the label shall identify the name of the telecom room from which the drop originated, the letter of the patch panel where the drop is terminated and the patch panel port number. For example, Telecom Room “150”, Patch Panel “B”, Patch Panel Port 48 = “150-B-48”.

E. Telecom Room Horizontal Data, Voice and Video Cable: At the patch panel, the label shall identify the name of the room in which the drop is terminated, the Outlet number in the room, and the jack number within the telecom outlet plate. For example, Room 102, Telecom Outlet 2, Jack 3 = “102-2-3”.

F. Patch Panels: Each patch panel in the telecom room shall have an alpha label (A-Z) located on the left hand side of the panel. Patch panel “A” shall be located at the top of the first rack in the telecommunications room. Patch panels beneath patch panel “A” shall be labeled B, C, etc. If additional patch panels are present in additional racks in the wiring closet, the patch panels adjacent to the left-most rack (when facing the racks) shall continue the sequential labeling beginning with the patch panel at the top of the next rack. The lettering scheme will reset in each telecom room. For example, Telecom Room 150, Rack 1, Patch Panel B = “B”.

G. Patch Panel Ports: Each port shall be labeled with the name of the room in which the drop is terminated, the outlet number in the room, and the jack number within the telecom outlet plate. For example, Room 102, Telecom Outlet 2, Jack 3 = “102-2-3”.

3.4 ADMINISTRATION

A. As-Built Drawings.

1. The Contractor shall provide As-Built drawings at the end of the project. One (1) reproducible and (1) blue line shall be provided. Electronic versions of the drawings in AutoCAD version 2000/2002 shall also be provided. The following information shall be provided on the As-Built Drawings:

   a. Plan location of all telecom outlets.
   b. Quantity and type of drops at each telecom outlet.
   c. Telecom room where the drops are terminated.
   d. Cable tray layout. Provide dimensions from building grid lines to locate cable tray.
   e. J-hook layout. Provide dimensions from building grid lines to locate J-hook runs.
   f. Conduits and pull box layout. Provide dimensions from building grid lines to locate conduits and pull boxes.
   g. Backbone cable runs and pair/strand counts.
   h. Horizontal and vertical sleeve layout.
   i. Outside plant vaults and pull boxes. Provide dimensions from curbs to locate vaults and pull boxes.
   j. Outside plant conduits. Provide dimensions from curbs to locate conduit.

B. Materials Listing

1. The contractor shall provide a spreadsheet indicating the materials and quantities used on the project. At a minimum, the spreadsheet will contain the following information: Item description, manufacturer, part number, quantity and color (where applicable).

END OF SECTION 270800

SECTION 271500 – HORIZONTAL CABLING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The Contractor shall provide all equipment, materials, labor, and services necessary to complete the horizontal cabling system, and to ensure that it is in compliance with requirements stated or reasonably inferred by the Specifications and the Contract Drawings.

B. The horizontal cabling is that portion of the telecommunication cabling system that extends from the work area telecommunications outlet to the patch panel or termination block in the telecommunications room.

C. This section includes minimum requirements for the following

1. Indoor / Outdoor Rated Category 6 Cabling.
2. Category 6 8-Position Jacks
3. Work Area 4-Port Plastic Faceplates
4. Work Area 2-Port Surface Mounted Side Entry Box
5. Category 6 Workstation Cords.
6. Velcro Cable Straps

1.2 REGULATIONS AND CODE COMPLIANCE

A. Materials and work specified herein shall comply with the requirements of Specification Section 27 01 00 1.4 and in particular the following code requirements

1. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises.
2. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunication Cabling and Components Standard.
4. ANSI/TIA-606-A -- The Administration Standard for the Telecommunications
5. ANSI/NFPA-70, 2005 -- National Electrical Code (NEC).
6. Underwriter’s Laboratories, Inc. (UL).

1.3 QUALITY ASSURANCE

A. All materials shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the Specification shall be subject to the control and approval of the Owner's Representative. Equipment and materials shall be of the quality and the manufacturer indicated. The equipment specified is based upon the acceptable manufacturers listed.

B. The Contractor shall strictly adhere to all Category 6 installation practices when installing unshielded twisted-pair cabling.

1.4 SUBMITTALS

A. Manufacturer's Data Sheets: Submit manufacturers data sheets for the following items

1. Horizontal Category 6 Cabling.
2. Category 6 8-Position Jacks
3. Work Area 4-Port Plastic Faceplates
4. Work Area 4-Port Stainless Steel Faceplates
5. Work Area 2-Port Surface Mounted Side Entry Box
6. Category 6 Workstation Cords.
7. Velcro Cable Straps

B. Bill of Materials: Submit a detailed bill-of-materials listing all manufacturers, part numbers, and quantities proposed for use on this project.

1.5 DELIVERY, STORAGE & HANDLING

A. Visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are to be returned to the supplier and replaced at no additional cost to the Owner.

1.6 GUARANTEE

A. The Category 6 horizontal voice and data cabling system including work area jacks, horizontal cabling, patch panels and patch cords shall be covered by a minimum 20-year system warranty from Belden/CDT, CommScope Systimax or approved equal (see Specification Section 27 01 00 1.9).

B. The Telecom Contractor will be responsible for fulfilling the requirements necessary to obtain one of the specified product warranties. This may require that the Contractor be a "Certified Installer" by the manufacturer. It may also require manufacturer specialized training, field installation oversight, field test verification, etc.

PART 2 – PRODUCTS

2.1 INDOOR / OUTDOOR RATED HORIZONTAL CATEGORY 6 CABLE

A. The horizontal cabling must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.6.

B. Provide indoor/outdoor rated horizontal CAT 6 data cabling suitable for underground duct installation. Cabling shall be 4-pair, Category 6 unshielded twisted pair.

C. Provide quantity of CAT 6 cables at each telecom outlet as shown on the drawings.
D. Physical Characteristics

1. Category 6 cable shall meet or exceed the requirements of ANSI/TIA/EIA–568-B.2 and ANSI/TIA/EIA–568-B.2 Addendum 1.

2. Cable shall have a listed UV resistant polyolefin jacket with a flooded core.

3. The cable jacket must have the following legible markings

a. Manufacturer's name.
b. Copper conductor gauge.
c. Pair count.
d. UL and CSA listing.

e. Manufacturer's trademark.
f. Category rating.
g. Sequential foot markings, in one foot increments.
h. Jacket rating (CMP).

E. Transmission Characteristics

1. Cable shall conform to ANSI/TIA/EIA–568-B.2 Addendum 1 as shown below.

Frequency (MHz)	Solid Conductor Cable Insertion Loss (dB)	NEXT Loss (dB)	PSNEXT Loss (dB)	ELFEXT Loss (dB)	Power Sum ELFEXT (dB)	Return Loss (dB)
1	2.0	74.3	72.3	67.8	64.8	20.0
4	3.8	65.3	63.3	55.8	52.8	23.0
8	5.3	60.8	58.8	49.7	46.7	24.5
10	6.0	59.3	57.3	47.8	44.8	25.0
16	7.6	56.2	54.2	43.7	40.7	25.0
20	8.5	54.8	52.8	41.8	38.8	25.0
25	9.5	53.3	51.3	39.8	36.8	24.3
31.25	10.7	51.9	49.9	37.9	34.9	23.6
62.5	15.4	47.4	45.4	31.9	28.9	21.5
100	19.8	44.3	42.3	27.8	24.8	20.1
200	29.0	39.8	37.8	21.8	18.8	18.0
250	32.8	38.3	36.3	19.8	16.8	17.3

2. Propagation delay skew shall not exceed 45 ns per 100 meters for all frequencies from 1 MHz to 250 MHz.

F. Acceptable Products:

1. Mohawk Indoor/Outdoor rated VersaLAN P/N LT55553.
2. Or approved equal.

2.2 CATEGORY 6 MODULAR JACKS

A. The modular jacks must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.6.

B. All modular jacks shall be 8-pin Category 6 and will conform to the requirements of ANSI/TIA/EIA–568-B.2 Addendum 1.

C. Pin/Pair assignment shall be in accordance with T568B.

D. Modular jacks shall be manufactured by the same manufacturer as the patch panels in the telecommunication rooms.

E. Work area jacks for voice and data systems shall have different colors. Data jacks will be blue and voice jacks white.

F. Modular jacks shall have a 'CAT 6' designation on the face of the jack insert.

G. Modular jacks shall be “Keystone” style.

H. Acceptable Products:

1. Belden/CDT Category 6 KeyConnect Modular Jacks P/N AX101326 (color blue) and AX101320 (color white).
2. CommScope Uniprise UNJ600-BL (color blue) AND UNJ600-WH (color white).
3. Or equal.

2.3 WORK AREA 4-PORT PLASTIC FACEPLATES

A. The faceplates must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.6.

B. Provide UL listed faceplates. Faceplates should be white (verify with Architect), flush mounted and manufactured of high impact thermoplastic.

C. Faceplates shall have top and bottom label holders with plastic inserts.

D. Provide faceplates with a minimum of 4 and a maximum of 6 modules. Provide blank inserts in unused openings.

E. Faceplates shall accept “Keystone” style modular jacks.

F. Faceplates shall be manufactured by the same manufacturer as the outlet jacks and shall be compatible with the submitted outlet jacks.

G. Acceptable Products:

1. Belden/CDT 4-Port KeyConnect Faceplate P/N AX102249 (color white) – verify color w/Architect.
2. CommScope Uniprise M14L-246 (color white).
3. Or equal.

2.4 WORK AREA 4-PORT STAINLESS STEEL FACEPLATES

A. Provide UL listed stainless steel faceplates at workstation outlets.

B. Provide 4-port faceplates. Provide blank inserts in unused openings.

C. Faceplates shall accept “Keystone” style modular jacks.

D. Faceplates shall be manufactured by the same manufacturer as the outlet jacks and shall be compatible with the submitted outlet jacks. Provide “keystone” jacks as necessary.

E. Acceptable Products:

1. Stainless SG Faceplate. Belden/CDT AX102009.
2. CommScope Systimax M14SP.
3. Or Approved Equal.

2.5 2-PORT SURFACE MOUNTED ENCLOSURES

A. Provide 2-port side entry box for termination of cabling for wireless access points located above ceilings.

B. A 25'-0" cable loop shall be provided at all wireless access point locations to allow the workstation outlet to be relocated anywhere in a 25'-0" radius.

C. Acceptable Products:

1. Belden/CDT 2-Port KeyConnect Side Entry Box P/N AX102652 (White).
2. CommScope Systimax Part Number M102SMB-B-262 (White).
3. Or equal.

2.6 CATEGORY 6 WORKSTATION CORDS

A. The workstation cords must meet the specific manufacturer system warranty requirements listed in Specification Section 27 15 00 1.6.

B. Provide (1) 15'-0" category 6 UTP workstation cord for every (2) data drops.

C. Category 6 Workstation cords shall meet or exceed the requirements of ANSI/TIA/EIA 568-B.2.

D. Workstation cords should be white, made from stranded conductors and have 8-position RJ-45 style snagless plugs on each end with molded strain relief boots.

E. Cabling used for workstation cords shall be manufactured by the same manufacturer as the horizontal cabling and shall be of the same product line. Electrical characteristics and performance of the patch cables shall be nearly identical to the horizontal cable with exceptions given due to differences between solid and stranded conductors as indicated in the following table.

Frequency (MHz)	Stranded Conductor Cable Insertion Loss (dB)
1	2.4
4	4.5
8	6.4
10	7.1
16	9.1
20	10.2
25	11.4
31.25	12.8
62.5	18.5
100	23.8
200	34.8
250	39.4

F. Workstation cords shall be rated for use as communications cable and shall have the designation "CM" or "CMR" printed on the jacket.

G. Workstation cords shall be identical in construction to the patch cords in the telecommunications rooms. See Specification Section 27 11 00 for patch cord Acceptable Products:

1. Belden/CDT GigaFlex PS6+ Modular Cord P/N AX350047 (15 ft).
2. CommScope Uniprise UNC6 P/N UNC-WH-15F.

3. Or equal.

2.7 VELCRO CABLE STRAPS

A. Loosely bundle horizontal cabling with Velcro tie wraps.

B. Velcro tie wraps shall ¾” in width and cut from a continuous roll.

C. Install Velcro cable ties at 2’-0” intervals outside of the telecom rooms and 1’-0” intervals inside the telecom rooms.

D. Do not exceed qty (50) cables per bundle.

E. Acceptable Products

1. Panduit TAK-TY HLSP (plenum).
2. Leviton 43115-075.
3. Or equal.

PART 3 – EXECUTION

3.1 HORIZONTAL CABLE ROUTING AND TERMINATION

A. Ten feet of cable slack shall be stored at the telecom room and three feet of cable slack will be provided in the ceiling space above the telecom outlet for each installed cable.

B. All horizontal cables will be installed in cable bundles. Cable bundles will not exceed 50 cables per bundle and will be loosely bound with velcro straps. Cables in a bundle should be uncombed until entry into each rack's vertical cable management, where the cables are to be combed and dressed together until terminated on each patch panel.

C. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points or consolidation points specifically shown on the drawings.

D. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturers requirements and reference documents.

E. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, The Contractor shall install appropriate supports to support the cabling.

F. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

G. Cables shall be labeled with self-adhesive labels. At the work area outlet, the cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate. At the Telecom Room, each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle where the label is obscured from view shall not be acceptable.

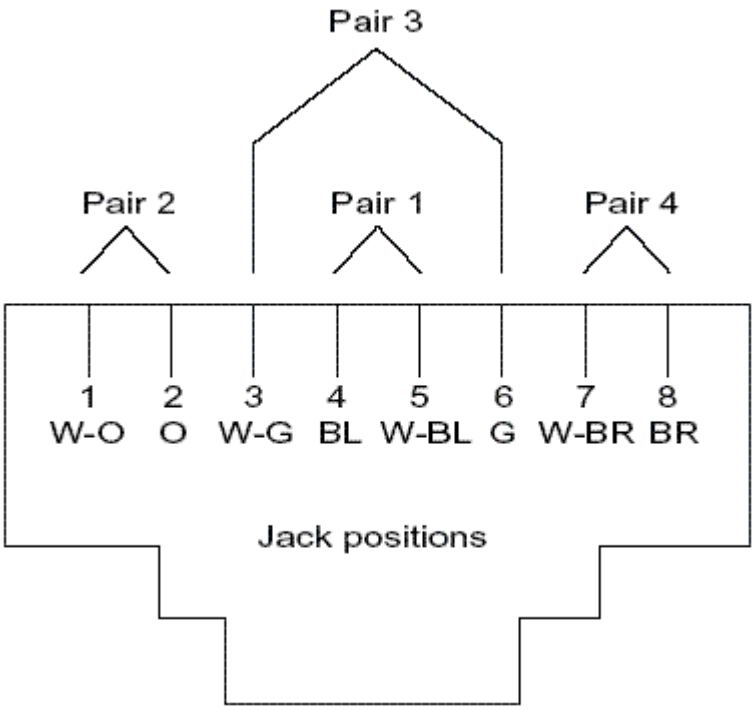
H. Cables shall be installed in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer’s recommendations and installation guides, and best industry practices.

I. Plastic “zip-ties” shall not be permitted within the Structured Cabling System. “Velcro” type (hook and loop) tie wraps shall be used for the purpose of bundling / managing horizontal and backbone cabling (must be plenum rated if installed within a plenum space).

J. Horizontal UTP pair untwist at the termination shall not exceed 0.5”.

K. Jack pin/pair assignments shall be T568B for all installed horizontal cabling unless otherwise specified within the Project Documents.

1. T568B Jack pin/pair assignments are as follows:



L. For horizontal cabling, if a J-hook System is used to support cable bundles all horizontal cables shall be supported at a maximum of 48” intervals. J-hooks must be secured to a permanent, stable component of the building structure. J-Hooks shall not be attached to wires, cables, etc. The horizontal pathway shall not permit any motion in cabling it supports. Cable quantities shall not exceed J-Hook System manufacturer recommendations or 25 cables, whichever is fewer.

M. At no point shall cables rest on acoustic ceiling grids or panels, or be attached to any portion of the building accept conduit/innerduct, raceway, ladder rack, cable tray and J-hooks.

N. Horizontal Category 6 distribution cables shall be bundled or distributed together in groups of no more than 50 cables. When larger quantities are distributed together in ladder rack or cable tray, cables shall be separated into groups of fifty or fewer cables with a minimum of two inches of separation maintained between them at all points.

O. The cable length between the work area outlet and the termination in the telecommunications closet shall not exceed 295 feet. Any horizontal cable runs longer

than 295 feet should be brought to the immediate attention of the Owner's Representative prior to installation.

P. When placing cable, the Contractor shall maintain the following minimum clearance from sources of electro-magnetic interference (EMI).

1. 6” clear from power conductors.
2. 12” clear from fluorescent lighting fixtures and ballasts.
3. 36” clear from transformers and motors.

3.2 WORK AREA OUTLETS

A. Work Area outlets and connectors shall be installed in accordance with manufacturer’s recommendations and installation guides, and best industry practices.

B. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA/EIA-568-B standard document, manufacturer’s recommendations and best industry practices.

C. Pair untwist at the termination shall not exceed 0.5”.

D. Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.

END OF SECTION 271500

SECTION 312000 - STRUCTURAL EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all site stripping, excavation, fill, backfill, and grading, as specified herein, and as noted on the Drawings.

B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.2 QUALITY ASSURANCE

A. Testing Agency: Local testing laboratory with a minimum of three years experience in testing soil materials. All reports prepared by the Testing Agency shall be signed by a Professional Engineer registered to practice as a Civil Engineer in the state of Nevada.

B. Testing laboratory shall have the same required qualifications as the Testing Agency but shall be retained by the Owner. Testing laboratory will make field tests as directed of the "in place" materials to assure conformance with Contract Documents.

C. Source Quality Control: Prior to delivery to site, the Testing Agency shall test all imported soil material for conformance with Contract Documents. Also on site fill materials shall be approved by the Geotechnical Engineer prior to placing.

D. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

E. Use equipment adequate in size, capacity, and numbers to accomplish the Work of this Section in a timely manner.

F. In addition to complying with the requirements of governmental agencies having jurisdiction, comply with the directions of the Geotechnical Engineer, as approved by the Architect.

G. Reference Standards:

1. ASTM - American Society for Testing and Materials.
   a. D 422 - Particle Size Analysis of Soils.
   b. D 424 – Plastic Limit and Plasticity Index of Soils.
   c. D 1556 - Standard Test Method for Density of Soil in Place by the Sand Cone Method.
   d. D 1557 - Standard Test Methods for Moisture-Density Relations of Soils Using 10-pound Rammer and 18-inch Drop.
   e. D 2487 - Classification of Soils for Engineering Purposes.
   f. D 3017 - Moisture Content of Soil and Soil-aggregate in place by Nuclear Methods.
2. State of Nevada, Standard Specifications for Road and Bridge Construction.

1.3 SUBMITTALS

A. Test Reports: Submit test reports on proposed imported materials, and compaction test reports on all compacted materials.

1.4 JOB CONDITIONS

A. Existing Conditions:

1. Information shown on the Drawings regarding existing site conditions is believed to be correct, but it is not guaranteed. Contractors shall visit the site for necessary information and data regarding present ground levels, ground water level, conditions of property, locations and size of obstructions, and access, etc.
2. Where existing utilities are encountered which are not shown on the Drawings or evident from a site inspection, contact the Architect immediately for instructions. If such lines are inadvertently broken through no fault of the Contractor's operation, they shall be repaired by the Contractor, and an adjustment will be made in payment by the Owner. Breakage of lines shown on the Drawings or evident by a site inspection will be repaired by the Contractor at no increase in Contract Sum.

B. Protection:

1. Provide, and maintain all barricades, shoring, bracing, etc., as required by federal and State codes. Contractor shall assume all responsibility for damage to utilities, streets, etc., that may be caused by this Work.
2. Maintain temporary drainage routes during construction so that rainfall or snow-melt will drain from site and not accumulate or pond.

C. Sequencing, Scheduling and Coordination: The Contractor may schedule and sequence his operations as he desires to optimize the Work of this SECTION.

PART 2 - PRODUCTS

2.1 MATERIALS

A. For structural fill and backfill use imported or approved on-site materials which are non-expansive conforming to the following: Granular soil, free of organic material and debris and free of clods, lumps and rocks larger than 4-inch diameter. Material shall be reasonably well graded with not more than 35-percent passing a No. 200 sieve, not more than 70-percent passing a No. 40 sieve, and not less than 70 percent passing a ¾" sieve, liquid limit – 30 maximum, plastic index – 15 maximum. All material shall be approved by the Geotechnical Engineer prior to delivery and use.

B. Site non-structural fill may be any on site materials free of debris and rocks larger than 4-inch diameter or imported materials as specified in "A" above.

C. Drain Rock: Provide clean, crushed 1" minus rock or open graded drain rock, or use a ¾" rock topped with chips to prevent concrete from penetrating the drain rock. Drain Rock materials shall be approved by the Geotechnical Engineer prior to delivery and use.

D. Aggregate Base for interior concrete slabs, exterior concrete slabs, and sidewalk base: Comply with Nevada Highway Department Type 2, Class B, Aggregate Base.

E. Moisture Barrier: A moisture barrier shall be provided under all interior slabs on grade unless noted otherwise. It shall be placed directly below the aggregate base. The moisture barrier shall be Mirafi “MCF-1212”, Stego Wrap 15 mil, or approved equal.

F. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Lay out the building and all site work in conformance with Contract Documents. Establish necessary benchmarks. Protect them and existing benchmarks shown on the Site Plan, until completion of the Work.

3.3 PERFORMANCE

A. Perform no earthwork during inclement weather, or when excessive moisture is present in the fill material.

B. Should rainfall or snow-melt occur following footing excavation and prior to pouring footing, dry the excavation thoroughly and recompact the soils below the footing prior to placing footing.

C. Use no frozen fill. Place no fill on frozen ground.

D. Remove and replace in-place fills which are frozen prior to the placement of any additional fill.

E. When rains or snow-melt interrupt fill operations, inspect the surface before more fill is placed to assure that detrimental conditions do not exist.

F. Clearing and Grubbing: The areas to receive compacted fill for support of foundations, paving, and slabs shall be stripped of all debris, fill soils, crop growth, vegetation, surface trash, roots larger than 2 inches in diameter, and incidental topsoils as determined by the Geotechnical Engineer.

G. Stripping: Any existing debris and former construction shall be completely removed from the site.

H. Excavation:

1. Excavate as necessary to obtain required subgrade elevations.
2. Form all footings with wood, metal, or earth forms as specified in SECTION 031000, "CONCRETE FORMWORK."

I. Compaction of Exposed Soils: The soils exposed by excavations, which are to receive compacted fill or footings, shall be scarified, watered or dried as necessary to within 2% of optimum, and compacted to a depth of 12", to at least 95-percent of maximum dry density. If, in the opinion of the Geotechnical Engineer, the existing soils at the bottom of the footing excavations are at 95-percent of maximum dry density or above, then these soils may not require scarification and recompaction, as determined by the Geotechnical Engineer.

K. Moisture Barrier:

1. Where moisture barrier is required by plans, place moisture barrier beneath aggregate base.

M. Aggregate Base:

1. Provide the aggregate base placed on top of the moisture barrier membrane and compact to at least 95 percent under pavement and other exterior and interior slabs. Also compact the upper 12" of subgrade below this base to 95 percent relative compaction.
2. Establish finish grade of base at the required elevation with a level uniform surface varying not more than 1/2-inch when measured in any direction with a 10-foot straight edge.

N. Site Grading:

1. After completion of all excavation, fill and backfill, rake surface to a 4-inch depth to remove all rocks and debris in excess of 2-inches in diameter. Remove this material from the site.
2. Grade all areas including excavated and filled sections and transition areas to obtain a finished surface, reasonably smooth, compacted, and free from irregular surface changes. Leave all ditches, swales, and gutters finished to drain readily.

3.4 FIELD QUALITY CONTROL

A. Soil Compaction Test: The Owner will pay the testing Laboratory for the first compaction test at any test location. All retests required because fill materials were not compacted to the required density shall be paid for by the Contractor.

B. The Geotechnical Engineer shall review all sitework and footing excavations before any concrete is cast, and submit a letter of compliance to the Architect.

C. If, in the Geotechnical Engineer's opinion, based on reports of the testing laboratory, subgrade or fills have been placed below specified density, provide additional compacting and testing.

3.5 MAINTENANCE

A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

END OF SECTION 312000