

Bid No.010522
Thomas Jefferson Middle School HVAC Project

Specifications:



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SECTION 01 10 00**SUMMARY****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section Includes:

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

- B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: Jefferson Middle School HVAC Replacement.

1. Project Location: 1407 Sunset Ave., Madera, CA 93637.

- B. Owner: Madera Unified School District; 1205 S. Madera Ave., Madera, CA 93637.

1. Owner's Representative: Curtis Manganaan 559-675-4534.

- C. Engineer: LP Engineers, Inc.; 895 W. Ashlan Ave, Ste. 101, Clovis, CA 93612. Garen Lencioni 559-348-2130.

- D. Engineer's Consultants: Engineer has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Architect: Dave Baisa
2. Structural Engineer: Brooks ransom Associates;
3. Electrical Engineer: John Chong Engineering;

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 1. Removal of existing Heating systems with addition of Air Conditioning Units to Cafeteria and Gym along with all associated other Work indicated in the Contract Documents. Also adding Evaporative Cooling to the Wrestling Room.
- B. Type of Contract:
 1. Project will be constructed under a single prime contract.

1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. 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: Confine construction operations to Cafeteria and Gymnasium Buildings.
 2. Driveways, Walkways and Entrances: Keep driveways 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 for storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 2. Provide not less than **72** hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
1. Engineer will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.7 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 7 a.m. to 4 p.m., Monday through Friday, unless otherwise indicated.
1. Weekend Hours: **<Insert restrictions on times permitted for weekend work>.**
 2. Early Morning Hours: **<Insert restrictions or references to regulations by authorities having jurisdiction for restrictions on noisy work>.**
 3. Hours for Utility Shutdowns: **<Insert Owner's restrictions>.**
 4. Hours for **[Core Drilling]** **<Insert noisy activity>: <Insert Owner's restrictions>.**
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
1. Notify **Owner** not less than **two** days in advance of proposed utility interruptions.
 2. Obtain **Owner's** written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
1. Notify **Owner** not less than **two** days in advance of proposed disruptive operations.
 2. Obtain **Owner's** written permission before proceeding with disruptive operations.
- E. Restricted Substances: Use of tobacco products and other controlled substances **on Project site** is not permitted.

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

1.8 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 **published as part of the U.S. National CAD Standard and scheduled on Drawings.**
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 21 00**ALLOWANCES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
 - 3. Quantity allowances.
 - 4. Contingency allowances.
 - 5. Testing and inspecting allowances.
- C. Related Requirements:
 - 1. Section 01 22 00 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
 - 2. Section 01 40 00 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.3 DEFINITIONS

- A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.4 ACTION SUBMITTALS

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

1.5 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's[**overhead, profit, and**] related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the

Contract Sum. These costs include delivery, installation, **taxes**, insurance, equipment rental, and similar costs.

- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.6 TESTING AND INSPECTING ALLOWANCES

- A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.
- B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.
- C. Costs of testing and inspection services not required by the Contract Documents are not included in the allowance.
- D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.7 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
 - 3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION****3.1 EXAMINATION**

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

3.2 PREPARATION

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

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Contingency Allowance: Include a contingency allowance of \$100,000.00 for use according to Owner's written instructions.
- B. Allowance No. 2: Testing and Inspection Allowance: Include the sum of \$1,000.00 for testing concrete to be provided by Owner as specified in Section 03 30 00 "Cast-in-Place Concrete."
- C. Allowance No. <Insert number>: [**Lump-Sum**] [**Unit-Cost**] [**Quantity**] [**Contingency**] [**Testing and Inspecting**] Allowance: Include the sum of <Insert dollar or quantity amount of allowance>; Include <Insert allowance description> as specified in Section <Insert Section number> "<Insert Section title>"[and as shown on Drawings].
 - 1. This allowance includes [**material cost**] [**receiving, handling, and installation**] [**and Contractor overhead and profit**].
 - 2. Coordinate quantity allowance adjustment with corresponding unit-price requirements in Section 01 22 00 "Unit Prices."

END OF SECTION

SECTION 01 25 00

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 01 21 00 "Allowances" for products selected under an allowance.
 - 2. Section 01 60 00 "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. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

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 method cannot be provided, if applicable.
 - b. Coordination of 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 substitutions 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 as well as 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 California Code of Regulations.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions 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. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within **seven** days of receipt of a request for substitution. Engineer will notify Contractor **through Construction Manager** 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 Engineer's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Engineer 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.

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than **15** days prior to time required for preparation and review of related submittals.
1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Engineer will consider requests for substitution if received within **60** days after **the Notice to Proceed**. Requests received after that time may be considered or rejected at discretion of Engineer.
1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 26 00**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 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Engineer will issue **through Construction Manager** supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on **AIA Document G710**.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: **Engineer** 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 **Engineer** are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within **time specified in Proposal Request or 20 days, when not otherwise specified**, 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 **forms acceptable to Engineer**.

- 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 **Engineer**.

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 **form acceptable to Engineer**.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 01 21 00 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, **Engineer** will issue a Change Order for signatures of Owner and Contractor on **AIA Document G701** or **AIA Document G701CMA**.

1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: **Engineer** may issue a Construction Change Directive on **AIA Document G714** or **AIA Document G714CMA**. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- 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.

1.8 WORK CHANGE DIRECTIVE

- A. Work Change Directive: **Engineer** may issue a Work Change Directive on EJCDC Document C-940. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work 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

SECTION 01 29 00

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 01 21 00 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Section 01 32 00 "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.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Engineer at earliest possible date, but no later than **seven** days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
 - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Engineer.
 - c. Engineer's Project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
2. Arrange schedule of values consistent with format of **AIA Document G703** or **EJCDC Document C-620**.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 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. Provide multiple line items for principal subcontract amounts in excess of **five** percent of the Contract Sum.
5. 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.
6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Closeout Costs: Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling **five** percent of the Contract Sum and subcontract amount.
11. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Engineer by the **first** of the month. The period covered by each Application for Payment is one month, ending on the **last day of the month**.
 - 1. Submit draft copy of Application for Payment **seven** days prior to due date for review by Engineer.
- D. Application for Payment Forms: Use **AIA Document G702 and AIA Document G703** or **AIA Document G732 and AIA Document G703** or **EJCDC Document C-620** as form for Applications for Payment.
 - 1. Other Application for Payment forms proposed by the Contractor shall be acceptable to **Engineer** and Owner. Submit forms for approval with initial submittal of schedule of values.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. **Engineer** will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

- G. Transmittal: Submit **three** signed and notarized original copies of each Application for Payment to **Engineer** by a method ensuring receipt **within 24 hours**. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from **[entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application]**.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 5. Products list (preliminary if not final).
 6. Sustainable design action plans, including preliminary project materials cost data.
 7. Schedule of unit prices.
 8. Submittal schedule (preliminary if not final).
 9. List of Contractor's staff assignments.
 10. List of Contractor's principal consultants.
 11. Copies of building permits.
 12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 13. Initial progress report.
 14. Report of preconstruction conference.
 15. Certificates of insurance and insurance policies.
 16. Performance and payment bonds.
 17. Data needed to acquire Owner's insurance.
- J. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

- K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706.
 5. AIA Document G706A.
 6. AIA Document G707.
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 00**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. RFIs.
 - 4. Digital project management procedures.
 - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.
 - 4. Section 01 91 13 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Engineer, 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. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within **15** days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and 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. Post copies of list in project meeting room, in temporary field office and in prominent location in **each** built facility. Keep list current at all times.

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.
- B. Coordination: Each contractor shall **cooperate with Project coordinator who shall** coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with 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 with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities **and direction of Project coordinator** to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated 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 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 Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles,

door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. 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.
 7. 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.
 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. Review: Engineer will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make suitable modifications and resubmit.
 10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 2. File Preparation Format: **DWG** or **DXF**, Version **2016**, operating in **Microsoft Windows** operating system.
 3. File Submittal Format: Submit or post coordination drawing files using **format same as file preparation format** or **PDF format**.
 4. BIM File Incorporation: **Develop and incorporate** coordination drawing files into BIM established for Project.
 - a. **Perform** three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Engineer.
 5. Engineer will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Digital Data Software Program: Drawings are available in **2016 Autocad, Windows based software**.

- c. Contractor shall execute a data licensing agreement in the form of **AIA Document C106**.

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Engineer will return without response those RFIs submitted to Engineer by other entities controlled by Contractor.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Engineer.
 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.
- C. RFI Forms: **AIA Document G716**.
 1. Attachments shall be electronic files in PDF format.
- D. Engineer's Action: Engineer will review each RFI, determine action required, and respond. Allow **seven** working days for Engineer's response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.
 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 Engineer's actions on submittals.

- g. Incomplete RFIs or inaccurately prepared RFIs.
- 2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt by Engineer of additional information.
- 3. Engineer'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 01 26 00 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within **10** days of receipt of the RFI response.
- E. 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 Engineer.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Engineer's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer within **seven** days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Engineer's Digital Data Files: Digital data files of Architect's **CAD drawings** will be provided by Engineer for Contractor's use during construction.
 - 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 - 2. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 - 3. Digital Drawing Software Program: Contract Drawings are available in **2016 Autocad, Windows based software.**
 - 4. Contractor shall execute a data licensing agreement in the form of **AIA Document C106 Digital Data Licensing Agreement.**
 - a. Subcontractors, and other parties granted access by Contractor to Engineer's digital data files shall execute a data licensing agreement in the form of **AIA Document C106.**
 - 5. An alternate Licensing agreement form may be requested by Contractor to Engineer.
 - 6. The following digital data files will be furnished for each appropriate discipline:
 - a. Floor plans.

- b. Reflected ceiling plans.
 - c. Mechanical Floor Plans.
- B. PDF Document Preparation: Where PDFs are required to be submitted to Engineer, prepare 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.
 - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

- A. General: **Schedule and conduct** meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within **three** days of the meeting.
- B. Preconstruction Conference: **Engineer will schedule and conduct** a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than **15** days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner, **Owner's Commissioning Authority**, Engineer, 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.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Sustainable design requirements.
 - o. Preparation of Record Documents.
 - p. Use of the premises **and existing building**.
 - q. Work restrictions.

- r. Working hours.
 - s. Owner's occupancy requirements.
 - t. Responsibility for temporary facilities and controls.
 - u. Procedures for moisture and mold control.
 - v. Procedures for disruptions and shutdowns.
 - w. Construction waste management and recycling.
 - x. Parking availability.
 - y. Office, work, and storage areas.
 - z. Equipment deliveries and priorities.
 - aa. First aid.
 - bb. Security.
 - cc. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Sustainable design requirements.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - l. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: **Schedule and conduct** a project closeout conference, at a time convenient to Owner and Engineer, but no later than **30** days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, **Owner's Commissioning Authority**, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Procedures for completing and archiving web-based Project software site data files.
 - d. Submittal of written warranties.
 - e. Requirements for completing sustainable design documentation.
 - f. Requirements for preparing operations and maintenance data.
 - g. Requirements for delivery of material samples, attic stock, and spare parts.
 - h. Requirements for demonstration and training.
 - i. Preparation of Contractor's punch list.
 - j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - k. Submittal procedures.
 - l. Coordination of separate contracts.
 - m. Owner's partial occupancy requirements.
 - n. Installation of Owner's furniture, fixtures, and equipment.
 - o. Responsibility for removing temporary facilities and controls.
 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: **Conduct** progress meetings at **biweekly** intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, **Owner's Commissioning Authority** and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how

construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

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

- 1) Interface requirements.
- 2) Sequence of operations.
- 3) Resolution of BIM component conflicts.
- 4) Status of submittals.
- 5) Status of sustainable design documentation.
- 6) Deliveries.
- 7) Off-site fabrication.
- 8) Access.
- 9) Site use.
- 10) Temporary facilities and controls.
- 11) Progress cleaning.
- 12) Quality and work standards.
- 13) Status of correction of deficient items.
- 14) Field observations.
- 15) Status of RFIs.
- 16) Status of Proposal Requests.
- 17) Pending changes.
- 18) Status of Change Orders.
- 19) Pending claims and disputes.
- 20) Documentation of information for payment requests.

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

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

F. Coordination Meetings: **Conduct** Project coordination meetings at **biweekly** intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, **Owner's Commissioning Authority** and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.

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

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

- b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Deliveries.
 - 6) Off-site fabrication.
 - 7) Access.
 - 8) Site use.
 - 9) Temporary facilities and controls.
 - 10) Work hours.
 - 11) Hazards and risks.
 - 12) Progress cleaning.
 - 13) Quality and work standards.
 - 14) Status of RFIs.
 - 15) Proposal Requests.
 - 16) Change Orders.
 - 17) Pending changes.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 00**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. Startup construction schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Unusual event reports.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.

1. Float time **is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.**
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
1. Working electronic copy of schedule file, where indicated.
 2. PDF file.
 3. **Two** paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup construction schedule.
1. Submittal of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
 3. Total Float Report: List of activities sorted in ascending order of total float.
 4. Earnings Report: Compilation of Contractor's total earnings from **commencement of the Work** until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at **weekly** intervals.
- H. Material Location Reports: Submit at **weekly** intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.

- J. Unusual Event Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including **phasing, work stages, area separations, interim milestones and partial Owner occupancy.**
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures, **including commissioning activities.**
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. 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.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 - 1. In-House Option: Owner may waive requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

- B. Time Frame: Extend schedule from date established for **the Notice to Proceed** to date of **final 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. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than **20** days, unless specifically allowed by Engineer.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - a. **Mechanical Equipment.**
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than **15** days for startup and testing.
 - 5. Commissioning Time: Include no fewer than **15** days for commissioning.
 - 6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
 - 7. Punch List and Final Completion: Include not more than **10** days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work under More Than One Contract: Include a separate activity for each contract.
 - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use-of-premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.
 - 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

- a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
 - n. Commissioning.
- 8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- 9. Other Constraints: Retain "Milestones" Paragraph below if the Contract Documents include requirements for certain work to be completed by specific dates.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, **and the following interim milestones:**
 - 1. Temporary enclosure and space conditioning.
 - 2. "Cost Correlation" Paragraph below establishes progress measured in dollar volume of the Work.
- F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 - 1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.
- G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and the Contract Time.
- H. Contractor's Construction Schedule Updating: At **monthly** intervals, update schedule to reflect actual construction progress and activities. Issue schedule **one week** before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- I. Recovery Schedule: When periodic update indicates the Work is **14** or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- J. Distribution: Distribute copies of approved schedule to Engineer, 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.

1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within **seven** days of date established for **the Notice to Proceed**.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first **90** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.9 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within **30** days of date established for **the Notice to Proceed**.
1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in **10** percent increments within time bar.

1.10 CPM SCHEDULE REQUIREMENTS

- A. General: Prepare network diagrams using AON (activity-on-node) format.

- B. Startup Network Diagram: Submit diagram within **14** days of date established for **the Notice to Proceed**. Outline significant construction activities for the first **90** days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a **cost- and resource-loaded**, time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than **30** days after date established for **the Notice to Proceed**.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and inspection.
 - j. Commissioning.
 - k. Punch list and final completion.
 - l. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of **5** percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Engineer.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
 1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.

- b. Submit value summary printouts **one week** before each regularly scheduled progress meeting.

1.11 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. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Testing and inspection.
 - 8. Accidents.
 - 9. Meetings and significant decisions.
 - 10. Unusual events.
 - 11. Stoppages, delays, shortages, and losses.
 - 12. Meter readings and similar recordings.
 - 13. Emergency procedures.
 - 14. Orders and requests of authorities having jurisdiction.
 - 15. Change Orders received and implemented.
 - 16. **Construction** Change Directives received and implemented.
 - 17. Services connected and disconnected.
 - 18. Equipment or system tests and startups.
 - 19. Partial completions and occupancies.
 - 20. Substantial Completions authorized.
- B. Material Location Reports: At **weekly** intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
 - 1. Material stored prior to previous report and remaining in storage.
 - 2. Material stored prior to previous report and since removed from storage and installed.
 - 3. Material stored following previous report and remaining in storage.
- C. 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.
- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
 - 1. Submit unusual event reports directly to Owner within **one** day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 33**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.
 - 3. Final completion construction photographs.
 - 4. Preconstruction video recordings.
 - 5. Periodic construction video recordings.
- B. Related Requirements:
 - 1. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 3. Section 02 41 16 "Structure Demolition" for photographic documentation before building demolition operations commence.
 - 4. Section 02 41 19 "Selective Demolition" for photographic documentation before selective demolition operations commence.
 - 5. Section 31 10 00 "Site Clearing" for photographic documentation before site clearing 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 and video recording**. 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. Submit photos **on CD-ROM or thumb-drive**. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description **in file metadata tag**:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Engineer.

- d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.
- C. Printed Photographs: Submit **two** sets of prints of each photographic view within **seven** days of taking photographs.
 - 1. Format: **8-by-10-inch** smooth-surface matte prints on single-weight, paper; enclosed back to back in clear plastic sleeves punched for three-ring binder. Include copy of key plan indicating each photograph's location and direction. Provide one binder for each set of prints.
 - 2. Identification: On back of each print, label with the following information:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Date photograph was taken if not date stamped by camera.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.
- D. Video Recordings: Submit video recordings within **seven** days of recording.
 - 1. Submit video recordings **on CD-ROM or thumb drive**. Include copy of key plan indicating each video's location and direction.
 - 2. Identification: With each submittal, provide the following information **in file metadata tag**:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Date video recording was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - 3. Transcript: Prepared on **8-1/2-by-11-inch** paper, punched and bound in three-ring binders. Provide label on front and spine. Include a cover sheet with label information. Include name of Project and date of video recording on each page.
- E. Time-Lapse Video: Submit time-lapse sequence video recordings **simultaneously with recording**.
 - 1. Submit time-lapse sequence video recordings **monthly on CD-ROM or thumb drive**.
 - 2. Identification: For each recording, provide the following information **in file metadata tag**:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Date(s) and time(s) video recording was recorded.
 - f. 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 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of **12** megapixels, and at an image resolution of not less than **3200 by 2400** pixels. Use flash in low light levels or backlit conditions.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of **12** megapixels and capable of recording in full high-definition mode. Provide supplemental lighting in low light levels or backlit conditions.
- C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- D. Metadata: Record accurate date and time from camera.
- E. File Names: Name media files with **date** and **Project area** and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before **commencement of demolition or starting construction**, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by **Engineer**.
 - 1. Flag **construction limits** before taking construction photographs.
 - 2. Take **20** photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take **20** photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take **20** photographs **monthly coinciding 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.
- E. Time-Lapse Sequence Construction Photographs: Take **20** photographs as indicated, to show status of construction and progress since last photographs were taken.
 - 1. Frequency: Take photographs **monthly, on the same date each month**.
 - 2. Vantage Points: Following suggestions by **Engineer** and Contractor, photographer to select vantage points. During each of the following construction phases, take not less

than **two** of the required shots from same vantage point each time to create a time-lapse sequence as follows:

- a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 - d. Interior Work, through date of Substantial Completion.
- F. Final Completion Construction Photographs: Take **20** photographs after date of Substantial Completion for submission as Project Record Documents. **Engineer** will inform photographer of desired vantage points.
- G. Additional Photographs: Engineer may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

1.7 CONSTRUCTION VIDEO RECORDINGS

- A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.
- B. Narration: Describe scenes on video recording by **audio narration by microphone while** video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
1. Confirm date and time at beginning and end of recording.
 2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.
- C. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.
- D. Preconstruction Video Recording: Before starting **demolition or construction**, record video recording of Project site and surrounding properties from different vantage points, as directed by **Engineer**.
1. Flag **construction limits** before recording construction video recordings.
 2. Show existing conditions adjacent to Project site before starting the Work.
 3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of **demolition or construction**.

4. Show protection efforts by Contractor.
- E. Periodic Construction Video Recordings: Record video recording **monthly coinciding with the cutoff date associated with each Application for Payment**. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be **5 minutes(s)**.
- F. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.
 1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every **one** minute, from same vantage point each time, to create a time-lapse sequence of **5 minutes** in length as follows:
 - a. Commencement of the Work, through completion of subgrade construction.
 - b. Above-grade structural framing.
 - c. Exterior building enclosure.
 2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during **construction work** hours.
 3. Vantage Points: Following suggestions by **Engineer** and Contractor, photographer shall select vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00

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:

- 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
 - 3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 01 32 33 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and final completion construction photographs.
 - 5. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 6. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 7. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 8. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 9. Section 01 79 00 "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 Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
1. 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 Engineer's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Engineer.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.
 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.

16. Signature of transmitter.
- B. Options: Identify options requiring selection by Engineer.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. PDF Submittals:
 1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal. Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number and description.
 2. Provide a space approximately **6 by 8 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
 3. Action Submittals: Submit **pdf** copies of each submittal unless otherwise indicated. Engineer will return **pdf** copies.
 4. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using **AIA Document G810** transmittal form.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Engineer.
 - a. Engineer will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
- 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.
 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. **Engineer reserves** the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on **Engineer's** receipt of submittal. No extension of the

Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow **15** 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 **15** days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Engineer's consultants, Owner, or other parties is indicated, allow **21** days for initial review of each submittal.

a. Architectural, Structural and Electrical Items.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Engineer and to Engineer's consultants, allow **15** days for review of each submittal. Submittal will be returned to **Engineer** before being returned to Contractor.

a. Submit one copy of submittal to concurrent reviewer in addition to Engineer.

D. Resubmittals: Make resubmittals in same form as initial submittal.

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

E. 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.

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

1.7 SUBMITTAL REQUIREMENTS

A. 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 unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show 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 Shop Drawings, and before or concurrent with Samples.
- B. 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 **unless submittal based on Engineer's digital data drawing files is otherwise permitted.**
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. Paper 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. BIM Incorporation: **Develop and incorporate** Shop Drawing files into BIM established for Project.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 4. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
 5. 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.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 6. 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. Engineer will return submittal with options selected.
- 7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit **three** sets of Samples. Engineer will retain **two** Sample sets; remainder will be returned. **Mark up and retain one returned Sample set as a project record Sample.**
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least **three** sets of paired units that show approximate limits of variations.
- D. 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.
- E. 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.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. 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.
3. 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.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. 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.

H. Test and Research Reports:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 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 insufficient to perform services or certification required, submit a written request for additional information to Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit **digitally signed PDF file and three** 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.
- C. BIM Incorporation: **Incorporate** delegated-design drawing and data files into BIM established for Project.
 - 1. Prepare delegated-design drawings in the following format: **Same digital data software program, version, and operating system as original Drawings.**

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with **a uniform approval stamp**. Include 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.
 - 1. Engineer will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ENGINEER REVIEW

- A. Action Submittals: Engineer will review each submittal, indicate corrections or revisions required, **and return it**.
 - 1. PDF Submittals: Engineer will indicate, via markup on each submittal, the appropriate action, **as follows**:
 - a. **No Exceptions, Make Corrections Noted, Submit Specified Items, Rejected, Revise & Resubmit and/or See Attached Letter.**
- B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer 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 Engineer.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Engineer will **return without review** submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Engineer without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

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 special procedures for alteration work.

1.3 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Engineer's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- 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 Engineer.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep existing items that are not to be removed or dismantled.
- L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

- A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.
1. Schedule construction operations in sequence required to obtain best Work results.
 2. Coordinate sequence of alteration work activities to accommodate the following:
 - a. Owner's continuing occupancy of portions of existing building.
 - b. Owner's partial occupancy of completed Work.
 - c. Other known work in progress.
 - d. Tests and inspections.
 3. Detail sequence of alteration work, with start and end dates.
 4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
 5. Use of elevator and stairs.
 6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.
- B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns **and adjacent to restricted areas**. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. **Access to restricted areas may not be obstructed.** Plan and execute the Work accordingly.

1.5 PROJECT MEETINGS FOR ALTERATION WORK

- A. Preliminary Conference for Alteration Work: Before starting alteration work, **Engineer will conduct** conference at **Project site**.
1. Attendees: In addition to representatives of Owner, Engineer, and Contractor, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
 2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
 - a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Fire-prevention plan.
 - c. Governing regulations.
 - d. Areas where existing construction is to remain and the required protection.
 - e. Hauling routes.
 - f. Sequence of alteration work operations.
 - g. Storage, protection, and accounting for salvaged and specially fabricated items.
 - h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
 - i. Qualifications of personnel assigned to alteration work and assigned duties.
 - j. Requirements for extent and quality of work, tolerances, and required clearances.

- k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.
 - 3. Reporting: **Contractor will record** conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.
- B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at **biweekly** intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 - 1. Attendees: In addition to representatives of Owner, Engineer, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
 - 2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
 - a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
 - b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
 - c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:
 - 1) Interface requirements of alteration work with other Project Work.
 - 2) Status of submittals for alteration work.
 - 3) Access to alteration work locations.
 - 4) Effectiveness of fire-prevention plan.
 - 5) Quality and work standards of alteration work.
 - 6) Change Orders for alteration work.
 - 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 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 or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.
 - 1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed **at Project site**.

1.7 INFORMATIONAL SUBMITTALS

- A. Alteration Work Subschedule:
 - 1. Submit alteration work subschedule within **30** days of date established for **commencement of alteration work**.
- B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.
- C. Alteration Work Program: Submit **30 days** before work begins.
- D. Fire-Prevention Plan: Submit **30 days** before work begins.

1.8 QUALITY ASSURANCE

- A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of **five** recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.
 - 1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
 - a. Construct new mockups of required work whenever a supervisor is replaced.
- B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- C. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work 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 fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.
- E. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.9 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged 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 **on-site designated by Owner**.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
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 items functional for use indicated.

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

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation 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.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures **5 deg F** or more above the dew point.

E. Storage Space:

1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space **does not include** security **and climate control** for stored material.
2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.10 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of **preconstruction photographs and preconstruction videotapes**.

1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."

B. Discrepancies: Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

- C. Owner's Removals: Before beginning alteration work, verify in correspondence with Owner that the following items have been removed:
 - 1. Any Furniture, Wrestling Mats, etc. that will be in the way of construction.
- D. Size Limitations in Existing 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 existing spaces, areas, rooms, and openings, including temporary protection, by **12 inches** or more.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.
 - 1. Use only proven protection methods, appropriate to each area and surface being protected.
 - 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
 - 3. Erect temporary barriers to form and maintain fire-egress routes.
 - 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
 - 5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
 - 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
 - 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
 - 8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.
- B. Temporary Protection of Materials to Remain:
 - 1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
 - 2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.
- C. 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.
- D. Utility and Communications Services:
 - 1. Notify Owner, Engineer, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
 - 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration 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.
- E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Engineer immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.
1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- F. Existing Roofing: Prior to the start of work in an area, install roofing protection **as indicated on Drawings**.

3.2 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, unless necessary for the immediate work.
 - a. If combustible material cannot be removed, provide fire blankets to cover such materials.
- B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using 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 practicable, 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 high-temperature 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 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 personnel perform final fire-safety inspection each day beginning no sooner than **30 minutes** after conclusion of work **in each area** to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
 - e. Maintain fire-watch personnel at **each area of** Project site until **60 minutes** after conclusion of daily work.
- C. Fire-Control Devices: Provide and 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 personnel are trained in fire-extinguisher and blanket use.
- D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.
- 1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.
- B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.
- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

- A. Have specialty work performed only by qualified specialists.
- B. Ensure that supervisory personnel are present when work begins and during its progress.
- C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation **photographs or video recordings**. Comply with requirements in Section 01 32 33 "Photographic Documentation."
- D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

- E. Notify Engineer of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
 - 1. Do not proceed with the work in question until directed by Engineer.

END OF SECTION

SECTION 01 40 00

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 inspection 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 quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, **Commissioning Authority**, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
 - 1. Section 01 21 00 "Allowances" for testing and inspection allowances.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of **five** 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.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. 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, assembly, 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).
- D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and 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.
1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
 2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as **freestanding temporary built elements or as part of permanent construction**, consisting of multiple products, assemblies, and subassemblies.
 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.
- E. 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.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. 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.
- J. 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. Contractor's quality-control services do not include contract administration activities performed by Engineer.
- 1.4 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 Engineer.

1.5 CONFLICTING REQUIREMENTS

- A. **Conflicting Standards and Other Requirements:** If compliance with two or more standards or requirements are specified and the standards or requirements 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 Engineer for direction 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 Engineer for a decision before proceeding.

1.6 ACTION SUBMITTALS

- A. **Shop Drawings:** For **integrated exterior** mockups.
 - 1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- B. **Delegated-Design Services Submittal:** In addition to Shop Drawings, Product Data, and other required submittals, submit a statement 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, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.7 INFORMATIONAL SUBMITTALS

- A. **Contractor's Quality-Control Plan:** For quality-assurance and quality-control activities and responsibilities.
- B. **Qualification Data:** For Contractor's quality-control personnel.
- C. **Contractor's Statement of Responsibility:** When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. **Testing Agency Qualifications:** For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within **10** days of **Notice to Proceed**, and not less than **five** days prior to preconstruction conference. Submit in format acceptable to Engineer. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager **may also serve as Project superintendent**.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 3. Owner-performed tests and inspections indicated in the Contract Documents, **including tests and inspections indicated to be performed by Commissioning Authority**.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 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, telephone number, and email address 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 inspection.
 - 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, telephone number, and email address 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, telephone number, and email address 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.

1.10 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- 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, applying, 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. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to **ASTM E329**; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. 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.
- I. 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.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.

- b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens and test assemblies, mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer **and Commissioning Authority**, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups of size indicated.
 - 2. Build mockups in location indicated or, if not indicated, as directed by Engineer.
 - 3. Notify Engineer **seven** days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
 - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 6. Obtain Engineer's approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow **seven** days for initial review and each re-review of each mockup.
 - 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 8. Demolish and remove mockups when directed unless otherwise indicated.
 - L. Integrated Exterior Mockups: Construct integrated exterior mockup **according to approved Shop Drawings**. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.
 - M. Room Mockups: Construct room mockups **according to approved Shop Drawings** incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Engineer to evaluate quality of the Work. Comply with requirements in "Mockups" Paragraph.
- 1.11 QUALITY CONTROL
- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. Payment for these services will be made from testing and inspection allowances, as authorized by Change Orders.
 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
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. Engage a qualified testing agency to perform 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 inspection 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 inspection 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. 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.
- D. Testing Agency Responsibilities: Cooperate with Engineer, **Commissioning Authority** and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Engineer, **Commissioning Authority**, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations 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 duties of Contractor.
- E. 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 01 33 00 "Submittal Procedures."

- F. **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.
- G. **Associated Contractor Services:** Cooperate with agencies and representatives 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 inspection. 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 inspection equipment at Project site.
- H. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. **Schedule of Tests and Inspections:** Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents **as a component of Contractor's quality-control plan**. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.
 - 1. **Distribution:** Distribute schedule to Owner, Engineer, **Commissioning Authority**, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 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:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Engineer, **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 Engineer **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.
- 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 reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Engineer, **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 Engineer **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 ACCEPTABLE TESTING AGENCIES

- A. <Insert list of firms acceptable to perform designated tests and inspections>.

3.2 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 Engineer.
 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 Engineer's, **Commissioning Authority's**, reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

3.3 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, 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 01 73 00 "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

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: 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. **Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."** The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).

31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWP - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CE - Conformite Europeenne; <http://ec.europa.eu/growth/single-market/ce-marking/>.
51. CEA - Canadian Electricity Association; www.electricity.ca.
52. CEA - Consumer Electronics Association; www.ce.org.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.pbmdf.com.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csagroup.com.
65. CSA - CSA International; www.csa-international.org.
66. CSI - Construction Specifications Institute (The); www.csinet.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHI - Door and Hardware Institute; www.dhi.org.
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; www.eciaonline.org.
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; www.eima.com.
77. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
78. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); www.intertek.com.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.

82. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
85. FM Approvals - FM Approvals LLC; www.fmglobal.com.
86. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridarooft.com.
88. FSA - Fluid Sealing Association; www.fluidsealing.com.
89. FSC - Forest Stewardship Council U.S.; www.fscus.org.
90. GA - Gypsum Association; www.gypsum.org.
91. GANA - Glass Association of North America; www.glasswebsite.com.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
97. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
98. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
99. IAS - International Accreditation Service; www.iasonline.org.
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; www.iccsafe.org.
102. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
103. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
104. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
105. IEC - International Electrotechnical Commission; www.iec.ch.
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
110. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
111. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
112. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
117. ISO - International Organization for Standardization; www.iso.org.
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; www.itu.int/home.
120. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; www.lightning.org.
123. MBMA - Metal Building Manufacturers Association; www.mbma.com.
124. MCA - Metal Construction Association; www.metalconstruction.org.
125. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
126. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
127. MHIA - Material Handling Industry of America; www.mhia.org.
128. MIA - Marble Institute of America; www.marble-institute.com.
129. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
130. MPI - Master Painters Institute; www.paintinfo.com.

131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
132. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
133. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
134. NADCA - National Air Duct Cleaners Association; www.nadca.com.
135. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
136. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
137. NBI - New Buildings Institute; www.newbuildings.org.
138. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
139. NCMA - National Concrete Masonry Association; www.ncma.org.
140. NEBB - National Environmental Balancing Bureau; www.nebb.org.
141. NECA - National Electrical Contractors Association; www.necanet.org.
142. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
143. NEMA - National Electrical Manufacturers Association; www.nema.org.
144. NETA - InterNational Electrical Testing Association; www.netaworld.org.
145. NFHS - National Federation of State High School Associations; www.nfhs.org.
146. NFPA - National Fire Protection Association; www.nfpa.org.
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; www.nfrc.org.
149. NHLA - National Hardwood Lumber Association; www.nhla.com.
150. NLGA - National Lumber Grades Authority; www.nlga.org.
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
153. NRCA - National Roofing Contractors Association; www.nrca.net.
154. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
155. NSF - NSF International; www.nsf.org.
156. NSPE - National Society of Professional Engineers; www.nspe.org.
157. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
159. NWFA - National Wood Flooring Association; www.nwfa.org.
160. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
161. PDI - Plumbing & Drainage Institute; www.pdionline.org.
162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
163. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
164. RFCI - Resilient Floor Covering Institute; www.rfci.com.
165. RIS - Redwood Inspection Service; www.redwoodinspection.com.
166. SAE - SAE International; www.sae.org.
167. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
168. SDI - Steel Deck Institute; www.sdi.org.
169. SDI - Steel Door Institute; www.steeldoor.org.
170. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; www.siaonline.org.
173. SJI - Steel Joist Institute; www.steeljoist.org.
174. SMA - Screen Manufacturers Association; www.smainfo.org.
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
176. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
177. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
178. SPIB - Southern Pine Inspection Bureau; www.spib.org.
179. SPRI - Single Ply Roofing Industry; www.spri.org.
180. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
181. SSINA - Specialty Steel Industry of North America; www.ssina.com.

182. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
183. STI - Steel Tank Institute; www.steeltank.com.
184. SWI - Steel Window Institute; www.steelwindows.com.
185. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
186. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
187. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
188. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
189. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
190. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
191. TMS - The Masonry Society; www.masonrysociety.org.
192. TPI - Truss Plate Institute; www.tpinst.org.
193. TPI - Turfgrass Producers International; www.turfgrasssod.org.
194. TRI - Tile Roofing Institute; www.tilerroofing.org.
195. UL - Underwriters Laboratories Inc.; www.ul.com.
196. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
197. USAV - USA Volleyball; www.usavolleyball.org.
198. USGBC - U.S. Green Building Council; www.usgbc.org.
199. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
200. WA - Wallcoverings Association; www.wallcoverings.org.
201. WASTEC - Waste Equipment Technology Association; www.wastec.org.
202. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
203. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
204. WDMA - Window & Door Manufacturers Association; www.wdma.com.
205. WI - Woodwork Institute; www.wicnet.org.
206. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
207. WWPA - Western Wood Products Association; www.wwpa.org.

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

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

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

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.

11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
 12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 13. SD - Department of State; www.state.gov.
 14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
 15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
 17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 18. USP - U.S. Pharmacopeial Convention; www.usp.org.
 19. USPS - United States Postal Service; www.usps.com.
- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
 3. DSCC - Defense Supply Center Columbus; (See FS).
 4. FED-STD - Federal Standard; (See FS).
 5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 6. MILSPEC - Military Specification and Standards; (See DOD).
 7. USAB - United States Access Board; www.access-board.gov.
 8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 3. CDHS; California Department of Health Services; (See CDPH).
 4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
 5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
 6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
 7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservation.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 50 00**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 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, **Owner's construction forces**, Engineer, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: **Owner will pay** sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: **Owner will pay** water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: **Owner will pay** electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

- B. Implementation and Termination Schedule: Within **15** days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold.
- F. 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. 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.
- C. Accessible Temporary Egress: Comply with applicable provisions in **the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1**.

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. 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.

- B. 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 **galvanized-steel** bases for supporting posts.
- C. 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, Engineer, 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 **10** 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. Heating and cooling equipment necessary to maintain a uniform indoor temperature of ~~68 to 72 deg F~~.
 - 5. Lighting fixtures capable of maintaining average illumination of ~~20 fc~~ at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

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.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of **8** at each return-air grille in system and remove at end of construction **and clean HVAC system as required in Section 01 77 00 "Closeout Procedures."**

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 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 01 10 00 "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.

3.3 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. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to **private system indicated** as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. 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.
- E. 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.
 - 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- F. Temporary Heating and Cooling: Provide temporary heating and cooling 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.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed **according to coordination drawings**.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- H. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service **overhead** unless otherwise indicated.
 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install **WiFi cell phone access equipment and one** land-based telephone line(s) for each field office.
1. Provide additional telephone lines for the following:
 - a. Provide **one** telephone line(s) for Owner's use.
 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Engineer's office.

- f. Engineer's Consultants offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
- L. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Engineer and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
 - 1. Processor: Intel Core i5 or i7.
 - 2. Memory: **4** gigabyte.
 - 3. Disk Storage: **500** gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
 - 4. Display: **24-inch** LCD monitor with 256-Mb dedicated video RAM.
 - 5. Full-size keyboard and mouse.
 - 6. Network Connectivity: **10/100BaseT Ethernet**.
 - 7. Operating System: Microsoft Windows 7 Professional.
 - 8. Productivity Software:
 - a. Microsoft Office Professional, 2010 or higher, including Word, Excel, and Outlook.
 - b. Adobe Reader 11.0 or higher.
 - c. WinZip 7.0 or higher.
 - 9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
 - 10. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum **1.0** Mbps upload and **15** Mbps download speeds at each computer.
 - 11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
 - 12. Backup: External hard drive, minimum **1** terabyte, with automated backup software providing daily backups.

3.4 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 E136. 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. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas **within construction limits indicated** on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
- D. 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.
- E. Parking: **Use designated areas of Owner's existing** parking areas for construction personnel.
- F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- G. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 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 touch up signs so they are legible at all times.
- H. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."
- I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."
- J. 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.

3.5 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.
 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- 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 01 10 00 "Summary."

- C. 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.
- D. Tree and Plant Protection: Comply with requirements specified in Section 01 56 39 "Temporary Tree and Plant Protection."
- 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. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: **Before construction operations begin**, furnish and install site enclosure fence in a manner that will prevent people 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.**
- H. 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 workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by **Owner** from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of **6-mil** polyethylene sheet on each side. Cover floor with two layers of **6-mil** polyethylene sheet, extending sheets **18 inches** up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

- a. Construct vestibule and airlock at each entrance through temporary partition with not less than **48 inches** between doors. Maintain water-dampened foot mats in vestibule.
 - 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 4. Insulate partitions to control noise transmission to occupied areas.
 - 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 6. Protect air-handling equipment.
 - 7. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
- 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
- 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- B. Exposed Construction Period: 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 Period: 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 and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: 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 temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 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 and require replacing.
 - 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 Engineer.
 - c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within **48** hours.

3.7 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. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. 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. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove

materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION

SECTION 01 56 39**TEMPORARY TREE AND PLANT PROTECTION****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 general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Section 01 50 00 "Temporary Facilities and Controls" for temporary site fencing.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by **a diameter tape or the average of the smallest and largest diameters** at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by **a diameter tape or the average of the smallest and largest diameters** at a height 54 inches above the ground line **for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the ground.**
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and **defined by a circle concentric with each tree with a radius 12 times the tree's caliper size and with a minimum radius of 96 inches unless otherwise indicated.**
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site.**
 - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

- a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
- b. Arborist's responsibilities.
- c. Quality-control program.
- d. Coordination of Work and equipment movement with the locations of protection zones.
- e. Trenching by hand or with air spade within protection zones.
- f. Field quality control.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
 - 2. Detail fabrication and assembly of protection-zone fencing and signage.
 - 3. Indicate extent of trenching by hand or with air spade within protection zones.
- C. Samples: For each type of the following:
 - 1. Organic Mulch: **1-quart** volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
 - 2. Protection-Zone Fencing: Assembled Samples of **manufacturer's standard size made from full-size components**.
 - 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 - 1. Species and size of tree.
 - 2. Location on site plan. Include unique identifier for each.
 - 3. Reason for pruning.
 - 4. Description of pruning to be performed.
 - 5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.7 QUALITY ASSURANCE

- A. Arborist Qualifications: **Certified Arborist as certified by ISA or Certified Arborist-Municipal Specialist as certified by ISA or Licensed arborist in jurisdiction where Project is located or Current member of ASCA or Registered Consulting Arborist as designated by ASCA.**
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
 1. Storage of construction materials, debris, or excavated material.
 2. Moving or parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Soil: **Stockpiled soil mixed with planting soil** of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
 1. Mixture: Well-blended mix of **two parts stockpiled soil to one part planting soil.**

- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
 - 1. Type: **Ground or shredded bark.**
 - 2. Size Range: **3 inches maximum, 1/2 inch minimum.**
 - 3. Color: Natural.

- C. Protection-Zone Fencing: Fencing fixed in position and meeting **one of** the following requirements: **Previously used materials may be used when approved by Engineer.**
 - 1. Chain-Link Protection-Zone Fencing: **Galvanized-steel** fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with 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 rails; with 0.177-inch- diameter top tension wire** and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - a. Height: **72 inches.**
 - 2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.
 - a. Height: **48 inches.**
 - b. Color: High-visibility orange, nonfading.
 - 3. Gates: **Single-** swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width **36 inches.**

- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 - 1. Size and Text: **As shown on Drawings.**
 - 2. Lettering: **3-inch-** high minimum, **black** characters on **white** background.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain **or to be relocated**. Tie **a 1-inch blue vinyl tape around** each tree trunk at 54 inches (1372 mm) above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
 - 1. Apply **2-inch** uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within **6 inches** of tree trunks.

3.3 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones **before materials or equipment are brought on the site and construction operations begin** in a manner that will prevent people **and animals** from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Chain-Link Fencing: Install to comply with ASTM F567 and with manufacturer's written instructions.
 - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 3. Access Gates: Install **where indicated**; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Engineer. Install one sign spaced approximately every **50 feet** on protection-zone fencing, but no fewer than **four** signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Engineer and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- B. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- C. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots **as follows**:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Cut Ends: **Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.**
 - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 4. Cover exposed roots with burlap and water regularly.
 - 5. Backfill as soon as possible.
- B. Root Pruning at Edge of Protection Zone: Prune tree roots **12 inches inside** of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches **as directed by arborist**.
 - 1. Prune to remove only **injured**, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 - 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 - 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

- a. Type of Pruning: **Cleaning and thinning** where indicated.
 - b. Specialty Pruning: **Structural and utility** where indicated.
- B. Unless otherwise directed by arborist and acceptable to Engineer, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and **dispose of off-site**.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
- 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is **2 inches** or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Engineer.
- 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Engineer.
- B. Trees: Remove and replace trees indicated to remain that are more than **25** percent dead or in an unhealthy condition **before the end of the corrections period** or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures **4 inches** or smaller in caliper size.
2. Large Trees: Provide **one** new tree(s) of **4-inch** caliper size for each tree being replaced that measures more than **4 inches** in caliper size.

a. Species: **As selected by Engineer.**

- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a **2-inch** uniform thickness to remain.
- D. Soil Aeration: Where directed by Engineer, aerate surface soil compacted during construction. Aerate **10 feet** beyond drip line and no closer than **36 inches** to tree trunk. Drill **2-inch**-diameter holes a minimum of 12 inches deep at **24 inches** o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION 01 57 23**TEMPORARY STORM WATER POLLUTION CONTROL****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. Temporary stormwater pollution controls.

1.3 STORMWATER POLLUTION PREVENTION PLAN

- A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents and is bound into this Project Manual.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.
 - 1. Meet with Owner, Engineer, and earthwork subcontractor.
 - 2. Review requirements of the SWPPP, including permitting process, worker training, and inspection and maintenance requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Stormwater Pollution Prevention Plan (SWPP): Within **15** days of date established for commencement of the Work, submit completed SWPPP.
- B. EPA authorization under the EPA's "2017 Construction General Permit (CGP)."
- C. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.
- D. Inspection reports.

1.6 QUALITY ASSURANCE

- A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.
 - 1. SWPPP Coordinator shall complete and finalize the SWPPP form.
 - 2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.
- B. Installers: Trained as indicated in the SWPPP.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

- A. Provide temporary stormwater pollution controls as required by the SWPPP.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.
- B. Locate stormwater pollution controls in accordance with the SWPPP.
- C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.
 - 1. Inspect, repair, and maintain SWPPP controls during construction.
 - a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.
- D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION

SECTION 01 60 00**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 01 21 00 "Allowances" for products selected under an allowance.
 - 2. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
 - 3. Section 01 42 00 "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 by Engineer 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 single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section,

provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.4 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design 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. Engineer's Action: If necessary, Architect will request additional information or documentation for evaluation within **seven** days of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within **15** days of receipt of request, or **seven** days of receipt of additional information or documentation, whichever is later.
 - a. Form of Engineer's Approval of Submittal: As specified in Section 01 33 00 "Submittal Procedures."
 - b. Use product specified if Engineer 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 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.

- c. Capacity.
 - d. Speed.
 - e. Ratings.
3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
- 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
- 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.
 - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00 "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 meeting requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Engineer will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 - 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Engineer in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Engineer, whose determination is final.
- B. Product Selection Procedures:
 - 1. Sole 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.
 - a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: ..."
 - 2. Sole 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.

- a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: ..."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will not** be considered **unless otherwise indicated**.
 - a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: ..."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
 - a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: ..."
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience **will not** be considered **unless otherwise indicated**.
 - a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: ..."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: ..."
7. 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.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require "match Engineer's sample," provide a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 2. Evidence that proposed product provides specified warranty.
 3. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.
 4. Samples, if requested.
- B. Submittal Requirements: Approval by the Engineer of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 73 00**EXECUTION****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for limits on use of Project site.
 - 2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
 - 3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the building.
 - 5. Section 07 84 13 "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 subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at **Project site**.

1. Prior to **submitting cutting and patching plan**, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
 - a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations.
 - c. Trade supervisor(s) responsible for patching of each type of substrate.
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For **land surveyor** or **professional engineer**.
- B. Certificates: Submit certificate signed by **land surveyor** or **professional engineer** 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.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- E. Certified Surveys: Submit **[two]** <Insert number> copies signed by **land surveyor** or **professional engineer**.
- F. Final Property Survey: Submit **10** copies showing the Work performed and record survey data.

1.6 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. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Plumbing piping systems.
 - f. Mechanical systems piping and ducts.
 - g. Control systems.
 - h. Communication systems.
 - i. Fire-detection and -alarm systems.
 - j. Conveying systems.
 - k. Electrical wiring systems.
 - l. Operating systems of special construction.
 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. **Other construction elements include but are not limited to the following:**
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer'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.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, **mechanical and electrical systems**, and other construction affecting the Work.
 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services; and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to **local utility** and **Owner** that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.
- B. General: Engage a **land surveyor** or **professional engineer** 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 Engineer 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 Engineer.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. 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 Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of **two** 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.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.
- E. Final Property Survey: Engage a **land surveyor** or **professional engineer** to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by **land surveyor** or **professional engineer**, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

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.
 - 4. Maintain minimum headroom clearance of **96 inches** in occupied spaces and **90 inches** in unoccupied spaces.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive 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 portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

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 01 10 00 "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** 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 re-hang 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 weather tight 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 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 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 01 50 00 "Temporary Facilities and Controls."** and **Section 01 74 19 "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 ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 13 "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 01 40 00 "Quality Requirements."

3.10 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. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

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

END OF SECTION

SECTION 01 74 19**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 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.

1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- 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 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction 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 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within **7** days of date established for **the Notice to Proceed**.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use **Form CWM-7 for construction waste and Form CWM-8 for demolition waste**. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in **tons**.
 - 4. Quantity of waste salvaged, both estimated and actual in **tons**.
 - 5. Quantity of waste recycled, both estimated and actual in **tons**.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in **tons**.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. Qualification Data: For **waste management coordinator and refrigerant recovery technician**.
- H. 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.

- I. Refrigerant Recovery: Comply with requirements in **Section 02 41 16 "Structure Demolition"** and **Section 02 41 19 "Selective Demolition"** for refrigerant recovery submittals.

1.7 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent **may** serve as Waste Management Coordinator.
- B. Refrigerant Recovery Technician Qualifications: **Type I** or **Type II** or **Type III** certified by EPA-approved certification program.
- C. Refrigerant Recovery Technician Qualifications: Comply with requirements in **Section 024116 "Structure Demolition."** and **Section 02 41 19 "Selective Demolition."**
- D. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- E. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. **Distinguish between demolition and construction waste.** Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of **demolition and construction** waste generated by the Work. Use **Form CWM-1 for construction waste and Form CWM-2 for demolition waste.** Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use **Form CWM-3 for construction waste and Form CWM-4 for demolition waste.** Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the

Work in compliance with **Section 02 41 16 "Structure Demolition."** and **Section 02 41 19 "Selective Demolition."**

2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use **Form CWM-5 for construction waste** and **Form CWM-6 for demolition waste**. Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in transportation and tipping fees by donating materials.
 7. Savings in transportation and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 RECYCLING RECEIVERS AND PROCESSORS

- A. Subject to compliance with requirements, available recycling receivers and processors include, but are not limited to, the following:

1. **<Insert names and telephone numbers of local recycling receivers and processors of recyclable materials>.**

2.2 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of **50** percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, **including the following**:

1. Demolition Waste:
 - a. Asphalt paving.

- b. Concrete.
- c. Concrete reinforcing steel.
- d. Brick.
- e. Concrete masonry units.
- f. Wood studs.
- g. Wood joists.
- h. Plywood and oriented strand board.
- i. Wood paneling.
- j. Wood trim.
- k. Structural and miscellaneous steel.
- l. Rough hardware.
- m. Roofing.
- n. Insulation.
- o. Doors and frames.
- p. Door hardware.
- q. Windows.
- r. Glazing.
- s. Metal studs.
- t. Gypsum board.
- u. Acoustical tile and panels.
- v. Carpet.
- w. Carpet pad.
- x. Demountable partitions.
- y. Equipment.
- z. Cabinets.
- aa. Plumbing fixtures.
- bb. Piping.
- cc. Supports and hangers.
- dd. Valves.
- ee. Sprinklers.
- ff. Mechanical equipment.
- gg. Refrigerants.
- hh. Electrical conduit.
- ii. Copper wiring.
- jj. Lighting fixtures.
- kk. Lamps.
- ll. Ballasts.
- mm. Electrical devices.
- nn. Switchgear and panelboards.
- oo. Transformers.

2. Construction Waste:

- a. Masonry and CMU.
- b. Lumber.
- c. Wood sheet materials.
- d. Wood trim.
- e. Metals.
- f. Roofing.
- g. Insulation.
- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.

- I. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Wood pallets.
 - 8) Plastic pails.

- m. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
 - 1) Paper.
 - 2) Aluminum cans.
 - 3) Glass containers.

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 01 50 00 "Temporary Facilities and Controls."

- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. **Coordinator shall be present at Project site full time for duration of Project.**

- C. 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.

- D. 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 and recycled.
 - 2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

- E. Waste Management in Historic Zones or Areas: Transportation equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by **12 inches** or more.

3.2 SALVAGING DEMOLITION WASTE

- A. Comply with requirements in **Section 02 41 16 "Structure Demolition"** **Section 02 41 19 "Selective Demolition"** for salvaging demolition waste.
- B. 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.
- C. Salvaged Items for Owner's Use: Salvage items for Owner's use 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 delivery to Owner.
 - 4. Transport items to Owner's storage area **on-site designated by Owner**.
 - 5. Protect items from damage during transport and storage.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

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 **accrue to 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. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum **4-inch** size.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum **4-inch** size.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Pulverize masonry to maximum **4-inch** size.
 - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. 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.
- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. 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.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

- J. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.
- K. Carpet **and Pad**: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet **and pad** in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- N. Conduit: Reduce conduit to straight lengths and store by material and size.
- O. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

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.
- 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.
- D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, 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. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.
- C. Burning: Do not burn waste materials.

END OF SECTION

SECTION 01 77 00

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 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 3. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at final completion.

1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by **Engineer**. Label with manufacturer's name and model number.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain **Engineer's** and **Owner's** signature for receipt of submittals.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
 - 6. Advise Owner of changeover in utility services.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.

8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of **10** days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
 5. Submit final completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, **starting with exterior areas first and proceeding from lowest floor to highest floor.**
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:

- a. Project name.
 - b. Date.
 - c. Name of Engineer.
 - d. Name of Contractor.
 - e. Page number.
4. Submit list of incomplete items in the following format:
- a. MS Excel electronic file. Engineer will return annotated file.
 - b. PDF electronic file. Engineer will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within **15** days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 - 1. Submit **on digital media acceptable to Engineer by email to Engineer.**
- E. Warranties in Paper Form:
 - 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.
- F. 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.

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

PART 3 - EXECUTION

3.1 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 not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. 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.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. 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.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with **NADCA ACR**. Provide written report on completion of cleaning.

- p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in **Section 01 50 00 "Temporary Facilities and Controls."** and **Section 01 74 19 "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

SECTION 01 78 23**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 manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 01 91 13 "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. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Engineer **and Commissioning Authority** will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:

1. Submit **on digital media acceptable to Engineer by email to Engineer**. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least **30** days before commencing demonstration and training. Engineer **and Commissioning Authority** will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least **15** days before commencing demonstration and training. Engineer **and Commissioning Authority** will return copy with comments.
 1. Correct or revise each manual to comply with Engineer's **and Commissioning Authority's** comments. Submit copies of each corrected manual within **15** days of receipt of Engineer's **and Commissioning Authority's** comments and prior to commencing demonstration and training.
- E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

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

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.

7. Name and contact information for Engineer.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.

2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
 2. Shutdown instructions for each type of emergency.
 3. Operating instructions for conditions outside normal operating limits.
 4. Required sequences for electric or electronic systems.
 5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
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. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.

5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

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

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

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

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

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

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

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

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; 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.

- a. 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.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.
- 1.11 PRODUCT MAINTENANCE MANUALS
- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)**

END OF SECTION

SECTION 01 78 39

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.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for final property survey.
 - 2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 78 23 "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 of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and **one** of file prints.
 - 2) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints and **three** set(s) of prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit **annotated PDF electronic files** of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit **annotated PDF electronic files and directories** of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit **annotated PDF electronic files and directories** of each submittal.
- E. Reports: Submit written report **biweekly** indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 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.
 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 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.
 - 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 Engineer'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. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
 2. Format: **DWG**, Version **2016**, **Microsoft Windows** operating system.
 3. Format: Annotated PDF electronic file **with comment function enabled**.
 4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 5. Refer instances of uncertainty to Engineer for resolution.
 6. Engineer will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 31 00 "Project Management and Coordination" for requirements related to use of Engineer's digital data files.
 - b. Engineer will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file **with comment function enabled**.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Engineer.
 - e. Name of Contractor.

1.5 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. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note related Change Orders, **record Product Data**, and record Drawings where applicable.
- B. Format: Submit record Specifications as **annotated PDF electronic file**.

1.6 RECORD PRODUCT DATA

- 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. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, **record Specifications**, and record Drawings where applicable.
- C. Format: Submit record Product Data as **annotated PDF electronic file**.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as **PDF electronic file**.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store record documents 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 Engineer's reference during normal working hours.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

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 instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For **instructor** and **videographer**.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit **two** copies within **seven** days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Engineer.
 - d. Name of Construction Manager.

- e. Name of Contractor.
 - f. Date of video recording.
2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
 3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
 4. At completion of training, submit complete training manual(s) for Owner's use prepared in same **paper and PDF file** format required for operation and maintenance manuals specified in Section 01 78 23 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Engineer.

1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.

- l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.

- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, **through Engineer** with at least **seven** days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of **an oral** performance-based test.
- F. Cleanup: Collect used and leftover educational materials and **remove from Project site**. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of **12** megapixels and capable of recording in full HD mode.
 - 1. Submit video recordings **on CD-ROM or thumb drive**.
 - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.

- c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by **audio narration by microphone while** video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION

SECTION 02 41 19

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 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 01 56 39 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
 - 3. Section 01 73 00 "Execution" for cutting and patching procedures.
 - 4. Section 01 35 16 "Alteration Project Procedures" for general protection and work procedures for alteration projects.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and **store**.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 PREINSTALLATION MEETINGS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, **for environmental protection, for dust control and for noise control**. Indicate proposed locations and construction of barriers.
- D. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's **building manager's and other tenants'** on-site operations are uninterrupted.
 - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Use of elevator and stairs.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 "Photographic Documentation." Submit before Work begins.
- F. 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.

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

1.7 CLOSEOUT SUBMITTALS

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

1.8 QUALITY ASSURANCE

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

1.9 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Furniture, Wrestling Mat, etc. that may be damaged during demolition.
- C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 - 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 - 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
 - 3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.
- F. 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 **12 inches** or more.
- G. Storage or sale of removed items or materials on-site is not permitted.

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

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

1.10 WARRANTY

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

- 1. **<Insert warranted system>.**

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

1.11 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. **Perform** an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

- D. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of **preconstruction photographs or video and templates**.
 - 1. Comply with requirements specified in Section 01 32 33 "Photographic Documentation."
 - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
 - 3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off utilities with utility companies.
 - 3. 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.
 - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings 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 and leave in place.
 - 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.
 - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 - 5. Maintain fire watch during and for at least **2** hours after flame-cutting operations.
 - 6. Maintain adequate ventilation when using cutting torches.
 - 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 - 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 10. Dispose of demolished items and materials promptly. **Comply with requirements in Section 01 74 19 "Construction Waste Management and Disposal."**

- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area **on-site designated by Owner**.
 - 5. Protect items from damage during transport and storage.
- D. 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.
- E. 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.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least **3/4 inch** at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." **Do not use methods requiring solvent-based adhesive strippers.**
- F. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section **<Insert Section number and title>** for new roofing requirements.
 - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
 - 2. Remove existing roofing system down to substrate.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site **and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them according to Section 01 74 19 "Construction Waste Management and Disposal."**
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 01 74 19 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.8 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.

3.9 SELECTIVE DEMOLITION SCHEDULE

- A. Remove: Concrete walls, roofing, ceilings, ductwork, piping, etc. indicated on drawings.
- B. Remove and Salvage: Acoustic ceiling Tiles.
- C. Remove and Reinstall: Acoustic ceiling Tiles.
- D. Existing to Remain: Mechanical Equipment shown and indicated to remain on drawings.
- E. Dismantle: Plumbing connections.

END OF SECTION

SECTION 07 92 00**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. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Urethane joint sealants.
 - 4. Immersible joint sealants.
 - 5. Silyl-terminated polyether joint sealants.
 - 6. Mildew-resistant joint sealants.
 - 7. Polysulfide joint sealants.
 - 8. Butyl joint sealants.
 - 9. Latex joint sealants.
 - 10. .

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.4 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.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in **1/2-inch-** wide joints formed between two **6-inch-** long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by **manufacturer and witnessed by a qualified testing agency**.
- C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 - 1. Joint-sealant location and designation.
 - 2. Manufacturer and product name.
 - 3. Type of substrate material.
 - 4. Proposed test.
 - 5. Number of samples required.
- D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- F. Field-Adhesion-Test Reports: For each sealant application tested.
- G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with **stone** or **masonry** substrates.
 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
 7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
- B. 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 Engineer.
 2. Conduct field tests for each kind of sealant and joint substrate.
 3. Notify Engineer seven days in advance of dates and times when test joints will be erected.
 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 5. 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.
 6. 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.

1.8 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.

1.9 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: **Two** years from date of Substantial Completion.
- B. 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.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

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. Colors of Exposed Joint Sealants: **As selected by Engineer from manufacturer's full range.**

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
- B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
- C. Silicone, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability. nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.
- D. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

- E. Silicone, Acid Curing, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
- F. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
- G. Silicone, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.
- H. Silicone, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
- I. Silicone, S, P, 100/50, T, NT: Single-component, pourable, plus 100 percent and minus 50 percent movement capability traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 100/50, Uses T and NT.
- J. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
- K. Silicone, M, P, 100/50, T, NT: Multicomponent, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade P, Class 100/50, Uses T and NT.

2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- 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 C920, Type S, Grade NS, Class 100/50, Use NT.
- C. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
- D. Silicone, Nonstaining, S, NS, 100/50, T, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.
- E. Silicone, Nonstaining, M, NS, 50, NT: Nonstaining, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.

2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

- B. 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 C920, Type S, Grade NS, Class 100/50, Uses T and NT.
- C. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
- D. Urethane, S, P, 35, T, NT: Single-component, pourable, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 35, Uses T and NT.
- E. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
- F. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
- G. Urethane, M, NS, 25, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.
- H. Urethane, M, NS, 50, T, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T and NT.
- I. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.
- J. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 50, Uses T and NT.
- K. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

2.5 IMMERSIBLE JOINT SEALANTS

- A. Immersible Joint Sealants. Suitable for immersion in liquids; ASTM C1247, [**Class 1**] [**Class 2**]; tested in deionized water unless otherwise indicated
- B. Urethane, Immersible, S, NS, 100/50, NT, I: Immersible, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses NT, and I.
- C. Urethane, Immersible, S, NS, 35, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT and I.

- D. Urethane, Immersible, S, NS, 50, T, NT, I: Immersible, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T, NT, and I.
- E. Urethane, Immersible, S, NS, 35, T, NT, I: Immersible, single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses T, NT, and I.
- F. Urethane, Immersible, S, NS, 25, T, NT, I: Immersible, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T, NT, and I.
- G. Urethane, Immersible, S, P, 50, T, NT, I: Immersible, single-component, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 50, Uses T, NT, and I.
- H. Urethane, Immersible, S, P, 25, T, NT, I: Immersible, single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T, NT, and I.
- I. Polysulfide, Immersible, M, NS, 25, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses NT and I.
- J. Urethane, Immersible, M, NS, 50, T, NT, I: Immersible, multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Uses T, NT, and I.
- K. Urethane, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T, NT, and I.
- L. Polysulfide, Immersible, M, NS, 25, T, NT, I: Immersible, multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T, NT, and I.
- M. Urethane, Immersible, M, P, 25, T, NT, I: Immersible, multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T, NT, and I.

2.6 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

- A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
- B. STPE, S, NS, 35, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 35, Use NT.
- C. STPE, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

- D. STPE, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 100, Uses T and NT.
- E. STPE, S, NS, 50, T, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 50, Uses T and NT.
- F. STPE, S, NS, 35, T, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses T and NT.
- G. STPE, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
- H. STPE, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.

2.7 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
- C. STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.8 POLYSULFIDE JOINT SEALANTS

- A. Polysulfide, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Polysulfide, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade NS, Class 25, Use NT.
- C. Polysulfide, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, polysulfide joint sealant; ASTM C920, Type M, Grade P, Class 25, Uses T and NT.

2.9 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

2.10 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.11 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.
- B. Cylindrical Sealant Backings: ASTM C1330, [**Type C closed-cell material with a surface skin** and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. 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.

2.12 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. 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.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 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. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. 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 C1193 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 C1193 unless otherwise indicated.
 - 4. Provide flush joint profile at according to Figure 8B in ASTM C1193.
 - 5. Provide recessed joint configuration of recess depth and at according to Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform **10** tests for the first **1000 feet** of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each **1000 feet** of joint length thereafter or one test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether

joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 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.

3.6 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.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 1. Joint Locations:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints between plant-precast architectural concrete paving units.
 - d. Joints in stone paving units.
 - e. Tile control and expansion joints.
 - f. Joints between different materials listed above.
 - g. Other joints as indicated on Drawings.
 2. Joint Sealant: **Urethane, M, P, 50, T, NT.**
 3. Joint-Sealant Color: **As selected by Engineer from manufacturer's full range of colors.**
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
 1. Joint Locations:
 - a. Joints in pedestrian plazas.
 - b. Joints in swimming pool decks.
 - c. Other joints as indicated on Drawings.

2. Joint Sealant: **Urethane, immersible, S, P, 25, T, NT, I.**
 3. Joint-Sealant Color: **As selected by Engineer from manufacturer's full range of colors.**
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints in glass unit masonry assemblies.
 - f. Joints in exterior insulation and finish systems.
 - g. Joints between metal panels.
 - h. Joints between different materials listed above.
 - i. Perimeter joints between materials listed above and frames of **doors, windows and louvers.**
 - j. Control and expansion joints in **ceilings and other overhead surfaces.**
 - k. Other joints as indicated on Drawings.
 2. Joint Sealant: **Silicone, nonstaining, S, NS, 50, NT.**
 3. Joint-Sealant Color: **As selected by Engineer from manufacturer's full range of colors.**
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in brick flooring.
 - d. Control and expansion joints in tile flooring.
 - e. Other joints as indicated on Drawings.
 2. Joint Sealant: **Urethane, S, P, 25, T, NT.**
 3. Joint-Sealant Color: **As selected by Engineer from manufacturer's full range of colors.**
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of **unit masonry, concrete walls and partitions.**
 - d. Joints on underside of plant-precast structural concrete **beams and planks.**
 - e. Other joints as indicated on Drawings.
 2. Joint Sealant: **Urethane, S, NS, 25, NT.**
 3. Joint-Sealant Color: **As selected by Engineer from manufacturer's full range of colors.**

- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of **interior doors and windows.**
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: **Acrylic latex.**
 3. Joint-Sealant Color: **As selected by Engineer from manufacturer's full range of colors.**
- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: **Silicone, mildew resistant, acid curing, S, NS, 25, NT.**
 3. Joint-Sealant Color: **As selected by Engineer from manufacturer's full range of colors.**
- H. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 2. Joint Sealant: **Butyl-rubber based.**
 3. Joint-Sealant Color: **As selected by Engineer from manufacturer's full range of colors.**

END OF SECTION

SECTION 09 21 16**GYPSUM BOARD SHAFT WALL ASSEMBLIES****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 gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: **As indicated** on drawings.
- B. STC Rating: **As indicated** on drawings.
- C. Gypsum Shaftliner Board:
 - 1. Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, **1 inch** thick, with double beveled long edges.
 - 2. Moisture- and Mold-Resistant Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, **1 inch** thick, and with double beveled long edges.
 - 3. Moisture- and Mold-Resistant, Fiberglass-Mat Faced: ASTM C1658/C1658M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, **1 inch** thick, and with double beveled long edges.
- D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
 - 1. Protective Coating: **Coating with equivalent corrosion resistance of ASTM A653/A653M, G40** unless otherwise indicated.
- E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
 - 1. Depth: [**2-1/2 inches**] [**4 inches**] [**6 inches**].
 - 2. Minimum Base-Metal Thickness: [**0.018 inch**] [**0.030 inch**] [**0.033 inch**].
- F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least **2 inches** long and matching studs in depth.
 - 1. Minimum Base-Metal Thickness: [**Matching steel studs**] [**0.018 inch**] [**0.021 inch**] [**0.030 inch**] [**0.033 inch**].
- G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly

indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- H. Finish Panels: **[As indicated.] [Gypsum board as specified in Section 092900 "Gypsum Board."]** **[Gypsum veneer plaster as specified in Section 092613 "Gypsum Veneer Plastering."]** **[Cementitious backer units as specified in Section 092900 "Gypsum Board."]** **[Cementitious backer units as specified in Section 093013 "Ceramic Tiling."]** **<Insert finish panels>.**
- I. Sound Attenuation Blankets: As specified in **[Section 092900 "Gypsum Board."]** **[Section 092613 "Gypsum Veneer Plastering."]**

2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in **[Section 092900 "Gypsum Board"]** **[Section 092613 "Gypsum Veneer Plastering"]** that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- E. Reinforcing: Galvanized-steel reinforcing strips with **0.033-inch** minimum thickness of base metal (uncoated).
- F. Acoustical Sealant: Section 07 92 19 "Acoustical Joint Sealants."
- G. Gypsum Board Cants:
 - 1. Gypsum Board Panels: As specified in Section 09 29 00 "Gypsum Board," **Type X, 1/2- or 5/8-inch** panels.
 - 2. Adhesive: Laminating adhesive as specified in Section 09 29 00 "Gypsum Board."
 - 3. Non-Load-Bearing Steel Framing: As specified in Section 09 22 16 "Non-Structural Metal Framing."

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. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 07 81 00 "Applied Fireproofing."
- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
 - 2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

- G. Control Joints: Install control joints **according to ASTM C840 and in specific locations approved by Engineer** while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Gypsum Board Cants: At projections into shaft **exceeding 4 inches**, install gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at **24 inches** o.c. with screws fastened to shaft wall framing.
 - 2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at **24 inches** o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than **1/8 inch** from the plane formed by faces of adjacent framing.

3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for interior ceilings.
- B. Related Requirements:
 - 1. Section 09 51 23 "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with fully concealed suspension systems, stapling, or adhesive bonding.
- C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, **6 inches** in size.
- C. Samples for Initial Selection: For components with factory-applied finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Acoustical Panels: Set of **6-inch- square** Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of **6-inch-** long Samples of each type, finish, and color.
 - 3. Clips: Full-size **hold-down, impact and seismic** clips.
- E. Delegated-Design Submittal: For seismic restraints for ceiling systems.
 - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Ceiling suspension-system members.
 2. Structural members to which suspension systems will be attached.
 3. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 5. Size and location of initial access modules for acoustical panels.
 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
 7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
 8. Minimum Drawing Scale: **1/8 inch = 1 foot.**
- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed by **manufacturer and witnessed by a qualified testing agency.**
- D. Evaluation Reports: For each acoustical panel ceiling suspension system **and anchor and fastener type**, from ICC-ES.
- E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 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. Acoustical Ceiling Units: Full-size panels equal to **2** percent of quantity installed.
 2. Suspension-System Components: Quantity of each exposed component equal to **2** percent of quantity installed.
 3. Hold-Down Clips: Equal to **2** percent of quantity installed.
 4. Impact Clips: Equal to **2** percent of quantity installed.

1.8 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of typical ceiling area as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design seismic restraints for ceiling systems.
- B. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.
- C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: **Class [A] [B] [C]** according to ASTM E1264.
 2. Smoke-Developed Index: **[50] [450]** or less.
- D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS

- A. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- B. Classification: Provide **fire-resistance-rated** panels as follows:
1. Type and Form: Type III, mineral base with painted finish; **[Form 1, nodular] [Form 2, water felted] [Form 4, cast or molded]**.
 2. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 1, nodular; with **[glass-fiber cloth] [washable vinyl-film]** overlay.
 3. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with **[vinyl overlay on face] [vinyl overlay on face and back] [vinyl overlay on face, back, and sealed edges] [fiberglass-fabric overlay on face]**.
 4. Type and Form: Type XII, glass-fiber base with membrane-faced overlay; **[Form 1, plastic] [Form 2, cloth] [Form 3, other]**. Binder shall not contain urea formaldehyde.
 5. Type and Form: Type XX, high-density, ceramic- and mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
 6. Pattern: **[C (perforated, small holes)] [CD (perforated, small holes and fissured)] [CE (perforated, small holes and lightly textured)] [D (fissured)] [E (lightly textured)] [F (heavily textured)] [G (smooth)] [GH (smooth and printed)] [I (embossed)] [J (embossed-in-register)] [K (surface scored)] [Z (other patterns as described)] [and] [as indicated by manufacturer's designation] <Insert pattern>.**
- C. Color: **White**.
- D. Light Reflectance (LR): Not less than **[LR indicated in a schedule] [0.65] [0.70] [0.75] [0.80] [0.85] [0.90]**.
- E. Ceiling Attenuation Class (CAC): Not less than **[CAC indicated in a schedule] [20] [25] [30] [35] [40] <Insert CAC>**.
- F. Noise Reduction Coefficient (NRC): Not less than **[NRC indicated in a schedule] [0.40] [0.50] [0.55] [0.60] [0.65] [0.70] [0.75] [0.80] [0.85] [0.90] [0.95] [1.00] <Insert NRC>**.
- G. Articulation Class (AC): Not less than **[AC indicated in a schedule] [170] [180] [190] [200] [210] <Insert AC>**.
- H. Edge/Joint Detail: **[Square] [Reveal sized to fit flange of exposed suspension-system members] [Flush reveal sized to fit flange of exposed suspension-system members] [Beveled, kerfed, and rabbeted long edges and square, butt-on short edges] [As indicated by manufacturer's designation]**.
- I. Thickness: **5/8 inch**.

J. Modular Size: **[24 by 24 inches] [24 by 48 inches].**

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.

1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C635/C635M.

B. Wide-Face, Capped, Double-Web, **[Fire-Rated]**, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, **G30** coating designation; with prefinished **15/16-inch-** wide metal caps on flanges.

1. Structural Classification: **[Intermediate] [Heavy]-**duty system.

2. End Condition of Cross Runners: **[Override (stepped)] [or] [butt-edge]** type.

3. Face Design: Flat, flush.

4. Cap Material: **[Cold-rolled steel] [or] [aluminum].**

5. Cap Finish: **[Painted white] [Painted in color as selected from manufacturer's full range] [Painted to match color indicated by manufacturer's designation] [Painted to match color of acoustical unit] [Plated with metallic finish as selected from manufacturer's full range] [Plated with metallic finish indicated by manufacturer's designation] [Natural finish for aluminum].**

C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, **G30** coating designation; with prefinished **9/16-inch-** wide metal caps on flanges.

1. Structural Classification: **[Intermediate] [Heavy]-**duty system.

2. End Condition of Cross Runners: **[Override (stepped)] [or] [butt-edge]** type.

3. Face Design: **[Flat, flush] [Flanges formed with an integral center reveal].**

4. Cap Material: **[Cold-rolled steel] [or] [aluminum].**

5. Cap Finish: **[Painted white] [Painted in color as selected from manufacturer's full range] [Painted to match color indicated by manufacturer's designation] [Painted to match color of acoustical unit] [Plated with metallic finish as selected from manufacturer's full range] [Plated with metallic finish indicated by manufacturer's designation] [Natural finish for aluminum].**

D. Narrow-Face, Steel-Capped, Double-Web, Fire-Rated Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, **G30** coating designation; with prefinished, cold-rolled, **9/16-inch-** wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.

2. Face Design: Flat, flush.

3. Cap Finish: **[Painted white] [Painted in color as selected from manufacturer's full range] [Painted to match color indicated by manufacturer's designation] [Painted to**

match color of acoustical unit] [Plated with metallic finish as selected from manufacturer's full range] [Plated with metallic finish indicated by manufacturer's designation].

- E. Narrow-Face, Uncapped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, **G30** coating designation; to produce structural members with **9/16-inch-** wide faces.
1. Structural Classification: **[Intermediate] [Heavy]-duty system.**
 2. Face Design: **[With 1/8-inch- wide, slotted, box-shaped flange] [With 1/4-inch- wide, slotted, box-shaped flange] [Flanges formed in stepped design with a center protrusion projecting 19/64 inch below flange surfaces supporting panel faces and forming 3/16-inch- wide reveals between edges of protrusion and those of panels].**
 3. Face Finish: Painted **[white] [in color as selected from manufacturer's full range] [to match color indicated by manufacturer's designation] [to match color of acoustical unit].**
 4. Reveal Finish: Painted **[to match flange color] [white] [black] [in color other than flange color as selected from manufacturer's full range of contrasting reveal colors].**
- F. Wide-Face, Aluminum-Capped, Double-Web, **[Fire-Rated,]** Hot-Dip Galvanized, **G60**, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, **G60** coating designation; with prefinished, **15/16-inch-** wide aluminum caps on flanges.
1. Structural Classification: **[Intermediate] [Heavy]-duty system.**
 2. Face Design: Flat, flush.
 3. Cap Finish: **[Painted white] [Painted to match color indicated by manufacturer's designation] [Painted to match color of acoustical unit] [Natural finish].**
- G. Wide-Face, Single-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet electrolytically zinc coated, with prefinished flanges of width indicated.
1. Structural Classification: Heavy-duty system.
 2. Face Finish: Painted **[white] [black].**
- H. Wide-Face, Capped, Double-Web, Stainless-Steel Suspension System: Main and cross runners roll formed from Type 304 or 316 stainless-steel sheet, with prefinished **15/16-inch-** wide, stainless-steel caps on flanges.
1. Structural Classification: Intermediate-duty system.
 2. Face Design: Flat, flush.
- I. Narrow-Face, Single-Web, Extruded-Aluminum Suspension System: Main and cross runners formed from extruded aluminum to produce structural members with **9/16-inch-** wide faces.
1. Structural Classification: **[Intermediate] [Heavy]-duty system.**
 2. Face Design: Screw-slot profile.
 3. Face Finish: **[Painted white] [Satin anodized according to AAMA 611, AA-M12C22A31].**
 4. Reveal Finish: **[Match face finish] [Painted white] [Painted black].**
- J. Extra-Wide-Face, **[Double] [Single]-**Web, Metal Suspension System: Main and cross runners formed from **[extruded aluminum] [aluminum-capped steel] [steel-capped steel] <Insert description>** to produce structural members with **[1-1/2-inch-] [2-inch-]** wide flanges.

1. Structural Classification: **[Intermediate] [Heavy]**-duty system.
2. Face Design: Flat, flush.
3. Face Finish: **[Painted white] [Satin anodized according to AAMA 611, AA-M12C22A31]**.
4. Gasket System: Clean-room type.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to **five** times that imposed by ceiling construction, as determined by testing according to ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: **[Cast-in-place] [Postinstalled expansion] [Postinstalled bonded]** anchors.
 - b. Corrosion Protection: Carbon-steel components zinc plated according to ASTM B633, Class SC 1 (mild) service condition.
 - c. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316.
 - d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.
 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to **10** times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
 3. Nickel-Copper-Alloy Wire: ASTM B164, nickel-copper-alloy UNS No. N04400.
 4. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than **[0.106-inch-] [0.135-inch-]** diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than **7/8 inch** wide; formed with **0.04-inch-** thick, galvanized-steel sheet complying with ASTM A653/A653M, **G90** coating designation; with bolted connections and **5/16-inch-** diameter bolts.
- F. Hold-Down Clips: Manufacturer's standard hold-down.
- G. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

- H. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- I. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- J. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- K. Clean-Room Gasket System: Where indicated, provide manufacturer's standard system, including **[manufacturer's standard] [closed-cell PVC] [neoprene] [antimicrobial]** gasket and related adhesives, tapes, seals, and retention clips, designed to seal out foreign material from and maintain positive pressure in clean room.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide **[stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member]**.
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
 - 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of **1.5 mils**. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section **07 92 19 "Acoustical Joint Sealants."**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements

for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, **seismic design requirements**, and manufacturer's written instructions.
 - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required **and, if permitted with fire-resistance-rated ceilings,** to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.

10. Space hangers not more than **48 inches** o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than **8 inches** from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than **16 inches** o.c. and not more than **3 inches** from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to **[long] [short]** axis of space.
 - c. Install panels in a basket-weave pattern.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 6. Install **hold-down, impact and seismic** clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
 - a. Hold-Down Clips: Space **24 inches** o.c. on all cross runners.
 7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
 8. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of **1/8 inch in 12 feet**, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of **1/8 inch in 12 feet**, non-cumulative.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: **Owner will engage** a qualified special inspector to perform the following special inspections:
 - 1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.
- B. Testing Agency: **Owner will engage** a qualified testing agency to perform tests and inspections.
- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
 - 1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for **200 lbf** of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for **440 lbf** of tension.
 - 2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 91 13

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. Concrete.
 - 2. Fiber-cement board.
 - 3. Clay masonry.
 - 4. Concrete masonry units (CMUs).
 - 5. Steel and iron.
 - 6. Galvanized metal.
 - 7. Aluminum (not anodized or otherwise coated).
 - 8. Copper.
 - 9. Stainless steel.
 - 10. Wood.
 - 11. Fiberglass.
 - 12. Plastic.
 - 13. Portland cement plaster (stucco).
 - 14. Gypsum board.
 - 15. Cotton or canvas insulation covering.
 - 16. Bituminous-coated surfaces.
- B. Related Requirements:
 - 1. **[Section 05 12 00 "Structural Steel Framing"] [Section 05 12 13 "Architecturally Exposed Structural Steel Framing"]** for shop priming of metal substrates.
 - 2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 05 51 16 "Metal Floor Plate Stairs" for shop priming metal floor plate stairs.
 - 4. Section 05 51 19 "Metal Grating Stairs" for shop priming metal grating stairs.
 - 5. Section 05 52 13 "Pipe and Tube Railings" for shop **[priming] [painting]** pipe and tube railings.
 - 6. **[Section 05 53 13 "Bar Gratings"] [Section 05 53 16 "Plank Gratings"] [Section 05 53 19 "Expanded Metal Gratings"]** for shop priming metal gratings.
 - 7. Section 09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood substrates.
 - 8. Section 09 96 00 "High-Performance Coatings" for tile-like coatings.

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 D523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

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 topcoat product.
- C. 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. 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.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

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 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Engineer will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Engineer will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Engineer at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer 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.

1.7 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.

1.8 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. Products: Subject to compliance with requirements, **[provide product] [provide one of the products] [available products that may be incorporated into the Work include, but are not limited to products]** listed in the Exterior Painting Schedule for the paint category indicated.

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. Colors: **[As selected by Architect from manufacturer's full range] [Match Architect's samples] [As indicated in a color schedule] <Insert requirements>.**
1. **[Ten] [Twenty] [Thirty] <Insert number>** percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint 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 paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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. Concrete: 12 percent.
 2. Fiber-Cement Board: 12 percent.
 3. Masonry (Clay and CMUs): 12 percent.
 4. Wood: 15 percent.
 5. Portland Cement Plaster: 12 percent.
 6. Gypsum Board: 12 percent.
- C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
- D. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- 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 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. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer **but not less than the following:**
1. SSPC-SP 2.
 2. SSPC-SP 3.
 3. SSPC-SP 7/NACE No. 4.
 4. SSPC-SP 11.
- G. 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.
- H. 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.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. 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.
- K. 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 both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. 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.
 - h. Any exposed sheet metal ductwork.

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 Engineer, 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. Concrete Substrates, Nontraffic Surfaces:

1. Latex System **[MPI EXT 3.1A] [MPI EXT 3.1K]:**
 - a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Prime Coat: Latex, exterior, matching topcoat.
 - c. Intermediate Coat: Latex, exterior, matching topcoat.
 - d. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**
 - e. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15.**
 - f. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11.**
 - g. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119.**
2. Latex over Latex Aggregate System **MPI EXT 3.1B:**
 - a. Prime Coat: Textured coating, latex, flat, **MPI #42.**
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15.**
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11.**
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119.**
3. Latex Aggregate System **MPI EXT 3.1N:**

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Textured coating, latex, nonflat, **MPI #41**.
 - d. Topcoat: Textured coating, latex, flat, **MPI #42**.
4. High-Build Latex System **MPI EXT 3.1L**: Dry film thickness of not less than **10 mils**.
- a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex, exterior, high build, **MPI #40**.
5. Water-Based Light Industrial Coating System **MPI EXT 3.1C**:
- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3**.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.
- B. Concrete Substrates, Traffic Surfaces:
1. Latex Floor Paint System **MPI EXT 3.2A**:
- a. Prime Coat: Floor paint, latex, matching topcoat.
 - b. Intermediate Coat: Floor paint, latex, matching topcoat.
 - c. Topcoat: Floor paint, latex, low gloss (maximum MPI Gloss Level 3), **MPI #60**.
2. Latex Deck Coating System **MPI EXT 3.2B**:
- a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Deck coating, latex, **MPI #127**.
3. Alkyd Floor Enamel System **MPI EXT 3.2D**:
- a. Prime Coat: Floor enamel, matching topcoat.
 - b. Intermediate Coat: Floor enamel, matching topcoat.
 - c. Topcoat: Floor enamel, alkyd, gloss (MPI Gloss Level 6), **MPI #27**.
 - d. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
4. Clear Water-Based Sealer System **MPI EXT 3.2H**:
- a. Prime Coat: Sealer, water based, matching topcoat.
 - b. Intermediate Coat: Sealer, water based, matching topcoat.
 - c. Topcoat: Sealer, water based, for concrete floors, **MPI #99**.

5. Clear Sealer System **MPI EXT 3.2G**:

- a. Prime Coat: Sealer, solvent based, matching topcoat.
- b. Intermediate Coat: Sealer, solvent based, matching topcoat.
- c. Topcoat: Sealer, solvent based, for concrete floors, **MPI #104**.

C. Cement Board Substrates:

1. Latex System [**MPI EXT 3.3A**] [**MPI EXT 3.3J**]:

- a. Prime Coat: Latex, exterior, matching topcoat.
- b. Prime Coat: Primer, alkali resistant, water based, **MPI #3**.
- c. Intermediate Coat: Latex, exterior, matching topcoat.
- d. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
- e. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
- f. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
- g. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.

2. Latex Aggregate System **MPI EXT 3.3G**:

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Textured coating, latex, nonflat, **MPI #41**.
- d. Topcoat: Textured coating, latex, flat, **MPI #42**.

3. High-Build Latex System **MPI EXT 3.3H**: Dry film thickness of not less than **10 mils**.

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Latex, exterior, high build, **MPI #40**.

4. Water-Based Light Industrial Coating System **MPI EXT 3.3C**:

- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3**.
- b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
- d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
- e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.

5. Alkyd System **MPI EXT 3.3B**:

- a. Prime Coat: Primer, latex for exterior wood, **MPI #6**.

- b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
- c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
- d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
- e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.

D. Clay Masonry Substrates:

- 1. Latex System **MPI EXT 4.1A**:
 - a. Prime Coat: Latex, exterior, matching topcoat.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
- 2. Latex Aggregate System **MPI EXT 4.1B**:
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Textured coating, latex, nonflat, **MPI #41**.
 - d. Topcoat: Textured coating, latex, flat, **MPI #42**.
- 3. High-Build Latex System **MPI EXT 4.1H**: Dry film thickness of not less than **10 mils**.
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex, exterior, high build, **MPI #40**.
- 4. Water-Based Light Industrial Coating System **MPI EXT 4.1C**:
 - a. Prime Coat: Light industrial coating, exterior, water based, matching topcoat.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.

E. CMU Substrates:

- 1. Latex System **MPI EXT 4.2A**:
 - a. Prime Coat: Block filler, latex, interior/exterior, **MPI #4**.

- b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
2. Latex over Alkali-Resistant Primer System **MPI EXT 4.2L**:
- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
3. Latex Aggregate System **MPI EXT 4.2B**:
- a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Textured coating, latex, nonflat, **MPI #41**.
 - d. Topcoat: Textured coating, latex, flat, **MPI #42**.
4. High-Build Latex System **MPI EXT 4.2K**: Dry film thickness of not less than **10 mils**.
- a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex, exterior, high build[, **MPI #40**.
5. Water-Based Light Industrial Coating System **MPI EXT 4.2C**:
- a. Prime Coat: Block filler, latex, interior/exterior, **MPI #4**.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.
- F. Steel and Iron Substrates:
- 1. Water-Based Light Industrial Coating System[**MPI EXT 5.1B**] [**MPI EXT 5.1C**]
[**MPI EXT 5.1M**] [**MPI EXT 5.1N**]:

- a. Prime Coat: Primer, zinc rich, inorganic, **MPI #19**.
 - b. Prime Coat: Primer, alkyd, anti-corrosive for metal, **MPI #79**.
 - c. Prime Coat: Primer, rust inhibitive, water based **MPI #107**.
 - d. Prime Coat: Primer, epoxy, anti-corrosive **MPI #101**.
 - e. Prime Coat: Shop primer specified in Section where substrate is specified.
 - f. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - g. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
 - h. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - i. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.
2. Water-Based Light Industrial Coating over Epoxy System **MPI EXT 5.1R**:
- a. Prime Coat: Primer, epoxy, anti-corrosive **MPI #101**.
 - b. Intermediate Coat: Epoxy, high build, low gloss **MPI #108**.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.
3. Alkyd System [**MPI EXT 5.1D**] [**MPI EXT 5.1Q**]:
- a. Prime Coat: Primer, alkyd, anticorrosive, for metal, **MPI #79**.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Prime Coat: Primer, metal, surface tolerant, **MPI #23**.
 - d. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - e. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - f. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - g. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
4. Quick-Dry Enamel System **MPI EXT 5.1A**:
- a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76**.
 - b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
 - c. Topcoat: Alkyd, quick dry, semi-gloss (MPI Gloss Level 5), **MPI #81**.

- d. Topcoat: Alkyd, quick dry, gloss (MPI Gloss Level 7), **MPI #96.**
5. Aluminum Paint System **MPI EXT 5.1K:**
- a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, **MPI #79.**
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Aluminum paint, matching topcoat.
 - d. Topcoat: Aluminum paint, **MPI #1.**
- G. Galvanized-Metal Substrates:
1. Latex System [**MPI EXT 5.3A**] [**MPI EXT 5.3H**]:
- a. Prime Coat: Primer, galvanized, cementitious, **MPI #26.**
 - b. Prime Coat: Primer, galvanized, water based, **MPI #134.**
 - c. Intermediate Coat: Latex, exterior, matching topcoat.
 - d. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**
 - e. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15.**
 - f. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11.**
 - g. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119.**
2. Water-Based Light Industrial Coating System [**MPI EXT 5.3G**] [**MPI EXT 5.3J**] [**MPI EXT 5.3K**]:
- a. Prime Coat: Primer, galvanized, cementitious, **MPI #26.**
 - b. Prime Coat: Primer, galvanized, water based, **MPI #134.**
 - c. Prime Coat: Primer, epoxy, anti-corrosive, **MPI #101.**
 - d. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - e. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161.**
 - f. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163.**
 - g. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164.**
3. 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, flat (MPI Gloss Level 1), **MPI #8.**
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94.**

- e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9.**
- 4. Aluminum Paint System **MPI EXT 5.3F:**
 - a. Prime Coat: Primer, galvanized, cementitious, **MPI #26.**
 - b. Intermediate Coat: Aluminum paint, matching topcoat.
 - c. Topcoat: Aluminum paint, **MPI #1.**
- H. Aluminum Substrates:
 - 1. Latex System **MPI EXT 5.4H:**
 - a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95.**
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15.**
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11.**
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119.**
 - 2. Water-Based Light Industrial Coating System **MPI EXT 5.4G:**
 - a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95.**
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161.**
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163.**
 - e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164.**
 - 3. Alkyd System [**MPI EXT 5.4A**] [**MPI EXT 5.4F**]:
 - a. Pretreatment Prime Coat: Vinyl wash primer, **MPI #80.**
 - b. Prime Coat: Primer, quick dry, for aluminum, **MPI #95.**
 - c. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - d. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8.**
 - e. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94.**
 - f. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9.**
- I. Copper Substrates:
 - 1. Latex System **MPI EXT 5.5H:**

- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
2. Water-Based Light Industrial Coating System **MPI EXT 5.5G**:
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.
3. Alkyd System [**MPI EXT 5.5A**] [**MPI EXT 5.5F**]:
- a. Prime Coat: Vinyl wash primer, **MPI #80**.
 - b. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.
 - c. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - d. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - e. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - f. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
- J. Stainless-Steel Substrates:
1. Latex System **MPI EXT 5.6F**:
- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
2. Water-Based Light Industrial Coating System **MPI EXT 5.6G**:

- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.
3. Alkyd System **MPI EXT 5.6A**:
- a. Prime Coat: Vinyl wash primer, **MPI #80**.
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
- K. Wood Substrates: Glued-laminated construction.
1. Latex over Latex Primer System **MPI EXT 6.1L**:
- a. Prime Coat: Primer, latex for exterior wood, **MPI #6**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
2. Latex over Alkyd Primer System **MPI EXT 6.1A**:
- a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
3. Alkyd System **MPI EXT 6.1B**:
- a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.

- b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
- L. Wood Substrates: Exposed framing.
- 1. Latex over Latex Primer System **MPI EXT 6.2M**:
 - a. Prime Coat: Primer, latex for exterior wood, **MPI #6**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
 - 2. Latex over Alkyd Primer System **MPI EXT 6.2A**:
 - a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
 - 3. Alkyd System **MPI EXT 6.2C**:
 - a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
- M. Wood Substrates: **Wood trim, Architectural woodwork, Doors, Window, Wood board siding and wood fences.**
- 1. Latex over Latex Primer System **MPI EXT 6.3L**:
 - a. Prime Coat: Primer, latex for exterior wood, **MPI #6**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.

- d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
2. Latex System **MPI EXT 6.3A**:
- a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
3. Water-Based Light Industrial Coating System **MPI EXT 6.3J**:
- a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - d. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.
4. Alkyd System **MPI EXT 6.3B**:
- a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
- N. Wood Substrates: Wood-based panel products.
1. Latex over Latex Primer System **MPI EXT 6.4K**:
- a. Prime Coat: Primer, latex for exterior wood, **MPI #6**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.

- f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
- 2. Latex over Alkyd Primer System **MPI EXT 6.4G**:
 - a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
- 3. Alkyd System **MPI EXT 6.4B**:
 - a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
- O. Wood Substrates: Traffic surfaces, including **lumber decking and stairs**.
 - 1. Latex Porch and Floor Paint over Latex Primer System **MPI EXT 6.5E**:
 - a. Prime Coat: Primer, latex for exterior wood, **MPI #6**.
 - b. Intermediate Coat: Latex floor paint, matching topcoat.
 - c. Topcoat: Latex floor paint, low gloss, **MPI #60**.
 - d. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
 - 2. Latex Porch and Floor Paint over Alkyd Primer System **MPI EXT 6.5A**:
 - a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Latex floor paint, matching topcoat.
 - c. Topcoat: Latex floor paint, low gloss, **MPI #60**.
 - d. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
 - 3. Latex Deck Coating System (for Plywood Decks) **MPI EXT 6.5G**:
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex Deck Coating, **MPI #127**.
 - 4. Alkyd Floor Enamel System **MPI EXT 6.5B**:

- a. Prime Coat: Floor enamel, alkyd, gloss, matching topcoat.
 - b. Intermediate Coat: Floor enamel, alkyd, gloss, matching topcoat.
 - c. Topcoat: Floor enamel, alkyd, gloss (MPI Gloss Level 6), **MPI #27**.
 - d. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
- 5. Alkyd Floor Enamel over Wood Preservative System **MPI EXT 6.5C**:
 - a. Preservative Coat: Preservative, for exterior wood, **MPI #37**.
 - b. Prime Coat: Floor enamel, alkyd, gloss, matching topcoat.
 - c. Intermediate Coat: Floor enamel, alkyd, gloss, matching topcoat.
 - d. Topcoat: Floor enamel, alkyd, gloss (MPI Gloss Level 6), **MPI #27**.
 - e. Additive: Manufacturer's standard additive to increase skid resistance of painted surface.
- P. Wood Substrates: Wood shingles and shakes (excluding roofs).
 - 1. Latex over Latex Primer System **MPI EXT 6.6E**:
 - a. Prime Coat: Primer, latex for exterior wood, **MPI #6**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
 - 2. Latex over Alkyd Primer System **MPI EXT 6.6A**:
 - a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
 - 3. Alkyd System **MPI EXT 6.6B**:
 - a. Prime Coat: Primer, alkyd for exterior wood, **MPI #5**.
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.

- e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.

Q. Fiberglass Substrates:

1. Latex System **MPI EXT 6.7A:**

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
- d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
- e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
- f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.

2. Water-Based Light Industrial Coating System **MPI EXT 6.7C:**

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
- d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
- e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.

3. Alkyd System **MPI EXT 6.7B:**

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
- c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
- d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
- e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.

R. Plastic Trim Fabrication Substrates:

1. Latex System **MPI EXT 6.8A:**

- a. Prime Coat: Primer, bonding, water based, **MPI #17**.
- b. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- c. Intermediate Coat: Latex, exterior, matching topcoat.
- d. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
- e. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.

- f. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - g. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
2. Water-Based Light Industrial Coating System **MPI EXT 6.8C**:
- a. Prime Coat: Primer, bonding, water based, **MPI #17**.
 - b. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
 - c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - d. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161**.
 - e. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163**.
 - f. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164**.
3. Alkyd System **MPI EXT 6.8B**:
- a. Prime Coat: Primer, bonding, water based, **MPI #17**.
 - b. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
 - c. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - d. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - e. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - f. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
- S. Portland Cement Plaster Substrates:
1. Latex System [**MPI EXT 9.1A**] [**MPI EXT 9.1J**]:
- a. Prime Coat: Latex, exterior, matching topcoat.
 - b. Prime Coat: Primer, alkali resistant, water based, **MPI #3**.
 - c. Intermediate Coat: Latex, exterior, matching topcoat.
 - d. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10**.
 - e. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - f. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - g. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
2. High-Build Latex System **MPI EXT 9.1H**: Dry film thickness of not less than **10 mils**.
- a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex, exterior, high build, **MPI #40**.

3. Water-Based Light Industrial Coating System **MPI EXT 9.1B:**
 - a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161.**
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163.**
 - e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164.**
- T. Exterior Gypsum Board Substrates:
 1. Latex System **MPI EXT 9.2A:**
 - a. Prime Coat: Primer, latex for exterior wood (reduced), **MPI #6.**
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**
 - d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15.**
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11.**
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119.**
 2. Latex Aggregate System **MPI EXT 9.2C:**
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Textured coating, latex, nonflat, **MPI #41.**
 - d. Topcoat: Textured coating, latex, flat, **MPI #42.**
 3. High-Build Latex System **MPI EXT 9.2D:** Dry film thickness of not less than **10 mils.**
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Latex, exterior, high build, **MPI #40.**
 4. Alkyd System **MPI EXT 9.2B:**
 - a. Prime Coat: Primer, latex for exterior wood (reduced), **MPI #6.**
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8.**
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94.**
 - e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9.**

U. Exterior Canvas Substrates:

1. Latex System **MPI EXT 10.1A:**

- a. Prime Coat: Latex, exterior, matching topcoat.
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**
- d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15.**
- e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11.**
- f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119.**

2. Water-Based Light Industrial Coating System **MPI EXT 10.1B:**

- a. Prime Coat: Light industrial coating, exterior, water based, matching topcoat.
- b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), **MPI #161.**
- d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), **MPI #163.**
- e. Topcoat: Light industrial coating, exterior, water based, gloss (MPI Gloss Level 6), **MPI #164.**

3. Alkyd System **MPI EXT 10.1C:**

- a. Prime Coat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**
- b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
- c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8.**
- d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94.**
- e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9.**

4. Aluminum Paint System **MPI EXT 10.1D:**

- a. Prime Coat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**
- b. Intermediate Coat: Aluminum paint, matching topcoat.
- c. Topcoat: Aluminum paint, **MPI #1.**

V. Exterior Bituminous-Coated Substrates:

1. Latex System **MPI EXT 10.2A:**

- a. Prime Coat: Primer, rust inhibitive, water based, **MPI #107.**
- b. Intermediate Coat: Latex, exterior, matching topcoat.
- c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), **MPI #10.**

- d. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), **MPI #15**.
 - e. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), **MPI #11**.
 - f. Topcoat: Latex, exterior, gloss (MPI Gloss Level 6), **MPI #119**.
2. Latex Aggregate Coating System **MPI EXT 10.2B**:
- a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Textured coating, latex, nonflat, **MPI #41**.
 - d. Topcoat: Textured coating, latex, flat, **MPI #42**.
3. Alkyd System **MPI EXT 10.2C**:
- a. Prime Coat: Primer, rust inhibitive, water based, **MPI #107**.
 - b. Intermediate Coat: Exterior, alkyd enamel, matching topcoat.
 - c. Topcoat: Alkyd, exterior, flat (MPI Gloss Level 1), **MPI #8**.
 - d. Topcoat: Alkyd, exterior, semi-gloss (MPI Gloss Level 5), **MPI #94**.
 - e. Topcoat: Alkyd, exterior, gloss (MPI Gloss Level 6), **MPI #9**.
4. Aluminum Paint System **MPI EXT 10.2D**:
- a. Prime Coat: Primer, rust inhibitive, water based, **MPI #107**.
 - b. Intermediate Coat: Aluminum paint, matching topcoat.
 - c. Topcoat: Aluminum paint, **MPI #1**.

END OF SECTION

SECTION 09 91 23**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. Concrete.
2. Cement board.
3. Clay masonry.
4. Concrete masonry units (CMUs).
5. Steel and iron.
6. Galvanized metal.
7. Aluminum (not anodized or otherwise coated).
8. Copper.
9. Stainless steel.
10. Wood.
11. Fiberglass.
12. Plastic.
13. Gypsum board.
14. Plaster.
15. Acoustic panels and tiles.
16. Spray-textured ceilings.
17. Cotton or canvas insulation covering.
18. ASJ insulation covering.
19. Bituminous-coated surfaces.

- B. Related Requirements:

1. **[Section 05 12 00 "Structural Steel Framing"] [Section 05 12 13 "Architecturally Exposed Structural Steel Framing"]** for shop priming structural steel.
2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.
3. Section 05 51 13 "Metal Pan Stairs" for shop priming metal pan stairs.
4. Section 05 51 16 "Metal Floor Plate Stairs" for shop priming metal floor plate stairs.
5. Section 05 51 19 "Metal Grating Stairs" for shop priming metal grating stairs.
6. Section 05 52 13 "Pipe and Tube Railings" for shop **[priming] [painting]** pipe and tube railings.
7. **[Section 05 53 13 "Bar Gratings"] [Section 05 53 16 "Plank Gratings"] [Section 05 53 19 "Expanded Metal Gratings"]** for shop priming metal gratings.
8. Section 09 96 00 "High-Performance Coatings" for tile-like coatings.
9. Section 09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior 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 D523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

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 topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, **8 inches** square.
 - 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.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

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 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 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.

1.7 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.

1.8 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. Products: Subject to compliance with requirements, **available products that may be incorporated into the Work include, but are not limited to products** listed in the Interior Painting Schedule for the paint category indicated.

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. Colors: **[As selected by Architect from manufacturer's full range] [Match Architect's samples] [As indicated in a color schedule] <Insert requirements>.**
 - 1. **[Ten] [Twenty] [Thirty] <Insert number>** percent of surface area will be painted with deep tones.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint 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 paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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. Concrete: 12 percent.
 - 2. Fiber-Cement Board: 12 percent.
 - 3. Masonry (Clay and CMUs): 12 percent.
 - 4. Wood: 15 percent.
 - 5. Gypsum Board: 12 percent.
 - 6. Plaster: 12 percent.

- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.
- F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- G. 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 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.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer **but not less than the following**:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
 - 3. SSPC-SP 7/NACE No. 4.
 - 4. SSPC-SP 11.
- G. 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.
- H. 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.

- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 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.
- K. Cotton or Canvas Insulation Covering 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 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 **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.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - i. All sheet metal ductwork.
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 Engineer, 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. Concrete Substrates, Nontraffic Surfaces:
 1. Latex System **[MPI INT 3.1A] [MPI INT 3.1E]**:
 - a. Prime Coat: Primer, alkali resistant, water based, **MPI #3**.
 - b. Prime Coat: Latex, interior, matching topcoat.
 - c. Intermediate Coat: Latex, interior, matching topcoat.

- d. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - g. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - h. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - i. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
2. Latex over Latex Aggregate System **MPI INT 3.1B**:
- a. Prime Coat: Textured coating, latex, flat, **MPI #42**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
3. Latex Aggregate System **MPI INT 3.1N**:
- a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Textured coating, latex, nonflat, **MPI #41**.
 - d. Topcoat: Textured coating, latex, flat, **MPI #42**.
4. Institutional Low-Odor/VOC Latex System **MPI INT 3.1M**:
- 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, flat (MPI Gloss Level 1), **MPI #143**.
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144**.
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145**.
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146**.
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147**.

- h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
- 5. High-Performance Architectural Latex System **MPI INT 3.1C:**
 - a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
- 6. Water-Based Light Industrial Coating System **MPI INT 3.1L:**
 - a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151.**
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153.**
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154.**
- 7. Alkyd System **MPI INT 3.1D:**
 - a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
- 8. Concrete Stain System **MPI INT 3.1K:**
 - a. First Coat: Stain, interior, matching topcoat.
 - b. Topcoat: Stain, interior, **MPI #58.**
- B. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Enamel System **MPI INT 3.2A:**
 - a. Prime Coat: Floor paint, latex, matching topcoat.
 - b. Intermediate Coat: Floor paint, latex, matching topcoat.
 - c. Topcoat: Floor paint, latex, low gloss (maximum MPI Gloss Level 3), **MPI #60.**
 2. Alkyd Floor Enamel System **MPI INT 3.2B:**
 - a. Prime Coat: Floor enamel, alkyd, matching topcoat.
 - b. Intermediate Coat: Floor enamel, alkyd, matching topcoat.
 - c. Topcoat: Floor enamel, alkyd, gloss (MPI Gloss Level 6), **MPI #27.**
 3. Concrete Stain System **MPI INT 3.2E:**
 - a. First Coat: Stain, interior, for concrete floors, matching topcoat.
 - b. Topcoat: Stain, interior, for concrete floors, **MPI #58.**
 4. Water-Based Concrete Floor Sealer System **MPI INT 3.2G:**
 - a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
 - b. Topcoat: Sealer, water based, for concrete floors, **MPI #99.**
 5. Solvent-Based Concrete Floor Sealer System **MPI INT 3.2F:**
 - a. First Coat: Sealer, solvent based, for concrete floors, matching topcoat.
 - b. Topcoat: Sealer, solvent based, for concrete floors, **MPI #104.**
- C. Cement Board Substrates:
1. Latex System **MPI INT 3.3A:**
 - a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
 2. Institutional Low-Odor/VOC Latex System **MPI INT 3.3G:**
 - 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, flat (MPI Gloss Level 1), **MPI #143.**

- d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
3. High-Performance Architectural Latex System **MPI INT 3.3B:**
- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
4. Water-Based Light Industrial Coating System **MPI INT 3.3H:**
- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151.**
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153.**
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154.**
5. Alkyd System **MPI INT 3.3C:**
- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**

- f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**

D. Clay Masonry Substrates:

1. Latex System **MPI INT 4.1A:**

- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
- d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
- e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
- f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
- g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
- h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**

2. Latex Aggregate System **MPI INT 4.1B:**

- a. Prime Coat: Primer for textured coating, latex, flat, **as recommended in writing by topcoat manufacturer.**
- b. Intermediate Coat: Intermediate coat for textured coating, latex, flat, **as recommended in writing by topcoat manufacturer.**
- c. Topcoat: Textured coating, latex, nonflat, **MPI #41.**
- d. Topcoat: Textured coating, latex, flat, **MPI #42.**

3. Institutional Low-Odor/VOC Latex System **MPI INT 4.1M:**

- 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, flat (MPI Gloss Level 1), **MPI #143.**
- d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
- e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
- f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
- g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
- h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**

4. High-Performance Architectural Latex System **MPI INT 4.1L:**

- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**

- b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
5. Water-Based Light Industrial Coating System **MPI INT 4.1C:**
- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151.**
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153.**
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154.**
6. Alkyd System **MPI INT 4.1D:**
- a. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
7. Clear (2-Component) Polyurethane System **MPI INT 4.1K:**
- a. Prime Coat: Two-component polyurethane matching topcoat.
 - b. Intermediate Coat: Two-component polyurethane matching topcoat.
 - c. Topcoat: Varnish, aliphatic polyurethane, two-component (MPI Gloss Level 6 or MPI Gloss Level 7), **MPI #78.**
- E. CMU Substrates:
1. Latex System **MPI INT 4.2A:**
- a. Block Filler: Block filler, latex, interior/exterior, **MPI #4.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.

- c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
2. Latex Aggregate System **MPI INT 4.2B:**
- a. Prime Coat: Primer for textured coating, latex, flat, **as recommended in writing by topcoat manufacturer.**
 - b. Intermediate Coat: Intermediate coat for textured coating, latex, flat, **as recommended in writing by topcoat manufacturer.**
 - c. Topcoat: Textured coating, latex, nonflat, **MPI #41.**
 - d. Topcoat: Textured coating, latex, flat, **MPI #42.**
3. Institutional Low-Odor/VOC Latex System **MPI INT 4.2E:**
- a. Block Filler: Block filler, latex, interior/exterior, **MPI #4.**
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
4. High-Performance Architectural Latex System **[MPI INT 4.2D] [MPI INT 4.2P]:**
- a. Block Filler: Block filler, latex, interior/exterior, **MPI #4.**
 - b. Prime Coat: Primer, alkali resistant, water based, **MPI #3.**
 - c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**

- e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - f. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - g. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
5. Water-Based Light Industrial Coating System **MPI INT 4.2K:**
- a. Block Filler: Block filler, latex, interior/exterior, **MPI #4.**
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151.**
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153.**
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6)[, **MPI #154].**
6. Alkyd System [**MPI INT 4.2C**] [**MPI INT 4.2N**]:
- a. Block Filler: Block filler, latex, interior/exterior, **MPI #4.**
 - b. Sealer Coat: Primer sealer, latex, interior, **MPI #50.**
 - c. Intermediate Coat: Alkyd, interior, matching topcoat.
 - d. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - e. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - f. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - g. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
7. Clear (2-Component) Polyurethane System **MPI INT 4.2Q:**
- a. Prime Coat: Two-component polyurethane, matching topcoat.
 - b. Intermediate Coat: Two-component polyurethane, matching topcoat.
 - c. Topcoat: Varnish, aliphatic polyurethane, two component (MPI Gloss Level 6 or MPI Gloss Level 7), **MPI #78.**

F. Steel Substrates:

- 1. Latex System, Alkyd Primer [**MPI INT 5.1Q**] [**MPI INT 5.1QQ**]:
 - a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76.**
 - b. Prime Coat: Primer, alkyd, anti-corrosive, for metal, **MPI #79.**
 - c. Prime Coat: Shop primer specified in Section where substrate is specified.
 - d. Intermediate Coat: Latex, interior, matching topcoat.

- e. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - g. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - h. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - i. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - j. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
2. Latex over Shop-Applied Quick-Drying Shop Primer System **MPI INT 5.1X**:
- a. Prime Coat: Primer, quick dry, for shop application, **MPI #275**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
3. Institutional Low-Odor/VOC Latex System **MPI INT 5.1S**:
- a. Prime Coat: Primer, rust inhibitive, water based **MPI #107**.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143**.
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144**.
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145**.
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146**.
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147**.
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148**.
4. High-Performance Architectural Latex System **[MPI INT 5.1R] [MPI INT 5.1RR]**:
- a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76**.

- b. Prime Coat: Primer, alkyd, anti-corrosive, for metal, **MPI #79**.
 - c. Prime Coat: Shop primer specified in Section where substrate is specified.
 - d. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138**.
 - f. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139**.
 - g. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140**.
 - h. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141**.
- 5. Water-Based Light Industrial Coating System **MPI INT 5.1B**:
 - a. Prime Coat: Primer, rust-inhibitive, water based **MPI #107**.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151**.
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153**.
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154**.
- 6. Water-Based Light Industrial Coating System over Epoxy Primer System **MPI INT 5.1N**:
 - a. Prime Coat: Primer, epoxy, anti-corrosive **MPI #101**.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151**.
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153**.
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154**.
- 7. Water-Based Dry-Fall System [**MPI INT 5.1C**] [**MPI INT 5.1CC**]:
 - a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76**.
 - b. Prime Coat: Primer, alkyd, anti-corrosive, for metal, **MPI #79**.
 - c. Prime Coat: Shop primer specified in Section where substrate is specified.
 - d. Topcoat: Dry fall, latex, flat, **MPI #118**.

- e. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), **MPI #133.**
 - f. Topcoat: Dry fall, latex (MPI Gloss Level 3), **MPI #155.**
 - g. Topcoat: Dry fall, latex (MPI Gloss Level 5), **MPI #226.**
8. Water-Based Dry-Fall over Shop-Applied Quick-Drying Shop Primer System **MPI INT 5.1CCC:**
- a. Prime Coat: Primer, quick dry, for shop application, **MPI #275.**
 - b. Topcoat: Dry fall, latex, flat, **MPI #118.**
 - c. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), **MPI #133.**
 - d. Topcoat: Dry fall, latex (MPI Gloss Level 3), **MPI #155.**
 - e. Topcoat: Dry fall, latex (MPI Gloss Level 5), **MPI #226.**
9. Alkyd System [**MPI INT 5.1E**] [**MPI INT 5.1EE**]:
- a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76.**
 - b. Prime Coat: Primer, alkyd, anti-corrosive, for metal, **MPI #79.**
 - c. Prime Coat: Shop primer specified in Section where substrate is specified.
 - d. Intermediate Coat: Alkyd, interior, matching topcoat.
 - e. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - f. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - g. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - h. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
10. Alkyd over Surface-Tolerant Primer System **MPI INT 5.1T:**
- a. Prime Coat: Primer, metal, surface tolerant **MPI #23.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
11. Alkyd over Shop-Applied Quick-Drying Shop Primer System **MPI INT 5.1W:**
- a. Prime Coat: Primer, quick dry, for shop application, **MPI #275.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.

- c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49**.
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51**.
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47**.
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48**.
12. Quick-Dry Enamel System **MPI INT 5.1A**:
- a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76**.
 - b. Intermediate Coat: Alkyd, quick dry, matching topcoat.
 - c. Topcoat: Alkyd, quick dry, semi-gloss (MPI Gloss Level 5), **MPI #81**.
 - d. Topcoat: Alkyd, quick dry, gloss (MPI Gloss Level 7), **MPI #96**.
13. Alkyd Dry-Fall System [**MPI INT 5.1D**] [**MPI INT 5.1DD**]:
- a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76**.
 - b. Prime Coat: Primer, alkyd, anti-corrosive, for metal, **MPI #79**.
 - c. Prime Coat: Shop primer specified in Section where substrate is specified.
 - d. Topcoat: Dry fall, alkyd, flat, **MPI #55**.
 - e. Topcoat: Dry fall, alkyd (MPI Gloss Level 3), **MPI #89**.
 - f. Topcoat: Dry fall, alkyd, semi-gloss (MPI Gloss Level 5), **MPI #225**.
14. Alkyd Dry-Fall over Quick-Drying Primer System **MPI INT 5.1ZZ**:
- a. Prime Coat: Primer, quick dry, for shop application, **MPI #275**.
 - b. Topcoat: Dry fall, alkyd, flat, **MPI #55**.
 - c. Topcoat: Dry fall, alkyd (MPI Gloss Level 3), **MPI #89**.
 - d. Topcoat: Dry fall, alkyd, semi-gloss (MPI Gloss Level 5), **MPI #225**.
15. Aluminum Paint System [**MPI INT 5.1M**] [**MPI INT 5.1MM**]:
- a. Prime Coat: Primer, alkyd, quick dry, for metal, **MPI #76**.
 - b. Prime Coat: Primer, alkyd, anti-corrosive, for metal, **MPI #79**.
 - c. Prime Coat: Shop primer specified in Section where substrate is specified.
 - d. Intermediate Coat: Aluminum paint, matching topcoat.
 - e. Topcoat: Aluminum paint, **MPI #1**.

G. Galvanized-Metal Substrates:

- 1. Latex System [**MPI INT 5.3A**] [**MPI INT 5.3J**]:
 - a. Prime Coat: Primer, galvanized, cementitious, **MPI #26**.

- b. Prime Coat: Primer, galvanized, water based, **MPI #134.**
 - c. Intermediate Coat: Latex, interior, matching topcoat.
 - d. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - g. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - h. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - i. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
2. Institutional Low-Odor/VOC Latex System **MPI INT 5.3N:**
- a. Prime Coat: Primer, galvanized, water based, **MPI #134.**
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
3. High-Performance Architectural Latex System **MPI INT 5.3M:**
- a. Prime Coat: Primer, galvanized, water based, **MPI #134.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
4. Water-Based Light Industrial Coating System **[MPI INT 5.3B] [MPI INT 5.3K]:**

- a. Prime Coat: Primer, galvanized, cementitious, **MPI #26**.
 - b. Prime Coat: Primer, galvanized, water based, **MPI #134**.
 - c. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - d. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151**.
 - e. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153**.
 - f. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154**.
5. Water-Based Dry-Fall System **MPI INT 5.3H**:
- a. Prime Coat: Dry fall, water based, for galvanized steel, matching topcoat.
 - b. Topcoat: Dry fall, water based, for galvanized steel, flat (MPI Gloss Level 1), **MPI #133**.
6. Alkyd over Cementitious Primer System **MPI INT 5.3C**:
- a. Prime Coat: Primer, galvanized, cementitious, **MPI #26**.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49**.
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51**.
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47**.
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48**.
7. Alkyd Dry-Fall System (Cementitious Primer) **MPI INT 5.3F**:
- a. Prime Coat: Primer, galvanized, cementitious, **MPI #26**.
 - b. Topcoat: Dry fall, alkyd, flat, **MPI #55**.
 - c. Topcoat: Dry fall, alkyd (MPI Gloss Level 3) , **MPI #89**.
 - d. Topcoat: Dry fall, alkyd, semi-gloss (MPI Gloss Level 5), **MPI #225**.
8. Aluminum Paint System (Cementitious Primer) **MPI INT 5.3G**:
- a. Prime Coat: Primer, galvanized, cementitious, **MPI #26**.
 - b. Intermediate Coat: Aluminum paint, matching topcoat.
 - c. Topcoat: Aluminum paint, **MPI #1**.
- H. Aluminum (Not Anodized or Otherwise Coated) Substrates:
1. Latex System **MPI INT 5.4H**:
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.

- b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
2. Institutional Low-Odor/VOC Latex System **MPI INT 5.4G:**
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95.**
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
3. High-Performance Architectural Latex System **MPI INT 5.4F:**
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
4. Water-Based Light Industrial Coating System **MPI INT 5.4E:**
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95.**

- b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151**.
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153**.
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154**.
5. Alkyd System [**MPI INT 5.4A**] [**MPI INT 5.4J**]:
- a. Prime Coat: Primer, vinyl wash, **MPI #80**.
 - b. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.
 - c. Intermediate Coat: Alkyd, interior, matching topcoat.
 - d. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49**.
 - e. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51**.
 - f. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47**.
 - g. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48**.
- I. Copper Substrates:
1. Latex System **MPI INT 5.5H**:
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
2. Institutional Low-Odor/VOC Latex System **MPI INT 5.5G**:
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143**.
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144**.

- e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
3. High-Performance Architectural Latex System **MPI INT 5.5F:**
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
4. Water-Based Light Industrial Coating System **MPI INT 5.5E:**
- a. Prime Coat: Primer, quick dry, for aluminum, **MPI #95.**
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151.**
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153.**
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154.**
5. Alkyd System **MPI INT 5.5A:**
- a. Prime Coat: Primer, vinyl wash, **MPI #80.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**

J. Stainless Steel Substrates:

1. Latex System **MPI INT 5.6H**:

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
- d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
- e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
- f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
- g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
- h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.

2. High-Performance Architectural Latex System **MPI INT 5.6G**:

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
- c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138**.
- d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139**.
- e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140**.
- f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141**.

3. Water-Based Light Industrial Coating System [**MPI INT 5.6A**] [**MPI INT 5.6F**]:

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- b. Prime Coat: Primer, quick dry, for aluminum, **MPI #95**.
- c. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
- d. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151**.
- e. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153**.
- f. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154**.

4. Alkyd System **MPI INT 5.6B**:

- a. Prime Coat: Primer, vinyl wash, **MPI #80**.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49**.
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51**.
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47**.
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48**.
- K. Wood Substrates: Glued-laminated construction.
- 1. Latex over Latex Primer System **MPI INT 6.1M**:
 - a. Prime Coat: Primer, latex, for interior wood, **MPI #39**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
 - 2. Latex over Alkyd Primer System **MPI INT 6.1A**:
 - a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
 - 3. Institutional Low-Odor/VOC Latex System **MPI INT 6.1Q**:
 - a. Prime Coat: Primer, latex, for interior wood, **MPI #39**.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

- c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
4. High-Performance Architectural Latex System **MPI INT 6.1N:**
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
5. Alkyd System **MPI INT 6.1B:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
- L. Wood Substrates: Exposed framing.
1. Latex over Latex Primer System **MPI INT 6.2D:**
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**

- d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
2. Latex over Alkyd Primer System **MPI INT 6.2A:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
3. Institutional Low-Odor/VOC Latex System **MPI INT 6.2L:**
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39.**
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
4. High-Performance Architectural Latex System **MPI INT 6.2B:**
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

- c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
5. Alkyd System **MPI INT 6.2C:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
- M. Wood Substrates: **Wood trim, Architectural woodwork, Doors, Windows and wood board paneling.**
1. Latex over Latex Primer System **MPI INT 6.3T:**
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
2. Latex over Alkyd Primer System **MPI INT 6.3U:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**

- e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
3. Institutional Low-Odor/VOC Latex System **MPI INT 6.3V:**
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39.**
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
4. High-Performance Architectural Latex System **MPI INT 6.3A:**
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
5. Water-Based Light Industrial Coating System **MPI INT 6.3P:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151.**

- d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153**.
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154**.
6. Water-Based Alkyd System **MPI INT 6.3BB**:
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39**.
 - b. Intermediate Coat: Alkyd, water based, matching topcoat.
 - c. Topcoat: Alkyd, water based, gloss (MPI Gloss Level 6-7), **MPI #157**.
7. Alkyd System **MPI INT 6.3B**:
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45**.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49**.
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51**.
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47**.
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48**.
- N. Wood Substrates: **Wood paneling and casework**.
1. Latex over Latex Primer System **MPI INT 6.4R**:
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
2. Latex over Alkyd Sealer System **MPI INT 6.4A**:
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.

- e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
3. Institutional Low-Odor/VOC Latex System **MPI INT 6.4T**:
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39**.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143**.
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144**.
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145**.
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146**.
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147**.
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148**.
4. High-Performance Architectural Latex System **MPI INT 6.4S**:
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39**.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138**.
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139**.
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140**.
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141**.
5. Water-Based Light Industrial Coating System **MPI INT 6.4N**:
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45**.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151**.

- d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153.**
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154.**
6. Alkyd System **MPI INT 6.4B:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
- O. Wood Substrates: Traffic surfaces, including **floors and stairs.**
1. Latex Porch & Floor Enamel System **MPI INT 6.5G:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Floor paint, latex, matching topcoat.
 - c. Topcoat: Floor paint, latex, low gloss (maximum MPI Gloss Level 3), **MPI #60.**
2. Alkyd Floor Enamel System **MPI INT 6.5A:**
- a. Prime Coat: Floor enamel, alkyd, matching topcoat.
 - b. Intermediate Coat: Floor enamel, alkyd, matching topcoat.
 - c. Topcoat: Floor enamel, alkyd, gloss (MPI Gloss Level 6), **MPI #27.**
- P. Wood Substrates: Wood shingles and shakes.
1. Latex over Latex Primer System **MPI INT 6.6F:**
- a. Prime Coat: Primer, latex, for interior wood, **MPI #39.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
2. Latex over Alkyd Primer System **MPI INT 6.6A:**

- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
3. Alkyd System **MPI INT 6.6B**:
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45**.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49**.
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51**.
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47**.
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48**.

Q. Fiberglass Substrates:

1. Latex System [**MPI INT 6.7AA**] [**MPI INT 6.7A**]:
- a. Prime Coat: Primer, bonding, water based, **MPI #17**.
 - b. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
 - c. Intermediate Coat: Latex, interior, matching topcoat.
 - d. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - g. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - h. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - i. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
2. Institutional Low-Odor/VOC Latex System **MPI INT 6.7J**:
- a. Prime Coat: Primer, bonding, water based, **MPI #17**.

- b. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
 - c. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - d. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143**.
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144**.
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145**.
 - g. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146**.
 - h. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147**.
 - i. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148**.
3. High-Performance Architectural Latex System **MPI INT 6.7H**:
- a. Prime Coat: Primer, bonding, water based, **MPI #17**.
 - b. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
 - c. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138**.
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139**.
 - f. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140**.
 - g. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141**.
4. Water-Based Light Industrial Coating System **MPI INT 6.7C**:
- a. Prime Coat: Primer, bonding, water based, **MPI #17**.
 - b. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
 - c. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - d. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151**.
 - e. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153**.
 - f. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154**.
5. Alkyd System **MPI INT 6.7B**:

- a. Prime Coat: Primer, bonding, water based, **MPI #17**.
- b. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- c. Intermediate Coat: Alkyd, interior, matching topcoat.
- d. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49**.
- e. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51**.
- f. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47**.
- g. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48**.

R. Plastic Substrates:

1. Latex System **MPI INT 6.8E**:

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- b. Intermediate Coat: Latex, interior, matching topcoat.
- c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
- d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
- e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
- f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
- g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
- h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.

2. Institutional Low-Odor/VOC Latex System **MPI INT 6.8F**:

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69**.
- b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
- c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143**.
- d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144**.
- e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145**.
- f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146**.
- g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147**.
- h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148**.

3. High-Performance Architectural Latex System **MPI INT 6.8A**:

- a. Prime Coat: Primer, bonding, solvent based, **MPI #69.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
4. Water-Based Light Industrial Coating System **MPI INT 6.8C:**
- a. Prime Coat: Primer, bonding, solvent based, **MPI #69.**
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151.**
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153.**
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154.**
5. Alkyd System **MPI INT 6.8B:**
- a. Prime Coat: Primer, bonding, solvent based, **MPI #69.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
- S. Spray-Textured Ceiling Substrates:
- 1. Latex, Flat System **MPI INT 9.1A:** Spray applied.
 - a. Prime Coat: Latex, interior, flat, matching topcoat.
 - b. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - 2. Latex System **MPI INT 9.1E:** Spray applied.
 - a. Prime Coat: Latex, interior, matching topcoat.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**

- d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
3. Latex over Alkyd Sealer System **MPI INT 9.1B:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - c. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - f. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - g. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
4. Alkyd, Flat System **MPI INT 9.1C:**
- a. Prime Coat: Alkyd, interior, flat matching topcoat.
 - b. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
5. Alkyd over Alkyd Sealer System **MPI INT 9.1D:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**

T. **Gypsum Board and Plaster Substrates:**

1. Latex over Latex Sealer System **MPI INT 9.2A:**
- a. Prime Coat: Primer sealer, latex, interior, **MPI #50.**
 - b. Prime Coat: Latex, interior, matching topcoat.
 - c. Intermediate Coat: Latex, interior, matching topcoat.
 - d. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**

- e. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - g. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - h. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - i. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
2. Latex over Alkyd Primer System (for Plaster Only) **MPI INT 9.2K:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
3. Institutional Low-Odor/VOC Latex System **MPI INT 9.2M:**
- 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, flat (MPI Gloss Level 1), **MPI #143.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
4. High-Performance Architectural Latex System **MPI INT 9.2B:**
- a. Prime Coat: Primer sealer, latex, interior, **MPI #50.**
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.

- c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - e. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - f. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
5. Water-Based Light Industrial Coating System **MPI INT 9.2L:**
- a. Prime Coat: Primer sealer, latex, interior, **MPI #50.**
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), **MPI #151.**
 - d. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5), **MPI #153.**
 - e. Topcoat: Light industrial coating, interior, water based, gloss (MPI Gloss Level 6), **MPI #154.**
6. Alkyd over Latex Sealer System **MPI INT 9.2C:**
- a. Prime Coat: Primer sealer, latex, interior, **MPI #50.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
- U. Acoustic Panels and Tiles:
1. Latex, Flat System **MPI INT 9.3A:**
- a. Prime Coat: Latex, interior, matching topcoat.
 - b. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
2. Latex over Alkyd Sealer System **MPI INT 9.3B:**
- a. Prime Coat: Primer sealer, alkyd, interior, **MPI #45.**
 - b. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**
 - c. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - d. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**

- e. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - f. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - g. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
3. Institutional Low-Odor/VOC Latex System **MPI INT 9.3D:**
- a. Prime Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - b. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143.**
 - c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
4. High-Performance Architectural Latex System **MPI INT 9.3E:**
- a. Prime Coat: Latex, interior, high performance architectural, matching topcoat.
 - b. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 2), **MPI #138.**
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3), **MPI #139.**
 - d. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 4), **MPI #140.**
 - e. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), **MPI #141.**
5. Alkyd, Flat System **MPI INT 9.3C:**
- a. Prime Coat: Alkyd, interior, matching topcoat.
 - b. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
- V. **Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings.**
1. Latex System **MPI INT 10.1A:**
- a. Prime Coat: Primer sealer, latex, interior, **MPI #50.**
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53.**

- d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44.**
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52.**
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43.**
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54.**
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114.**
2. Institutional Low-Odor/VOC Latex System **MPI INT 10.1D:**
- a. Prime Coat: Primer sealer, latex, interior, **MPI #50.**
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (MPI Gloss Level 1), **MPI #143.**
 - d. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 2), **MPI #144.**
 - e. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), **MPI #145.**
 - f. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), **MPI #146.**
 - g. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), **MPI #147.**
 - h. Topcoat: Latex, interior, institutional low odor/VOC, gloss (MPI Gloss Level 6), **MPI #148.**
3. Alkyd System **MPI INT 10.1B:**
- a. Prime Coat: Primer sealer, latex, interior, **MPI #50.**
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49.**
 - d. Topcoat: Alkyd, interior, (MPI Gloss Level 3), **MPI #51.**
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47.**
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48.**
4. Aluminum Paint System **MPI INT 10.1C:**
- a. Prime Coat: Primer sealer, latex, interior, **MPI #50.**
 - b. Intermediate Coat: Aluminum paint matching topcoat.
 - c. Topcoat: Aluminum paint, **MPI #1.**

W. Bituminous-Coated Substrates:

- 1. Latex System **MPI INT 10.2A:**

- a. Prime Coat: Primer, rust inhibitive, water based, **MPI #107**.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), **MPI #53**.
 - d. Topcoat: Latex, interior (MPI Gloss Level 2), **MPI #44**.
 - e. Topcoat: Latex, interior (MPI Gloss Level 3), **MPI #52**.
 - f. Topcoat: Latex, interior (MPI Gloss Level 4), **MPI #43**.
 - g. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), **MPI #54**.
 - h. Topcoat: Latex, interior, gloss (MPI Gloss Level 6, except minimum gloss of 65 units at 60 degrees), **MPI #114**.
2. Alkyd System **MPI INT 10.2B**:
- a. Prime Coat: Primer, rust inhibitive, water based, **MPI #107**.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, flat (MPI Gloss Level 1), **MPI #49**.
 - d. Topcoat: Alkyd, interior (MPI Gloss Level 3), **MPI #51**.
 - e. Topcoat: Alkyd, interior, semi-gloss (MPI Gloss Level 5), **MPI #47**.
 - f. Topcoat: Alkyd, interior, gloss (MPI Gloss Level 6), **MPI #48**.
3. Aluminum Paint System **MPI INT 10.2C**:
- a. Prime Coat: Primer, rust inhibitive, water based, **MPI #107**.
 - b. Intermediate Coat: Aluminum paint, matching topcoat.
 - c. Topcoat: Aluminum paint, **MPI #1**.

END OF SECTION

SECTION 22 00 00**GENERAL PLUMBING PROVISIONS****PART 1 - GENERAL****1.01 GENERAL CONDITIONS:**

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 22.

1.02 CODES AND REGULATIONS:

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:
 - 1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
 - 2. California Building Code – CBC.
 - 3. California Mechanical Code – CMC.
 - 4. California Plumbing Code – CPC.
 - 5. California Green Building Code.
 - 6. American Gas Association – AGA.
 - 7. American National Standards Institute – ANSI.
 - 8. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
 - 9. American Society of Mechanical Engineers – ASME.
 - 10. American Society for Testing and Materials – ASTM.
 - 11. American Water Works Association – AWWA.
 - 12. Cast Iron Soil Pipe Institute – CISPI.
 - 13. California Electrical Code – CEC.
 - 14. National Electrical Manufacturers Association – NEMA.
 - 15. National Fire Protection Association – NFPA.
 - 16. National Sanitation Foundation – NSF.
 - 17. Plumbing and Drainage Institute – PDI.
 - 18. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
 - 19. Underwriters' Laboratory – UL.
 - 20. Occupational Safety and Health Act - OSHA.
 - 21. California Assembly Bill 1953 (AB1953).

1.03 PERMITS AND FEES:

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.04 COORDINATION OF WORK:

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, fixtures, equipment, supports, etc.

shall be carefully planned, prior to installation of any work, to avoid all interference's with each other, or with structural, electrical or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.05 GUARANTEE:

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.06 EXAMINATION OF SITE:

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.07 SUBMITTALS:

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
 - 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.
- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.
- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings

and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.08 RECORD DRAWINGS:

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, sewer, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 - PRODUCTS

2.01 PROTECTIVE COATING FOR UNDERGROUND PIPING:

- A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.02 CONCRETE ANCHORS:

- A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.03 SEISMIC RESTRAINTS:

- A. All plumbing systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Guidelines for Seismic Restraint of Mechanical Systems" dated 2006 by SMACNA.

2.04 SYSTEM IDENTIFICATION:

- A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where

lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.

- B. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location and piping service. Mount in glazed frame where directed.

PART 3 - EXECUTION

3.01 SCHEDULING OF WORK:

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.02 CONDUCT OF WORK:

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Plumbing Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.
- D. **IAQ Management plan will be in effect for T-24 Certification. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.03 EXCAVATION AND BACKFILL:

- A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.
- B. Backfill:
 - 1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
 - 2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is

determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.

3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.
- C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.04 OPENINGS, CUTTING AND PATCHING:

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.05 MANUFACTURER'S RECOMMENDATIONS:

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.06 QUIETNESS:

- A. Piping and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.07 DAMAGES BY LEAKS:

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.08 CLEANING:

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

*** END OF SECTION ***

SECTION 22 00 01**PLUMBING****PART 1 - GENERAL****1.01 GENERAL CONDITIONS:**

- A. The foregoing Section 22 00 00, General Plumbing Provisions shall form a part of this specification.

1.02 SCOPE:

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials and services necessary for a complete, lawful and operating plumbing system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Domestic water system.
 - 2. Condensate drains.
 - 3. Gas piping.
- B. Work Specified Elsewhere:
 - 1. Concrete and reinforcing steel.
 - 2. 23 00 01, Heating, Ventilating and Air Conditioning.

1.03 CODES AND STANDARDS:

- A. All pipe, pipe or plumbing fittings or fixture, solder, or flux shall be lead free that provides water for human consumption per California Assembly Bill 1953 (AB1953).
- B. See Section 22 00 00 for additional requirements.

1.04 SUBMITTALS:

- A. Provide product data for all materials per Division 01.

PART 2 - MATERIALS**2.01 PIPING MATERIALS:**

- A. Water and Gas:
 - 1. Cold Water Piping:
 - a. Inside Building: Schedule 40 galvanized steel pipe, ASTM A120. 150 psi galvanized malleable iron screwed fittings, ANSI B16.3 or Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. Brazesafe, Silcan or equal brazing material.
 - b. Outside Building Below Grade: Same as Inside Building with protective coating on ferrous pipe or Schedule 40 PVC pipe thru 2", Class 315 2" thru 4".
 - 2. Gas Piping:
 - a. Above Grade: Schedule 40 black steel pipe, ASTM A120. 150 psi black malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. Galvanized pipe and fittings will not be allowed. Flexible connections shall be convoluted brass with dielectric couplings, AGA approved. Outside building flexible connections shall be convoluted stainless steel with dielectric couplings, AGA approved. Prime and paint all piping.

- b. Outside Building – Below Grade: Same as Inside Building – Above Grade, with protective coating of ferrous pipe or medium density polyethylene (MDPE) PE2708 or PE2406 pipe manufactured in accordance with ASTM D2513 and IAPMO Standards.
- B. Condensate Drain Piping: Same as cold water piping.
- C. Valves and Specialties:
 - 1. Valves:
 - a. General: Manufacturer's model numbers are listed to complete description. Milwaukee, Kitz, Apollo, Nibco, Stockham or equal. All valves shall be full size of upstream piping. **Ball valves shall be substituted for gate valves 2" and smaller. Butterfly valves shall be substituted for gate valves 2-1/2" and larger. C_v factors for ball valves shall not be less than equal size gate valves.**
 - b. Plug Valve: Eccentric bronze plug. Nickel chromium alloy iron body. Bronze bushings. Buna-N O-rings. UL approved for gas distribution. 175 psi WOG. DeZurick Series 400 or equal.
 - c. Ball Valves: Two or three piece construction, forged bronze body, chrome plated brass ball, threaded ends, teflon seats, PTFE or reinforced teflon stem seals, lever handle. Underground valves shall have "T" handle. Provide one operating "T" extension handle for all underground valves. Milwaukee BA100/150, BA300/350, Nibco or equal.
 - d. Gas Valves: 2" and smaller, Milwaukee BB2-100; 2-1/2" and larger, Rockwell #142 or equal.
 - e. Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic areas; G5 in roadways.
 - 2. Miscellaneous Specialties:
 - b. Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi.
 - c. Dielectric Coupling: Insulating coupling rated for 250 psig. EPCO or equal.
- D. Miscellaneous Piping Items:
 - 1. Pipe Support:
 - a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum load per manufacturer's recommendation. Felt lined, B-Line B3690F, Unistrut or equal.
 - b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Unistrut, Superstrut or equal.
 - 2. Pipe Sleeves: 24 gage galvanized steel. Adjust-to-Crete #10 with #99 thimble for floors. #100 for walls.
 - 3. Flashing: Vent flashing and flashing for piping through roof shall be prefabricated 24 gauge galvanized steel roof jacks with 8" square flange around pipe. For tile or other roofing systems where pliable flashing is required, flashing shall be lead. Seal with weatherproofing mastic.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION:

- A. General:
 - 1. Piping Layout: Piping shall be concealed in walls, above ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Owner's Representative. No structural member shall be cut, notched, bored or otherwise altered unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints shall be installed as required. Vertical lines shall be installed to allow for

building settlement without damage to piping. All exposed piping to be primed and painted, see painting section.

2. Joints:

- a. Threaded: Pipe shall be cut square, and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
- b. Welded or Brazed: Filler rod shall be of the same suitable alloy as pipe. Welding or brazing shall be performed in accordance with requirements of recognized published standards of practice and by licensed or otherwise certified contractors. Welder or Brazer shall be a person who specialized in welding or brazing of pipes and holds a recognized certificate of competency from a recognized testing laboratory, based on the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
- c. Other: Joints other than threaded or welded shall be installed in accordance with manufacturer's recommendations.
- d. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
- e. Electrical Equipment: Joints shall be avoided, where possible, over electrical equipment.
- f. Copper pipe 1-1/2" or less may be soldered. Above 1-1/2" and all below grade shall be brazed.

3. Fittings:

- a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
- b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
- c. Unions: A union shall be installed on the leaving side of each valve, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
- d. Valves: All valves shall be full line size. At equipment connections, valves shall be full size of upstream piping.

4. Pipe Support:

- a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. All pressure piping, drainage piping above grade and metallic piping of dissimilar metal from hangers shall have isolating shield, or felted hangers.
- i. Screwed Pipe:

Pipe Size Between Supports*	Max. Spacing
(in)	(ft)
1/2	6
3/4	8
1	8
1-1/4 & larger	10

* Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings.

- ii. Copper Tubing: Copper tubing shall be supported at approximately six (6) foot intervals for piping one and one-half (1-1/2) inches and smaller in diameter and ten (10) foot intervals for piping two (2) inches and larger in diameter.
- iii. Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.
- b. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for approval.

5. Excavation and Backfill: Minimum cover on all piping shall be as follows unless otherwise noted:

- a. Up to 2-1/2" pipe - 24" cover.
 - b. 3" and larger pipe - 30".
- 6. Miscellaneous:
 - a. Escutcheons: Provide chromium plated escutcheons where piping penetrates walls, ceilings or floors in finished areas.
 - b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" clearance between sleeve and pipe or pipe insulation.
 - c. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined.
- B. Water Piping: Connections to branches and risers shall be made from the side of the main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Provide ball valve shutoff for each building and at each connection to equipment and trap primers. Shock absorbers shall be installed in a vertical position at end of branch runs as specified in this section whether specifically shown or not on drawings. Connections to equipment shall be made with flexible connectors. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs.
- C. Gas Piping: Shall be pitched to drain to drip legs at each piece of equipment. No unions shall be installed except at connections to equipment. Provide shutoff at each equipment connection. Connections to equipment shall be made with flexible connectors. Under floor piping shall be sleeved, sealed and vented. Polyethylene or polyvinyl chloride pipe and fittings shall be joined in accordance with manufacturer's recommendation. Metal-to-plastic transition fittings shall be installed at all transitions. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs. All gas below grade shall have continuous caution tape installed 12" above gas line. All exposed gas piping shall be primed and painted, see painting section.
- D. Condensate Drain Piping: Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide trap at each air handling unit to prevent air leakage. Connections to equipment shall be made with flexible connection unless connection is internally isolated.

3.02 TESTS AND ADJUSTMENTS:

- A. General: Unless otherwise directed, tests shall be witnessed by the Owner's Representative. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair his work, and that of other contractors, to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections. However, all connections between sections previously tested and new section shall be included in the new test. New sections shall be isolated from existing sections for testing purposes. There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.
- B. Gravity System:
 - 1. Condensate Piping: Maintain 15 psig water pressure for a duration of 4 hours.
- C. Pressure Systems:
 - 1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.

2. Domestic Cold Water Piping: Maintain 60 psig water pressure for a minimum duration of 2 hours.
3. Gas Piping: Maintain 60 psig air pressure for a minimum duration of 2 hours.

*** END OF SECTION ***

SECTION 23 00 00**GENERAL MECHANICAL PROVISIONS****PART 1 - GENERAL****1.01 GENERAL CONDITIONS:**

- A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.02 CODES AND REGULATIONS:

- A. All work and materials shall be in full accordance with current rules and regulations of applicable codes. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:
 - 1. California Code of Regulations – CCR:
 - a. Title 8, Industrial Relations.
 - b. Title 24, Building Standards.
 - 2. California Building Code – CBC.
 - 3. California Mechanical Code – CMC.
 - 4. California Plumbing Code – CPC.
 - 5. California Green Building Code.
 - 6. Air Diffusion Council – ADC.
 - 7. American Gas Association – AGA.
 - 8. Air Moving and Conditioning Association – AMCA.
 - 9. American National Standards Institute – ANSI.
 - 10. Air Conditioning and Refrigeration Institute – ARI.
 - 11. American Society of Heating, Refrigerating and Air Conditioning Engineers –ASHRAE.
 - 12. American Society of Mechanical Engineers –ASME.
 - 13. American Society for Testing and Materials –ASTM.
 - 14. American Water Works Association – AWWA.
 - 15. California Electrical Code – CEC.
 - 16. National Electrical Manufacturers Association – NEMA.
 - 17. National Fire Protection Association – NFPA.
 - 18. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
 - 19. Underwriters' Laboratory – UL.
 - 20. Occupational Safety and Health Act - OSHA.

1.03 PERMITS AND FEES:

- A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.04 COORDINATION OF WORK:

- A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc.

shall be carefully planned, prior to installation of any work, to avoid all interference's with each other, or with structural, electrical or architectural elements. Verify the proper voltage and phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.05 GUARANTEE:

- A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.06 EXAMINATION OF SITE:

- A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.07 SUBMITTALS:

- A. Submit shop drawings in accordance with Division 01.
- B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:
 - 1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
 - 2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
 - 3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.
- C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.
- D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings

and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.08 OPERATION AND MAINTENANCE INSTRUCTIONS:

- A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for Title 24 Requirements)**
- B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.
- C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.
- D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.09 RECORD DRAWINGS:

- A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 - PRODUCTS**2.01 CONCRETE ANCHORS:**

- A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.02 SEISMIC RESTRAINTS:

- A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Guidelines for Seismic Restraint of Mechanical Systems" dated 2006 by SMACNA.

2.03 SYSTEM IDENTIFICATION:

- A. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.
- B. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.04 EQUIPMENT SUPPORT FRAMES:

- A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 - EXECUTION**3.01 SCHEDULING OF WORK:**

- A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.02 CONDUCT OF WORK:

- A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Divisions engaged upon this project or to the Owner.
- B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.
- C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

- D. IAQ Management plan will be in effect for T-24 Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.**

3.03 OPENINGS, CUTTING AND PATCHING:

- A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.04 MANUFACTURER'S RECOMMENDATIONS:

- A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.05 QUIETNESS:

- A. Ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.06 DAMAGES BY LEAKS:

- A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.07 CLEANING:

- A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

*** END OF SECTION ***

SECTION 23 00 01**HEATING, VENTILATING AND AIR CONDITIONING****PART 1 - GENERAL****1.01 GENERAL CONDITIONS:**

- A. The foregoing Section 23 00 00, General Mechanical Provisions shall form a part of this specification.

1.02 SCOPE:

- A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials and services necessary for a complete, lawful and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
 - 1. Heating, ventilating and air conditioning equipment.
 - 2. Air distribution system (Ductwork, Air Terminals, etc.).
 - 3. System insulation.
 - 4. Controls and control wiring and conduit for control wiring.
- B. Work Specified Elsewhere:
 - 1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the electrical section.
 - 2. Connection of gas and condensate drains to equipment.
 - 3. Access doors.

PART 2 - MATERIALS**2.01 DUCTWORK MATERIALS:**

- A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.
- B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A527.
- C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu/hr sq. ft.- degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.
- D. Fabric Ductwork (Ductsox):
 - 1. Ductsox Sedona XM Fabric, Fabric Air Trevira CS 150 or Approved Equal: Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics: 100% Flame Retardant Anti-Microbial with 10 year warranty Fabric Construction, Weight: 6.75 oz./ yd² per ASTM D3776, Air Permeability: 2 +2 -1 ASTM D737 Frazier, Temperature Range: 0 degrees F to 180 degrees F, NFPA 90-A, Color by Architect and selected from manufacturers standard list of colors. System shall include field adjustable balancing devices (Ductsox AFD).

2. Provide suspension hardware as follows: One Row, H-Track All-In-One with shape retaining hoops Suspension System shall include aluminum H-Track system located 1.5" above TDC (top dead center) of DuctSox system. Hardware to include 10' sections of track, snap sliders, splice connections, vertical cable supports for 8' spacing, cable clamps and end caps as required. System attachment shall be made using snap tab connector to slider spaced on 24 inch centers.
 3. Manufacturer shall submit calculations and shop drawings of duct layout for each air system specified with DuctSox.
- E. Spiral Duct: Ductwork shall be galvanized steel with uni-seal spiral seamlock and uni-seal fittings, ASTM A653. United McGill Corp or equal. All exposed spiral duct shall be painted, color selected by Owner.
- F. Round Duct on Roof: Ductwork shall be double wall insulated galvanized steel with solid welded seam longitudinal seam-K27. United McGill Corp or equal.
- G. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230 or equal.
- H. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoe Seal-Flex or equal.
- I. Duct Joints:
1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
 - a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
 - b. Ducts 48 inches and larger, Ductmate Regular, Nexus (SMACNA "J" Type connection) or equal.
- J. Fiber Tape: Mineral impregnated fiber tape and plastic activator-adhesive. Hardcast Inc., United McGill Uni-Cast or equal.
- K. Evaporative Cooler Duct: Ductwork shall be double wall insulated galvanized steel exterior and aluminum or stainless steel interior, glass fiber insulation. 1.5 lb./cu. ft. density, 2" thick minimum, R-8. Thermal conductivity shall not exceed 0.13 Btu/ hr. sq. ft.-degrees F at a mean temperature of 75 degrees F. CSG Insulation Corp., Manville, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for double wall duct are clear (net) opening inside.

2.02 AIR TERMINALS AND DUCT FITTINGS:

A. Grilles: (Grilles, Registers and Diffusers)

1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of J & J, Krueger, Barber-Colman, Anemostat, Price, Titus or equal. Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.
2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be re-selected by the Contractor for the proper diffusion, spread, drop and throw.
3. Frame and Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.

- B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP or equal.
- C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.
- D. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6" maximum blade width, 16-gage blade, 48" maximum length, nylon or oil impregnated bronze bearings, 1/2" diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1" less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12" length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

2.03 DUCTWORK INSULATION MATERIALS:

- A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50.
- B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.
- C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.
- D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.04 EQUIPMENT:

- A. General Requirements:
 - 1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
 - 2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
 - 3. Ratings:
 - a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be CSA (US) certified, except that boilers shall be CSA (US) certified or UL listed.
 - b. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
 - 4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.

5. Electrical:
 - a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
 - b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
 - c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEAO. Vertical motors outdoors shall be ODP or TEFC and shall have rain caps.
 - d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
 - e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
 - f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.
6. Fan Selection:
 - a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM and efficiency lines.
 - b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
 - a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
 - b. Filter Media: 2" media. MERV-11. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP-Eleven.
 - c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/- 2% of full scale. Range as required. Provide static pressure sensors, tubing and

mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.

8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16-gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/- 10%, selected at mid range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.

B. Air Conditioning Unit (thru 15 tons):

1. General: Self-contained heating/cooling unit designed for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. Multivane, centrifugal supply fan. ARI certified. Gas equipment AGA certified. BDP, Carrier, York, Trane, Lennox and Daikin.
2. Refrigeration: Sealed Hermetic compressor with heater, high/ low pressure switch, recycling timer. Air-cooled condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 45 degrees F, unless otherwise noted.
3. Heat: Gas fired. Aluminized or ceramic-coated welded steel heat exchanger. Electric ignition. Automatic gas valve, 100% safety shutoff.
4. Economizer with barometric relief: Economizer shall be a modulating gear driven type where the unit will relief 100% during economizer mode. Economizer is shipped separately and shall be field installed under this section.
 - a. Modulating Economizer Sequence of Operation:

The economizer system initially responds to a signal from the cooling thermostat and functions as a true first stage for cooling, while providing maximum fuel economy. The economizer is automatically locked out during the heating mode and holds the outdoor air damper at the minimum position settings.

During the occupied period, the discharge sensor provides a signal to the actuator during free cooling or economizer mode. The signal opens the economizer damper until the discharge temperature drops below 50 degrees F. At this time the signal causes the motor to drive the damper back to minimum position. As the discharge temperature climbs to 60 degrees F the motor will drive back open. During the occupied period, the actuator will not close past the minimum position. **(The setpoints maybe changed by Commissioning Contractor to optimize controls for Title 24 Requirements.)**

If the fully open actuator cannot satisfy the space demand, mechanical cooling is sequenced on.

During the unoccupied period, the actuator will override minimum position setting and drive fully closed. On a loss of power, the actuator will spring return fully closed.

When in heating operation, or when outdoor air temperature or enthalpy conditions are high, economizer operation is locked out, and actuator is held at minimum position.

The staging relay is used when the first stage compressors must provide mechanical cooling when assisting the economizer.

The staging relay can be omitted when the second stage compressors can be used to assist the economizer with mechanical cooling.

b. CO2 Sensor Economizer Integration:

When a CO2 sensor is used in conjunction with an economizer, the minimum position jumper between P and P1 on the logic is removed, and the sensor connected. When the CO2 sensor gets a reading higher than the setpoint, the sensor will signal the logic to modulate the o/a dampers open. The HVAC unit functions as if there is no economizer during the CO2 call for fresh air.

When the CO2 level falls below the setpoint, the damper modulates back to the minimum position.

5. Guarantee: Provide 5 year extended parts warranty on the condenser coil and compressor.

C. Air Conditioning Unit (Above 25 Tons):

1. Description:

- a. Self-Contained - Factory assembled and tested; designed for slab installation; and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration, gas heater, filters, and dampers. Provide 5 year compressor warranty and 15 year non-prorated heat exchanger warranty. Aeon or approved equal.

2. Construction:

- a. Unit shall be completely factory assembled, piped and wired and shipped in one section.
- b. Unit shall be specifically designed for outdoor slab mount application with a fully weatherproof cabinet.
- c. All cabinet walls, access doors, roof and floor shall be a high performance composite panel constructed with G90 galvanized steel on both sides and a closed cell polyurethane foam interior core providing a rigid, impact resistant surface.
 - i. The walls of the air tunnel compartments shall be 2 inches thick with a minimum R value of 12.5.
 - ii. The walls of the coil compartment shall be 1-½ inches thick with a minimum R value of 9.4.
 - iii. The roof of the air tunnel compartments shall be sloped at a minimum of ¼ inch per foot and shall be an average of 2-½ inches thick and an R value of 15.7.
 - iv. The floor of the conditioned air and control compartments shall be 1 inch thick with a minimum R value of 6.25.
 - v. The access doors shall be 1-½ inches thick with a minimum R value of 9.4.
 - vi. The foam shall have a minimum density of 2 pounds per cubic feet.
 - vii. All foam material shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610 degrees F.
 - viii. All panels shall have a thermal break with no metal path from inside to outside.
- d. Paint finish shall be capable of withstanding at least 2000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
- e. Unit specific color coded wiring diagrams shall match the unit color coded wiring and will be provided in both point-to-point and ladder form.
- f. Diagrams shall also be laminated in plastic and permanently affixed inside the control compartment.
- g. Access to filters, heating section, and other items needing periodic checking or maintenance shall be through hinged access doors with quarter turn lockable latches. Door fastening screws are not acceptable. The blower access door shall be bolted closed.

- h. Access doors shall have stainless steel hinges and full perimeter gasketing.
 - i. All openings through the base pan of the unit shall have upturned flanges of at least 1/2" in height around the opening through the base pan.
 - j. Air side service access doors shall have rain break overhangs.
 - k. Unit shall have decals and tags to indicate unit lifting and rigging, service areas and caution areas. Installation and maintenance manuals shall be supplied with each unit.
- 3. Supply Fans:
 - a. The fan shall be direct drive single width single inlet un-housed airfoil centrifugal, plenum fans. Supply fans shall have all aluminum construction. Fans attached to 1760 rpm motors shall be rated for a minimum of 1800 RPM maximum speed. Fans attached to 1170 rpm motors shall be rated for a minimum of 1200 RPM maximum speed. Direct drive fans shall be directly connected to and supported by the motor shaft. Motor bearings shall be rated for 200,000 hours service and shall have external lubrication connections. Fan(s) and motor(s) shall be dynamically balanced, and the entire fan assembly mounted on rubber isolators. Supply air shall be from the bottom of the cabinet. Variable Volume Systems VFD drive(s) shall be factory mounted and wired to the fan motor(s).
- 4. Outside Air:
 - a. Shall be a fully modulating economizer integral controls. The outside air damper and return air damper assembly shall be constructed of extruded aluminum, hollow core, air foil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 25 CFM of leakage per sq. ft. of damper area when subjected to 2 in. w.g. air pressure differential across the damper. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure.
- 5. Return Fan Section:
 - a. Power Return Fans: Axial flow direct drive fans shall be constructed of a polymeric material with fiberglass reinforcement and adjustable blade pitch. Direct drive fans shall be directly connected to and supported by the motor shaft. Motor bearings shall be rated for 200,000 hours service and shall have external lubrication connections. Fan(s) and motor(s) shall be dynamically balanced. Variable Volume Systems VFD drive(s) shall be factory mounted and wired to the fan motor(s).
- 6. Condenser:
 - a. Air Cooled Condenser Section:
 - i. The condensing section shall be equipped with vertical discharge axial flow direct drive fans. Direct drive fans shall be directly connected to and supported by the motor shaft.
 - ii. The condenser coils shall be sloped at least 30 degrees to protect the coils from damage.
 - iii. Condenser coils shall be copper tubes with aluminum fins mechanically bonded to the tubes.
 - iv. Condenser coils to be sized for a minimum of 10°F of refrigerant sub-cooling.
 - v. Provide 3/4"x18" GA. expanded aluminum condenser coil guards shop fabricated and installed by contractor.
- 7. Filters: 2-inch-thick, fiberglass, throwaway with an ASHRAE efficiency of 30%. With direct dial reading Magnehelic gauge mounted in the control compartment
- 8. Evaporator Coils:
 - a. Evaporator coils shall be copper tube with aluminum fins mechanically bonded to the tubes.
 - b. Evaporator coils shall have galvanized steel end casings.
 - c. Evaporator coils shall have equalizing type vertical tube headers.
 - d. Evaporator coils shall be furnished with a thermostatic expansion valve.

- e. Evaporator coils shall be furnished with a double sloped stainless steel drain pan for the positive drainage of condensate.
 - f. A drain connection shall be provided on each side of the unit. The manufacturer shall provide a P-trap condensate drain fitting for field installation to the drain connections.
9. Refrigeration System:
- a. Compressors shall be scroll type with internal thermal overload protection and mounted on the compressor manufacturer's recommended rubber vibration isolators. Each compressor shall have independent refrigerant circuits.
 - b. Compressors shall be mounted in an isolated compartment to permit operation of the unit without affecting air flow when the door to the compartment is open.
 - c. Compressors shall be isolated from the base pan and supply air to avoid any transmission of noise from the compressor into the building area.
 - d. System shall be equipped with thermostatic expansion valve type refrigerant flow control.
 - e. System shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant controls.
 - f. Unit shall be equipped with Schrader type service fittings on both the high side and low pressure sides of the system.
 - g. Unit shall be equipped with refrigerant liquid line dryers.
 - h. Unit shall be fully factory charged with refrigerant.
 - i. Hot gas bypass shall be provided on all refrigerant circuits.
 - j. Each compressor shall be individually staged for capacity control.
 - k. All circuits shall be equipped with liquid line sight glasses.
 - l. Unit shall be equipped with a 5 minute anti-short cycle delay timer for each stage.
 - m. Unit shall be equipped with 20 second between stage delay timers for each stage.
10. Gas Heat Section:
- a. Unit shall heat using natural gas fuel and with a minimum four stages of heat capacity.
 - b. Unit shall be provided with a gas heating furnace consisting of an aluminized steel heat exchanger with multiple concavities, an induced draft blower and an electric pressure switch to lockout the gas valve until the combustion chamber is purged and combustion air flow is established. Drum type heat exchangers or heat exchanger tubes with separate internal turbulators are not acceptable.
 - c. Unit shall be provided with a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
 - d. Unit shall have gas supply piping entrances in the unit base for through the curb gas piping and in the outside cabinet wall for across the roof gas piping.
 - e. The gas heat exchanger shall carry a 15 year non pro-rated warranty.
11. Controls: Programmable thermostat.
12. Smoke Detector:
- a. Unit shall be provided with a smoke detector (Notifier #FSD-751P, CSFM #3240-0028:205) sensing in the supply air portion of the unit wired to shut off the unit control circuit for the supply air fan and to alert the Fire Alarm System.
13. Power:
- a. Unit shall be provided with a factory installed and wired internal disconnect.
 - b. Unit shall be provided with phase and brown-out protection to shut down all motors in the unit if the phases are more than 10% out of balance on voltage, or the voltage is more than 10% under design voltage or on phase reversal.
14. Curb:
- a. Curb shall be constructed of insulated galvanized steel. Curbs are to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasketing shall be furnished within the control compartment of the slab mounted unit to be mounted on the curb immediately before mounting of the slab mounted unit. Curb shall be 36 inches high

and include horizontal supply duct connection, return duct connection and turning vanes within curb.

D. Evaporative Coolers:

1. Heavy-duty type, with epoxy coated galvanized steel construction.
2. Furnish centrifugal blower with performance certified in accordance with AMCA 210 test procedures, pump (with transformer when required), and 6 position rotary wall switch.
3. Provide level adjustment on distribution trough.
4. Use resilient mounts on motor.
5. Manufacturer: Essick/ Champion, Arvin, Arctic Circle, Adobe Air/ Alpine, Champion or approved equal.

PART 3 – EXECUTION

3.01 DUCTWORK INSTALLATION:

A. General:

1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards". Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
2. Seismic bracing: All ducts shall be braced and supported per SMACNA Guidelines for "Seismic Restraints Manual for Mechanical Systems" dated 1998, including Appendix E.
3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
5. Ducted Returns: All air handling that is not directly located in the space that it serves shall have ducted returns.
6. Open ends of ductwork shall be covered during construction to keep inside clean.

B. Low Velocity-Low Pressure (up to 2000 ft/ min; up to 2.0 in. water):

1. Sheet Metal Ductwork:
 - a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
 - b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
 - c. Duct Joints: Seal duct joints airtight with fiber tape and adhesive per manufacturer's printed instruction. Ducts in weather shall be sealed air and water tight with duct mastic before closing and taping.
 - i. Where Ductmate type joints are used, the manufacturer's designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.
 - d. Dampers: Install volume control damper and damper regulator in all branch ducts.
 - e. Duct dimensions shown on drawings for lined ducts, are clear net openings inside of lining.
 - f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rain water to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.
2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft. Single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with

SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).

3.02 AIR TERMINALS AND DUCT FITTINGS INSTALLATION:

- A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on drawings and manufacturers instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.

3.03 DUCTWORK INSULATION INSTALLATION:

- A. General: All supply and return sheet metal ductwork shall be insulated.
- B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure with foil tape at all joints for a complete vapor barrier.
- C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining. Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and also secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.04 EQUIPMENT INSTALLATION:

- A. General: It shall be the responsibility of the contractor to insure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.
- B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.
- C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through job completion. Complete installation and start up checks according to manufacturer's written instructions.

3.05 TEMPERATURE CONTROL SYSTEM:

- A. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F, or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees F between full heating and full cooling. Thermostats shall be 7 day programmable, Venstar T8900 color touch screen, WiFi or equal with sub-base capable of battery back up or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit.

3.06 SYSTEM AIR BALANCE:

- A. Scope: Provide the services of a qualified independent test and balance agency certified by the Associated Air Balance Council (AABC) or The National Environmental Balancing Bureau (NEBB) to test, adjust and balance, retest, and record performance of the system to obtain design quantities as specified. Balancing contractor must also be TABB certified and have a C-20 license.

- B. Qualifications: Prior to commencing work, the agency shall be approved by the Owner's Representative.
- C. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC standards.
- D. Procedure: General: Balanced quantities shall be plus 5%, minus 5% of design quantities. All name-plate data, manufacturer, model, and serial numbers shall be recorded for each item tested.
- E. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Owner's Representative at his discretion may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Owner's Representative in making any tests he may require during this period of time.
- F. Air Balance Procedure (for each Air Handling System):
 - 1. All air filters shall be clean when air balance is performed.
 - 2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
 - 3. Adjust blower RPM to design requirements.
 - 4. Record motor full load amperes.
 - 5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
 - 6. Record system static pressures, inlet and discharge.
 - 7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.
 - 8. Adjust system for design CFM recirculated air.
 - 9. Adjust system for design CFM outside air.
 - 10. Record entering air temperatures. (DB heating, DB and WB cooling.)
 - 11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
 - 12. Adjust all main supply and return air ducts to design CFM.
 - 13. Adjust all zones to design CFM, supply and return.
 - 14. Adjust all diffusers, grilles and registers to plus 10%, minus 0% of design requirements.
 - 15. Adjust CFM at all exhaust fans, make-up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.
 - 16. Each grille, diffuser and register shall be identified as to location.
 - 17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees downward deflection unless otherwise noted. Make a notation of any that are not set properly.
 - 18. Size, type and manufacturer of diffusers, grilles, registers and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
 - 19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
 - 20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
 - 21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
 - 22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts, dampers or the addition of dampers cleaning of insect screens and replacement of filters required for correct balance as recommended by air balance agency, at no additional cost to Owner.
 - 23. Set, test and adjust packaged heating/ cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.

*** END OF SECTION ***

SECTION 26 01 00**ELECTRICAL GENERAL PROVISIONS****PART 1 - GENERAL****1.01 CONDITIONS**

- A. All of the applicable requirements of Division 1 apply to the work of this Section.

1.02 DESCRIPTION OF WORK

- A. Furnish all labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as indicated on the Drawings or described in these Specifications and as required to make a complete working electrical installation.
- B. Work Included:
1. Complete system of branch circuit wiring and equipment for lights, power and allied equipment as required per drawings.
 2. Furnish and install fixtures, lamps, wall switches and convenience outlets as shown on drawings.
 3. All hangers, anchors, sleeves, chases and supports for fixtures, all electrical equipment materials.
 4. Furnish, install and connect switches etc., required for equipment covered by other sections of these specifications.
 5. Furnish, install and set up complete low voltage system which are including Public address Telephone, Intercom, Paging, MA Television, Intrusion alarm, Fire alarm, system clock and Computer network system.
 6. Acceptance Tesing.
- C. Work Included But Not Specified Under Other Sections:
1. Consult all other Sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete, finished and workmanlike installation.
- D. Work Furnished Under Another Section Requiring Installation and Connections Under This Section:
1. The following items are furnished under other Sections. Under this section, install the equipment and provide electrical service, make requisite connections and perform operational test only.
 - a. Starters and disconnects not in motor control centers, except as shown on electrical plans.

- b. Furnish Control Equipment (both line and low voltage and furnish and install motors).

1.03 QUALITY ASSURANCE

- A. General: Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid proposed. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications.

- B. Codes:

Work shall be performed in accordance with all applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:

1. California Electrical Code (CEC)
2. California Code of Regulations (CCR) Title 24, Part 3, Basic Electrical Requirements, State Building Standards Electrical Code.
3. National Fire Protection Association (NFPA).

- C. Standards: Equipment and materials specified under this Division shall conform to the following standards where applicable:

1. UL Underwriters' Laboratories
2. ASTM American Society for Testing Materials
3. IPCEA Insulated power Cable Engineer Association.
4. NEMA National Electrical Manufacturer's Association
5. ANSI American National Standards Institute
6. ETL Electrical Testing Laboratories

All base material shall be ASTM and/or ANSI standards.

All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the CEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

1.04 SUBMITTALS

- A. General: Refer to Section 01001.

1.05 JOB CONDITIONS

- A. Examination of Site: The CONTRACTOR shall visit the site and determine the locale, working conditions and the conditions in which the electrical work will take place.

- B. Protection: Keep conduits, junction boxes and other openings closed to prevent entry of foreign matter. Cover equipment devices, apparatus and protect them against dirt, or mechanical damage, during the construction period. Prior to final acceptance, restore to original condition any apparatus or equipment damaged including restoration of damaged shop coats of paint. Nor rust or damage will be permitted.

1.06 DRAWINGS

- A. Accuracy:

- 1. Drawings for the Work under this Section are diagrammatic.

1.07 CUTTING, PAINTING AND PATCHING

- A. Structural members shall in no case be drilled, bored or notched in such a manner that will impair their structural value. Cutting of holes, if required, shall be done with core drill and only with the approval of the project Structural Engineer.
- B. Cutting shall be under the direct supervision of the CONTRACTOR. Include as necessary for the Work of this Section.

1.08 INSTALLATION

- A. Preparation, handling and installation shall be in accordance with manufacturer's written instructions and technical data. Coordinate work and cooperate with others in furnishing and placing this work. Work to reviewed shop drawings for work done by other trades and to field measurements as necessary to properly fit the work.
- B. Conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

1.09 EQUIPMENT ANCHORAGE

- A. The manufacturer shall provide anchorage calculations for the electrical equipment so that it shall remain attached to the mounting surface after experiencing forces in conformance with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4.
- B. The manufacturer shall recommend the method of anchoring the equipment to the mounting surface and shall provide the purchaser with the assembly dimensions, weights and approximate centers of gravity.

1.10 FIELD QUALITY CONTROL

- A. General: Perform tests to prove installation is in accordance with contract requirements. Perform tests in presence of the engineer and furnish test equipment, facilities and technical personnel required to perform tests. Tests shall be conducted during the construction period and at completion to determine conformity with applicable codes and with these Specifications.
- B. Tests: In addition to specific system test described elsewhere, tests shall include:
- C. Insulation Resistance: Perform 600-volt DC tests for one minute on all equipment rated 300 volts and higher, feeder and branch circuit conductors, including the neutral. Make a typed record of all readings to be included in a maintenance instructions. Repair or replace circuits showing less than 10 megohms resistance to ground.

- D. Circuit Continuity: Test all feeder and branch circuits for continuity. Test all neutrals for improper grounds.
- E. Equipment Operations: Test motors for correct operation and rotation.
- F. Product Failure: Any products which fail during the tests or are ruled unsatisfactory by the Engineer shall be replaced, repaired or corrected as prescribed by the Engineer at the expense of the CONTRACTOR. Tests shall be performed after repairs, replacements or corrections until satisfactory performance is demonstrated.
- G. Miscellaneous: Include all test results in the maintenance manual. Cost, if any, for all tests shall be paid by the CONTRACTOR.

1.11 CLEANING AND ADJUSTING

Cleaning: After other work such as standing, painting, etc. has been completed, clean panel boards, switchboards and other electrical equipment to remove dust, dirt, grease or other marks. Leave work in clean conditions.

1.12 PROJECT RECORD DRAWINGS

- A. All changes to drawings shall be made by qualified draftspersons to match existing linework and lettering as closely as possible. When all changes have been made to drawings, CONTRACTOR shall have full size sepias and two sets of prints made of the entire set at his cost. See Supplemental General Conditions, Item No. 10, Record Drawings.

END OF SECTION 26 01 00

SECTION 26 05 00**BASIC MATERIALS AND METHODS****PART 1 - GENERAL****1.01 ORDINANCES, REGULATIONS AND CODES**

a. All work must conform to the requirements which fall within the scope of the regulations in the Codes or under the jurisdiction of any of the governing bodies listed.

1. The California Code of Regulations, Titles 19 thru 25.
2. The California Electric Code as applicable under current state and local regulations (latest edition and supplements.)
3. State Board of Health.
4. CAL-OSHA Regulations.
5. Nothing in these Specifications or shown on the plans, shall relieve the Contractor from full compliance with applicable portions of any of the above regulations pertaining to work which he is installing under this Contract.

1.02 SCOPE OF WORK

a. This portion of the work includes the furnishing of all labor and materials necessary for the complete wiring system to outlets and all equipment shown on the drawings or covered by this Section of the Specifications. In general, the work, includes the following:

1. New electrical distribution including main switchboard trenching, backfill and conduit.
2. Furnish, install and connect wire, conduit and switches, etc. required for equipment covered by other sections of these Specifications.
3. Secondary voltage distribution systems 120/208v, 3 phase 4 wires including switchboards, panelboards and feeders. electrical service including main switchboard trenching, backfill and conduit. Other voltage distribution system 277/480v 3 phase 4.
4. Complete system of branch circuit wiring, conduit and distribution equipment for lights, receptacles and power.
5. All excavating and backfill as required for electrical work.
6. The patching and repair of all work modified or damaged by the installation of work under this contract.
7. Complete interior and exterior electrical systems shown on drawings.
8. Provision and set up of complete Fire Alarm System per plans.
9. Provision and set up of complete Telephone PA/IC Clock system per plans.
10. Provision and set up of complete Data Communication system per plans.
11. Provision and set up of complete sport light system per plans.

b. The Contractor shall furnish and install all work necessary to make complete systems, whether or not such details are mentioned in these Specifications or shown on the drawings, but which are necessary in order to make complete working systems, excepting only those portions that are specifically mentioned therein or plainly marked on the accompanying drawings as being installed by other Contractors.

c. The Contractor must coordinate his work with the work of other trades so as to provide raceways, conductors and outlets in the correct location for the equipment served, including all data communication, mechanical, and plumbing equipment and connect same. The Contractor must provide power of the correct voltage and phase to each item of equipment. Verify with equipment nameplate prior to pulling any wire and prior to installing circuitbreaker.

d. Before construction starts, the contractor shall arrange a coordination meeting with the General contractor and all other sub contractors supplying equipment that requires electrical connections. All electrical requirements shall be verified and any problems shall be immediately reported to the engineer. Equipment items to verify shall include but not be limited to: Voltage, amps, phase, location, orientation, space requirements, type of connection, starter and disconnect location and provision, control system operation and requirements, etc.

e. The above list is given for the convenience of the contractor and is not considered all-inclusive.

1.03 PERMITS AND FEES

Pay for and obtain all permits, inspection fees, etc., as required for the completion of all work included in this Contract. Any inspection Certificates required shall be obtained and delivered to the Owner.

1.04 EXAMINATION OF DRAWINGS AND SITE

Before submitting bid, the Contractor shall carefully examine the Structural, Mechanical and Plumbing Drawings for this work, along with the Specifications for same in addition to the drawings and specifications governing the work of this trade. He shall also visit the site of the proposed construction and familiarize himself with all the site conditions. No subsequent allowances will be made to the Contractor because of his negligence in complying with the above or his alleged inability to understand the requirements.

1.05 SUBMITTALS

- a. Shop drawings of power service and distribution equipment cuts shall be submitted for approval in seven (7) copies within thirty (30) days after the award of the contract.
- b. Equipment or material furnished or incorporated in construction without prior approval of the Engineer may be rejected and if rejected shall be removed from the structure and replaced with approved equipment or material at the Contractor's expense.
- c. Shop drawing for all low voltage system including equipment layout and riser diagram.

1.06 RECORD DRAWINGS

See Division 1.

1.07 CATALOG DATA AND OPERATING INSTRUCTIONS

Upon completion of the work in this Contract, the Engineer shall be furnished with a complete set of catalog data which describes each piece of equipment installed under this Contract. The catalog shall be bound in a set and shall be clearly labeled as to each item of equipment used.

1.08 WORK NOT INCLUDED

The furnishing and installation of motors.

PART 2.00 PRODUCTS

2.01 MATERIALS AND COMPONENTS

- a. All materials, appliances and equipment except that furnished by the Owner shall be new and the best of their respective kinds, free from all defects, bear U.L. Label and of the make, brand or quality specified or as accepted by the Engineer as herein provided. This shall also apply to all parts of the work whether or not this particular paragraph is referred to by number.
- b. All apparatus, conduit systems, etc., shall be installed and interconnected so as to form complete systems as herein specified and/or shown on all the accompanying drawings. This Contractor shall furnish and install all work necessary to make complete working systems, excepting only those portions that are specifically mentioned herein or plainly marked on accompanying drawings as being furnished by other Contractors.

2.02 RACEWAYS AND FITTINGS

- a. Shall be as manufactured by Triangle Conduit and Cable Company, Allied Tube and Conduit Corporation, American Flexible Conduit Company, Carlon or approved.
- b. Galvanized rigid steel conduits (RSC) -
 - 1. May be used in all locations.
 - 2. For underground runs in direct contact with earth, conduit shall be factory wrapped with PVC tape or shall have factory applied PVC coating.
- c. Galvanized intermediate metallic conduit (IMC) - May be used in indoor locations not in direct contact with earth.
- d. Galvanized electrical metallic tubing (EMT) - May be used in indoor dry locations in which it is:
 - 1. Not subject to physical damage.
 - 2. Not in direct contact with earth.
 - 3. Not in concrete slabs.
 - 4. Not in hazardous areas.
 - 5. In masonry walls, not in same cells as rebars.
 - 6. On roof or walk cover, when specifically shown on drawings.
- e. Non-metallic rigid conduit - Shall be PVC Schedule 40 and may be used:
 - 1. Underground.
- f. Flexible steel conduit - May be used in dry locations for final connections to:
 - 1. Mechanical equipment, not to exceed 18 inches.
 - 2. Facilitate wiring in tight locations, when approved by Engineer.
- g. Liquid-tight flexible steel conduit - Shall be used in outdoor or wet locations for final connection to motors or other mechanical equipment, not to exceed 18 inches.
- h. Fittings -
 - 1. Shall be threaded type only for rigid and intermediate steel conduits.
 - 2. For electrical metallic tubing (EMT), fittings shall be:
 - a) Set-screw with steel housing or compression type for sizes 1/2" through 1", in dry locations.
 - b) Compression type for sizes larger than 1" or in wet locations and in masonry walls.
 - 3. For non-metallic conduits and tubings:

- a) Fittings shall be PVC type. Use PVC adapters at all boxes and panelboards.
 - b) Brush apply PVC cement.
 - c) All PVC components, (conduits, fittings, cement) shall be of same manufacturer.
- 4. Flexible metallic conduits: Compression type.
- 5. Liquid-tight flexible metallic conduits: Liquid-tight, compression type.
- 6. Use of the following is prohibited:
 - a) Crimp-on, tap-on, indenter type fittings.
 - b) Spray (aerosol) PVC cement.
- i. Any exposed raceway in rooms other than utility rooms shall be wiremold type with finish as selected by Engineer.

2.03 CONDUCTORS (Wire)

- a. All wire installed in this contract shall be of a standard manufacturer as approved by the National Board of Fire Underwriters and be of the size as indicated on the drawings. All wire shall bear the Underwriters's label and shall be brought to the job in unbroken packages and approved by the Job Inspector before same is installed.
- b. All power wiring conductors shall be type THWN copper, unless otherwise noted.
- c. Number 12 AWG gauge wire shall be the smallest gauge wire used, except for signal circuits which shall be as shown on plans or as specified under other sections of these specifications.
- d. All wire #8 AWG gauge or larger shall be stranded.
- e. Splices on all wire less than 8 gauge shall be with insulated Ideal "Wing Nuts", "Scotchlock", or equal, spring connectors.
- f. Splices in wires 8 gauge and larger shall be made with crimp on solderless connector, Scotch, Burndy or equal. Connectors to switches or bus bar shall be made with one piece lugs for all wires, sized for conductors as shown on plans.
- g. All wiring in underground conduits or pull boxes including signal wiring shall be listed by the manufacturer as suitable for use in wet locations. Splices are not permitted in underground pull boxes except where approved by Engineer.

2.04 PULL BOXES

- a. Pull Boxes shall meet all code requirements as to size for conduits terminating therein and to thickness of material used in fabrication.
 - 1. Fabricated sheet steel pull boxes shall be installed only in dry, protected locations and shall be furnished with knockouts and removable screw cover. Box shall be finished with one coat of zinc chromate and a coat of primer sealer and where exposed to public view shall be painted to match the surrounding surface.
 - 2. Weatherproof sheet steel pull boxes shall be fabricated of code gauge galvanized sheet steel with two coats of rust resistant finish and shall be furnished with gasket and made completely weathertight.
 - 3. Approved manufacturers for metal boxes are Circle AW, Crouse Hinds, Steel City or equal.
 - 4. Weatherproof concrete pull boxes, junction boxes and telephone boxes shall be Christy Concrete Products or equal. All boxes shall have lids marked "Electrical Power", "Electrical Signal", etc.

2.05 OUTLETS

- a. All outlet boxes concealed in dry locations shall be standard one or two piece galvanized knock-out outlet boxes, National, Steel City, Appleton, Bowers or approved equal. In wet locations use cast aluminum boxes.
- b. Any unused boxes shall be equipped with a cover plate.

2.06 RECEPTACLES AND PLATES

- a. Furnish and install 20A, 125 volt, 3 wire grounding type duplex receptacles at all receptacle outlets as indicated on drawings, specification grade Leviton, Bryant, Sierra or approved.
- b. All receptacle plates shall be stainless steel except in wet locations use weatherproof cover.

2.07 MOTOR DISCONNECTS

- a. Shall be fused switch with dual element fuses. Horse power rated and quick-make quick-break type. Fuse rating shall comply with motor manufacturer's recommendations. Switch shall be UL listed. Disconnects shall have external operating handles.
- b. Provide disconnects for all motors if not provided by others.
- c. Disconnect switches shall be located so as not to obscure any part of the HVAC unit's nameplate data.
- d. Disconnects shall be heavy duty rated. Operating handle shall be lockable in open or closed position.
- e. Each disconnect switch shall have a ground connector (lay in wire type) which shall be used for grounding the disconnect enclosure. The ground wire shall continue and be connected to the enclosure of the equipment served.

PART 3.00 EXECUTION

3.01 LOCATIONS

- a. The work as laid out is to some extent diagrammatic, and the location thereon indicated may be approximate only. The Contractor, therefore, shall install all the equipment, apparatus, conduit runs and the like as follows:
 - 1. Adhere to the location indicated as far as possible.
 - 2. Maintain ample head room in all rooms and passageways, clearance around all apparatus and equipment and under pipe lines for unrestricted passage and for easy servicing of all apparatus, equipment, devices and the like.
 - 3. Verify the exact locations of all equipment and other apparatus or devices as indicated on the drawings. In the event these drawings do not sufficiently indicate the locations for all such fixtures, apparatus or devices, the Contractor shall obtain the exact locations from the Engineer.

3.02 VERIFICATION OF DIMENSIONS

- a. The Contractor shall, as work progresses, verify the dimensions of the spaces available for the installation of the work and he shall assume full responsibility for the proper locations and grading of each portion thereof.

- b. Where the work requires connections to be made to equipment that is furnished and set in place by others, the Contractor shall obtain exact rough-in dimensions from the installer of such equipment and he shall install the connections in a neat and workmanlike manner and shall insure that required working clearances are obtained.

3.03 INTENT

It is the intention to provide systems that are complete in every respect without further cost to the Owner. Anything not shown in drawings, or indicated in the specifications, but required for complete operating systems shall be included as part of this Contract.

3.04 SPECIAL NOTE

Attention of Contractor is hereby called to all work covered by notes on the drawings. Work covered by notes must be furnished and installed whether it is specifically mentioned in these specifications or not.

3.05 STANDARD PRACTICE

All work not shown in complete details shall be installed in conformance with the best standard practice for the trade.

3.06 CHANGES

- a. Should it be necessary to change any of the sizes, dimensions, or locations of any of the equipment from those shown on the plans, the same shall be made with the approval of the Engineer but without any additional expense to the Owner.
- b. The Contractor shall consider the number of outlets for electric equipment shown on plans as final, but the Engineer reserves the right to shift same, within reason, to a location and position which will meet more completely final requirements.

3.07 CONTRACTOR'S RESPONSIBILITY

The Contractor shall be responsible for the safety and good condition of all materials and equipment until final acceptance by the Owner. He shall erect and maintain suitable barriers, protective devices, lights and warning signs where required for the protection of the public and employees about the buildings. He shall be fully responsible for any loss or injury to persons or property resulting from his neglect or the carelessness and neglect of his employees.

3.08 CUTTING AND PATCHING

This Contractor shall do all cutting and patching of the work for the installation of the equipment and materials as approved by the Engineer. All patching shall accurately match the adjoining work.

3.09 FOUNDATIONS AND SUPPORTS

This Contractor shall provide all foundations, supports and hangers, etc., as required to install the equipment as specified or shown on the drawings. All equipment shall be supported, braced and cross-braced in such manner as to prevent sway and/or lateral movement.

3.10 EXCAVATION AND BACKFILLING

- a. Excavating required for the installation of the work shall be done by this Contractor. Underground lines outside the buildings shall be installed with a minimum cover of 24", except depth of utility services shall comply with respective utility company requirements.
- b. The conduit shall be laid on firm soil cut true and even to afford bearing for the full length of the barrel of the pipe. Any part of the trench excavated below grade shall be corrected with thoroughly compacted material approved by the Engineer.
- c. When the bottom uncovered at subgrade is soft and, in the opinion of the Engineer, cannot support the conduit, a further depth shall be excavated and refilled to conduit foundation grade as required by the Engineer.
- d. Trenches and other excavations shall be backfilled in six inch (6") layers of dampened earth, each layer tamped in a manner approved by the Engineer, to the density of the surrounding undisturbed earth. Any surplus excavation resulting from these excavations shall be distributed over the site as directed by the Engineer. Pudding will not be permitted where electrical conduits occur. Back fill material shall be free of roots, rocks or foreign materials of any kind.
- e. No excavation below the level of, or adjacent to, foundations of footings shall be made except in a manner approved by the Engineer.
- f. A six inch wide red ribbon stating "**CAUTION ELECTRIC LINE BURIED BELOW**" shall be installed 12" above conduit, full length of ditch.
- g. Electrical conduit shall not be run in excavations provided for plumbing or heating pipes, unless separated by a minimum of 12 inches.
- h. Verify location of all underground lines with Owner and utility companies before starting excavation.

3.11 SITE CONDITIONS

- a. Where existing utilities are shown on the plans, extreme care shall be exercised in excavating near these utilities to avoid any damage thereto, and the Contractor shall be held responsible for any such damage caused by this operation.
- b. The general location and arrangement of conduit piping, apparatus, etc., as shown in the drawings or herein specified and all installations shall be made in accordance therewith. Information on the drawings relative to existing services is approximate only. Minor deviations required to conform to actual locations shall be made without additional cost to Owner.
- c. The location of any existing utility services shown on the drawings is approximate and shall be checked by this Contractor for exact location.
- d. Should utilities not shown on the plans be found during excavations, the Contractor shall promptly notify the Engineer for instructions as to further action. Failure to do so will make the Contractor liable for any damage there arising from his operations after discovery of such utilities not shown on the plans. These utilities shall be removed or relocated as directed by the Engineer. An equitable adjustment in the Contract will be made for the additional work involved.
- e. The Contractor shall use special precautions where excavations are made in the areas near electrical ducts since they may be high voltage ducts. All such ducts shall be exposed by careful hand excavation so as not to damage the ducts or cause injury to personnel and shall be suitable marked with warning signs, barricades, etc. as required.

3.12 FIRE RATED AREAS

Where conduit or boxes penetrate fire rated ceilings, walls or floors provide a fire rated enclosure or fire stop. Rating of enclosure or fire stop shall match or exceed rating of area penetrated. Verify location of fire rated areas with General Contractor.

3.13 CONDUIT SYSTEMS

- a. A conduit system shall be installed for all wiring. Conduit shall be run continuous between outlets, etc., and with the minimum number of bends.
- b. PVC 40 or rigid steel factory wrapped with PVC tape shall be used for underground runs.
- c. All conduit shall be delivered to the site of construction in their original bundles. Each length of conduit shall bear the label of the National Board of Fire Underwriters. All conduit subjected to rough usage while on the job before installation and not acceptable to the Engineer shall be removed from the premises upon notice.
- d. The joints in all conduits installed underground or exposed to the weather, shall be made liquid tight. All underground conduit outside of the buildings shall be buried to a depth of not less than 24" below finish grade. Utility services shall comply with utility company requirements. Two or more conduit runs installed in a common trench shall be separated horizontally by at least four inches (4"). Electrical conduit runs installed in a common trench with other utility lines shall be separated horizontally from such lines by at least twelve inches (12").
- e. Changes in direction shall be made with conduit sweep elbows or long radius bends made on the job. Where two or more conduits are grouped in exposed locations, the sweeps shall be struck from the same center forming concentric arcs.
- f. All joints in conduit shall be made with standard coupling. In making joints, conduits must be truly and accurately cut and threaded (where applicable) with straight thread, smoothly reamed and squarely butted. All conduit shall be kept corked and dry during construction, using plastic caps or conduit pennies held in place with conduit bushings. Should dirt or moisture collect in any conduit, the Contractor shall swab them out to the satisfaction of the Engineer.
- g. Conduits ending at the motors and equipment shall be carried as close as possible to the terminal blocks making allowance for the movement of the motors when they are equipped with slide rails. The connection between the conduit terminals on the motor and the conduit shall be made with liquid-tight flexible conduit using the proper fittings.
- h. All conduits where they enter panel boxes, pull boxes, or outlet boxes shall be secured in place by galvanized locknuts and bushings - one (1) locknut inside and one (1) locknut outside of box with bushing on end of conduit. Bushing shall be plastic where conductors are #4 or larger.
- i. Where conduits are run exposed, the same shall be installed straight and true with reference to the adjacent construction.
- j. Conduit 1" and above shall have plastic insulated grounding bushings.
- k. All empty conduit shall be equipped with a #12 galvanized iron pull wire continuous from outlet to outlet.
- l. Flexible connections in outdoor and damp locations shall be flexible liquid-tight metal conduit or non-corrosive seamless metallic tubing with water-tight connections.

- m. Install roof jacks for this construction in accordance with other sections of this Specification.
- n. The maximum allowed length of flex conduit at equipment connections is 18".
- o. Expansion joints for conduit shall be provided where required to compensate for thermal expansion and contraction.
- p. No conduit smaller than 1/2 inch electrical trade size shall be used.
- q. Support conduits on roof on 2" X 4" redwood blocks spaced 5 feet apart and set in mastic.

3.14 OUTLETS

- a. In general, the locations of electrical work shall be as shown on the drawings; however, the Contractor shall make changes necessary to suit conditions on the job directed by the Engineer or his representative.

3.15 CONDUCTOR IDENTIFICATION & INSTALLATION

- a. All feeders and branch circuits shall be tagged in all pull boxes and in the gutters of all panels to which they connect.
- b. All wiring shall be done in identified neutrals.
- c. No wire shall be installed until all work of other contractors that might cause injury to the said wire has been completed. Care shall be used to pull wires to insure that no damage occurs to the insulation. Powdered soapstones or wire ease shall be used for pulling in wires.
- d. Splices in underground boxes shall be made with crimp on compression connectors and insulated with heat shrink sleeves or with splice kits listed by the manufacturer for wet locations. Wire nuts are not permitted.

3.16 IDENTIFICATION OF SWITCHES AND APPARATUS

All switchboard circuits, externally operated switches and apparatus used for the operation of or control of circuits, appliances, or equipment shall be properly identified with bakelite nameplates 1" x 3". All such nameplates shall be submitted to the Engineer before being secured on the apparatus by screws. Card holders in any form are not acceptable.

3.17 ACCESS OPENING

It shall be the responsibility of the Contractor to provide sufficient and convenient access openings, panels, etc., in the building construction where required for the maintenance of, installation and/or removal of all equipment, or other items of the various systems and equipment.

3.18 CLEANING UP

- a. The Contractor shall keep the premises free from accumulations of his waste material or rubbish. At the completion of the work, he shall remove all his rubbish, tools, scaffolding and surplus materials from and about the buildings, leaving the premises in a clean condition.
- b. All exterior surfaces of exposed equipment and material shall be thoroughly cleaned of all dirt, cement, plaster and other debris, including the exterior surfaces of all conduit, conduit fittings, conduit hangers, insulation and the like.

- c. All surfaces to be painted shall be carefully wiped or otherwise cleaned; cracks and corners scraped out clean, grease and oil spots removed so that surfaces may receive paint without further preparation.
- d. All plated materials shall be thoroughly cleaned and polished.

3.19 DAMAGE BY LEAKS

The Contractor shall be responsible for all damage to any part of the premises caused by breaks in conduit or fixtures furnished and/or installed by him under this specification for a period of one (1) year from date of acceptance of the project by the Owner.

3.20 COORDINATION

- a. HEATING, AIR CONDITIONING, PLUMBING AND OTHER MECHANICAL WORK
 - 1. The Contractor shall be responsible for furnishing and installing of all fused disconnect switches, conduits, wire, fittings, etc.
 - 2. Install all electrical equipment where it is not already installed as a part of a unit furnished by the equipment Contractor. (See Drawings of respective Section).
 - 3. The Contractor shall furnish fused disconnect switches for pumps, motors and air conditioning and handling units, if they are not furnished by others. Fuses shall be dual element, rated per equipment manufacturer's recommendations.
 - 4. Thermal overload switches shall be furnished for all fractional horsepower motors where such protection is not included as a part of another contract.
 - 5. All equipment outlets and control outlets shown on the plans are approximate only. Verify exact locations with Equipment Contractor.
 - 6. All control conduit and wiring is covered in Division 15.
 - 7. Furnish and install W.P., convenience outlet (120V) within 25 ft. of all A.C. units.
 - 8. Coordinate with general contractors, mechanical contractors and equipment suppliers before bid submitted and again before rough-in started to verify that all systems are complete and all components are provided including starters, disconnects, relays, solenoids, control conduit, and wire, etc.

3.21 MISCELLANEOUS EQUIPMENT

- a. Contractor shall be responsible for electrical hook up and connections to all electrical equipment whether furnished by this Contractor or others, including wiring, conduit, disconnects, circuit breakers, etc., even if not shown on drawings. Verify all requirements with equipment supplier before rough in.

3.22 PRELIMINARY OPERATION

Should the Owner require through the Engineer that any portion of the systems or equipment herein specified be operated prior to the final completion and acceptance of the work, the Contractor shall consent. Such operation shall be under the supervision and direction of the Contractor, but all expenses therefor shall be paid by the Owner, separate and distinct from

any money paid on account therefor of the Contract. Such preliminary operation, or payment therefor, shall not be construed as an acceptance of any of the work under the Contract. The Engineer shall approve any expense incurred by the Contractor before payment by the Owner.

3.23 GUARANTEE AND TESTS

- a. Equipment of all kinds installed by this Contractor shall be tested to determine whether it fulfills the requirements of these specifications. The Contractor shall furnish all labor necessary to adjust the operation of the apparatus and made the connections for the tests. After the tests have been completed, the Contractor shall restore all connections, apparatus, etc., to their original condition.
- b. Should any piece of apparatus or any material or work fail in any of these tests, it shall be immediately removed and be replaced with new material by this Contractor at his expense and the portion of the work replaced be again tested by the Contractor.
- c. Except as otherwise specified, all materials, apparatus equipment furnished and installed under the Electrical Section of this specification shall be new and free from all defects. Should any trouble develop within a period of one (1) year from date of acceptance of the work, due to inferior or faulty material and/or workmanship, the trouble shall be corrected and material and equipment replaced by the Contractor without expense to the Owner.
- d. The entire installation shall be free from short circuits and improper grounds. Each individual circuit shall be tested at the panel with the equipment connected for proper operation. Ground tests shall meet the requirements of the California Electrical Code. Upon completion of the work, a final inspection of the Engineer and other interested authorities shall be conducted. This Contractor shall guarantee to repair or replace at his expense any material or equipment that develops defects or is determined not to be in conformance with the plans and specifications, during a period of one year after work is accepted by the Owner.

END OF SECTION 26 05 00

SECTION 26 05 53**ELECTRICAL IDENTIFICATION****PART 1 – GENERAL****1.01 RELATED DOCUMENTS:**

- A. Drawings and general provisions of the Contract, including General Section 00700 and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY:

- A. This Section includes identification of electrical materials, equipment, and installations.

1.03 SUBMITTALS:

- A. General: Submit each item in this Paragraph according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Schedule of identification nomenclature to be used for identification signs and labels.
- D. Samples for each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

1.04 QUALITY ASSURANCE:

- A. Comply with California Electrical Code.
- B. Comply with ANSI C2.

1.05 SEQUENCING AND SCHEDULING:

- A. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
- B. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

PART 2 – PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Brady USA, Inc.; Industrial Products Division.
 - 2. Carlton Industries, Inc.
 - 3. Cole-Flex Corp.
 - 4. EMED Co., Inc.
 - 5. Ideal Industries, Inc.
 - 6. Panduit Corp.

2.02 RACEWAY AND CABLE LABELS

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, California Electrical Code, and these Specifications.

- B. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
 - 1. Color: Black legend on orange field.
 - 2. Legend: Indicates voltage and services.
- C. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend is over-laminated with a clear, weather- and chemical-resistant coating.
- D. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic bands sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- E. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).
- F. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
 - 1. Size: Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick).
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed Legend: Indicates type of underground line.
- G. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- H. Aluminum, Wraparound Marker Bands: Bands cut from 0.0140-inch (0.4 mm) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- I. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.
- J. Aluminum-Faced Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch (0.05 mm) thick, laminated with moisture-resistant acrylic adhesive, and punched for the fastener. Preprinted legends suit each application.
- K. Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: 2 x 2 inches (51 x 51 mm) x 0.05 inch (1.3 mm).

2.03 ENGRAVED NAMEPLATES AND SIGNS:

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, California Electrical Code, and these Specifications.
- B. Engraving stock, melamine plastic laminate, 1/16-inch (1.6 mm) minimum thick for signs up to 20 sq. in. (129 sq. cm), 1/8-inch (3.2 mm) thick for larger sizes.
 - 1. Engraved Legend: Black letters on white face.
 - 2. Punched for mechanical fasteners.
- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for the application. 1/4-inch (6.4 mm) grommets in corners for mounting.

- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose acetate butyrate signs with 0.0396 inch (1 mm) galvanized steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6.4 mm) grommets in corners for mounting.
- E. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS:

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties with the following features:
 - 1. Minimum Width: 3/16 inch (5 mm).
 - 2. Tensile Strength: 50-lb. (22.3 kg) minimum.
 - 3. Temperature Range: Minimum 40 to 185 degrees F (minimum 4 to 85 degrees C).
 - 4. Color: As indicated where used for color-coding.
- B. Paint: Alkyd-urethane enamel over primer as recommended by enamel manufacturer.

PART 3 – EXECUTION

3.01 INSTALLATION:

- A. Install identification devices according to manufacturer's written instructions.
- B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations used in the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- E. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
- F. Install painted identification as follows:
 - 1. Clean surfaces of dust, loose material, and oily films before painting.
 - 2. Prime Surfaces: For galvanized metal, use single-component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy-duty, acrylic-resin block filler. For concrete surfaces, use clear, alkali-resistant, alkyd binder-type sealer.
 - 3. Apply one intermediate and one finish coat of silicone alkyd enamel.
 - 4. Apply primer and finish materials according to manufacturer's instructions.
- G. Identify Raceways and Exposed Cables of Certain Systems with Color Banding: Band exposed and accessible raceways of the systems listed below for identification.
 - 1. Bands: Pretensioned, snap-around, colored plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, complete encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
 - 2. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15 m) maximum intervals in straight runs, and at 25 feet (7.6 m) in congested areas.
 - 3. Colors—as follows:
 - a. Fire-Alarm System: Red.
 - b. Fire-Suppression Supervisory and Control System: Red and yellow.

- c. Combined Fire-Alarm and Security System: Red and blue.
- d. Security System: Blue and yellow.
- e. Mechanical and Electrical Supervisory System: Green and blue.
- f. Telecommunications System: Green and yellow.

- H. Install Circuit Identification Labels on Boxes: Label externally as follows:
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 - 2. Concealed Boxes: Plasticized card-stock tags.
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- I. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Where multiple lines installed in a common trench or concrete envelop, do not exceed an overall width of 16 inches (400 mm); use a single line marker.
 - 1. Limit use of line markers to direct-buried cables.
 - 2. Install line marker for underground wiring, both direct buried and in raceway.
- J. Color-Code Conductors: Secondary service, feeder, and branch circuit conductors throughout the secondary electrical system.
 - 1. 208/120-V System--as follows:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 - 2. 480/277-V System--as follows:
 - a. Phase A: Yellow.
 - b. Phase B: Brown.
 - c. Phase C: Orange.
 - d. Neutral: White.
 - e. Ground: Green.
 - 3. Factory-apply color the entire length of the conductors, except the following field-applied, color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply the last two turns of tape with no tension to prevent possible unwinding. Use 1-inch (25 mm) wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
 - 4. For all system voltages:
 - a. Isolated ground conductors: Green with yellow stripe.
 - b. Mark with a 1" band of green tape, followed by a 1" band of yellow tape, followed by a 1" band of green tape.
- K. Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms.
 - 1. Legend: 1/4 inch (6.4 mm) steel letter and number stamping embossing with legend corresponding to indicated circuit designations.
 - 2. Fasten tags with nylon cable ties; fasten bands using integral ears.
- L. Apply identification to conductors as follows:
 - 1. Conductors to be extended in the future: Indicate source and circuit numbers.
 - 2. Multiple power or lighting circuits in the same enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding for voltage and phase indication of secondary circuit.

3. Multiple control communications circuits in the same enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- M. Apply warning, caution, and instruction signs and stencils as follows:
1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
 2. Emergency-Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8 inch (9 mm) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- N. Install Identification as follows:
1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide a single line of text with 1/2 inch (13 mm) high lettering on a 1 1/2 inch (38 mm) high label; where two lines of text are required, use lettering 2 inches (51 mm) high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment.
 - a. Panel boards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Electrical switchgear and switchboards.
 - e. Motor control centers.
 - f. Motor starters.
 - g. Push-button stations.
 - h. Contactors.
 - i. Remote-controlled switches.
 - j. Dimmers.
 - k. Control devices.
 - l. Transformers.
 - m. Telephone switching equipment.
 - n. Clock/program master equipment.
 - o. TV/audio monitoring master station.
 - p. Fire-alarm master station or control panel.
 - q. Security-monitoring master station or control panel.
 2. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push-buttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panel boards and alarm/signal components where labeling is specified elsewhere. For panel boards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

END OF SECTION 26 05 53

SECTION 26 10 00
RACEWAYS, BOXES AND CABINETS

PART 1: GENERAL

1-01 SUMMARY:

- A. Section Includes: Devices for electrical wiring.
 - 1. Raceways include the following:
 - a. Rigid metal conduit
 - b. Intermediate metal conduit
 - c. Polyvinyl chloride (PVC) externally coated rigid steel conduit.
 - d. PVC externally coated intermediate metal conduit.
 - e. Electrical metallic tubing (EMT).
 - f. Flexible metal conduit.
 - g. Liquidtight flexible conduit
 - h. Rigid nonmetallic conduit
 - i. Wireway
 - j. Surface raceways.
 - 2. Boxes, enclosures, and cabinets include the following:
 - a. Device boxes
 - b. Outlet boxes
 - c. Pull and junction boxes
 - db. Cabinets and hinged cover enclosures
- B. Related Sections:
 - 1. Section 26050 - Basic Electrical Materials and Methods
 - 2. Section 26140 - Wiring Devices

1-02 SUBMITTALS:

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification sections.
- B. Product data for surface raceway, precast concrete boxes, wireway and fittings, floor boxes, hinged cover enclosures and cabinets.
- C. Shop drawings for nonstandard boxes, enclosures, and cabinets. Include layout drawings showing components and wiring.
- D. Precast vaults and boxes:
 - 1. Submit detailed drawings for the construction and installation of precast pullboxes. Show dimensions of boxes and thickness of walls, floors, and top slabs. Show reinforcing wire and steel. Show materials of construction by ASTM reference and grade.
 - 2. Submit calculations signed by licensed civil engineer indicating compliance with design criteria.

1-03 QUALITY ASSURANCE:

- A. Regulatory Requirements:
 - 1. California Electrical Code (CEC)
 - 2. State of California:

- a. Title 8 - Electrical Safety Orders
 - b. Title 19 - California Code of Regulations
 - c. Title 24 - Building Standards
 - d. Occupational Safety and Health Act (OSHA)
- 3. Underwriters Laboratories (UL):
 - a. All materials shall be listed by Underwriters' Laboratories when label service is regularly furnished and standards have been established.
- 4. National Electrical Manufacturers Association (NEMA).
- 5. American National Standards Institute (ANSI)
- 6. NFPA 70 for components and installation.
- 7. Electronic Industries Association EIA/TIA-569 Standard for Telecommunication Pathways and Spaces.
- B. Coordination: Conduit routing as shown is generally diagrammatic unless specifically dimensioned or details. Coordinate layout and installation of raceway and boxes with other construction elements ensuring adequate headroom, working clearance and access.

PART 2: PRODUCTS

2-01 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to the following:
 - 1. Metal Conduit and Tubing:
 - a. Alflex Corp.
 - b. Allied Tube and Conduit, Grinnel Co.
 - c. Anamet, Inc., Anaconda Metal Hose
 - d. Anixter Brothers, Inc.
 - e. Carol Cable Co., Inc.
 - f. Cole-Flex Corp.
 - g. Flexcon, Inc., Coleman Cable Systems, Inc.
 - h. Spiraduct, Inc.
 - i. Triangle PWC, Inc.
 - j. Wheatland Tube Co.
 - 2. Nonmetallic Tubing and Conduit:
 - a. Anamet, Inc., Anaconda Metal Hose
 - b. Arnco Corp
 - c. Can-Tex Industries, Harsco Corp
 - d. Carlon
 - e. Certainteed Corp, Pipe & Plastics Group
 - f. Cole-Flex Corp
 - g. Condux International, Electrical Products
 - h. Electri-Flex Co.
 - i. George-Ingraham Corp
 - j. Hubbell, inc., Raco, Inc.
 - k. R&G Sloan Manufacturing Co., Inc.
 - l. Spiraduct, Inc.
 - m. Thomas & Betts Corp
 - 3. Conduit Bodies and Fittings:
 - a. Scott Fetzer Company, Adaleet-PLM

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- b. American Electric, Construction Materials Group
- c. Emerson Electric Co., Appleton Electric Co
- d. Carlon
- e. Hubbell, Inc., Killark Electric Manufacturing Co.
- f. General Signal, O-Z/Gedney Unit
- g. Spring City Electrical manufacturing Co.

4. Wireway:

- a. Hoffman Engineering Co.
- b. Keystone/Rees, Inc.
- c. Square D Co.

5. Surface Nonmetallic Raceway:

- a. Hubbell, Inc., Wiring Device Division – Media Trak 10
- b. Panduit Corp. – Twin 70 Series
- c. Wiremold 5400 Series

6. Boxes, Enclosures, and Cabinets:

- a. Butler Manufacturing Co., Walker Division
- b. Cooper Industries, Midwest Electric
- c. Erickson Electrical Equipment Co.
- d. American Electric, FL Industries
- e. Hoffman Engineering Co., Federal-Hoffman, Inc.
- f. Hubbell Inc., Killark Electric Manufacturing Co.
- g. General Signal, O-Z/Gedney
- h. Parker Electrical Manufacturing Co.
- i. Racal, Inc., Hubbell Inc.
- j. Robroy Industries, Inc., Electrical division
- k. Square D Co.
- l. Thomas & Betts Corp
- m. Woodhead Industries, Inc., Daniel Woodhead Co.

2-02 METAL CONDUIT AND TUBING:

- A. Rigid Steel Conduit: ANSI C80.1
- B. Rigid Aluminum Conduit: ANSI C80.5
- C. Intermediate Metal Conduit: ANSI C80.6
- D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1
- E. Plastic-Coated Intermediate Metal Conduit and Fittings: NEMA RN 2.
- F. Electrical Metallic Tubing and Fittings: ANSI C80.3 with set-screw or compression-type fittings.
- G. Flexible Metal Conduit: Zinc-coated steel
- H. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket
- I. Fittings: NEMA FB 1, compatible with conduit/tubing materials.

2-03 NONMETALLIC CONDUIT AND TUBING:

- A. Electrical Nonmetallic Tubing (ENT): NEMA C 13.
- B. Rigid Nonmetallic Conduit (RNC): NEMA TC 2, Schedule 40 or 80 PVC.
- C. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

2-04 WIREWAYS:

- A. Material: Sheet metal sized and shaped as indicated.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireway as required

- for complete system.
- C. Select features where not otherwise indicated, as required to complete wiring system and to comply with NEC
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2-05 SURFACE RACEWAY:

- A. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceway.
- B. Surface Nonmetallic Raceway: 2-piece, two, channel construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.

2-06 OUTLET AND DEVICE BOXES:

- A. Sheet Metal Boxes: NEMA OS 1
- B. Cast Metal Boxes: NEMA FB 1 type FD, cast fer alloy box with gasketed cover.
- C. Nonmetallic Boxes: NEMA OS 2

2-07 FLOOR BOXES:

- A. Floor boxes with flush plate or pedestal fittings: Boxes shall be cast or sheet metal,

2-08 PULL AND JUNCTION BOXES:

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2-09 CABINETS AND ENCLOSURES:

- A. Hinged Cover Enclosures: NEMA 250, steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.
- B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

2-10 PRECAST CONCRETE VAULTS AND PULLBOXES:

- A. Vaults and boxes shall be precast design produced by a manufacturer regularly engaged in the manufacture of precast boxes. Boxes shall be designed in accordance with the following criteria:
 1. Dry Active Earth Pressure = 45 pcf
 2. Wet Active Earth Pressure = 94 pcf
 3. Traffic Load = HS 20-44 loading in accordance with the Standard specifications for Highway Bridges by ASHTO.
 4. Allowable soils bearing capacity = 2000 psf
 5. Passive Earth Pressure = 200 psf
 6. Live Load Surcharge = 100 psf
 7. Cement shall be ASTM C150 Type II.
 8. Provide concrete admixtures as specified in Section 03001.
 9. Set built-in items in place before depositing concrete. Provide cable racks, rack arms and insulators to accommodate cable.
 10. Mortar shall comply with ASTM C37, Type S, or use grout complying with Section 03001.

PART 3: EXECUTION

3-01 EXAMINATION:

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- A. Examine surfaces to receive raceways, boxes, enclosures and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3-02 WIRING METHODS:

- A. Outdoors: Use the following wiring methods:
 1. Exposed: Rigid or intermediate metal conduit.
 2. Concealed: Rigid or intermediate metal conduit
 3. Underground, Single Run: Rigid nonmetallic conduit
 4. Underground, Grouped: Rigid nonmetallic conduit.
 5. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.
 6. Boxes and Enclosures: NEMA Type 3R or Type 4.
- B. Indoors: Use the following wiring methods:
 1. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit, except in wet or damp locations use liquidtight flexible metal conduit.
 2. Damp or Wet Locations: Rigid steel conduit
 3. Exposed: Electrical metallic tubing conduit.
 4. Concealed: Electrical metallic tubing conduit.
 5. Boxes and Enclosures: NEMA Type 1, except in damp or wet locations use NEMA Type 4, stainless steel.

3-03 INSTALLATION:

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.
- C. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.
- D. Install raceways level and square and at proper elevations. Provide adequate headroom.
- E. Complete raceway installation before starting conductor installation.
- F. Use temporary closures to prevent foreign matter from entering raceway.
- G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- H. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
- I. Use raceway fittings compatible with raceway and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings.
- J. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.

- K. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banked raceways together, on common supports where practical.
 - 2. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends of parallel raceways.
- L. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - 2. Use insulating bushings to protect conductors.
- M. Tighten set screws of threadless fitting with suitable tool.
- N. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
- O. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so that end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- P. Install pull wires in empty raceways. Use No.14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb (90 kg) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull wire.
- Q. Telephone and Signal System raceways 2-Inch Trade Size and Smaller: In addition to the above requirements, install in maximum lengths of 150 feet (45 m) and with a maximum of two 90-deg bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.
- K. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
 - 1. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 - 2. Where conduits from underground raceway enter data or communications wiring cabinets.
 - 3. Where otherwise required by the CEC.
- L. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches (150 mm) above the floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor.
- M. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

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- V. PVC Externally Coated Rigid Steel Conduit: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduit.
- W. Surface Metal Raceway: Install a separate green ground conductors in raceway from the junction box supplying the raceway to receptacle or fixture ground terminals.
 - 1. Select each surface metal raceway outlet box to which a lighting fixture is attached to be of sufficient diameter to provide a seat for the fixture canopy.
 - 2. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed (provide a backplate slightly smaller than the fixture canopy), no additional surface mounted outlet box need be installed.
- X Install hinged cover enclosures and cabinets plumb. Support at each corner.
- Y. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3-04 PROTECTION:

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touch-up coating recommended by the manufacturer.

3-05 CLEANING:

- A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION 26 10 00

SECTION 26 11 10**CONDUIT****PART 1 - GENERAL****1.01 CONDITIONS**

- A. All of the applicable requirements of Division 1 apply to the work of this Section.

1.02 WORK INCLUDED

- A. Work Included: All labor, materials and equipment necessary to complete the installation of:
1. Rigid Steel Conduit and fittings.
 2. PVC Insulated Rigid Steel Conduit and fittings.
 3. Intermediate Metal Conduit and fittings.
 4. Electrical Metallic Tubing and fittings.
 5. Miscellaneous Conduit fittings.

1.03 WORK SPECIFIED UNDER OTHER SECTIONS

- A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete, finished and workmanlike installation.
1. Section 26010: Electrical General Provisions.
 2. Section 26190: Supporting Devices.

1.04 SUBMITTALS

- A. Submit in accordance with the requirements of Section 16010: Electrical General Provisions, the following items:
1. Conduit data sheets.
 2. Fitting data sheets.
 3. A list of conduit types indicating where each type of conduit will be used.

PART 2 - PRODUCTS**2.01 RIGID STEEL CONDUIT (RSC)**

- A. Conduit, Rigid Steel: Full weight, threaded, hot-dip galvanized, inside enameled, conforming to ANSI C80.1.
- B. Three Piece Couplings: Electroplated, cast malleable iron. Efcor 165 series, OZ/Gedney 4-50 series or equal.
- C. Set-screw Connectors: Electroplated, concrete tight, cast malleable iron with threaded male hub. Efcor 1720 B series, OZ/Gedney 28-050T series or equal.
- D. Insulating Bushings: Threaded cast malleable iron body with insulated throat and steel "lay-in" ground lug with compression screw. OZ/Gedney BLG series or equal.

2.02 PVC INSULATED RIGID STEEL CONDUIT (PVC RSC)

- A. Galvanized steel conduit conforming to ANSI C80.1 with nominal 40 mil thermoplastic vinyl coating, heat fused and bonded to the exterior of the conduit.
- B. Fittings: Conduit couplings and connectors shall be as specified for rigid steel conduit and shall be factory PVC coated with an insulating jacket equivalent to that of the coated material.

2.03 MISCELLANEOUS CONDUIT FITTINGS

- A. Expansion/Expansion-Deflection Fittings: OZ/Gedney Company type Dx, Spring City type EDF or equal with integral bonding jumper for use with rigid steel conduits.

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Minimum Conduit Size: Unless otherwise noted on Drawings, minimum conduit size shall be 3/4".

3.02 INSTALLATION

- A. Sizing: All conduit runs shown on the Drawings are sized based on the use of rigid steel conduit and THW copper conductors.
- B. Install conduit free from dents and bruises. Conduits shall be well protected and tightly covered during construction using metallic bushings and bushing "pennies" to seal open ends.
- C. In making joints in rigid steel conduit, ream conduit smooth after cutting and threading.
- D. Clean any conduit in which moisture or any foreign matter has collected before pulling in conductors. Paint all field threaded joints to prevent corrosion.

- E. Conduit systems shall be electrically continuous throughout. Install code size, insulated, copper, green grounding conductors in all conduit runs for branch circuits and feeders. This conductor is not shown on the drawings.

3.03 CONDUIT LAYOUT

- A. Locations of conduit runs shall be planned in advance of the installation and shall not unnecessarily cross other conduits or pipe, nor prevent removal of ceiling tiles or panels, no block access to mechanical or electrical equipment.
- B. Where practical, install conduits in groups in parallel vertical or horizontal runs and at elevations that avoid unnecessary off-sets.
- C. Exposed conduit shall be run parallel or at right angles to the centerlines of columns and beams.
- D. Conduits shall not be placed closer than 12 inches to flue, parallel hot water, steam line or other heat producing source or three inches from such lines when crossing perpendicular to the runs.
- E. Metallic conduit shall not be in contact with other dissimilar metal pipes.

3.04 CONDUIT TERMINATIONS AND JOINTS

- A. Raceways shall be joined using specified couplings or transition couplings where dissimilar raceway systems are joined.
- B. Conduits shall be securely fastened to cabinets, boxes and gutters using two locknuts and an insulating bushing or specified insulated connectors. Install grounding bushings or bonding jumpers on all conduits terminating at concentric knockouts.

3.05 CONDUIT SUPPORTS

- A. All raceway systems shall be secured to building structures using specified fasteners, clamps and hangers spaced according to Code.
- B. Support single runs of conduit using one hole pipe straps.
- C. Multiple conduit runs shall be supported using "trapeze" hangers fabricated from construction channel, mounted to 3/8 inch diameter, threaded steel rods secured to building structures. Fasten conduit to construction channel with standard one hole pipe clamps or the equivalent. Provide lateral seismic bracing for hangers.
- D. Conduit installed above suspended ceilings shall be attached to the structural ceiling above.

END OF SECTION 26 11 10

SECTION 26 12 00**WIRES****PART 1 - GENERAL****1.01 CONDITIONS**

- A. All of the applicable requirements of Division 1 apply to the work of this Section.

1.02 WORK INCLUDED

- A. Provide all labor, materials and equipment necessary to complete the installation of:
 - 1. Building wire.
 - 2. Wire connections and terminations.

1.03 RELATED SECTIONS

- A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
- B. Section 26010: Basic Electric Requirements.
- C. Section 26111: Conduit

1.04 REFERENCES

- A. NEMA WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- B. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

1.05 SUBMITTALS

- A. Provide all submittal information in accordance with the requirements of Section 26010: Basic Electrical Requirements.
- B. Submit product specification data for all types of wire and indicating proposed use for each type.
- C. Submit manufacturer's instructions for splicing and terminating conductors.

PART 2 - PRODUCTS**2.01 CONDUCTOR MATERIAL**

Provide insulated copper conductors for all wires and cables. Use stranded conductors for AWG #8 and larger sizes.

2.02 MINIMUM CONDUCTOR SIZE

Provide minimum AWG #12 for all branch circuits. Provide minimum AWG #14 for all control circuits unless otherwise noted on the Drawings or in these Specifications.

2.03 COLOR CODING

Identify system conductors as to voltage and phase connections by means of color impregnated insulating or colored marking tape.

A. For 120/208 volt, 3 phase, 4 wire systems:

Phase A - Black
Phase B - Red
Phase C - Blue
Neutral - White
Ground - Green

B. For 480 volt, 3 phase, 4 wire systems:

Phase A - Brown
Phase B - Orange
Phase C - Yellow
Neutral - White or Gray with colored (not green) tracer
Ground - Green

2.04 BUILDING WIRE, 0 TO 600 VOLTS

A. Thermoplastic-insulated Building Wire: NEMA WC 5.

B. Rubber-insulated Building Wire: NEMA WC 3.

C. Use CEC type THHN for branch circuits.

D. Use CEC Type RHH or Type THHN, for wire installed in fixture raceways and used as branch circuit feeders.

E. Manufacturer: General Electric Company, Rome Cable, American Insulated Wire Corporation or equal.

2.05 ELECTRICAL SPRING CONNECTORS

Provide three part construction incorporating a non-restricted zinc coated steel spring enclosed in a steel sheet with an outer jacket of vinyl plastic with a flexible insulating skirt.

2.06 BOLTED PRESSURE CONNECTORS

Provide wide range-taking connectors with cast bronze compression bolts, designed for parallel taps, tees, crosses or end-to-end connections.

2.07 COMPRESSION TYPE TERMINATING LUGS

Provide tin plated copper compression lugs for installation with hand or hydraulically operated crimping tools and dies as stipulated by the lug manufacturer. Use termination lugs such as 3M "Scotchlock" series 30014, Burndy Type "YA-L" series or equal.

2.08 SPLICING AND INSULATING TAPE (600 VOLTS AND BELOW)

Provide black, ultraviolet proof, self-extinguishing, 7 mil thick vinyl general purpose electrical tape with a dielectric strength of 10,000 volts suitable for temperatures from minus 18 degrees C to 105 degrees C.

2.09 INSULATING PUTTY (600 VOLTS AND BELOW)

Provide pads or rolls of non-corrosive, self-fusing, one eight inch thick rubber putty with PVC backing sheet. Use putty suitable for temperatures from minus 17.8 degrees C to 37.8 degrees C with a dielectric strength of 570 volts/mil minimum.

2.10 INSULATING RESIN

Provide two part liquid epoxy resin with resin and catalyst in premeasured, sealed mixing pouch. Use resin with a set up time of approximately 30 minutes at 21.1 degrees C and with thermal and dielectric properties equal to the insulating properties of the cables immersed in the resin.

2.11 TERMINAL STRIP CONNECTORS

- A. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support. Use Efcor "Quick-Crimp" Series, Thomas & Betts RA series or equal.
- B. Fasten crimp type connectors or terminals using a crimping tool recommended by the connector manufacturer.
- C. Provide insulated overlap splices with tinned seamless electrolytic copper barrel with funnel wire entry and insulation support. Use Efcor #BG-200, CG-200 or DG-200, Thomas & Betts Series R or equal.
- D. Provide insulated butt splices with tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support. Use Efcor BH-200, CH-200 or DH-200, Thomas & Betts Series R or equal.

PART 3 - EXECUTION

3.01 GENERAL WIRING METHODS

- A. Install all conductors in raceway unless noted.
- B. Make conductor lengths for parallel circuits equal.

- C. Splice only in junction or outlet boxes.
- D. Neatly train and bundle wiring inside boxes, control centers, equipment enclosures and panelboards.
- E. Provide AWG #10 pig tails on all wiring devices served by AWG #8 conductors and larger.

3.02 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Take care in pulling conductors so that insulation is not damaged. Use UL listed, non-petroleum base and insulating type pulling compound as needed.
- B. Completely and thoroughly swab raceway system before installing conductors.

3.03 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. Terminate and splice wires in accordance with manufacture's instructions.
- C. Thoroughly clean wires before installing lugs and connectors.
- D. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- E. Unless otherwise noted, join wires in sizes from #18 to #10 AWG, solid or stranded conductor, with insulation rated 105 degrees C or less with insulated electrical spring connectors.
- F. Join or tap stranded conductors from #8 AWG to 750 MCM using bolted pressure connectors. Insulate mechanical compression taps AWG #6 and larger using pre-molded, snap-molded, snap-on insulating boots or specified conformable insulating putty overwrapped with two half-lapped layers of vinyl insulating tape.
- G. Terminate conductors from size #6 AWG to 750 MCM copper using compression terminating lugs.
- H. Terminate wires in Terminal Cabinets using terminal strip connectors.
- I. Terminate spare conductors with electrical tape.
- J. Make up all splices in accessible junction or outlet boxes with connectors as specified herein with separate tails of correct color to be made up to slice. Provide at least six (6) inches of tails packed in box after splice is made up.

3.04 IDENTIFICATION

- A. Securely tag all branch circuits, noting the purpose of each. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each circuit with the corresponding circuit number.
- B. Color code conductors size #8 and larger using specified phase color markers and identification tags.
- C. Provide all terminal strips with each individual terminal identified with specified vinyl markers.

3.05 FIELD QUALITY CONTROL

- A. Inspect wires for physical damage and proper connection.
- B. Torque test conductor connections and terminations to manufacturer's recommended values.
- C. Provide all terminal strips with each individual terminal identified with specified vinyl markers.

END OF SECTION 26 12 00

SECTION 26 14 00**WIRING DEVICES****PART 1- GENERAL****1-01 SUMMARY:**

- A. Section Includes:
 - 1. Receptacles
 - 2. Connectors
 - 3. Switches
 - 4. Finish Plates
- B. Related Sections:
 - 1. Section 16050 - Basic Electrical Materials and Methods
- C. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specifications sections, apply to this Section.

1-02 SUBMITTALS:

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specifications.
- B. Product Data: Manufacturer's specifications for each product specified.
- C. Samples:
 - 1. For color selection: Submit samples of all colors available for devices and finish plates.
- D. Operations and Maintenance Data: Furnish for materials and products specified for inclusion in the Operations and Maintenance Manual specified in Section 01730.

PART 2 - PRODUCTS**2-01 MANUFACTURERS:**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturer's offering products that may be incorporated into the Work includes but are not limited to, the following:
 - 1. Wiring Devices:
 - a. Arrow Hart Div., Cooper Industries
 - b. Bryant Electric, Inc.
 - c. General Electric Co.
 - d. Hubbell, Inc.
 - e. Leviton Mfg. Co. Inc.
 - f. Pass & Seymour / Legrand
 - g. Sierra
 - h. Slater Electric, Inc.
 - 2. Wiring Devices for Hazardous (Classified) Locations:
 - a. Crouse-Hinds Electrical Construction

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- b. Kilark Electrical Mfg. Co.
 - c. Pyle - National Co.
- 3. Multi-Outlet Assemblies:
 - a. Kellems Div. Hubbell, Inc.
 - b. Wiremold Co.
 - c. Panduit Co.
- 4. Floor Service Outlets, and Telephone / Power Poles:
 - a. Hubbell, Inc.
 - b. Pass & Seymour / LeGrand
 - c. Square D Co.
 - d. Walker Div. Butler Mfg.
 - e. Wiremold Co.

2-02 WIRING DEVICES:

- A. Comply with NEMA Standard WD1, "General Purpose Wiring Devices".

	Switch 15A IPST	Switch 20A IPSt	Receptacle 15A Duplex	Receptacle 20A Duplex
Arrow Hart	1891	1991	5252	5739
Bryant	4801	4901	5252	5362
General Electric	GE5931	GE5951	GE4060	GE4108
Hubbell	1201	1221	5252	5362
Leviton	53501	53521	5096	5896
P & S	15-AC-1	20-AC-1	5252	5352
Sierra	5011	5021	1402	1462
Slater	700	740	3200	3300

- 1. Key locking type switches alike.
 - 2. Color: Device and face plates shall match.
- B. Face Plates: NEMA 1 equivalent.
 - 1. Interior locations:
 - a. Flush mounted: 302 stainless steel .040" thick, satin finish.
 - b. Surface mounted: Galvanized steel.
 - 2. Exterior or wet locations: Factory finished with protective cap and weatherproof gasket.
 - 3. Color: As selected by Architect.
- C. Receptacles, Straight-Blade and Locking Type: Comply with UL Standard 498 "Electrical Attachment Plugs and Receptacles", heavy-duty grade except as otherwise indicated.
- D. Receptacles, Straight-Blade and Locking type: Except as otherwise indicated, comply with

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Federal Specification W-C-596 and heavy-duty grade of UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide NRTL (Nationally Recognized Testing Laboratory) labeling of devices to verify these compliances.

- E. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated and with the following additional requirements:
 - 1. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit interrupters," feed-through type, with integral NEMA 5-20R duplex receptacle arranged to protect connected downstream receptacles on the same circuit. Design units for installation in a 2 - 3/4 inch deep outlet box without an adapter.
- F. Snap Switches: Quiet-type a.c. switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification W-S-896.
- G. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permits separate or common feed connection.
 - 2. Switch: 20 ampere, 120-277 V a.c.
 - 3. Receptacle: NEMA configuration 5-15R.
- H. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:
 - 4. Color: Matches wiring device except as otherwise indicated.
 - 5. Plate-Securing Screws: Metal with heads colored to match plate finish.
 - 6. Material for Finished Spaces: 0.04-inch-thick, type 302, satin-finished stainless steel, except as otherwise indicated.
 - 7. Material for Unfinished Spaces: Galvanized steel

2-03 MULTI-OUTLET ASSEMBLIES:

- A. Comply with Standard UL 5, "Surface Metal Raceways and Fittings."
- B. Components of Assemblies: Products of a single manufacturer designed to be used together to provide a complete matching assembly of raceways and receptacles.
- C. Raceway material: Anodized aluminum with manufacturer's standard corrosion-resistant finish.
- D. Wire: No.1 2 AWG.

PART 3 - EXECUTION

3-01 INSTALLATION:

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- D. Protect devices and assemblies during painting.
- E. Adjust locations at which floor service outlets are installed to suite the indicated arrangement of and furnishings.

3-02 IDENTIFICATION:

- A. Comply with Division 16 Section "Electrical Identification."
 - 1. Switches: Where 3 or more switches are ganged, and elsewhere where indicated, identify each switch with approved legend engraved on wall plate.
 - 2. Receptacles; Identify the panelboard and circuit number from which served. With engraved wall plate.

3-03 FIELD QUALITY CONTROL:

- A. Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 6 times.
- B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.
- C. Replace damaged or defective components.

3-04 CLEANING:

- A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 26 14 00

SECTION 26 15 00**WIRE CONNECTIONS****PART 1 - GENERAL****1.01 CONDITIONS**

- A. All of the applicable requirements of Division 1 apply to the work of this Section.

1.02 WORK INCLUDED

- A. Wire Connections.
- B. Terminating Lugs.
- C. Splicing and insulating Materials.
- D. Terminal Strip Connectors.

1.03 WORK INCLUDED BUT SPECIFIED UNDER OTHER SECTIONS

- A. Section 26010: Electrical General Provisions.
- B. Section 26111: Conduit.
- C. Section 26120: Wires.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Bolted Pressure Connectors: Wide range-taking, designed for parallel taps, tees, crosses or end-to-end connections. Cast bronze compression bolts.
- B. Compression Type Terminating Lugs: Tin plated copper compression lugs for use with hand or hydraulically operated crimping tools and dies as stipulated by the lug manufacturer. Termination lugs shall be 3M "Scotchlock" series 30014, Burndy Type "YA-L" series or equal.
- C. Splicing and Insulating Tape (600 volts and below): General purpose electrical tape shall be suitable for temperatures from minus 18 degrees C to 105 degrees C, shall be black, ultraviolet proof, self-extinguishing, 7 mil thick vinyl with a dielectric strength of 10,000 volts.
- D. Insulating Putty (600 volts and below): Pads or rolls of non-corrosive, self-fusing, one eighth inch thick rubber putty with PVC backing sheet. Putty shall be suitable for temperatures from minus 17.8 degrees C to 37.8 degrees C and shall have a dielectric strength of 570 volts/mil minimum.
- E. Terminal Strips: Shall be furnished in required quantity plus 25% spare. Install in continuous rows in terminal cabinets. Terminal strips shall be of the barriered open back, screw type with ampere ratings as required. All terminals shall be identified with numbering sequence being used for a particular system. Terminal strips shall be Beau Barrier or equal.

- F. Terminal Strip Connectors: Locking tongue style, pressure type, solderless lug.
- G. Crimp Type Connectors:
 - 1. Insulated fork or ring crimp terminals, tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support. Efcor "Quick-Crimping" Series, Thomas & Betts RA series or equal.
 - 2. All crimp type connectors or terminals shall be fastened using a crimping tool recommended by the connector manufacturer.
 - 3. Insulated overlap splices, tinned seamless electrolytic copper barrel with funnel wire entry and insulation support, Efcor #BG-200, CG-200 or DG-200, Thomas & Betts Series R or equal.
 - 4. Insulated butt splices, tinned seamless electrolytic copper barrel with center stop, funnel wire entry and insulation support. Efcor BH-200, CH-200, Thomas & Betts Series R or equal.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Unless otherwise noted, wires in sizes from #18 to #8 AWG, solid or stranded conductor, with insulation rated 105 degrees C or less shall be joined with electrical spring connectors.
- B. Fixtures Connection: Splice fixture wire to circuit wiring with electrical spring conductors.
- C. Stranded conductors from #6 AWG to 750 MCM shall be joined or tapped using bolted pressure connectors.
- D. Terminating Lugs: Conductors from size #6 AWG to 750 MCM copper, shall be terminated using compression terminating lugs.
- E. Terminate wires in Terminal Cabinets using terminal strip connectors.
- F. Install cable ties as required to maintain harnessing.

END OF SECTION 26 15 00

SECTION 26 19 00

SUPPORTING DEVICES

PART 1 - GENERAL

1.01 CONDITIONS

- A. All of the applicable requirements of Division 1 apply to the work of this Section.

1.02 WORK INCLUDED

- A. Conduit and equipment supports
- B. Fastening hardware

1.03 RELATED WORK

Section 03300 - Cast-in-Place Concrete

1.04 COORDINATION

Coordinate size, shape, and location of concrete pads with section 03300, Cast-in-place Concrete.

1.05 QUALITY ASSURANCE

Support system shall be adequate for weight of equipment and conduit, including wiring, that they carry.

1.06 SEISMIC DESIGN REQUIREMENTS

Refer to Section 01210,1.7.s.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Support Channel : Galvanized or painted steel.
- B. Hardware : Corrosion resistant.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors or preset inserts. Do not use spring - steel clips and clamps.

- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum-board partitions and walls; expansion anchors or expansion anchor on concrete surfaces; sheet-metal screws in sheet metal studs; and wood screws in wood construction.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.
- D. Do not use power-actuated anchors without written permission from the General Contractor.
- E. Do not drill structural-steel members without written permission from the General Contractor.
- F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hex-head bolts with spring-type lock washers under all nuts.
- G. In wet locations, install free-standing electrical equipment on concrete pads.
- H. Install surface-mounted cabinets and panelboards with at least four anchors.
- I. Bridge studs top bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

END OF SECTION 26 19 00

SECTION 26 45 20**GROUNDING****PART 1 - GENERAL****1-01 RELATED DOCUMENTS:**

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

1-02 SUMMARY:

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1-03 SUBMITTALS:

- A. General: Submit each item in this Article according to the Conditions of the contract and Division 1 Specification Sections.

PART 2 - PRODUCTS**2-01 MANUFACTURERS:**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Apache Grounding; Nashville Wire Products
 - 2. Change: A.B. Chance Co.
 - 3. Erico Inc.; Electrical products Group
 - 4. Heary Brothers Lightning Protection Co.
 - 5. Ideal Industries, Inc.
 - 6. ILSCO
 - 7. Kearney
 - 8. O-Z/Gedney Co.
 - 9. Racor, Inc.
 - 10. Thomas & Betts, Electrical
 - 11. Utilco Co.

2-02 GROUNDING AND BONDING PRODUCTS:

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of California Electrical Code (CEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2-03 WIRE AND CABLE GROUNDING CONDUCTORS:

- A. Equipment Grounding Conductors: Bare stranded copper cable
- B. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
- C. Bare Copper Conductors: Conform to the following:
 - 1. Solid Conductors: ASTM B3
 - 2. Assembly of Stranded Conductors: ASTM B8
 - 3. Tinned Conductors: ASTM B33

2-04 MISCELLANEOUS CONDUCTORS:

- A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Bonding Straps: Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, except as indicated.

2-05 CONNECTOR PRODUCTS:

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2-06 GROUNDING ELECTRODES:

- A. Grounding Rods: Copper-clad steel
 - 1. Minimum Size: 5/8 inch by 96 inches (16 by 2400 mm)

PART 3 - EXECUTION

3-01 APPLICATION:

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specified types, larger sizes, or more conductors than required by NEC are indicated.

3-02 INSTALLATION:

- A. General: Ground electrical systems and equipment according to CEC requirements, except where drawings or specifications exceed CEC requirements.
- B. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

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3-03 CONNECTIONS:

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Mask aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
 - 6. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
 - 7. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
 - 8. Tighten screws and bolt for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
 - 9. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

3-04 FIELD QUALITY CONTROL:

- A. Independent Testing Agency: Engage an independent electrical testing organization to perform tests described below.
- B. Tests: Subject the grounding system at the relocatable building to a megger test. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.
- C. Maximum grounding to resistance value shall not exceed 25 ohms.

- D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, provide additional grounding electrodes and retest until the specified value is achieved.
- E. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION 26452

SECTION 26 47 00**PANELBOARDS****PART 1: GENERAL****1-01 SUMMARY:**

- A. Section Includes: Lighting and power panelboards and associated auxiliary equipment rated 600 V and less.
- B. Related Sections:
 - 1. Section 26050 - Basic Electrical Materials and Methods
 - 2. section 26195 Electrical Identification
- C. Related Documents

1-02 SUBMITTALS:

- A. General:
- B. Product Data:
 - 1. Panelboards
 - 2. Accessory Items
 - 3. Specified Components
- C. Shop Drawings for panelboards, including:
 - 1. Plan
 - 2. Sections
 - 3. Elevations
 - 4. Indicate tabulations for installed devices, major features, and voltage rating including:
 - A. Enclosure type with details for types other than NEMA 250, Type 1.
 - B. Bus configuration and current ratings
 - C. Short-circuit current rating of panelboard
 - D. Features, characteristics, ratings and factory settings of individual protective devices and auxiliary components.
 - E. Wiring Diagrams: Details of schematic diagram including control wiring and differentiating between manufacturer-installed and field-installed wiring.
- D. Quality Assurance:
 - 1. qualification Data: For firms and persons specified in "Quality Assurance" Article.
 - 2. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

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E. Closeout Submittals:

1. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
2. Maintenance Data: For panelboard components to include in the maintenance manuals specified in Division 1. Include manufacturer's written instructions for testing circuit breakers.

1-03 QUALITY ASSURANCE:

- A. Testing Agency Qualifications: Comply with OSHA criteria for accreditation of testing laboratories, Title 29, Par 1907, or shall be a full member company of the InterNational Electrical Testing Association.
 1. Testing Agency's Field supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in engineering Technologies, to supervise on-site testing specified in Part 3.
- B. Listing and Labeling: Provide products specified in this section that are listed and labeled.
 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
- C. Comply with NFPA 70.
- D. Comply with NEMA PB 1

1-04 EXTRA MATERIALS:

- A. Keys: 6 spares of each type for panelboard cabinet lock.

PART 2: PRODUCTS

2-01 MANUFACTURERS:

- A. Available Manufacturers: subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. American Circuit Breaker corp.
 2. Eaton Corp.: Westinghouse & Cutler-Hammer Products
 3. General Electric Co.; Electrical Distribution & Control Div.
 4. Siemens Energy & Automation, Inc.
 5. Square D Co.

2-02 MANUFACTURED UNITS:

- A. Panelboard Fabrication:

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1. Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA PB 1, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
 - A. Outdoor Locations: NEMA 250, Type 3F.
 - B. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - C. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - D. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
2. Front: Secured to box with concealed trim clamps. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box.
3. Directory Frame: Metal, mounted inside each panelboard door.
4. Bus: Hard drawn copper of 98 percent conductivity.
5. Main and Neutral Lugs: Compression type.
6. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
7. Service Equipment Approval: Listed for use as service equipment for panelboards with main service disconnect.
 - A. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 - B. Hinged Front Cover: Entire front trim hinged to box with standard door within hinged trim cover.
 - C. Split Bus: Vertical bus of indicated panelboards divided into 2 vertical sections with connections as indicated.
 - D. Skirt for surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and floor.
8. Extra Gutter Space: Dimensions and arrangement as indicated.
 - A. Gutter Barrier: Arranged to isolate section of gutter as indicated.
 - B. Column type Panelboard configuration: Narrow cabinet extended as wireway to overhead junction box equipped with ground and neutral terminal bases.
 - C. Subfeeder: Overcurrent protective device or lug provision as indicated.
9. Feed-through Lugs: Sized to accommodate feeders indicated.

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B. Lighting and Appliance Branch-Circuit Panelboards:

1. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
2. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

C. Distribution Panelboards:

1. Doors: In panelboard front, except omit in fusible-switch panelboard, unless otherwise indicated. Secure door with vault-type latch with tumbler lock, all keyed alike.
2. Branch-Circuit Breakers: Where overcurrent protective devices are indicated to be circuit breakers, use bolt-on circuit breakers, except circuit breakers 225-A frame size and greater may be plug-in type where individual positive-locking device requires mechanical release for removal.

B. Overcurrent Protective Devices:

1. Molded-Case Circuit Breaker: NEMA AB 1, handle lockable.
 - A. Characteristics: frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
 - B. Application Listing: Appropriate for application, including type SWD for switching fluorescent lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.
 - C. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
 - D. Circuit Breakers, 400 A and Larger: Field-adjustable short-time and continuous current settings.
 - E. Current-Limiting Trips: Where indicated, let-through ratings less than NEMA FU 1, Class RK-5.
 - F. Current Limiters: Where indicated, integral fuse listed for circuit breaker.
 - G. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
 - H. Shunt Trip: Where indicated.
2. Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses, handle lockable.

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C. Transient Voltage surge Suppressor:

1. Description: IEEE C62.41, selected to meet requirements for category indicated.
 - A. Exposure: Low
2. Impulse sparkover voltage coordinated with system circuit voltage.
3. Factory mounted with UL-recognized mounting devices.

D. Controllers:

1. Motor Controllers: NEMA ICS 2, Class A combination controller equipped for panelboard mounting, with the following accessories and pilot devices as indicated:
 - A. Individual control power transformers.
 - B. Fuses for control power transformers
 - C. Bimetallic element overload relay.
2. Contractors: NEMA ICS 2, Class A combination controller equipped for panelboard mounting, with the following accessories and pilot devices as indicated:
 - A. individual control power transformers.
 - B. Fuses for control power transformers.
 - C. Indicating lights.
 - D. Seal-in contact.
 - E. At least one convertible auxiliary contact. Provide more as indicated.
 - F. Push buttons.
3. Controller Disconnect Switches: Fusible switch integral with or adjacent to and interlocked with controller.
4. Contractors in Main Bus: NEMA ICS 2, Class A, mechanically held general-purpose controller, with current rating, poles, and connections as indicated; factory mounted in indicated panelboard.
 - A. Control power Source: Control-power transformer of capacity indicated, with fused primary and secondary terminals, and connected to main bus ahead of contactor connection.

E. Accessory Components and Features:

1. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.
2. Portable Test Set: Arranged to permit testing of functions of solid-state trip devices without removal from panelboard.

PART 3: EXECUTION

3-01 INSTALLATION:

- A. Install panelboards and accessory items according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.
- C. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.
- D. Circuit Directory; Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.
- E. Install filler plates in unused spaces.
- F. Wiring in Panelboard gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.
- G. Identification:
 - 1. Identify field-installed wiring and components and provide warning signs as specified in Division 16 Section "Basic Electrical Materials and Methods."
 - 2. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion resistant screws.
- H. Grounding:
 - 1. Make equipment grounding connection for panelboards as indicated.
 - 2. Provide ground continuity to main electrical ground bus as indicated.
- I. Connections:
 - 1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3-02 FIELD QUALITY CONTROL:

- A. Prepare for acceptance tests as follows:
 - 1. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.
 - 2. Make continuity tests of each circuit.
- B. Testing Agency: provide services of a qualified independent testing agency to perform specified testing.

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- C. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
3. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.
- D. Balancing Loads: After Substantial Completion, but not more than 2 months after Final Acceptance, conduct load-balancing measurements and make circuit changes as follows:
1. Perform measurements during period of normal working load as advised by Owner.
 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 3. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
 4. Tolerances: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as required to meet this minimum requirement.
- E. Infrared Scanning: After Substantial Completion, but not more than 2 months after Final Acceptance, perform an infrared scan of each panelboard. Remove fronts to make joints and connections accessible to a portable scanner.
1. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scanning of each panelboard 11 months after date of Substantial completion.
 2. Instrument: Use an approved infrared scanning device designed to measure temperature or detect significant deviations from normal values. Provide calibration record for device used.
 3. Record of Infrared Scanning: Prepare a certified report identifying panelboards checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3-03 ADJUSTING:

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3-04 CLEANING:

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- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 26470

SECTION 26 48 10
MOTOR CONTROLLERS

PART 1: GENERAL

1-01 RELATED DOCUMENTS:

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

1-02 SUMMARY:

- A. This Section includes AC motor-control devices rated 600V and less that are supplied as enclosed units.
- B. Related Sections include the following:
 - 1. Division 26 Section "Basic Electrical Materials and Methods" for general materials and installation methods.
 - 2. Division 26 - Section "Electrical Identification" for labeling materials.
 - 3. Division 26 - Section "Fuses"

1-03 SUBMITTALS:

- A. Product Data: For products specified in this Section. Include dimensions, ratings, and data on features and components.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For products to include in the maintenance manuals specified in Division 1.
- D. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1-04 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Maintain, within 100 miles (160 km) of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Field Testing Agency Qualifications: An independent testing agency with experience and capability to satisfactorily conduct testing indicated without delaying the Work. Evaluation criteria shall be according to ASTM E 699.
- C. Source Limitations: Obtain similar motor-control devices through one source from a single manufacturer.
- D. Comply with NFPA 70.

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- E. Listing and Labeling: Provide motor controllers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": s defined in the California Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

1-05 COORDINATION:

- A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.
- B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

1-06 EXTRA MATERIALS:

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Spare Fuses and Incandescent Indicating Lamps: furnish 1 spare for every 5 installed units, but not less than 1 set of 3 of each kind.

PART 2: PRODUCTS

2-01 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
 - 2. Allen-Bradley Co.; Industrial Control Group.
 - 3. Crouse-Hinds ECM; Cooper Industries, Inc. Div.
 - 4. General Electric Co.; Electrical Distribution & Control Div.
 - 5. Siemens Energy & Automation, Inc.
 - 6. Square D Co.

2-02 MANUAL MOTOR CONTROLLERS:

- A. Description: NEMA ICS 2, general purpose, Class A with toggle action and overload element.

2-03 MAGNETIC MOTOR CONTROLLERS:

- A. Description: NEMA ICS 2 , Class A, full voltage, nonreversing, across the line, unless

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otherwise indicated.

- B. Control Circuit: 120V; obtained from integral control power transformer, unless otherwise indicated. Include a control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
- C. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.
 - 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses indicated. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by a Nationally Recognized Testing Laboratory.
 - 2. Nonfusible Disconnect: NEMA KS 1, heavy-duty, nonfusible switch.
 - 3. Circuit Breaker Disconnect: NEMA AB 1, motor-circuit protector with field-adjustable short-circuit trip coordinated with motor locked-rotor amperes.
- D. Overload Relay: Ambient-compensated type with inverse-time-current characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect, and with appropriate adjustment for duty cycle.
- E. Overload Relay: NEMA ICS 2, Class 10 tripping characteristics selected to protect motor against voltage unbalance and single phasing.

2-04 ENCLOSURES:

- A. Description: Flush or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - 3. Other Wet or Damp Indoor Locations: NEMA 205, Type 4.

2-05 ACCESSORIES:

- A. Devices are factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break push-button station with a factory-applied hasp arranged so a padlock can be used to lock push button in depressed position with control circuit open.
- D. Control Relays: Auxiliary and adjustable time-delay relays.

PART 3: EXECUTION

3-01 APPLICATIONS:

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- A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Use fractional-horsepower manual controllers for single-phase motors, unless otherwise indicated.
- D. Use manual controllers for 3-phase motors up to 5 hp not requiring automatic or remote control.
- E. Push-Button Stations: In covers of magnetic controllers of manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact of low-voltage protection.
- F. Hand-Off-automatic Selector Switches: In covers of manual and magnetic controllers of motors started and stopped by automatic controls or interlocks with other equipment.

3-02 INSTALLATION:

- A. Install independently mounted motor-control devices according to manufacturer's written instructions.

3-03 IDENTIFICATION:

- A. Identify motor-control components and control wiring according to Division 16 Section "Electrical Identification."

3-04 CONTROL WIRING INSTALLATION:

- A. Install wiring between motor-control devices according to Division 16 Section "Wires and Cables."
- B. Bundle, train, and support wiring in enclosures
- C. Connect hand-off-automatic switch and other automatic control devices where available.
 - 1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
 - 2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3-05 CONNECTIONS:

- A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

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3-06 CLEANING:

- A. Remove paint splatters and other spots, dirt, and debris. Touch-up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

END OF SECTION 26 48 10

SECTION 26 85 00**FIRE ALARM SYSTEM****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Expandable emergency evacuation fire alarm system.

1.2 REFERENCES section 26 00 00**1.3 SYSTEM DESCRIPTION**

- A. A new intelligent reporting, Style 7 networked, fully peer-to-peer, microprocessor-controlled fire detection and emergency voice alarm communication system shall be installed in accordance with the specifications and as indicated on the Drawings.
- B. Each Signaling Line Circuit (SLC) and Notification Appliance Circuit (NAC): Limited to only 80 percent of its total capacity during initial installation.
- C. Basic Performance:
 - 1. Network Communications Circuit (NetSOLO) Serving Network Nodes: Wired using single twisted non-shielded 2-conductor cable or connected using approved fiber optic cable between nodes in Class A configuration.
 - 2. Signaling Line Circuits (SLC) Serving Addressable Devices: Wired Class A.
 - 3. Initiation Device Circuits (IDC) Serving Non-addressable Devices Connected to Addressable Monitor Modules: Wired Class A.
 - 4. Notification Appliance Circuits (NAC) Serving Strobes, Horns and Speakers: Wired Class A.
 - 5. On Class A Configurations: Single ground fault or open circuit on Signaling Line Circuit shall not cause system malfunction, loss of operating power, or ability to report alarm.
 - 6. Alarm Signals Arriving at INCC COMMAND CENTER: Not be lost following primary power failure until alarm signal is processed and recorded.
 - 7. Transponders:
 - a. Operate in peer-to-peer fashion with other panels and transponders in system.
 - b. Each transponder shall store copy of audio evacuation messages and tones.
 - c. Systems that use centralized message storage and control at main fire alarm control panel shall not be acceptable.
 - 8. Network Node Communications, Audio Evacuation Channels and Fire Phone Communications:
 - a. Communicated between panels and transponders on single twisted pair of copper wires or fiber optic cables.
 - b. To enhance system survivability, ability to operate on loss of INCC Command Center, short or open of entire riser at INCC Command Center shall be demonstrated at time of system acceptance testing.
 - c. Systems that are not capable of providing true Class A performance for fire fighter's phone communications shall not be acceptable.
 - 9. Signaling Line Circuits (SLC):

- a. Reside in remote transponders with associated audio zones.
 - b. SLC modules shall operate in peer-to-peer fashion with all other panels and transponders in system.
 - c. On loss of INCC Command Center, each transponder shall continue to communicate with remainder of system, including all SLC functions and audio messages located in all transponders.
 - d. Systems that provide a "Degraded" mode of operation upon loss of INCC Command Center or short in riser shall not be acceptable.
 10. Audio Amplifiers and Tone-Generating Equipment: Electrically supervised for normal and abnormal conditions.
 11. Amplifiers: Located in transponder cabinets serving no more than 3 floors per transponder to enhance system survivability, reduce required riser wiring, simplify installation, and reduce power losses in length of speaker circuits.
 12. Speaker NAC Circuits: Arranged such that there is a minimum of 1 speaker circuit per fire alarm zone.
 13. Notification Appliance Circuits (NAC), Speaker Circuits, and Control Equipment: Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.
 14. Speaker Circuits:
 - a. Electrically supervised for open and short circuit conditions.
 - b. If short circuit exists on speaker circuit, it shall not be possible to activate that circuit.
 - c. Arranged for 25 or 70 VRMS and shall be power limited in accordance with NEC
 - d. 20 percent spare capacity for future expansion or increased power output requirements.
 15. Speaker Circuits and Control Equipment:
 - a. Arranged such that loss of any 1 speaker circuit will not cause loss of any other speaker circuit in system.
 - b. Systems utilizing "bulk" audio configurations shall not be acceptable.
 16. 2-Way Telephone Communication Circuits:
 - a. Shall communicate digitally over the network between transponders.
 - b. Supervised for open and short circuit conditions.
 - c. Short circuit condition on 2-way telephone communications circuit shall result in trouble condition and not result in call-in condition.
 17. Voice Communication:
 - a. Connect telephone circuits to speaker circuits to allow voice communication over speaker circuit from telephone handset.
 - b. Capable of remote phone-to-phone conversations and party-line communications as required.
- D. Basic System Functional Operation: When fire alarm condition is detected and reported by 1 of the system alarm initiating devices, the following functions shall immediately occur:
1. System Alarm LEDs: Flash.
 2. Local Piezo-Electric Signal in Control Panel: Sound at a pulse rate.
 3. 80-Character LCD Display: Indicate all information associated with fire alarm condition, including type of alarm point and its location within protected premises.
 4. Historical Log: Record information associated with fire alarm control panel condition, along with time and date of occurrence. History Log shall have capacity for recording up to 4,100 events.
 5. System output programs assigned via control-by-event equations to be activated by particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
 - a. Close Fire Doors

- b. Shot down air handlers as required by code
 - c. Notify the Central Station or Municipal Tie.
- 6. Strobes flash synchronized continuously.
- 7. Audio Portion of System: Sound alert tone followed by pre-recorded message determined by event and this scenario repeating or other message as approved by local authority until system is reset.
- E. Fire Alarm System Functionality:
 - 1. Provide complete, electrically supervised distributed, Class A networked analog/addressable fire alarm and control system, with analog initiating devices, integral multiple-channel voice evacuation, and fire fighter's phone system.
 - 2. Fire Alarm System:
 - a. Consist of multiple-voice channels with no additional hardware required for total of 4 channels.
 - b. Incorporate multiprocessor-based control panels, including model E3 Series modules includes Intelligent Network INCC Command Center(s) (INCC), Intelligent Loop Interface (ILI-MB-E3 or ILI95-MB-E3), Intelligent Network Transponders (INX), communicating over peer-to-peer token ring network with standard capacity of up to 64 nodes expandable to 122.
 - 3. Each ILI-MB-E3 or ILI95-MB-E3 Node: Incorporate 2 Signaling Line Circuits (SLC), with capacity to support in Velociti ® mode up to 159 analog addressable detectors and 159 addressable modules per ILI-MB-E3 SLC or support in Apollo mode up to 126 detectors and modules per ILI95-MB-E3 SLC.
 - 4. Voice, Data, and Fire Fighter's Phone Riser: Transmit over single pair of wires or fiber optic cable.
 - 5. Each Intelligent Network Transponder: Capable of providing 16 distributed voice messages, fire fighter phones connections, SLC loop for audio control devices, and integral network interface.
 - 6. Each Network Node: Incorporate Boolean control-by-event programming, including as a minimum AND, OR, NOT, and Timer functions.
 - 7. Control Panels: Capability to accept firmware upgrades via connection with laptop computer, without requirement of replacing microchips.
 - 8. Network:
 - a. Based on peer-to-peer token ring technology operating at 625 K baud, using Class A configuration.
 - b. Capability of using twisted-pair wiring, pair of fiber optic Multi-mode cable strands up to 200 microns or Single-mode optimized for 9/125 microns, or any combination, to maximize flexibility in system configuration.
 - 9. Each Network Node:
 - a. Capability of being programmed off-line using Windows-based software supplied by fire alarm system manufacturer. Capability of being downloaded by connecting laptop computer into any other node in system. Systems that require system software to be downloaded to each transponder at each transponder location shall not be acceptable.
 - b. Capability of being grouped with any number of additional nodes to produce a "Region", allowing that group of nodes to act as 1, while retaining peer-to-peer functionality. Systems utilizing "Master/Slave" configurations shall not be acceptable.
 - c. Capability of annunciating all events within its "Region" or annunciating all events from entire network, on front panel LCD or touchscreen display without additional equipment.
 - 10. Each SLC Network Node: Capability of having integral DACT (digital alarm communicator transmitter) that can report events in either its region, or entire network to single central station monitoring account.

11. Each Control Panel: Capability of storing its entire program, and allow installer to activate only devices that are installed during construction, without further downloading of system.
12. Password Protection: Each system shall be provided with 4 levels of password protection with up to 16 passwords.
13. Have the capacity for multiple pre-recorded messages (at least sixteen (16), but more if required by local AHJ) and address a list of subjects.
 - a. Fire evacuation and relocation
 - b. Intruder or hostile person sighted within or around the building grounds
 - c. Directions to occupants to take cover within building
 - d. Emergency weather conditions appropriate for local area
 - e. All Clear

1.4 SUBMITTALS

- A. Comply with Section 01330 (01 33 00) - Submittal Procedures.
- B. Include sufficient information, clearly presented, to determine compliance with the specifications and the Drawings.
- C. Equipment Submittals:
 1. Cover Page: Indicate the following:
 - a. Project name and address.
 - b. Engineered systems distributor's name and other contact information.
 - c. Installing contractor's name and other contact information.
 - d. Date of equipment submittals. Indicate on revised submittals the original submittal date and revised submittal date.
 2. Table of Contents: Lists each section of equipment submittal.
 3. Scope of Work Narrative: Detail indented scope of work.
 4. Sequence of Operations: Use matrix or written text format, detailing activation of each type of device and associated resulting activation of the following:
 - a. Control panel.
 - b. Annunciator panels.
 - c. Notification appliances.
 - d. Building fire safety functions, including elevator recall, elevator power shutdown, door lock release, door holder release, HVAC unit shutdown, smoke evacuation system activation, and stair pressurization fan activation.
 5. Bill of Material: Indicate for each component of system the following:
 - a. Quantity.
 - b. Model number.
 - c. Description.
 6. SLC Circuit Schedule: Detail address and associated description of each addressable device. Clearly provide information that indicates number of both active and spare addresses.
 7. Battery Calculations: Show load of each of, and total of, components of system along with standby and alarm times that calculations are based on. Show calculated spare capacity and size of intended battery.
- D. Shop Drawings:
 1. Cover Page: Indicate the following:
 - a. Project name and address.
 - b. Engineered systems distributor's name and other contact information.
 - c. Installing contractor's name and other contact information.
 - d. Date of equipment submittals. Indicate on revised submittals the original submittal

- date and revised submittal date.
 - 2. Floor Plans:
 - a. Provide separate floor plan for each floor.
 - b. If a floor plan must be split using match lines to fit on the page, provide match lines and match line references that refer to sheet number that shows area on opposite side of match line.
 - c. Prepare using AutoCAD.
 - d. Prepare to scale 1/8 inch = 1'-0", unless otherwise required by the Architect or Engineer.
 - e. Show equipment and device locations.
 - f. Show wiring information in point-to-point format.
 - g. Show conduit routing, if required by the AHJ.
 - 3. Title Block: Provide on each sheet and include, at a minimum, the following:
 - a. Project name.
 - b. Project address.
 - c. Sheet name.
 - d. Sheet number.
 - e. Scale of drawing.
 - f. Date of drawing.
 - g. Revision dates, if applicable.
 - 4. Control Panel: Provide sheet that details exterior and interior views of control panel and clearly shows associated wiring information.
 - 5. Annunciator Panels: Provide sheet that details exterior and interior views of annunciator panels and clearly shows associated wiring information.
- E. Certification: Submit with equipment submittals and shop drawings, letter of certification from major equipment manufacturer, indicating proposed engineered system distributor is an authorized representative of major equipment manufacturer.
- F. Project Record Drawings:
- 1. Submit complete project record drawings within 14 calendar days after acceptance test.
 - 2. Project record drawings shall be similar to shop drawings, but revised to reflect changes made during construction.
- G. Operation and Maintenance Manuals:
- 1. Submit complete operation and maintenance manuals within 14 calendar days after acceptance test.
 - 2. Operation and maintenance manuals shall be similar to equipment submittals, but revised to reflect changes made during construction.
 - 3. Include factory's standard installation and operating instructions.
- 1.5 QUALITY ASSURANCE**
- A. Codes and Standards:
- B. Equipment, Programming, and Installation Supervision:
- 1. Provide services of approved Platinum Level engineered systems distributor of Gamewell-FCI for equipment, programming, and installation supervision.
 - 2. Provide proof of factory training within 14 calendar days of award of the Contract.
- C. Software Modifications:
- 1. Provide services of Platinum Level Gamewell-FCI factory-trained and authorized technician

- to perform system software modifications, upgrades, or changes.
- 2. Provide use of all hardware, software, programming tools, and documentation necessary to modify fire alarm system software on-site.
- 3. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones.
- 4. System structure and software shall place no limit on type or extent of software modifications on-site.
- 5. Modification of software shall not require power-down of system or loss of system fire protection while modifications are being made.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials from damage during handling and installation.

1.7 COORDINATION

- A. Coordinate the Work of this section with the Work of other sections, including sprinkler systems as specified in Section_____, elevators as specified in Section_____, HVAC systems as specified in Section_____, and security/door locking systems as specified in Section_____.

1.8 WARRANTY

- A. Warranty Period for System Equipment: 1 year from date of final acceptance.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer and system devices model number are listed per plans.
- B. References to manufacturer's model numbers and other information is intended to establish minimum standards of performance, function, and quality

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and surfaces to receive fire alarm system.
 - 1. Notify Architect of conditions that would adversely affect installation or subsequent use.
 - 2. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

- A. Install fire alarm system in accordance with NFPA 72, NFPA 70, state and local codes, manufacturer's instructions, and as indicated on the Drawings.

- B. Conceal conduit, junction boxes, and conduit supports and hangers in finished areas. Conceal or expose conduit, junction boxes, and conduit supports and hangers in unfinished areas.
- C. Do not install smoke detectors before system programming and test period. If construction is ongoing during this period, take measures to protect smoke detectors from contamination and physical damage.
- D. Flush-mount fire detection and alarm system devices, control panels, and remote annunciators in finished areas. Flush-mount or surface-mount fire detection and alarm system devices, control panels, and remote annunciators in unfinished areas.
- E. Ensure manual stations are suitable for surface mounting or semi-flush mounting as indicated on the Drawings. Install not less than 42 inches, nor more than 48 inches, above finished floor measured to operating handle.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide service of competent, factory-trained technician authorized by manufacturer to technically supervise and participate during pre-testing and acceptance testing of system.
- B. Testing:
 - 1. Conduct complete visual inspection of control panel connections and test wiring for short circuits, ground faults, continuity, and insulation before energizing cables and wires.
 - 2. Close each sprinkler system control valve and verify proper supervisory alarm at INCC Command Center.
 - 3. Verify activation of flow switches.
 - 4. Open initiating device circuits and verify that trouble signal actuates.
 - 5. Open signaling line circuits and verify that trouble signal actuates.
 - 6. Open and short notification appliance circuits and verify that trouble signal actuates.
 - 7. Ground initiating device circuits and verify response of trouble signals.
 - 8. Ground signaling line circuits and verify response of trouble signals.
 - 9. Ground notification appliance circuits and verify response of trouble signals.
 - 10. Check alert tone and prerecorded voice message to alarm notification devices.
 - 11. Check installation, supervision, and operation of intelligent smoke detectors.
 - 12. Introduce on system each of the alarm conditions that system is required to detect. Verify proper receipt and proper processing of signal at INCC Command Center and correct activation of control points.
 - 13. Consult manufacturer's manual to determine proper testing procedures when system is equipped with optional features. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality, and similar.
- C. Acceptance Testing:
 - 1. Before installation shall be considered completed and acceptable by AHJ, a complete test using as a minimum, the following scenarios shall be performed and witnessed by representative approved by Engineer. Monitoring company and/or fire department shall be notified before final test in accordance with local requirements.
 - 2. Contractor's job foreman, in presence of representative of manufacturer, representative of Owner, and fire department shall operate every installed device to verify proper operation and correct annunciation at control panel.
 - 3. Open signaling line circuits and notification appliance circuits in at least 2 locations to verify

- presence of supervision.
4. Completely disconnect INCC Command Center from rest of network, including Voice INCC Command Center. Activate initiating device from transponder. All speaker circuits activated from each transponder shall transmit the correct evacuation or alert message. These messages shall be same messages transmitted with INCC Command Center activated. Default tones or messages shall not be acceptable.
 5. Completely disconnect INCC Command Center from rest of network. Activate initiating device. All control outputs supported by transponder SLC circuits shall operate under project programming mode. Default or degrade mode programming shall not be acceptable.
 6. Fire fighter phone riser shall be directly shorted between INCC Command Center and first transponder, followed by test of fire phones between INCC Command Center and farthest transponder. Phones shall operate in normal fashion.
 7. All audio risers shall be directly shorted between INCC Command Center and first audio transponder, followed by activation of alarm initiating device. Correct pre-recorded messages shall transmit from all speakers, including evacuation and alert channels. Default or degrade messages shall not be acceptable.
 8. When testing has been completed to satisfaction of both Contractor's job foreman and representatives of manufacturer and Owner, a notarized letter co-signed by each attesting to satisfactory completion of said testing shall be forwarded to Owner and fire department.
 9. Leave fire alarm system in proper working order and, without additional expense to Owner, replace defective materials and equipment provided within 1 year (365 days) from date of final acceptance by the owner.

3.4 DEMONSTRATION

- A. Provide instruction as required for operating fire alarm system.
- B. Provide hands-on demonstrations of operation of fire alarm system components and functions.

END OF SECTION