

SALT LAKE COMMUNITY COLLEGE ROOFTOP SOLAR ARRAY

SANDY, UTAH

**OWNER
DIVISION OF FACILITIES &
CONSTRUCTION MANAGEMENT
4110 STATE OFFICE BUILDING
SALT LAKE CITY, UTAH 84114**

**DFCM PROJECT
11018680**

**CONSTRUCTION
DOCUMENTS**

DIVISIONS 0 THRU 33

04 MAY 2011



VCBO ARCHITECTURE
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DIVISION 0 – BIDDING AND CONTRACT REQUIREMENTS

Section 00 3100	Available Information with Agreement Concerning Drawing Files on Electronic Media
Section 00 3101	Exemption Certificate

Refer to Division of Facilities Construction and Management (DFCM) website (dfcm.utah.gov) for documents related to State of Utah contract requirements.

SECTION 00 3100

AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.1 AGREEMENT CONCERNING DRAWING FILES ON ELECTRONIC MEDIA

- A. The electronic files will be distributed from the Architect to the General Contractor only once the following form has been signed. It will be the General Contractor's responsibility to control distribution.
- B. Valentiner Crane Brunjes Onyon Architects, L.L.C. (the Architect) does not assume any responsibility for the accuracy of the information contained in these drawing files. Any and all users are aware that differences may exist between the electronic files delivered and the printed hard-copy construction documents. In the event of a conflict between the signed and sealed hard-copy construction documents prepared by the Architect and the electronic files, the signed or sealed hard-copy construction documents shall govern.
- C. Any and all users who may obtain these drawings **from the General Contractor** under this agreement, including but not limited to; subcontractors, vendors, suppliers etc., agree to indemnify and hold harmless the Architect, its officers, directors, employees and sub-consultants against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising from any changes made by anyone other than the Architect or from any transfer or reuse of the electronic files including data contained in the files without the prior written consent of the Architect.
- D. Building Information Model (BIM) drawing files will be made available to the Contractor and its subcontractors for the purposes of preparing submittals for their portion of the work **only** after the "Agreement Concerning Drawing Files on Electronic Media" has been signed by the General Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

AGREEMENT CONCERNING DRAWING FILES ON ELECTRONIC MEDIA

Valentiner Crane Brunjes Onyon Architects, L.L.C. (the Architect) does not assume any responsibility for the accuracy of the information contained in these digital models. Any and all users are aware that differences may exist between the electronic files delivered and the printed hard-copy construction documents. In the event of a conflict between the signed and sealed hard-copy construction documents prepared by the Architect and the electronic files, the signed or sealed hard-copy construction documents shall govern.

Any and all users who may obtain these digital models from the General Contractor under this agreement, including but not limited to; subcontractors, vendors, suppliers etc., agree to indemnify and hold harmless the Architect, its officers, directors, employees and sub-consultants against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising from any changes made by anyone other than the Architect or from any transfer or reuse of the electronic files without the prior written consent of the Architect.

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

The digital Building Information Models provided will contain information as provided on construction documents. The user shall remove all notes, text, detail cuts and member designations from the electronic file prior to use. If used as submittal documents, submittals will be rejected if non-compliant. The drawing files provided by VCBO may not be reproduced or distributed to individuals outside the company or collective organization signing this agreement.

LIST OF DRAWINGS:

Project Name: **DFCM – SALT LAKE COMMUNITY COLLEGE ROOFTOP SOLAR ARRAY**
VCBO Project # **11010**

List of Revit Models: **Architectural, Structural, Mechanical and Electrical.**

ACCEPTANCE OF TERMS, CONDITIONS & LIMITATIONS:

Name of Company/Contractor

Signature of Company/Contractor
Representative

Printed Name of Individual Signing

Position/Title

Date

This agreement must be signed and returned to VCBO prior to release of any electronic document.

SECTION 00 3101

EXEMPTION CERTIFICATE

PART 1 - GENERAL

1.1 SUMMARY

- A. The **Salt Lake Community College** will take advantage of the new Tax Exempt Law effective January 1, 1996. Tax Exempt Form **TC-721G** must be used by the vendor when purchasing construction materials. Attached is a copy of Form TC-721G which must be completed and signed by the College Financial Officer or designee at the time of bid award.



Utah State Tax Commission

Exemption Certificate for Governments & Schools

(Sales, Use, Tourism and Motor Vehicle Rental Tax)

TC-721G

Rev. 12/08

Name of institution claiming exemption (purchaser)		Telephone Number	
Street Address	City	State	ZIP Code
Authorized Signature	Name (please print)	Title	
Name of Seller or Supplier:			Date

The person signing this certificate **MUST** check the applicable box showing the basis for which the exemption is being claimed. Questions should be directed (preferably in writing) to Taxpayer Services, Utah State Tax Commission, 210 N 1950 W, Salt Lake City, UT 84134. Telephone (801) 297-2200, or toll free 1-800-662-4335.

DO NOT SEND THIS CERTIFICATE TO THE TAX COMMISSION
Keep it with your records in case of an audit.

UNITED STATES GOVERNMENT OR NATIVE AMERICAN TRIBE
I certify the tangible personal property or services purchased are to be paid directly with funds from the entity noted on this form and will be used in the exercise of essential governmental or tribal functions. NOTE: Includes sales of tangible personal property to federally chartered credit unions. "Directly" does not include per diem, entity advances or similar indirect payments.

CONSTRUCTION MATERIALS PURCHASED FOR SCHOOLS OR PUBLIC TRANSIT DISTRICTS
I certify the construction materials purchased are on behalf of a public elementary or secondary school, or public transit district. I further certify the purchased construction materials will be installed or converted into real property owned by the school or public transit district.
Name of school or public transit district: _____
Name of project: _____

UTAH STATE AND LOCAL GOVERNMENTS AND PUBLIC ELEMENTARY AND SECONDARY SCHOOLS
Sales Tax License No. _____
I certify the tangible personal property or services purchased are to be paid directly with funds from the entity noted on this form and will be used in the exercise of that entity's essential functions. For construction materials, if the purchaser is a Utah state or local government, these construction materials will be installed or converted into real property by employees of this government entity. "Directly" does not include per diem, entity advances, or similar indirect payments. **CAUTION:** This exemption does not apply to government or educational entities of other states.

To be valid this certificate must be filled in completely, including a check mark in the proper box.

A sales tax license number is required only where indicated.

Please sign, date and, if applicable, include your license or exemption number.

NOTE TO SELLER: Keep this certificate on file since it must be available for audit review.

NOTE TO PURCHASER: Keep a copy of this certificate for your records. You must notify the seller of cancellation, modification, or limitation of the exemption you have claimed.

If you need an accommodation under the Americans with Disabilities Act, contact the Tax Commission at (801) 297-3811 or TDD (801) 297-2020. Please allow three working days for a response.

DIVISION 1 - GENERAL REQUIREMENTS

Section 01 1000	Summary of Work
Section 01 1900	Definitions and Standards
Section 01 2600	Contract Modification Procedures
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Section 01 7900	Demonstration and Training

SECTION 01 1000
SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Requirements of **DIVISION 0 - BIDDING REQUIREMENTS** and **DIVISION 1 - GENERAL REQUIREMENTS** apply to **every section** contained in the Project Manual, and shall govern the execution of Work required by the Contract Documents.
- B. Provide everything necessary for and incidental to proper and satisfactory completion of all Work specified and indicated or shown in the Contract Documents.
- C. The Project consists of the construction of **roof top solar arrays** at Salt Lake Community College, Miller Campus.

1.2 PROJECT LOCATION

- A. New solar arrays will be located atop the **Miller Automotive Training Center** at Salt Lake Community College Miller Campus, 9750 South 300 West, Sandy, Utah.

1.3 SEPARATE CONTRACTS

- A. **The Owner may enter into separate contracts for construction.** Each contractor shall be responsible to coordinate efforts with other trade contractors to ensure timely completion of the work.
- B. **Coordinate the Work** of this contract with the work of separate contractors to ensure timely completion of the work.

1.4 CODES

- A. **Law of place of building governs.** Conform to applicable requirements of the latest editions of the **International Building Code**, International **Building Code Standards**, International **Mechanical Code**, International **Plumbing Code**, National **Electrical Code**, **National Fire Protection Association** requirements, local ordinances, and **OSHA** requirements applicable to this project, unless a higher standard is called for, without additional cost to the Owner.
- B. **Comply with CABO/ANSI A117.1**, American National Standard, "**Accessible and Usable Buildings and Facilities**" latest edition which is in force for the project location, for handicapped accessibility.

1.5 CONTRACTOR USE OF PREMISES

- A. **General:** During the construction period the Contractor shall have use of the premises for construction operations, including:
 - 1. The Contractor's use of the premises is limited only by the **Owner's right** to perform work or to **retain other contractors** on portions of the Project

- B. **Use of the Site:** Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
1. **Driveways and Entrances:** Keep driveways and entrances serving the premises clear and available to emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 2. **Do not unreasonably encumber the site** with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary obtain and pay for such storage off-site.
 3. **Lock automotive type vehicles** such as passenger cars and trucks and other types of mechanized and motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place.

1.6 INCIDENTAL WORK

- A. **Any work**, materials or equipment that **may reasonably be inferred** from the **Contract Documents** as being required to produce the intended result shall be supplied by the Contractor at no additional cost to the owner whether or not specifically called for in the Contract Documents.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

END OF SECTION

SECTION 01 1900

DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. **Definitions:** Basic Contract definitions are included in the General Conditions.
1. **Directed:** Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted" mean "directed by the Architect", "requested by the Architect", and similar phrases. However, no implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
 2. **Approve:** The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the duties and responsibilities of the Architect as stated in General and Supplementary Conditions. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.
 3. **Furnish:** The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
 4. **Install:** The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
 5. **Provide:** The term "provide" means "to furnish and install, complete and ready for the intended use."
 6. **Protect:** Except as otherwise defined in greater detail, the term "protect" is used to describe the process of shielding from harm existing fixtures, elements or materials.
- B. **Specification Format and Conventions:**
1. **Specification Format:** The Specifications are organized into Divisions and Sections using the 33 division format and CSI/CSC's "MasterFormat" numbering system.
 - a. **Section Identification:** The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
 2. **Specification Content:** The Specifications use certain conventions for style of language and the intended meaning of terms, words, and phrases when used in particular situations. These conventions are as follows.
 - a. **Abbreviated Language:** Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

SECTION 01 2600

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. **Related Sections include the following:**
 - 1. **Division 1 Section "Product Requirements"** for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. **Architect will issue supplemental instructions** authorizing **Minor Changes** in the Work, **not involving** adjustment to the **Contract Sum** or the **Contract Time**, on forms issued by the **Architect** or the **Owner**.

1.4 PROPOSAL REQUESTS

- A. **Owner-Initiated Proposal Requests:** Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. **Proposal Requests** issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. **Within time specified** in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. **Include a list of quantities** of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. **Indicate applicable taxes**, delivery charges, equipment rental, and amounts of trade discounts.
 - c. **Include 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.

- B. **Contractor-Initiated Proposals:** If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to the Architect.
1. **Include a statement outlining reasons** for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. **Include a list of quantities of products** required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. **Indicate applicable taxes**, delivery charges, equipment rental, and amounts of trade discounts.
 4. **Include 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.
 5. **Comply** with requirements in **Division 1** Section "**Product Requirements**" if the proposed change requires substitution of one product or system for product or system specified.
- C. **Proposal Request Form:** Use forms issued by the **Architect** or the **Owner**.

1.5 CHANGE ORDER PROCEDURES

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

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. **Construction Change Directive:** Architect may issue a Construction Change Directive on **AIA Document G714**. 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.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION

SECTION 01 2900

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This **Section specifies** administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. **Related Sections** include the following:
 - 1. **Division 1 Section "Contract Modification Procedures"** for administrative procedures for handling changes to the Contract.

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. **Correlate line items** in the Schedule of Values with other required administrative forms and schedules, including the following:
 - 2. **Application for Payment** forms with Continuation Sheets.
 - a. Submit applications for payment on DFCM forms (<http://dfcm.utah.gov/StdDocs/index.html>, items 8 and 9).
 - 3. **Submittals Schedule.**
 - 4. **Submit the Schedule of Values to Architect** at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 5. **Sub-schedules:** Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- B. **Format and Content:** Use the 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 Architect.
 - c. Architect's project number.

- d. Contractor's name and address.
- e. Date of submittal.
- 2. **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.
 - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
- 3. **Provide a breakdown** of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
- 4. **Round amounts** to nearest whole dollar; total shall equal 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**. Include evidence of insurance or bonded warehousing if required.
- 6. **Provide separate line items** in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 7. **Each item** in the Schedule of Values and Applications for Payment **shall be complete**. Include total cost and proportionate share of general overhead and profit for each item.
 - a. **Temporary facilities** and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
- 8. **Schedule Updating:** Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. **General:** Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- 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 Forms:** Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

- D. **Application Preparation:** Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. **Entries shall match data on the Schedule of Values** and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. **Include amounts of Change Orders** and Construction Change Directives issued before last day of construction period covered by application.
- E. **Transmittal:** Submit **3 signed and notarized original copies** of each Application for Payment to Architect 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.
- F. **Waivers of Mechanic's Lien:** With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. **Submit partial waivers** on each item for amount requested, before deduction for retainage, on each item.
 2. **When an application shows** completion of an item, submit final or full waivers.
 3. **Owner reserves the right** to designate which entities involved in the Work must submit waivers.
 4. **Waiver Delays:** Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
 - a. **Submit final Application for Payment** with or preceded by 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 waivers of lien on forms, executed in a manner acceptable to Owner.
- G. **Initial Application for Payment:** Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Products list.
 5. Schedule of unit prices.
 6. Submittals Schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
 16. Initial settlement survey and damage report if required.

- H. **Application for Payment at Substantial Completion:** After issuing 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 Certificates of Partial Substantial Completion** issued previously for Owner occupancy of designated portions of the Work.
- I. **Final Payment Application:** Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. **Evidence of completion** of Project closeout requirements.
 2. **Insurance certificates** for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. **Updated final statement**, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "**Contractor's Affidavit of Payment of Debts and Claims.**"
 5. AIA Document G706A, "**Contractor's Affidavit of Release of Liens.**"
 6. AIA Document G707, "**Consent of Surety to Final Payment.**"
 7. **Evidence** that claims have been settled.
 8. **Final 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

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION

SECTION 01 3100

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. **This Section includes** administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
1. General project coordination procedures.
 2. Conservation.
 3. Coordination Drawings.
 4. Administrative and supervisory personnel.
 5. Project meetings.
- B. **Each contractor shall participate in coordination requirements.** Certain areas of responsibility will be assigned to a specific contractor.
- C. **Related Sections:** The following Sections contain requirements that relate to this Section:
1. **Division 1 Section "Execution Requirements"** for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 2. **Division 1 Section "Submittals"** for procedures for coordinating electronic submittals.
 3. **Division 1 Section "Closeout Procedures"** for coordinating Contract closeout.

1.3 COORDINATION

- A. **Coordination:** Coordinate construction operations included in various 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 with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 3. **Make adequate provisions** to accommodate items scheduled for later installation.
- B. **Memoranda:** If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- C. **Administrative Procedures:** Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors 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.
- D. **Administrative Software requirements:** The General Contractor shall create a project specific, web-based project processing software site for receiving and distributing all project related information (i.e. Submittals, RFI's, ASI's, Addenda, Construction documents, Project logs, Field reports, and Meeting minutes) using ATTOLIST (www.attolist.com or 877-442-3713) or an equal product that provides the following functionality:
1. FTP functions for secure, encrypted data storage for all project related information for control, transparency and information access for the Contractor, Design Team and Owner.
 2. The FTP site shall be used for processing and delivering Construction Administration, Document Management and Project Management functions.
 3. It shall include log functions for dating and tracking all project related documents.
 4. It shall include Automated notifications for document postings, due dates, document availability dates, and progress warnings for reviewers.
 5. The Contractor must still review all documents and add their stamp and comments directly to the PDF's.
 6. The General Contractor shall employ a PDF review software system such as Blue Beam (www.bluebeam.com) or another similar system for producing, formatting, and marking-up project related documents. The General Contractor shall review all the documents and adds their stamp and comments directly to the PDF prior to posting for the Design team to review.
 7. Include Administrative Software and ftp site cost in overhead and fees within the contract bid at no additional cost to the Owner.
 8. General Contractor shall provide to the Architect and Owner, an electronic archive of all data at the end of the project via DVD(s) for final project records.
- E. Contractor is to keep a **printed record** of all Construction Documents including all clarifications, RFI's and approved changes to the Contract **on site**.
- F. **Conservation:** Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.4 SUBMITTALS

- A. **Coordination Drawings:** Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. **Indicate relationship of components** shown on separate Shop Drawings.
 2. Indicate required installation sequences.

3. **Refer to Division 23 Section "Basic Mechanical Materials and Methods" and Division 26 Section "Basic Electrical Materials and Methods"** for specific Coordination Drawing requirements for mechanical and electrical installations.
- B. **Staff Names:** Within **5 business days** of starting construction operations, submit a list of **principal staff assignments**, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of **individuals assigned as standbys** in the absence of individuals assigned to Project.
 1. **Post copies** of list in Project meeting room, in temporary field office, and by each temporary telephone.
- C. **Submittal Log:** See section 'Submittals' for electronic delivery and record keeping.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. **General:** In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
 1. Include special personnel required for coordination of operations with other contractors.

1.6 PROJECT MEETINGS

- A. **General:** Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 1. **Attendees:** Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. **Agenda:** Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. **Minutes:** Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within [3] days of the meeting.
- B. **Preconstruction Conference:** Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than [15] days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
 1. **Attendees:** Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All 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. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing.
 - d. Designation of responsible personnel.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for processing Applications for Payment.
 - g. Distribution of the Contract Documents.
 - h. Submittal procedures.

- i. Preparation of Record Documents.
- j. Use of the premises.
- k. Responsibility for temporary facilities and controls.
- l. Parking availability.
- m. Office, work, and storage areas.
- n. Equipment deliveries and priorities.
- o. First aid.
- p. Security.
- q. Progress cleaning.
- r. Working hours.

C. **Progress Meetings:** Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. **Attendees:** In addition to representatives of Owner and Architect, 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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. **Agenda:** Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. **Contractor's Construction Schedule:** Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. **Review present and future needs** of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
 - 14) Documentation of information for payment requests.
3. **Reporting:** Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
 - 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.

1.7 REQUESTS FOR INFORMATION (RFI)

- A. **Procedure:** Immediately on discovery of the need for interpretation of Contract Document, and if not possible to request interpretation at Project meeting, prepare and submit an **RFI** in the form specified.
1. RFI's shall originate with **Contractor**. RFI's submitted by entities **other than Contractor** will be **returned with no response**.
 2. **Coordinate** and submit RFI's 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 interpretation and the following:
1. **Project name**.
 2. **Date**.
 3. Name of **Contractor**.
 4. Name of **Architect** and **Owner**.
 5. **RFI number**, numbered sequentially.
 6. **Specification Section** number and title and related paragraphs, as appropriate.
 7. **Drawing number** and detail references, as appropriate.
 8. **Field dimensions** and conditions, as appropriate.
 9. **Contractor's suggested solution(s)**. If Contractor's solution(s) impact the Contractor Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. **Contractor's signature**.
 11. **Attachments:** Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
 - a. **Supplementary drawings** prepared by Contractor shall include dimensions, thickness, structural grid references, and details of affected materials, assemblies, and attachments.
- C. **Hard-Copy RFI's:** Use the **form supplied** by the **Architect** or the **Owner**.
1. **Identify** each page of attachments with the RFI number and sequential page number.
 2. **Attachments** shall be electronic files in **Adobe Acrobat PDF** format.
- D. **Electronic RFI's:**
1. RFI's shall be **processed and delivered electronically** through web-based RFI processing software with sequential numbers.
- E. **Architect's Action:** Architect will review each RFI, determine action required, and return it. Allow **seven working days** for Architect's response for each RFI. RFI's received after **1:00 p.m.** will be considered as received the following working day.
1. **The following RFI's** will be returned **without action**:
 - a. Requests for **approval of submittals**.
 - b. Request for **approval of substitutions**.
 - c. Requests for **coordination information** already indicated in the Contract Documents.
 - d. Request for **adjustments in the Contract Time** or **Contract Sum**.
 - e. Requests for **interpretation of Architect's actions** on submittals.
 - f. **Incomplete RFI's** or RFI with numerous errors.
 2. **Architect's action** may include a **request for additional information**, in which case Architect's Time for response will start again.

3. **Architect's action** on RFI that may result a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. **If Contractor believes** the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Owner in writing within **10 calendar days** of receipt of the RFI response.

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

- G. **RFI Log**: Prepare, maintain, and submit a tabular log of RFI's organized by RFI number. Submit log monthly.
 1. **Project** name.
 2. Name and address of **Contractor**.
 3. Name and address of **Architect** and **Owner**.
 4. **RFI number** including RFI's that were dropped and not submitted.
 5. **RFI description**.
 6. **Date** the RFI was submitted.
 7. **Date** Architect's and Owner'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.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION

SECTION 01 3300

SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

- A. **This Section specifies** administrative and procedural requirements for submittals required for performance of the Work, including:
1. Contractor's construction schedule.
 2. Daily construction reports.
 3. Shop Drawings.
 4. Product Data.
 5. Samples.
 6. Deferred Submittals for review by the Building Code Official.
- B. **Administrative Submittals:** Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
1. Applications for payment.
 2. Performance and payment bonds.
 3. Insurance certificates.
 4. List of Subcontractors.
- C. **Inspection and test reports** are included in Section "Quality Control Services."
- D. **Related Documents:** Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.
1. **Division 1 - Project Management:** Electronic web-based construction administration software.

1.2 ELECTRONIC SUBMITTAL DELIVERY

- A. To minimize printing reimbursables, shipping reimbursables and the impact on the environment, submittals shall be processed and delivered electronically through a web-based submittal processing system.
- B. The Construction Manager, Contractor or Subcontractor shall originate submittals via the designated web-based submittal system. The Construction Manager or Contractor must first review and approve all submittals sent by Subcontractors prior to sending to design team. Include Contractor's certification that information complies with Contract Document requirements, record deviations from Contract Document requirements, including minor variations and limitations. Submittals uploaded by subcontractors shall not be visible to the Design team until the submittal becomes official and forwarded from the Construction Manager or Contractor to the Design team via the system with a transmittal.
- C. Submittals must follow the requirements outlined in this specification and as required in individual specification sections.

- D. The following types of submittals shall be delivered to the design team electronically in pdf format:
1. Product Data
 2. Shop Drawings
 3. Certifications
 4. ARRA Required Product Data
 5. Test Data
 6. Schedules
 7. Calculations
 8. Mix Designs
 9. Warranty Information
- E. **Samples And Color Selection**
1. All samples/color selections shall be delivered by mail or courier to the design team for review.
 2. Samples and color selection shall not be reviewed electronically.
 3. See separate specification sections for quantities and sample selection process. The design team shall return review comments via the web-based submittal processing system.
- F. **Submittal Stamps**
1. The Contractor or Construction Manager shall affix an electronic stamp to PDF submittals.
- G. **Submittal Logs**
1. The design and construction team shall collectively maintain the submittal log through web-based submittal processing software.
 2. It is not required that the Contractor maintain a separate submittal log between the Subcontractors and Contractor.
 3. Construction team shall make a reasonable effort to deliver all submittals electronically via web-based submittal processing software. Submittals shall not be delivered by email.
 4. Samples shall be logged in via web-based processing software, but delivered hardcopy by mail

1.3 SUBMITTAL PROCEDURES

- A. **No submittal will be accepted** by the Architect without the **General Contractor's action stamp**, clearly visible, indicating that the submittal has been fully reviewed by the General Contractor for compliance to the Construction Documents.
- B. Submittals with the General Contractors stamp but **not in compliance with the Construction Documents will be deemed incomplete** and returned without review. These will not be shown as received.
- C. **Coordination:** Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. **Coordinate transmittal** of different types of submittals for **related elements** of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. **The Architect reserves the right to withhold action** on a submittal requiring **coordination with other submittals** until related submittals are received.

- D. **Processing Time:** Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
1. **Initial Review:** Allow **15 business days** for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. **Concurrent Review:** Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow **20 business days** for initial review of each submittal.
 3. **Differed Submittal Review:** Where differed submittals are required by the Building Code Official allow review time as dictated by the Official.
 4. **If intermediate submittal** is necessary, process it in same manner as initial submittal.
 5. **Allow 15 business days** for processing each resubmittal.
 6. **No extension of the Contract Time** will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. **Submittal Preparation:** Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. **Include the following information** on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of **Architect**.
 - d. Name and address of **Contractor**.
 - e. Name and address of **Subcontractor**.
 - f. Name and address of **Supplier**.
 - g. Name of **Manufacturer**.
- F. **Submittal Transmittal:** Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
1. **On the form**, or separate sheet, record **deviations** from Contract Document requirements, including minor variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.
- G. **Submittal requirements for electronic PDF submittals:**
1. All submittals shall be created with native PDF files whenever possible. Do not print a PDF file, and scan in as an image file, as this will delete all file search functions typically embedded within a native PDF file.
 2. All PDF submittals shall be broken down by individual specification section. Do not collate multiple specification sections together into one non-separated submittal package (i.e. carpet, VCT, rubber base, and entry mats; though frequently provided by one installer, shall not be submitted as one non-separated package unless formatted as described below.)
 3. All PDF submittals that cover multiple items within one specification section, or PDF submittals that include multiple related specification sections shall have an index and be formatted with electronic book marks to distinguish various components from one another, and make each item easily retrievable without navigating through each page of an entire submittal.

1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. **Bar-Chart Schedule:** Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule.
1. **Provide a separate time bar** for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
 2. **Within each time bar** indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. **Prepare the schedule** on a sheet of sufficient width to show data for the entire construction period.
 4. **Secure time commitments** for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
 5. **Coordinate the Contractor's construction schedule** with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
 6. **Indicate completion** in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. **Distribution:** Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
1. **When revisions are made**, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. **Schedule Updating:** Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.5 DAILY CONSTRUCTION REPORTS

- A. **Daily Construction Report:** Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:
1. List of subcontractors at the site.
 2. Approximate count of personnel at the site.
 3. High and low temperatures, general weather conditions.
 4. Accidents and unusual events.
 5. Meetings and significant decisions.
 6. Stoppages, delays, shortages, losses.
 7. Meter readings and similar recordings.
 8. Orders and requests of governing authorities.
 9. Change Orders received, implemented.
 10. Services connected, disconnected.

- B. **Material Location Reports:** At monthly intervals, prepare 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.
- C. **Field Condition Reports:** Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

1.6 SPECIAL REPORTS

- A. **General:** Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. **Reporting Unusual Events:** 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, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1.7 SHOP DRAWINGS

- A. **Submit in timely manner to complete project**, but no later than **90 days** after Notice of Award.
 - 1. A fee of \$100.00 will be charged by the Owner, per submittal for all submittals past this date.
- B. **Submit newly prepared information**, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings.
- C. **Shop Drawings** include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 - 1. Dimensions.
 - 2. Identification of products and materials included.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
- D. **Sheet Size:** Submit Shop Drawings, layout drawings and other **Revit or CADD** style sheets formatted for 24" x 36" or 30" x 42" sheets. Details and drawings are to match or exceed construction bid document scales. **All drawings are to be submitted to scale.** All other product brochures and cut sheets can be provided in an 8-1/2x11 format.
- E. **Final Electronic Submittal:** Submit 2 prints, one for the Architect and one for the Owner at the end of the project or as requested by the parties during construction.
 - 1. If submittal was reviewed by members of the design team other than the Architect, provide an additional copy of the submittal for each design firm.
 - 2. The prints shall be marked-up and maintained as a **"Record Document"**.

- F. **Final Submittal:** Submit 5 prints. 2 prints will be retained; the remainder will be returned.
 - 1. One of the prints returned shall be marked-up and maintained as a "**Record Document**".
 - 2. **Do not use Shop Drawings** without an appropriate final stamp indicating action taken in connection with construction.

1.8 DEFERRED SUBMITTALS

- A. Some building elements are specified to be designed under the direction of the supplier or subcontractors. See the General Information sheet on the drawings for a list of required deferred submittals.
- B. All deferred submittals are to be submitted on same size sheet as original drawings (30 x 42 or 8 1/2 x 11). Drawings and calculations shall be on the Design professionals titleblock stating the project name and all other items specified under 'Submittal Preparation' above.
- C. Deferred submittals shall be submitted to the Architect who will disperse three copies to the Building Code Official for review as required by the IBC.
- D. Contractor shall include these submittal sheets in the Record Documents.

1.9 PRODUCT DATA

- A. **Submit in timely manner to complete project**, but no later than **90 days** after Notice of Award.
- B. **Collect Product Data into a single submittal** for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
 - 1. **Mark each copy to show applicable choices and options.** Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with recognized trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
- C. **Do not submit Product Data** until compliance with requirements of the Contract Documents has been confirmed.
- D. **Submittals:** Submit 4 copies of each required submittal; submit 6 copies where required for maintenance manuals. The Architect will retain one, and will return the other marked with action taken and corrections or modifications required.

- E. **Electronic Submittals:** Submit a pdf copy of each required submittal; include copies where required for maintenance manuals. See electronic submittal delivery and submittal procedures for further requirements

1.10 SAMPLES

- A. **Submit in timely manner** to complete project, but no later than **90 days** after Notice of Award.
- B. **Samples:** Submit full-size, fully fabricated samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
- C. **Submittals:** Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
 - 1. **Maintain sets of Samples**, as returned, at the Project site, for quality comparisons throughout the course of construction.

1.11 CONTRACTOR'S REVIEW

- A. **Contractor's Review:** Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. **Approval Stamp:** Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
- C. **Submittals not marked** with an approval stamp and those not in compliance with the Construction Documents shall be returned without further review. It is the Contractor's responsibility to review submittals for compliance prior to forwarding the submittal to the Design Team for review.

1.12 ARCHITECT'S ACTION

- A. **Architect's Action:** Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
 - 1. Compliance with specified characteristics is the Contractor's responsibility.

- B. **Action Stamp:** The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked to indicate the action taken.
1. **Corrections or comments made on the shop drawings** during this review **do not relieve the Contractor from compliance with requirements of the drawings and specifications.** This check is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for; confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION

SECTION 01 4000

QUALITY CONTROL SERVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. **This Section specifies administrative and procedural** requirements for quality control services.
- B. **Quality control services include inspections and tests** and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- C. **Inspection and testing services are required** to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
 - 1. **Specific quality control requirements** for individual construction activities are specified in the Sections that specify those activities.
 - 2. **Inspections, test and related actions** specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
- D. **Requirements for the Contractor** to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- E. **Related Documents:** Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 RESPONSIBILITIES

- A. **Contractor Responsibilities:**
 - 1. **Unless otherwise indicated** as the responsibility of another identified entity, **Contractor shall provide inspections, tests, and other quality-control services** specified elsewhere in the Contract Documents and required by authorities having jurisdiction. **Costs** for these services shall be **included in the Contract Sum**.
 - a. **Where individual Sections** specifically indicate that certain inspections, tests, and other quality-control services are the **Contractor's responsibility**, the Contractor shall employ and pay a qualified independent testing agency to perform quality-control services. Costs for these services are included in the Contract Sum.
 - b. **Where individual Sections specifically indicate that certain inspections, tests, and other quality-control services are the Owner's responsibility**, the Owner will employ and pay a qualified independent testing agency to perform those services.
 - 2. **Retesting:** The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

3. **Cost of Retesting:** Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
 4. **Associated Services:** The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
 - a. **Providing access to the Work** and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. **Taking adequate quantities** of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. **Providing facilities for storage** and curing of test samples, and delivery of samples to testing laboratories.
 - d. **Security and protection** of samples and test equipment at the Project site.
- B. **Owner Responsibilities:** The Owner will provide inspections, tests and similar quality control services **specified to be performed by independent agencies and not by the Contractor, except** where they are **specifically indicated as the Contractor's responsibility** or are provided by another **identified entity**. **Costs** for these services are **not included** in the Contract Sum.
1. **The Owner will employ and pay** for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the Owner's responsibility.
- C. **Duties of the Testing Agency:** The independent testing agency engaged to perform inspections, sampling and testing of materials and construction **specified in individual Specification Sections** shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
1. **The agency shall notify the Architect and Contractor** promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. **The agency is not authorized** to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- D. **Coordination:** The **Contractor** and **each agency** engaged to perform inspections, tests and similar services **shall coordinate** the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. **The Contractor is responsible for scheduling times** for inspections, tests, taking samples and similar activities.

1.3 SUBMITTALS

- A. **The independent testing agency** shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate
1. **Submit additional copies** of each written report directly to the governing authority, when the authority so directs.
 2. **Report Data:** Written reports of each inspection, test or similar service shall include, but not be limited to:
 - a. Date of issue.
 - b. Project title and number.

- c. Name, address and telephone number of testing agency.
- d. Dates and locations of samples and tests or inspections.
- e. Names of individuals making the inspection or test.
- f. Designation of the Work and test method.
- g. Identification of product and Specification Section.
- h. Complete inspection or test data.
- i. Test results and an interpretation of test results.
- j. Ambient conditions at the time of sample-taking and testing.
- k. Name and signature of laboratory inspector.
- l. Recommendations on retesting.

1.4 QUALITY ASSURANCE

- A. **Qualification for Service Agencies:** Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
 - 1. **Each independent inspection and testing agency** engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 TESTS REQUIRED

- A. **Tests required may include** but not be limited to the following (all items listed here may not occur, see drawings and associated section of the specifications):
 - 1. **Soil Report** per **IBC 2009, 1803.6** and testing per **1806.5.8.** of compacted fill during construction.
 - 2. **Special Inspections** per **IBC 2009, Section 1704** including fabricators.
 - a. **Welding** per **1704.3** and **Table 1704.3.**
 - b. **High strength bolts** per **1704.3.3** and **Table 1704.3.**
 - c. **Concrete** per **1704.4** and **Table 1704.4.**
 - d. **Soils** per **1704.7** and **Table 1704.7.**
- B. **It is recommended** that the contractor arrange for soils compaction and any other soils-related testing to be performed by or through the same firm that provided the initial soils investigation data. **A copy** of the **soils investigation data** is included with the project manual or **if not included** may be obtained from the **Architect's Office** upon request. The soils investigation is included for reference only.

3.2 REPAIR AND PROTECTION

- A. **General:** Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
1. **Protect construction** exposed by or for quality control service activities, and protect repaired construction.
 2. **Repair and protection is the Contractor's responsibility**, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 01 5050

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section specifies administrative and procedural requirements for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security and protection.
- B. Temporary construction and support facilities required for the project include but are not limited to the following:
 - 1. Sanitary facilities, including drinking water.
 - 2. Hoists.
 - 3. First aid station.
 - 4. Waste disposal services.
 - 5. Construction aids and miscellaneous general services and facilities.
- C. Security and protection facilities and services required for the project include but are not limited to the following:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, lights.
 - 3. Enclosure fence for stored material.
 - 4. Environmental protection.

1.2 QUALITY ASSURANCE

- A. **Regulations:** Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities, including but not limited to the following:
 - 1. Building codes, including requirements for permits, testing and inspection.
 - 2. Health and safety regulations.
 - 3. Utility company regulations and recommendations governing temporary utility services.
 - 4. Environmental protection regulations governing use of water and energy, and the control of dust, noise and other nuisances.
- B. **Standards:** Comply with the requirements of NFPA Code 241, "Building Construction and Demolition Operations", and ANSI A-10 Series standards for "Safety Requirements for Construction and Demolition", and the NECA National Joint Guideline NJG-6 "Temporary Job Utilities and Services."
- C. Refer to to the most current "**Guidelines for Bid Conditions for Temporary Job Utilities and Services**", as prepared jointly by AGC and ASC industry recommendations.

1.3 JOB CONDITIONS

- A. **General:** Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in the performance of the work. Maintain, expand as required and modify temporary services and facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.
- B. **Conditions of Use:** Operate temporary services and facilities in a safe and efficient manner. Do not overload temporary services or facilities, and do not permit them to interfere with the progress of the work. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.
 - 1. **Temporary Construction and Support Facilities:** Maintain temporary facilities in such a manner as to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary support facilities in a sanitary manner so as to avoid health problems and other deleterious effects.
 - 2. **Security and Protection:** Maintain site security and protection facilities in a safe, lawful and publicly acceptable manner. Take necessary measures to prevent erosion of the site.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. **General:** Provide new materials and equipment for temporary services and facilities, used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Architect.
- B. **Temporary Construction and Support Facilities:** Provide facilities that can be maintained properly throughout their use at the project site.
- C. **Temporary Offices and Similar Construction:** For temporary offices, fabrication shops, storage sheds and similar construction, provide either standard prefabricated or mobile units or the equivalent job-built construction.
 - 1. **Self-contained Toilet Units:** Provide single-occupant self-contained toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar non-absorbent material.
 - 2. **Tarpaulins:** Provide waterproof, fire-resistant, UL labeled tarpaulins with a flame-spread rating of 15 or less.
 - 3. **First Aid Supplies:** Comply with governing regulations and recognized recommendations within the construction industry.
 - 4. **Drinking Water:** Provide potable water approved by local health authorities.
 - 5. **Sign Materials:** For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thicknesses indicated. Provide exterior grade acrylic-latex-base enamel for painting panels and applying graphics.
- D. **Fire Extinguishers:** Provide type "A" fire extinguishers **for temporary offices and similar spaces** where there is a minimal danger of electrical or grease-oil-flammable liquid fires. **In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.**

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. **General:** Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.
1. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.

3.2 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. **General:** Provide a reasonably neat and uniform appearance in temporary construction and support facilities acceptable to the Architect/Engineer and the Owner.
1. Locate field offices, storage and fabrication sheds and other support facilities for easy access to the Work. Position offices so that windows give the best possible view of construction activities.
 2. Maintain field offices, storage and fabrication sheds, temporary sanitary facilities, waste collection and disposal systems, and project identification and temporary signs until near substantial completion. Immediately prior to substantial completion remove these facilities.
- B. **Sanitary Facilities:** Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with governing regulations including safety and health codes for the type, number, location, operation and maintenance of fixtures and facilities; provide not less than specified requirements. Install in locations that will best serve the project's needs.
1. Sanitary facilities located within the existing facility will not be permitted to be used by the Contractor.
- C. **Hoists:** Provide adequate facilities for hoisting materials and employees. Do not permit employees to ride hoists which comply only with requirements for hoisting materials. The Contractor is responsible for selection of type, size, and number of facilities. Truck cranes and similar devices used for hoisting are considered as being "tools and equipment" and not temporary facilities.
- D. **Collection and Disposal of Wastes:**
1. Establish a system for daily collection and disposal of waste or extraneous materials from all construction areas on site that may present a hazard to the project, its craftsmen and the expeditious construction of the work. The Contractor shall provide to the Owner a satisfactory method to assure clean-up is performed in a timely and expeditious fashion. Enforce requirements strictly. Do not hold collected materials at the site longer than 1 day. Handle waste materials that are hazardous, dangerous, or unsanitary separately from other inert waste by containerizing appropriately. Dispose of waste material in a lawful manner.
 - a. Burying or burning of waste materials on the site will not be permitted.
 - b. Washing waste materials down sewers or into waterways will not be permitted.
 - c. Provide rodent proof containers located on each floor level of construction work, to encourage depositing of lunch garbage and similar wastes by construction personnel.
 2. The Owner reserves the right to withhold payments and perform the clean-up, if necessary, at the expense of the Contractor, if unsatisfactory clean-up efforts are not performed in a timely fashion.

- E. **Construction Aids and Miscellaneous Services and Facilities:**
1. Design, construct, and maintain construction aids and miscellaneous general services and facilities as needed to accommodate performance of the work. Construction aids and miscellaneous general services and facilities include, but or not limited to the following:
 - a. Temporary stairs and ladders.
 - b. Guardrails and barriers.
 2. Stairs: Provide temporary stairs where ladders are not adequate for performance of work.
 3. Guardrails and Barriers: Provide guardrails at all unprotected edges of floor and roof openings, and at perimeter of roof and unenclosed floors.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. **General:** Provide a reasonably neat and uniform appearance to security and protection facilities acceptable to the Architect/Engineer and the Owner.
- B. **Temporary Fire Protection:**
1. Install and maintain temporary fire protection facilities of the types needed to adequately protect against reasonably predictable and controllable fire losses. Comply with applicable recommendations of the NFPA Standard 10 "Standard for Portable Fire Extinguishers". Locate fire extinguishers where they are most convenient and effective for their intended purpose. Store combustible materials in containers in recognized fire-safe locations.
 2. Develop and supervise an overall fire prevention and first-aid fire protection program for personnel at the project site. Review needs with the local fire department officials and establish procedures to be followed. Instruct personnel in methods and procedures to be followed. Post warnings and information and enforce strict discipline. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking of any kind on school property. Provide supervision of welding operations, and similar sources of ignition for possible fires.
- C. **Security Enclosure and Lockups:**
1. Install general temporary enclosure of partially completed areas of construction. Provide locking entrances adequate to deter unauthorized entrance, vandalism, theft and similar deleterious effects of violations of project security.
 2. Storage: Where materials and equipment must be temporarily stored, prior to and during construction, and are of substantial value or are attractive for possible theft, provide a secure lockup and enforce strict discipline in connection with the timing of installation and release of materials, so that the opportunity for theft and vandalism is minimized.
- D. **General Environmental Protection:** Provide general protection facilities, operate temporary facilities, conduct construction activities, and enforce strict discipline for personnel on the site in ways and by methods that comply with environmental regulations, and that minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result from the performance of work at the site. Avoid the use of tools and equipment which produce harmful noise. Restrict the use of noise making tools and equipment to hours of use that will minimize noise complaints from persons and firms near the project site.

3.4 OPERATION, TERMINATION AND REMOVAL

- A. **Supervision:** Enforce strict discipline in use of temporary services and facilities at the site. Limit availability of temporary services and facilities to essential and intended uses to minimize waste and abuse. Do not permit temporary installations to be abused or endangered. Do not allow hazardous, dangerous or unsanitary conditions to develop or persist on the project site.
- B. **Maintenance:** Operate and maintain temporary services and facilities in good operating condition throughout the time of use and until removal is authorized. Protect from damage by freezing temperatures and similar elements.
- C. **Termination and Removal:** Unless the Architect requests that it be maintained for a longer period of time, remove each temporary service and facility promptly when the need for it or a substantial portion of it has ended, or when it has been replaced by the authorized use of a permanent facility, or no later than substantial completion. Complete, or, if necessary, restore permanent work which may have been delayed because of interference with the temporary service or facility. Repair damaged work, clean exposed surfaces and replace work which cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary services and facilities and remain the property of the Contractor.

END OF SECTION

SECTION 01 6000

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. **This Section includes** the following administrative and procedural requirements: selection of products for use in Project; **product delivery, storage, and handling**; manufacturers' **standard warranties** on products; **special warranties**; **product substitutions**; and **comparable products**.
- B. **Related Sections** include the following:
1. **Division 1 Section "Definitions and Standards"** for applicable industry standards for products specified.
 2. **Division 1 Section "Closeout Procedures"** for submitting warranties for contract closeout.
 3. Divisions 2 through 33 **Sections** for specific requirements for **warranties** on products and installations specified to be warranted.

1.3 DEFINITIONS

- A. **Products:** Items purchased 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. Only new products are allowed to be used unless directed by the Architect in writing.
 3. **Comparable Product:** Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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. **Substitutions:** Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. **Basis-of-Design Product Specification:** Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

- D. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. **Special Warranty:** Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

- A. **Product List:** Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
 - 1. **Coordination:** Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 - 2. **Form:** Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 - i. Structural calculations for rooftop support frames and other structural components.
 - 3. **Initial Submittal:** Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - a. **At Contractor's option**, initial submittal may be limited to product selections and designations that must be established early in Contract period.
 - 4. **Completed List:** Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 - 5. **Architect's Action:** Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.
- B. **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 **CSI Form 13.1A** or equivalent..
 - 2. **Documentation:** Show compliance with requirements for substitutions and the following, as applicable:
 - a. **Statement** indicating why specified material or product cannot be provided.
 - b. **Coordination information**, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

- c. **Detailed comparison** of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. **Product Data**, including drawings and descriptions of products and fabrication and installation procedures.
 - e. **Samples**, where applicable or requested.
 - f. **List of similar installations** for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. **Material test reports** from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. **Research/evaluation reports** evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. **Detailed comparison** of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - j. **Cost information**, including a proposal of change, if any, in the Contract Sum.
 - k. **Contractor's certification** that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. **Contractor's waiver of rights** to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. **Architect's Action:** If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution **within 15 business days** of receipt of request, or **7 business days** of receipt of additional information or documentation, whichever is later.
- a. **Form of Acceptance:** Change Order.
 - b. **Use product specified** if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. **Basis-of-Design Product Specification Submittal:** Comply with requirements in **Division 1 Section "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, product selected shall be 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, **Architect will determine** which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. **Deliver, store, and handle products** using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
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 ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
 5. **Store products** to allow for inspection and measurement of quantity or counting of units.
 6. **Store materials** in a manner that will not endanger Project structure.
 7. **Store products** that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 8. **Comply with product manufacturer's written instructions** for temperature, humidity, ventilation, and weather-protection requirements for storage.
 9. **Protect stored products** from damage.

1.7 PRODUCT WARRANTIES

- A. **General:** 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.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
 2. Refer to **Divisions 2 through 33 Sections** for specific content requirements and particular requirements for submitting special warranties.
- C. **Submittal Time:** Comply with requirements in **Division 1 Section "Closeout Procedures."**

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

- A. **General Product Requirements:** Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
1. **Provide products complete with accessories,** trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.

2. **Standard Products:** If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. **Owner reserves the right** to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. **Where products** are accompanied by the term "**as selected**," Architect will make selection.
 5. **Where products** are accompanied by the term "**match sample**," sample to be matched is Architect's.
 6. **Descriptive, performance, and reference standard requirements** in the Specifications establish "**salient characteristics**" of products.
 7. **Or Equal:** Where products are specified by name and accompanied by the term "**or equal**" or "**or approved equal**" or "**or approved**," comply with provisions in "**Comparable Products**" Article to obtain approval for use of an unnamed product.
- B. **Product Selection Procedures:** Procedures for product selection include the following:
1. **Product:** Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
 - a. **Substitutions** may be considered, unless otherwise indicated.
 2. **Manufacturer/Source:** Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
 - a. **Substitutions** may be considered, unless otherwise indicated.
 3. **Products:** Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
 - a. **Substitutions** may be considered, unless otherwise indicated.
 4. **Manufacturers:** Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
 - a. **Substitutions** may be considered, unless otherwise indicated.
 5. **Available Products:** Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
 6. **Available Manufacturers:** Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
 7. **Product Options:** Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with provisions in "Product Substitutions" Article.
 8. **Basis-of-Design Products:** Where Specification paragraphs or subparagraphs titled "**Basis-of-Design Products**" are included and also introduce or refer to a list of manufacturers' names, provide either the specified 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 provisions in "**Comparable Products**" Article to obtain approval for use of an unnamed product.
 - a. **Substitutions** may be considered, unless otherwise indicated.

9. **Visual Matching Specification:** Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
10. **Visual Selection Specification:** Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
 - a. **Standard Range:** Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - b. **Full Range:** Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

- A. **Timing:** Architect 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 Architect.
- B. **Conditions:** Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 1. 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 Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution **does not require extensive revisions** to the Contract Documents.
 3. Requested substitution is **consistent** with the **Contract Documents** and will produce indicated results.
 4. Substitution request is **fully documented** and properly submitted.
 5. Requested substitution will **not adversely affect** Contractor's **Construction Schedule**.
 6. Requested substitution has received **necessary approvals** of **authorities having jurisdiction**.
 7. Requested substitution is **compatible** with other portions of the Work.
 8. Requested substitution has been **coordinated** with other portions of the Work.
 9. Requested substitution provides **specified warranty**.
 10. 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.

2.3 COMPARABLE PRODUCTS

- A. **Where products** or manufacturers are **specified by name**, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
1. **Evidence** that the proposed product **does not require extensive revisions** to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. **Detailed comparison** of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. **Evidence** that proposed product provides **specified warranty**.
 4. **List of similar installations** for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 5. **Samples**, if requested.

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION

SECTION 01 7300

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. **This Section includes** general procedural requirements governing **execution of the Work** including, but not limited to, the following:
1. Construction layout.
 2. Field engineering and surveying.
 3. General installation of products.
 4. Progress cleaning.
 5. Starting and adjusting.
 6. Protection of installed construction.
 7. Correction of the Work.
- B. **Related Sections** include the following:
1. **Division 1 Section "Project Management and Coordination"** for procedures for coordinating field engineering with other construction activities.
 2. **Division 1 Section "Submittals"** for administrative submittals and also product and procedural submittals.
 3. **Division 1 Section "Cutting and Patching"** for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
 4. **Division 1 Section "Closeout Procedures"** for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 SUBMITTALS

- A. **Qualification Data:** For land surveyor/professional engineer to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. **Certificates:** Submit certificate signed by land surveyor/professional engineer certifying that location and elevation of improvements comply with requirements.
- C. **Landfill Receipts:** Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- D. **Certified Surveys:** Submit two copies signed by land surveyor/professional engineer.
- E. **Final Property Survey:** Submit three copies and an electronic copy in pdf format showing the Work performed and record survey data.

1.4 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.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Existing Conditions:** The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
1. **Before construction**, verify the location and points of connection of **utility services**.
- B. **Existing Utilities:** 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 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; and underground electrical services.
 2. **Furnish location data** for work related to Project that must be performed by **public utilities** serving Project site.
- C. **Acceptance of Conditions:** 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. **Written Report:** Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 2. **Verify compatibility** with and suitability of substrates, including compatibility with existing finishes or primers.
 3. **Examine roughing-in** for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 4. **Examine walls, floors, and roofs** for suitable conditions where products and systems are to be installed.
 5. **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 Interruptions:** Do not interrupt utilities serving facilities occupied unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. **Notify Architect and Owner** not less than **two business days** in advance of proposed utility interruptions.
 - 2. **Do not proceed** with **utility interruptions** without Architect's and Owner's written permission.
- 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, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

- A. **Verification:** Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. **Contractor shall be responsible for determining final location of solar arrays.** Furnish design layout to Architect for review prior to beginning installation.
- C. **General:** Engage a land surveyor/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 dimensions** within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 3. **Inform installers** of lines and levels to which they must comply.
 - 4. Check the location, level and plumb, of every major element as the Work progresses.
 - 5. **Notify Architect** when deviations from required lines and levels exceed allowable tolerances.
 - 6. **Close site surveys** with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- D. **Site Improvements:** Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

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

3.4 FIELD ENGINEERING

- A. **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 Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. **Replace lost or destroyed permanent benchmarks** and control points promptly. Base replacements on the original survey control points.
- 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 sitework.
- E. **Final Property Survey:** Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor/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** as indicated in spaces without a suspended ceiling.
- 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. **Tools and Equipment:** Do not use tools or equipment that produce harmful noise levels.
- F. **Anchors and Fasteners:** Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
1. **Mounting Heights:** Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. **Allow for building movement**, including thermal expansion and contraction.
- G. **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.
- H. **Hazardous Materials:** Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

- A. **General:** Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials** more than **7 days** during normal weather or **3 days** if the temperature is expected to rise above 80 deg F (27 deg C).
 3. **Containerize hazardous and unsanitary waste materials** separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- 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:** Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. **Cutting and Patching:** Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
 - 1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. **Waste Disposal:** Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. **Protection:** 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.
- J. **Maintenance:** 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 smooth operation without damaging effects.
- K. **Limiting Exposures:** Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 DUST CONTROL

- A. **The Contractor** shall be responsible to provide continuous (7 days per week, 24 hours per day) fugitive dust control measures within the limits of the construction site, related sites and adjacent streets and roads. Dust control shall be provided for, but not be specifically limited to, the stabilization of unpaved roads, haul roads, access roads, spoil sites, borrow and material sources, excavations, embankments, stockpiles, and all other areas which become potential sources of dust as a result of construction activities.
- B. **Contractor's dust control measures** shall maintain compliance with the **General Utah Air Pollution Regulations**, R446 - Utah Air Conservation Regulations, Section 4.5, Fugitive Emissions, applicable County Air Pollution Control Ordinances, and as directed by the Architect. Dust control measures shall include but not be limited to the following:
 - 1. **Wetting of surfaces** with water as appropriate.
 - 2. **Minimizing surface disturbances.**

- C. **In order to control fugitive dust emissions**, Contractor shall apply the following procedures and techniques:
 - 1. **Cover loads of materials**, debris and waste materials taken from construction sites as needed to suppress dust during transit.
 - 2. **Water down** or apply other approved dust control measures to the construction site, haul roads and public access roads as needed to suppress dust.
 - 3. **All mud and dirt shall be removed** from vehicles prior to entering a paved or graveled area or road. Any mud or dirt that is carried out onto paved or graveled surfaces shall be removed from surfaces immediately and no less than daily.

3.8 STARTING AND ADJUSTING

- A. **Start equipment** and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. **Adjust operating components** for proper operation without binding. Adjust equipment for proper operation.
- C. **Test each piece** of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. **Manufacturer's Field Service:** If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. **Provide final protection** and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. **Comply with manufacturer's written instructions** for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

- A. **Repair or remove** and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
 - 1. **Repairing includes** replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. **Restore permanent facilities** used during construction to their specified condition.
- C. **Remove and replace damaged surfaces** that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. **Repair components** that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. **Remove and replace** chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. 75% of waste shall be diverted from the landfill by weight, of potential landfill trash/waste by recycling and/or salvage.
- E. Contractor shall submit a Waste Disposal Report at the completion of the project; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.
- F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2 DEFINITIONS

- A. **Clean:** Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. **Construction and Demolition Waste:** Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. **Hazardous:** Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. **Nonhazardous:** Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

- E. **Nontoxic:** Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. **Recyclable:** The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. **Recycle:** To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. **Recycling:** The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. **Return:** To give back reusable items or unused products to vendors for credit.
- J. **Reuse:** To reuse a construction waste material in some manner on the project site.
- K. **Salvage:** To remove a waste material from the project site to another site for resale or reuse by others.
- L. **Sediment:** Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. **Source Separation:** The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. **Toxic:** Poisonous to humans either immediately or after a long period of exposure.
- O. **Trash:** Any product or material unable to be reused, returned, recycled, or salvaged.
- P. **Waste:** Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.3 SUBMITTALS

- A. See **Section 01 3300** - Submittals, for submittal procedures.
- B. **Submit Waste Management** prior to any trash or waste removal, whichever occurs sooner; submit projection of all trash and waste that will require disposal and alternatives to landfilling.
- C. **Waste Management Plan:** Include the following information:
 1. **Analysis of the trash** and waste projected to be generated during the entire project construction cycle, including types and quantities.
 2. **Landfill Options:** The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).

3. **Landfill Alternatives:** List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - a. List each material proposed to be salvaged, reused, or recycled.
 - b. List the local market for each material.
 - c. State the estimated net cost, versus landfill disposal.
 4. **Meetings:** Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 5. **Materials Handling Procedures:** Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 6. **Transportation:** Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- D. **Waste Disposal Reports:** Submit at the completion of the project, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. **Submit Report** on a form acceptable to Owner.
 2. **Landfill Disposal:** Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 3. **Incinerator Disposal:** Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. **Recycled and Salvaged Materials:** Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 5. **Material Reused on Project:** Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards (cubic meters).
 - c. Include weight tickets as evidence of quantity.
 6. **Other Disposal Methods:** Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. **Manager:** Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. **Communication:** Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.
- C. **Instruction:** Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. **Meetings:** Discuss trash/waste management goals and issues at project meetings.
 - 1. Regular job-site meetings.
 - 2. Job safety meetings.
- E. **Facilities:** Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. **As a minimum, provide:**
 - a. **Separate area for storage** of materials to be reused on-site, such as wood cut-offs for blocking.
 - b. **Separate dumpsters** for each category of recyclable.
 - c. **Recycling bins** at worker lunch area.
 - 2. Provide containers as required.
 - 3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
 - 4. Provide materials for barriers and enclosures that are nonhazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
 - 5. Locate enclosures out of the way of construction traffic.
 - 6. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 7. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. **Hazardous Wastes:** Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. **Recycling:** Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

- H. **Reuse of Materials On-Site:** Set aside, sort, and protect separated products in preparation for reuse.
- I. **Salvage:** Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7700

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. **This Section includes** administrative and procedural requirements for contract closeout, including, but not limited to, the following:
1. Inspection procedures.
 2. Project Record Documents.
 3. Operation and maintenance manuals.
 4. Warranties.
 5. Instruction of Owner's personnel.
 6. Final cleaning.
- B. **Related Sections** include the following:
1. **Division 1 Section "Payment Procedures"** for requirements for Applications for Payment for Substantial and Final Completion.
 2. **Division 1 Section "Execution Requirements"** for progress cleaning of Project site.
 3. **Division 1 Section "Operation and Maintenance Data"** for operation and maintenance manual requirements.
 4. **Divisions 2 through 33 Sections** for specific closeout and special cleaning requirements for products of those Sections.

1.3 SUBSTANTIAL COMPLETION

- A. **Preliminary Procedures:** Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
1. **Prepare a list of items** to be completed and corrected (**punch list**), the value of items on the list, and reasons why the Work is not complete.
 2. **Advise Owner** of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. **Obtain and submit releases** permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 5. **Prepare and submit Project Record Documents**, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 6. **Deliver tools, spare parts, extra materials**, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

7. **Make final changeover** of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 8. **Complete startup testing** of systems.
 9. **Submit test/adjust/balance** records.
 10. **Terminate and remove temporary facilities** from Project site, along with mockups, construction tools, and similar elements.
 11. **Advise Owner of changeover** in heat and other utilities.
 12. **Submit changeover information** related to Owner's occupancy, use, operation, and maintenance.
 13. **Complete final cleaning requirements**, including touchup painting.
 14. **Touch up and otherwise repair and restore** marred exposed finishes to eliminate visual defects.
- B. **Inspection:** Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. **Reinspection:** Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. **Results of completed inspection** will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

- A. **Preliminary Procedures:** Before requesting final inspection for determining date of Final Completion, complete the following:
1. **Submit a final Application for Payment** according to **Division 1** Section "**Payment Procedures.**"
 2. **Submit certified copy** of Architect's **Substantial Completion** inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. **Submit evidence** of final, **continuing insurance** coverage complying with insurance requirements.
 4. **Submit pest-control** final inspection report and warranty.
 5. **Instruct Owner's personnel** in operation, adjustment, and maintenance of products, equipment, and systems.
- B. **Inspection:** Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect 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. **Reinspection:** Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
- C. **Additional Review Fees:** Should Architect perform more than one additional review, or extend it's construction period services more than 15 business days beyond the scheduled completion date, due to the failure of the Contractor's work to comply with the claims of status or completion made by the Contractor, Owner will compensate Architect for such additional/ extended services at the rate of \$500.00 per day. The Owner shall then deduct the amount of such compensation from the final payment to the Contractor.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. **Preparation:** Submit three copies 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 Architect.
 - d. Name of Contractor.
 - e. Page number.

1.6 PROJECT RECORD DOCUMENTS

- A. **General:** Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- B. **Record Drawings:** Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
1. **Mark Record Prints** to show the **actual** installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. **Give particular attention** to information on **concealed elements** that cannot be readily identified and recorded later.
 - b. **Accurately record** information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
 2. **Mark record sets with erasable**, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 3. **Mark important additional information** that was either shown schematically or omitted from original Drawings.
 4. **Note Construction Change Directive numbers**, Change Order numbers, alternate numbers, and similar identification where applicable.
 5. **Identify and date each Record Drawing**; include the designation "**PROJECT RECORD DRAWING**" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

- C. **Record Specifications:** Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. **Give particular attention to information on concealed products** and installations that cannot be readily identified and recorded later.
 2. **Mark copy with the proprietary name** and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. **Note related Change Orders**, Record Drawings, and Product Data, where applicable.
- D. **Record Product Data:** Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.
1. **Give particular attention to information on concealed products** and installations that cannot be readily identified and recorded later.
 2. **Include significant changes** in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. **Note related Change Orders**, Record Drawings, and Record Specifications, where applicable.
- E. **Miscellaneous Record Submittals:** Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. **Assemble a complete set of operation and maintenance data** indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
1. **Operation Data:**
 - a. Emergency instructions and procedures.
 - b. System, subsystem, and equipment descriptions, including operating standards.
 - c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
 - d. Description of controls and sequence of operations.
 - e. Piping diagrams.
 2. **Maintenance Data:**
 - a. Manufacturer's information, including list of spare parts.
 - b. Name, address, and telephone number of Installer or supplier.
 - c. Maintenance procedures.
 - d. Maintenance and service schedules for preventive and routine maintenance.
 - e. Maintenance record forms.
 - f. Sources of spare parts and maintenance materials.
 - g. Copies of maintenance service agreements.
 - h. Copies of warranties and bonds.

- B. **Organize operation and maintenance manuals** into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "**OPERATION AND MAINTENANCE MANUAL**," Project name, and subject matter of contents.

1.8 WARRANTIES

- A. **Submittal Time:** Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. **Organize warranty documents** into an orderly sequence based on the table of contents of the Project Manual.
 - 1. **Bind warranties** and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) 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.
- C. **Provide additional copies** of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

- A. **Instruction:** Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Provide instructors experienced in operation and maintenance procedures.
 - 2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.
 - 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

- B. **Program Structure:** Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
1. System design and operational philosophy.
 2. Review of documentation.
 3. Operations.
 4. Adjustments.
 5. Troubleshooting.
 6. Maintenance.
 7. Repair.

3.2 FINAL CLEANING

- A. **General:** Provide 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 portion of Project:
 - a. **Clean Project site**, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. **Sweep paved areas** broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. **Rake grounds** that are neither planted nor paved to a smooth, even-textured surface.
 - d. **Remove tools**, construction equipment, machinery, and surplus material from Project site.
 - e. **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. **Clean transparent materials**, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - i. **Remove labels** that are not permanent.

- j. **Touch up and otherwise repair and restore marred**, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) **Do not paint** over "UL" and similar labels, including mechanical and electrical nameplates.
 - k. **Wipe surfaces** of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. **Replace parts** subject to unusual operating conditions.
 - m. **Leave Project clean** and ready for occupancy.
- C. **Pest Control:** Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. **Cleaning Standards:** Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

SECTION 01 7800

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. **This Section includes** administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. **Operation and maintenance** documentation directory.
 - 2. **Emergency** manuals.
 - 3. **Operation manuals** for systems, subsystems, and equipment.
 - 4. **Maintenance manuals** for the care and maintenance of products, materials, and finishes systems and equipment.
 - 5. **Requirements and procedures** for operating the facility **after commissioning**.
- B. **Related Sections** include the following:
 - 1. **Division 1** Section "**Submittal Procedures**" for submitting copies of submittals for operation and maintenance manuals.
 - 2. **Division 1** Section "**Closeout Procedures**" for submitting operation and maintenance manuals.
 - 3. **Division 1** Section "**Project Record Documents**" for preparing Record Drawings for operation and maintenance manuals.
 - 4. Divisions 2 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

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 SUBMITTALS

- A. **Initial Submittal:** Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return one copy of draft and mark whether general scope and content of manual are acceptable.
- B. **Final Submittal:** Submit 2 of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
 - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

1.6 QUALITY ASSURANCE

- A. Coordinate with Commissioning Sections. The Commissioning Agent shall review the Operation and Maintenance Manuals for systems that were commissioned.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. **Organization:** Include a section in the directory for each of the following:
 - 1. List of **documents**.
 - 2. List of **systems**.
 - 3. List of **equipment**.
 - 4. Table of **contents**.
- B. **List of Systems and Subsystems:** List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. **List of Equipment:** List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. **Tables of Contents:** Include a table of contents for each emergency, operation, and maintenance manual.
- E. **Identification:** In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 MANUALS, GENERAL

- A. **Organization:** Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- B. **Title Page:** Enclose title page in transparent plastic sleeve. 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, address, and telephone number of Contractor.
 6. Name and address of Architect.
 7. 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.
1. **Binders:** Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. **Dividers:** Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. **Protective Plastic Sleeves:** Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 4. **Supplementary Text:** Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
 5. **Drawings:** Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- E. **Maintenance Inspection Requirements:** Describe inspection schedule and procedures necessary to promote durability of materials, components, and systems. Include the following:
1. **Exterior:** Inspection of exterior for assessment of possible water ingress. Indicate points of potential concern.
 2. **Equipment:** Seasonal inspection of equipment. Coordinate with Section 01 91 00 (01810) - Commissioning.

- F. **Environmental Requirements:**
1. Identify environmentally preferable materials and systems incorporated into the Project. Include: product model; manufacturer's name, address, phone, and website; and local technical representative, if any.
 - a. Describe maintenance procedures associated with environmentally preferable materials and systems. Provide cleaning recommendations in accordance with ASTM E1971.
 - 1) Include potential environmental impacts of recommended maintenance procedures and materials.
 - 2) Include potential indoor air quality impacts of the recommended maintenance procedures and materials.

2.3 OPERATION MANUALS

- A. **Content:** In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
 2. Performance and design criteria if Contractor is delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- B. **Descriptions:** Include the following:
1. Product name and model number.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- C. **Operating Procedures:** Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- D. **Systems and Equipment Controls:** Describe the sequence of operation, and diagram controls as installed.
- E. **Piped Systems:** Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

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

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. **Content:** For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. **Source Information:** List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard printed maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.

- D. **Maintenance Procedures:** Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training videotape, if available.

- E. **Maintenance and Service Schedules:** Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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

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

- H. **Warranties and Bonds:** Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

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

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

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

- D. **Operation and Maintenance Manuals:** Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- E. **Manufacturers' Data:** Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. **Drawings:** Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
1. Do not use original Project Record Documents as part of operation and maintenance manuals.
 2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."
- G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 7810

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. **This Section includes** administrative and procedural requirements for Project Record Documents, including the following:
 - 1. Record **Drawings**.
 - 2. Record **Specifications**.
 - 3. Record **Product Data**.
 - 4. Record **Submittals** as requested by the Owner.
- B. **Related Sections** include the following:
 - 1. **Division 1** Section "**Closeout Procedures**" for general closeout procedures.
 - 2. **Division 1** Section "**Operation and Maintenance Data**" for operation and maintenance manual requirements.
 - 3. Divisions 2 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. **Record Drawings:** Comply with the following:
 - 1. **Number of Copies:** Submit **one set** of marked-up Record Prints.
- B. **Record Specifications:** Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. **Record Product Data:** Submit one copy of each Product Data submittal.
 - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.
- D. **Record Shop Drawings:** Provide copies of shop drawings or other submittals as requested by the Owner.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. **Record Prints:** Maintain one set of white prints of the Contract Drawings and Shop Drawings.
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 prepare the 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 understandable drawing technique.
 - c. **Record data as soon as possible** after obtaining it. Record and check the markup before enclosing concealed installations.
 2. **Content:** Types of items requiring marking include, but are not limited to, the following:
 - a. **Dimensional changes** to Drawings.
 - b. Revisions to **details** shown on Drawings.
 - c. **Depths of foundations** below first floor.
 - d. **Locations and depths of underground utilities.**
 - e. Revisions to **routing of piping** and conduits.
 - f. Revisions to **electrical circuitry.**
 - g. **Actual equipment locations.**
 - h. **Duct size** and routing.
 - i. Locations of **concealed internal utilities.**
 - j. Changes made by **Change Order** or **Construction Change Directive.**
 - k. Changes made following **Architect's written orders.**
 - l. **Details not on the original** Contract Drawings.
 - m. **Field records** for variable and concealed conditions.
 - n. Record information on the **Work that is shown only schematically.**
 3. **Mark the Contract Drawings or Shop Drawings**, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
 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. Paragraph and subparagraphs below describe a procedure for assembling nearly correct reproducible Drawings. Add requirements for special printing methods on specific material, such as moisture-sensitive prints on mylar film. Delete if not required.

2.2 RECORD SPECIFICATIONS

- A. **Preparation:** Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Note related Change Orders, Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. **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.

2.4 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.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. **Recording:** Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. **Maintenance of Record Documents and Samples:** Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's and Owner's reference during normal working hours.

END OF SECTION

SECTION 01 7900

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
1. **Demonstration** of operation of systems, subsystems, and equipment.
 2. **Training** in operation and maintenance of systems, subsystems, and equipment.
 3. **Administrative and procedural requirements** for instructing Owner's personnel on environmental issues associated with operation and maintenance of the facility.
 4. **Demonstration** and training **DVD's**.
 5. **Minimum of 8 hours of demonstration and instruction to students.**
- B. **Related Sections** include the following:
1. **Division 1 Section "Project Management and Coordination"** for requirements for preinstruction conferences.
 2. **Divisions 2 through 33** Sections for specific requirements for demonstration and training for products in those Sections.
- C. **Unit Price for Instruction Time:** Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up.
- D. **DVD:** A high-density optical disk for storing large amounts of data, especially high-resolution audio-visual material

1.3 SUBMITTALS

- A. **Instruction Program:** Submit two copies of outline of instructional program for demonstration and training, including 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. At completion of training, submit two complete training manual(s) for Owner's use.
- B. **Qualification Data:** For firms and persons specified in Quality Assurance Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners and other information specified.
- 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.

- E. **Demonstration and Training CD's:** Submit two copies of videotaped session, converted to a CD 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 photographer.
 - c. Name of Architect and Construction Manager.
 - d. Name of Contractor.
 - e. Date videotape was recorded.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - 2. **Transcript:** Prepared on 8-1/2-by-11-inch (215-by-280-mm) paper, punched and bound in heavy-duty, 3-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding videotape. Include name of Project and date of videotape on each page.

1.4 QUALITY ASSURANCE

- A. **Instructor Qualifications:** A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

- B. **Preinstruction Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "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. Coordinate with commissioning requirements. Refer to Commissioning Sections.
 - 4. Review required content of instruction.
 - 5. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

- 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 has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. **Program Structure:** Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
1. **Photovoltaic systems**, including orientation for optimal performance.
 2. **Electrical service and distribution**, including transformers, switchboards, panelboards, uninterruptible power supplies and motor controls.
 3. **Lighting equipment** and controls.
- B. **In addition to demonstrations and instructions for Owner's maintenance personnel**, allow a minimum of **8 hours** of demonstration and instruction **to students** of Salt Lake Community College. Student session(s) shall be coordinated with College instructional staff and College class schedule.
- C. **Training Modules:** Develop a learning objective and teaching outline for each module as applicable. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. **Basis of System Design**, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Operating standards.
 - c. Regulatory requirements.
 - d. Equipment function.
 - e. Operating characteristics.
 - f. Limiting conditions.
 - g. Performance curves.
 2. **Documentation:** Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. 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. Required sequences for electric or electronic systems.
 - l. Special operating instructions and procedures.
5. **Adjustments:** Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. 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.

PART 3 - EXECUTION

3.1 PREPARATION

- A. **Assemble educational materials** necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. **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.
- B. **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 Construction Manager, with at least 14 days' advance notice.
- C. **Evaluation:** At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- D. **Cleanup:** Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING DVD'S

- A. **General:** Engage a qualified commercial photographer to record demonstration and training sessions. 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. **DVD Format:** Provide demonstration and training in CD format.
- C. **Recording:** Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- D. **Narration:** Describe scenes on videotape by audio narration by microphone while videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- E. **DVD:** Furnish each session in DVD format. If multiple topics are on the same **disc it is to be indexed** to allow searching of topics.

END OF SECTION

DIVISION 2 – EXISTING CONDITIONS

Section 02 4101
Section 02 4102

Cutting and Patching
Selective Demolition

SECTION 02 4101

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. The General Contractor is responsible to patch and repair any and all material disturbed during construction, this is to include but not limited to walls, floors, ceilings, asphalt, concrete, lawns and landscaping, roofs, etc.

1.3 DEFINITION

- A. **Cutting:** Removal of existing construction necessary to permit installation or performance of other Work.
- B. **Patching:** Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 SUBMITTALS

- A. **Cutting and Patching Proposal:** Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed.
 - 1. **Architect's Approval:** Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 QUALITY ASSURANCE

- A. **Structural Elements:** Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. **Operational Elements:** Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety, including but not limited to the following:
 - 1. Primary operational systems and equipment.
 - 2. Fire-protection systems.
 - 3. Communication systems.
 - 4. Electrical wiring systems.

- C. **Miscellaneous Elements:** Do not cut and patch the following elements or related 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.
 - 1. Piping, ductwork, vessels, and equipment.

- D. **Visual Requirements:** Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
 - 1. If possible, retain original Installer or fabricator to cut and patch exposed Work. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

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

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **General:** Comply with requirements specified in other Sections of these Specifications.

- B. **Existing Materials:** Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Examine surfaces** to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. **Compatibility:** Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 2. **Proceed with installation** only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. **Temporary Support:** Provide temporary support of Work to be cut.

- B. **Protection:** Protect existing 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.
- C. **Adjoining Areas:** Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. **Existing Services:** Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

3.3 PERFORMANCE

- A. **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 existing 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. **Cutting:** Cut existing 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. **General:** use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. **Existing Finished Surfaces:** Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. **Concrete/Masonry:** Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. **Mechanical and Electrical Services:** Cut off pipe or conduit 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.
 - 5. **Patching:** Proceed with patching after construction operations requiring cutting are complete.
- C. **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 possible. Patch masonry with masonry units and grout that match as closely as possible the original. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 1. **Inspection:** Where feasible, test and inspect patched areas after completion to demonstrate 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 eliminate evidence of patching and refinishing.

END OF SECTION

SECTION 02 4102

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. **This Section includes** the following:
 - 1. **Demolition and removal** of selected **site elements**.
 - 2. **Repair procedures** for selective demolition operations.
- B. **Related Sections** include the following:
 - 1. **Division 1 Section "Cutting and Patching"** for cutting and patching procedures for selective demolition operations.
 - 2. **Electrical Sections** for demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

- A. **Deconstruction:** Disassembly of buildings for the purpose of recovering materials
- B. **Demolish:** Completely remove and legally dispose of off-site.
- C. **Existing to Remain or Retain:** Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled
- D. **Protect:** Except as otherwise defined in greater detail, the term "protect" is used to describe the process of shielding from harm existing fixtures, elements or materials.
- E. **Protect and Maintain:** To remove deteriorating corrosion, reapply protective coatings, and install protective measures such as temporary guards; to provide the least degree of intervention.
- F. **Recycle:** Recovery of demolition waste for subsequent processing in preparation for reuse.
- G. **Remove:** To detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- H. **Remove and Salvage:** To detach items from existing construction and deliver them to Owner ready for reuse.

- I. **Remove and Reinstall:** To detach items from existing construction, repair and clean them for reuse, and reinstall them where indicated.
- J. **Salvage:** Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.
- K. **Stabilize:** To apply measures designed to reestablish a weather-resistant enclosure and the structural reinforcement of an item or portion of the building while maintaining the essential form as it exists at present.

1.4 MATERIALS OWNERSHIP

- A. **Historic items, relics, and similar objects** including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.5 SUBMITTALS

- A. **Qualification Data:** For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. **Proposed Dust-Control and Noise-Control Measures:** Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- C. **Schedule of items and materials to be salvaged:** Identify procedures for disassembly.
 - 1. Coordinate with Solid Waste Management Plan. Identify materials to be recycled. Identify materials to be salvaged for reuse on site and off site.
- 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 on-site operations are uninterrupted.
 - 2. Interruption of utility services.
 - 3. Coordination for shutoff, capping, and continuation of utility services.
 - 4. Locations of temporary partitions and means of egress.
 - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- E. **Inventory:** After selective demolition is complete, submit a list of items that have been removed and salvaged.
- F. **Pre-demolition Photographs or Videotape:** Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

- G. **Landfill Records:** Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

- A. **Demolition Firm Qualifications:** An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. **Regulatory Requirements:** Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. **Standards:** Comply with ANSI A10.6 and NFPA 241.
- D. **Pre-demolition Conference:** Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 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.

1.7 PROJECT 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. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. **Maintain access to existing walkways**, corridors, and other adjacent occupied or used facilities.
 - 1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- C. **Owner assumes no responsibility for condition of areas** to be selectively demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. **Hazardous Materials:** It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. **Storage or sale of removed items** or materials on-site will not be permitted.

- F. **Utility Service:** Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

- A. **Use repair materials** identical to existing materials.
 - 1. **If identical materials are unavailable** or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. **Use materials whose installed performance equals** or surpasses that of existing materials.
- B. **Comply with material and installation requirements** specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Verify** that utilities have been disconnected and capped.
- B. **Survey existing conditions** and correlate with requirements indicated to determine extent of selective demolition required.
- C. **Inventory and record** the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. **When unanticipated mechanical, electrical, or structural elements** that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. **Engage a professional engineer** to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. **Perform surveys** as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- A. **Existing Utilities:** Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. **Utility Interruption:** Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

- C. **Provide at least 72 hours'** notice to Owner if shutdown of service is required during changeover.
- D. **Utility Requirements:** Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
- E. **Owner will arrange to shut off indicated utilities** when requested by Contractor.
- F. **If utility services are required to be removed**, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
- G. **Cut off pipe or conduit in walls** or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
- H. **Utility Requirements:** Refer to Mechanical and Electrical Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- A. **Dangerous Materials:** Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- B. **Pest Control:** Employ a certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.
- C. **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.
 - 1. **Do not close or obstruct streets**, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
 - 2. **Erect temporary protection**, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 - 3. **Protect existing site improvements**, appurtenances, and landscaping to remain.
 - 4. **Erect a plainly visible fence** around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- D. **Temporary Facilities:** 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.
- E. **Temporary Enclosures:** Provide temporary enclosures for protection of existing building and 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 not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- F. **Temporary Partitions:** Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
- G. **Temporary Shoring:** Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

- A. **Temporary ventilation:** Provide temporary ventilation as specified in Section 01 5721 - Indoor Air Quality (IAQ) Management, and as follows:
1. Vacuum old carpets prior to removal using a certified Carpet and Rug Institute (CRI) Green Label vacuum cleaner. Vacuum floor immediately after old carpet is removed.
- B. **Dust Control:** Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
 2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- C. **Disposal:** Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- D. **Cleaning:** 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.

3.5 SELECTIVE DEMOLITION

- A. **General:** Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly.
 10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- B. **Existing Facilities:** Comply with Owner's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.
- C. **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.
- D. **Concrete:** Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- E. **Concrete Slabs-on-Grade:** Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. **General:** Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. **Burning:** Do not burn demolished materials.
- C. **Disposal:** Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

DIVISION 5 - METALS

Section 05 1200
Section 05 5000

Structural Steel
Metal Fabrications

SECTION 05 1200
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. **Extent of structural steel** work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. **Related Sections:**
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
 2. **Miscellaneous Metal Fabrications** are specified elsewhere in **Division 5**.
- C. **Definitions:** Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.

1.3 SUBMITTALS

- A. **Product Data:** Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
1. **High-strength bolts** (each type), including nuts and washers.
 2. **Shrinkage-resistant** grout.
- B. **Shop Drawings:** Submit shop drawings, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.
1. **Include details** of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, and show size, length, and type of each weld.
 - a. **Provide setting drawings**, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of others sections.
 2. **Comprehensive engineering analysis** of structural steel support frames signed and sealed by the qualified professional engineer responsible for its preparation.
 3. **Deferred Submittal:** To be submitted to the Building Code Official for structural peer review.
- C. **Test Reports:** Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.

- D. **Surveys:** Submit certified copies of each survey conducted by a registered professional engineer, showing elevations and locations of base plates and anchor bolts to receive structural steel, and final elevations and locations for major members. Indicate discrepancies between actual installation and contract documents.

1.4 QUALITY ASSURANCE

- A. **Source Quality Control:** Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
1. Promptly remove and replace materials or fabricated components which do not comply.
- B. **Fabricator Qualifications:** Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.
1. **Fabricator** must participate in the **AISC Quality Certification Program** and be designated an AISC-Certified Plant as follows:
 - a. **Category:** Category Cbd, complex steel building structures.
 2. **Fabricators without AISC Certification** shall provide **special inspectors** and conduct special inspections as required by **Authorities having jurisdiction**.
 3. **Other Certifications**, other than AISC, may be acceptable but must be submitted and approved by Authorities having jurisdiction prior to fabrication of any steel.
- C. **Design of Members and Connections:** Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
- D. **Promptly notify Architect** whenever design of members and connections for any portion of structure are not clearly indicated.
- E. **Codes and Standards:**
1. **Comply** with provisions of following, except as otherwise indicated:
 - a. AISC "**Code of Standard Practice for Steel Buildings and Bridges**", excluding the following: Section 1.5.1, Section 3.3 (first sentence and last sentence), Section 3.4, Section 4.2, Section 4.2.1, Section 4.2.2, Section 6.3.2, Section 7.5.4, and Section 7.11.5.
 2. AISC "**Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings**", including "Commentary" and Supplements thereto as issued.
 3. AISC "**Specifications for Architecturally Exposed Structural Steel**".
 4. AISC "**Specifications for Structural Joints using ASTM A 325 or A 490 Bolts**" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
 5. **American Welding Society (AWS) D1.1 "Structural Welding Code - Steel"**.
 6. ASTM A 6 "**General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use**".

- F. **Qualifications for Welding Work:** Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
1. **Provide certification** that welders to be employed in work have satisfactorily passed AWS qualification tests within the last 12 months.
 2. **If recertification of welders is required**, retesting will be Contractor's responsibility.

1.5 DELIVERY, STORAGE AND HANDLING

- A. **Deliver materials** to site at such intervals to ensure uninterrupted progress of work.
1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not to delay work.
- B. **Store materials** to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.6 CASH ALLOWANCE

- A. Contractor shall include a **cash allowance** of **\$5,000.00** beyond that which is required by the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. **Approved Manufacturers:** Subject to compliance with requirements, provide one of the following:
1. **Non-shrink Non-metallic Grout.**
 - a. **Euco N.S.;** Euclid Chemical Co.
 - b. **Masterflow 713;** Master Builders
 - c. **Five Star Grout;** U.S. Grout Corp.

2.2 MATERIALS

- A. **Metal Surfaces, General:** For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
- B. **Wide Flange Structural Steel Shapes:** ASTM A 992, Grade 50 enhanced.
1. **Other Structural Steel Shapes, Plates and Bars:** ASTM A 36.
- C. **Hollow Structural Sections (HSS):** ASTM A 500, Grade B.
- D. **Steel Castings:** ASTM A 27, Grade 65-35, medium-strength carbon steel.

- E. **Anchor Bolts:** ASTM A 307, headed type unless otherwise indicated.
- F. **Unfinished Threaded Fasteners:** ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.
 - 1. Provide hexagonal heads and nuts for all connections.
 - 2. Provide either hexagonal or square, heads and nuts, except use only hexagonal units for exposed connections.
- G. **High-Strength Threaded Fasteners:** Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.
 - 2. Direct tension indicator washers may be used at Contractor's option.
- H. **Electrodes for Welding:** Comply with AWS Code.
- I. **Cement Grout:** Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.
- J. **Non-metallic Shrinkage-Resistant Grout:** Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C621.

2.3 FABRICATION

- A. **Shop Fabrication and Assembly:** Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
 - 1. **Properly mark** and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
 - 2. **Where finishing is required**, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- B. **Connections:** Weld or bolt shop connections, as indicated.
 - 1. **Bolt field connections**, except where welded connections or other connections are indicated.
 - 2. **Provide high-strength threaded fasteners** for principal bolted connections, except where unfinished bolts are indicated.
 - 3. **Provide unfinished threaded fasteners** for only bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.
- C. **High-Strength Bolted Construction:** Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).

- D. **Welded Construction:** Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
 - 2. No welding shall be done on-site.

- E. **Shear Connectors:** Prepare steel surfaces as recommended by manufacturer of shear connectors. Where possible shop weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

2.4 SHOP FINISHING

- A. Galvanize structural steel members to comply with ASTM A 123/A 123M. Provide minimum 2.0 oz/sq ft (600 g/sq m) galvanized coating.

PART 3 - EXECUTION

3.1 PREPARATION

- A. **Surveys:** Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.

3.2 ERECTION

- A. **Temporary Shoring and Bracing:** Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Do not shore cambered steel beams unless otherwise indicated on drawings.
 - 1. **Temporary Planking:** Provide temporary planking and working platforms as necessary to effectively complete work.

- B. **Setting Bases and Bearing Plates:** Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
 - 1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

- C. **Adjustments:** Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout. Install high strength washers under nuts at all anchor bolts.

- D. **Grouting:** Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
1. Comply with manufacturer's instructions.
- E. **Field Assembly:** Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. **Level and plumb individual members** of structure within specified AISC tolerances.
 2. **Establish required leveling** and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
 3. **Splice members** only where indicated and accepted on shop drawings.
 4. **Field connections shall be bolted**, no welding on-site.
- F. **Erection Bolts:** On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- G. **Field Adjustments:** Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
1. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- H. **Gas Cutting:** Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.
- I. **Touch-Up Painting:** Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
1. **Apply by brush or spray** to provide minimum dry film thickness of 1.5 mils.

3.3 QUALITY CONTROL

- A. **Testing Agency:** Owner will employ and pay a qualified independent testing agency to perform field quality-control testing services specified in this section.
- B. **Testing agency shall conduct and interpret tests** and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
- C. **Provide access for testing agency** to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

- D. **Testing agency** may **inspect structural steel** at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.
- E. **Correct deficiencies** in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.
- F. **Shop Bolted Connections:** Inspect or test in accordance with AISC specifications.
- G. **Shop Welding:** Inspect and test during fabrication of structural steel assemblies, as follows:
 - 1. **Certify welders** and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
 - 2. **Perform visual inspection** of all welds.
 - 3. **Perform tests of welds** as follows. Inspection procedures listed are to be used at Contractor's option.
 - a. **Radiographic Inspection:** ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
 - b. **Ultrasonic Inspection:** ASTM E 164.
 - 4. **Inspection of shop welding** is not required if the fabricator complies with Section 1704.2.2 of the **2009 IBC**.
- H. **Field Bolted Connections:** Inspect in accordance with **2009 IBC** Section **1704.3.3**.

3.4 CLEANUP

- A. Refer to **Division 1**, Section "**Execution Requirements**".

END OF SECTION

SECTION 05 5000

METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This **Section includes** the following:
1. Steel **framing** and **supports** for **mechanical** and **electrical** equipment.
 2. Steel **framing** and **supports** for applications where framing and supports are **not specified in other Sections**.
 3. Miscellaneous **metal trim**.
- B. **Related Sections** include the following:
1. **Division 5** Section "**Structural Steel**" for structural-steel framing system components.
 2. **Division 6** Section "**Miscellaneous Carpentry**" for metal framing anchors and other rough hardware.

1.3 SUBMITTALS

- A. **Product Data:** For the following:
1. Paint products.
 2. Grout.
- B. **Shop Drawings General:** Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
1. Provide templates for anchors and bolts specified for installation under other Sections.
- C. **Structural calculations** by a Registered Professional or Structural Engineer in the State of the Project's location for approval by the Professional of Record. Calculations may include, but are not limited to:
1. Description of design criteria
 2. Stress and deflection analysis
 3. Selection of framing members, fittings, and accessories
- D. **Welding Certificates:** Copies of certificates for welding procedures and personnel.
- E. **Qualification Data:** For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

- A. **Fabricator Qualifications:** A firm experienced in producing metal fabrications 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.
- B. **Welding:** Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. **Architectural Exposed Steel:** All exposed steel members shall be detailed, fabricated and erected as **Architecturally Exposed Structural Steel (AESS) as defined in the AISC Code of Standard Practice.**

1.5 PROJECT CONDITIONS

- A. **Field Measurements General:** Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. **Established Dimensions:** Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.6 COORDINATION

- A. **Coordinate installation of anchorages for metal fabrications.** 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.

1.7 CASH ALLOWANCE

- A. Contractor shall include an allowance of **\$6,400.00** for **miscellaneous steel**, beyond that which is required by the contract documents..

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. **Metal Surfaces, General:** For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet.

2.2 FERROUS METALS

- A. **Steel Plates, Shapes, and Bars:** ASTM A 36/A 36M.
- B. **Steel Tubing:** Cold-formed steel tubing complying with ASTM A 500.
- C. **Steel Pipe:** ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- D. **Uncoated Hot-Rolled Steel Sheet:** Commercial quality, complying with ASTM A 569/A569M or structural quality, complying with ASTM A 570/A 570M, Grade 30, unless another grade is required by design loads.
- E. **Brackets, Flanges, and Anchors:** Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
- F. **Slotted Channel Framing:** Cold-formed metal channels with flange edges returned toward web and with 9/16-inch- (14.3-mm-) wide slotted holes in webs at 2 inches (51 mm) o.c.
 - 1. **Width of Channels:** 1-5/8 inches (41 mm).
 - 2. **Depth of Channels:** 1-5/8 inches (41 mm).
 - 3. **Metal and Thickness:** Uncoated steel complying with ASTM A 570, Grade 33; **14 gauge** (1.7-mm) minimum thickness.
 - 4. **Finish: Pre-galvanized** per ASTM A653
 - a. **Zinc coated by hot-dipped process** prior to roll forming at the steel mill
 - b. **Zinc coating thickness** shall be **G90** (0.75 mil = 0.45 oz./ sq. ft. surface area)
- G. **Cast-in-Place Anchors in Concrete:** Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. **Threaded or wedge type;** galvanized ferrous castings, either ASTM A 47 (ASTM A 47M) malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- H. **Welding Rods and Bare Electrodes:** Select according to AWS specifications for metal alloy welded.

2.3 PAINT

- A. **Galvanizing Repair Paint:** High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.4 FASTENERS

- A. **General:** Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

- B. **Bolts and Nuts:** Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. **Anchor Bolts:** ASTM F 1554, Grade 36.
- D. **Machine Screws:** ASME B18.6.3 (ASME B18.6.7M).
- E. **Lag Bolts:** ASME B18.2.1 (ASME B18.2.3.8M).
- F. **Wood Screws:** Flat head, carbon steel, ASME B18.6.1.
- G. **Plain Washers:** Round, carbon steel, ASME B18.22.1 (ASME B18.22M).
- H. **Lock Washers:** Helical, spring type, carbon steel, ASME B18.21.1 (ASME B18.21.2M).
- I. **Expansion Anchors:** Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
 - 1. **Material:** Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
- J. **Toggle Bolts:** FS FF-B-588, tumble-wing type, class and style as needed.

2.5 GROUT

- A. **Nonshrink, Nonmetallic Grout:** Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

- A. **Shop Assembly:** Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. **Shear and punch** metals cleanly and accurately. Remove burrs.
- C. **Ease exposed edges** to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- D. **Weld corners** and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. **Provide for anchorage** of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. **Cut, reinforce, drill, and tap metal fabrications** as indicated to receive finish hardware, screws, and similar items.
- G. **Fabricate joints** that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. **Allow for thermal movement** resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. **Temperature Change** (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- I. **Form exposed work true to line** and level with accurate angles and surfaces and straight sharp edges.
- J. **Remove sharp or rough areas** on exposed traffic surfaces.
- K. **Form exposed connections with hairline joints**, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. **General:** Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. **Fabricate units** from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
1. **Fabricate units from slotted channel framing** where required for deflection.
 2. **Where units are indicated to be cast into concrete** or built into masonry, equip with integrally welded steel strap anchors 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long at 24 inches (600 mm) o.c., unless otherwise indicated.
 3. **Furnish inserts** if units must be installed after concrete is placed.

- C. **Galvanize** miscellaneous framing and supports in the following locations:
 - 1. Exterior locations and where miscellaneous items will be concealed from view.

2.8 MISCELLANEOUS STEEL TRIM

- A. **Unless otherwise indicated**, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. **Provide cutouts, fittings, and anchorages as needed** to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c., unless otherwise indicated.
- C. **Galvanize miscellaneous steel trim** in the following locations:
 - 1. **Exterior.**

2.9 FINISHES, GENERAL

- A. **Comply with NAAMM's** "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.10 STEEL AND IRON FINISHES

- A. **Galvanizing:** Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. **Fastening to In-Place Construction:** Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. **Cutting, Fitting, and Placement:** Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. **Provide temporary bracing** or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

- D. **Fit exposed connections accurately together to form hairline joints.** Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

- E. **Field Welding:** Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- F. **Corrosion Protection:** Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. **General:** Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

- B. **Support steel girders on solid grouted masonry,** concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated at girders supported on concrete or masonry, install as specified above for setting and grouting bearing and leveling plates.

3.3 ADJUSTING AND CLEANING

- A. **Galvanized Surfaces:** Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

Section 06 1050

Miscellaneous Carpentry

SECTION 06 1050

MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This **Section includes** the following:
 - 1. **Rooftop equipment bases** and support curbs.
 - 2. **Wood furring**, grounds, nailers, and blocking.
 - 3. **Plywood backing** panels (for telephone and electrical equipment).

1.3 SUBMITTALS

- A. **General:** Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. **Wood treatment data as follows**, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
 - 1. **For each type of preservative-treated wood product**, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. **For waterborne-treated products**, include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
- C. **Submit research reports** or evaluation reports of the model code organization acceptable to authorities having jurisdiction evidencing compliance of the following wood products with specified requirements and building code in effect for Project.
 - 1. Engineered wood products.
- D. **Material test reports** from a qualified independent testing agency indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with performance requirements indicated.
- E. **Warranty of chemical treatment** manufacturer for each type of treatment.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. **Keep materials under cover and dry.** Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
 - 1. **For lumber and plywood pressure treated** with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. **Lumber Standards:** Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. **Inspection Agencies:** Inspection agencies, and the abbreviations used to reference them, include the following:
1. **NELMA** - Northeastern Lumber Manufacturers Association.
 2. **RIS** - Redwood Inspection Service.
 3. **SPIB** - Southern Pine Inspection Bureau.
 4. **WCLIB** - West Coast Lumber Inspection Bureau.
 5. **WWPA** - Western Wood Products Association.
- C. **Grade Stamps:** Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece.
- D. **Nominal Sizes:** Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
1. **Provide dressed lumber, S4S**, unless otherwise indicated.
 2. **Provide dry lumber with 19 percent** maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. **General:** Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.
1. **Do not use chemicals** containing **chromium** or **arsenic**.
 2. **For exposed items** indicated to receive stained finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- B. **Pressure treat aboveground items** with waterborne preservatives to a minimum retention of 0.25 lb/cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:
1. **Wood cants**, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. **Wood sills**, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
- C. **Pressure treat wood members in contact with ground** or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu. m).

2.3 DIMENSION LUMBER

- A. **General:** Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.
1. **Grade:** Standard, Stud, or No. 3.
 2. **Species:** Hem-fir; WCLIB or WWPA.

2.4 MISCELLANEOUS LUMBER

- A. **General:** Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. **Fabricate miscellaneous lumber** from dimension lumber of sizes indicated and into shapes shown.
- C. **Moisture Content:** 19 percent maximum for lumber items are not specified to receive wood preservative treatment.
- D. **Grade:** For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.5 PLYWOOD BACKING PANELS

- A. **For mounting electrical or telephone** equipment, provide fire-retardant-treated plywood panels with grade, **C-D Plugged Exposure 1**, in thickness indicated or, if not otherwise indicated, not less than **15/32 inch** (11.9 mm) thick.

2.6 FASTENERS

- A. **General:** Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. Where miscellaneous carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
- B. **Nails, Wire, Brads, and Staples:** FS FF-N-105.
- C. **Power-Driven Fasteners:** CABO NER-272.
- D. **Bolts:** Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.7 METAL FRAMING ANCHORS

- A. **General:** Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:
 - 1. **Research or Evaluation Reports:** Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.
 - 2. **Allowable Design Loads:** Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.
- B. **Galvanized Steel Sheet:** Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. **Discard units of material with defects** that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. **Set carpentry to required levels** and lines, with members plumb, true to line, cut, and fitted.
- C. **Fit carpentry to other construction;** scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. **Apply field treatment** complying with AWWA M4 to cut surfaces of preservative-treated lumber and plywood.
- E. **Securely attach carpentry work** as indicated and according to applicable codes and recognized standards.
- F. **Countersink nail heads** on exposed carpentry work and fill holes with wood filler.
- G. **Use fasteners of appropriate type and length.** Pre-drill members when necessary to avoid splitting wood.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. **Install where shown** and where required for screeding or attaching other work. Cut and shape to required size. Coordinate locations with other work involved.
- B. **Attach to substrates** to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Section 07 5400
Section 07 9200

Thermoplastic Membrane Roofing
Joint Sealants

SECTION 07 5400

THERMOPLASTIC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This **Section includes** the following:
1. **Modifications to existing mechanically fastened** membrane roofing system.
 2. **Pipe/conduit supports**
- B. **Related Sections** include the following:
1. **Division 6** Section "Miscellaneous **Carpentry**" for wood nailers, curbs, and blocking.
 2. **Division 7** Section "**Joint Sealants.**"

1.3 DEFINITIONS

- A. **Roofing Terminology:** Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. **Design Uplift Pressure:** The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- C. **Factored Design Uplift Pressure:** The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

- A. **General:** Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. **Material Compatibility:** Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.
- C. **FMG Listing:** Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
1. **Fire/Windstorm Classification:** Class **1A-90.**
 2. **Hail Resistance:** SH.

- D. **Warranty Preservation:** Coordinate all roof cutting and repair with original roof manufacturer.
 - 1. **Consult with original roofing contractor** as to warranty requirements and proper technique in modifying and repairing roof to accommodate structural and electrical penetrations.
 - 2. **Original Roofing Contractor:**
 - a. Superior Roofing and Sheet Metal, Inc.
3405 South 500 West
Salt Lake City, UT 84115
801-266-1473
 - 3. Do not proceed with any modification of existing roofing system without verifying compatibility with conditions of roof warranty.

1.5 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. **Shop Drawings:** For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Base flashings and membrane terminations.
- C. **Installer Certificates:** Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- D. **Manufacturer Certificates:** Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
- E. **Qualification Data:** For Installer and manufacturer.
- F. **Maintenance Data:** For roofing system to include in maintenance manuals.
- G. **Inspection Report:** Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
- B. **Manufacturer Qualifications:** A qualified manufacturer that has FMG approval for membrane roofing system identical to that used for this Project.
- C. **Source Limitations:** Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.

- D. **Fire-Test-Response Characteristics:** Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. **Exterior Fire-Test Exposure:** Class A; ASTM E 108, for application and roof slopes indicated.
 2. **Fire-Resistance Ratings:** ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.
- E. **Preliminary Roofing Conference:** Before starting roof deck construction, conduct conference at Project site. Comply with requirements for preinstallation conferences in Division 1 Section "Project Management and Coordination." Review methods and procedures related to roof deck construction and roofing system including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. **Weather Limitations:** Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Work on roof membrane shall be conducted so as to preserve the Owner's full rights under existing roof warranty. Work shall be strict accordance with warranty provisions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. **Available Products:** Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

- B. **Fabric-Reinforced Thermoplastic Polyolefin Sheet:** Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:
 - 1. **Available Manufacturers:**
 - a. **Firestone** Building Products Company.
 - b. Other manufacturers shall submit for approval prior to bidding. Manufacturers submitting alternate systems shall demonstrate compatibility with existing roofing membrane.
 - 2. **Thickness:** 60 mils (1.5 mm), nominal.
 - 3. **Exposed Face Color:** White.
 - 4. **Physical Properties:**
 - a. **Breaking Strength:** 225 lbf (1 kN); ASTM D 751, grab method.
 - b. **Elongation at Break:** 15 percent; ASTM D 751.
 - c. **Tearing Strength:** 55 lbf (245 N) minimum; ASTM D 751, Procedure B.
 - d. **Brittleness Point:** Minus 22 deg F (30 deg C).
 - e. **Ozone Resistance:** No cracks after sample, wrapped around a 3-inch- (75-mm-) diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F (40 deg C) and an ozone level of 100 pphm (100 mPa); ASTM D 1149.
 - f. **Resistance to Heat Aging:** 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F (116 deg C); ASTM D 573.
 - g. **Water Absorption:** Less than 4 percent mass change after 166 hours' immersion at 158 deg F (70 deg C); ASTM D 471.
 - h. **Linear Dimension Change:** Plus or minus 2 percent; ASTM D 1204.

2.2 AUXILIARY MATERIALS

- A. **General:** Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. **Sheet Flashing:** Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet membrane.
- C. **Bonding Adhesive:** Manufacturer's standard solvent-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.
- D. **Slip Sheet:** Manufacturer's recommended slip sheet, of type required for application.
- E. **Metal Termination Bars:** Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- F. **Metal Battens:** Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch (25 mm) wide by 0.05 inch (1.3 mm) thick, prepunched.
- G. **Fasteners:** Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- H. **Miscellaneous Accessories:** Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.3 ROOF INSULATION

- A. **General:** Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. **Polyisocyanurate Board Insulation:** ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces. Provide in thickness as required to match existing.
 - 1. **Available Manufacturers:**
 - a. **Atlas** Roofing Corporation.
 - b. **Firestone** Building Products Company.
 - c. **GenFlex** Roofing Systems.
 - d. **Hunter Panel** Polyisocyanurate
 - e. **RMAX**.
 - f. **Versico** Polyisocyanurate
 - g. **Johns Manville** Enrgy.

2.4 INSULATION ACCESSORIES

- A. **General:** Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. **Fasteners:** Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

2.5 WALKWAYS

- A. **Flexible Walkways:** Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (4 mm) thick, and acceptable to membrane roofing system manufacturer.
- B. **Basis of Design:** Firestone UltraPly TPO Premium Walkway Pad.

2.6 PIPE SUPPORTS

- A. **Basis of Design:** Pipe Pier Classic; www.pipepier.com
- B. **Components:**
 - 1. **Base:** Closed-cell, medium density, black polyethylene foam "Ethafoam HS 45"
 - 2. **Channel:** 14 gage, galvanized strut.
 - 3. **Hot melt adhesive-**bonding sheet metal to foam block "Bondmaster Instaweld 34-3378".
- C. **Size:** As recommended by manufacturer for conduit sizes and roof slope.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Examine substrates,** areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 5 Section "Steel Deck."
 - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. **Clean substrate** of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

- B. **Prevent materials from entering and clogging roof drains** and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. **Complete terminations and base flashings** and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

- A. **Coordinate** installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. **Comply** with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. **Trim surface of insulation** where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- D. **Mechanically Fastened Insulation:** Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

3.4 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

- A. **Install roofing membrane** over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
 - 1. **Install sheet** according to ASTM D 5082.
- B. **Start installation** of roofing membrane in presence of roofing system manufacturer's technical personnel.
- C. **Accurately align roofing membranes** and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. **Mechanically or adhesively** fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- E. **Apply roofing membrane** with **side laps shingled** with slope of roof deck where possible.
- F. **Seams:** Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. **Test lap edges with probe** to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.

2. **Verify field strength** of seams a minimum of twice daily and repair seam sample areas.
 3. **Repair tears**, voids, and lapped seams in roofing membrane that does not meet requirements.
- G. **Spread sealant or mastic bed** over **deck drain flange** at deck drains and securely seal roofing membrane in place with clamping ring.
- H. **In-Splice Attachment:** Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

3.5 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with sheet flashing.
- D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 WALKWAY INSTALLATION

- A. **Flexible Walkways:** Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.7 SUPPORT PIERS

- A. **Set support piers** on separation barrier, if recommended by roofing manufacturer or if required to maintain roof warranty.
- B. **Locate in accordance with manufacturer's recommendations.**
1. **Maximum spacing** between supports: **10 feet.** Support piping/conduit within 24 inches of each change of direction.
 2. **Center loads** on blocks.
 3. **Attach piping/conduit** with standard strut clamps and accessories.

3.8 FIELD QUALITY CONTROL

- A. **Final Roof Inspection:** Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

- B. **Repair or remove and replace** components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- C. **Additional testing and inspecting**, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

- A. **Protect membrane roofing system** from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. **Correct deficiencies** in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. **Clean overspray** and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 9200

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. **This Section includes** sealants for the following applications, including those specified by reference to this Section:
 - 1. **Exterior joints** in the following vertical surfaces and non-traffic horizontal surfaces:
 - a. Joints between **different materials** listed above.
 - b. **Other joints** as indicated.
 - 2. **All joints** between dissimilar materials.

1.3 PERFORMANCE REQUIREMENTS

- A. **Provide elastomeric joint sealants** that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. **Product Data:** For each joint-sealant product indicated.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. **Source Limitations:** Obtain each type of joint sealant through one source from a single manufacturer.
- C. **Preconstruction Compatibility and Adhesion Testing:** Submit to joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. **Use manufacturers standard test methods** to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. **Perform tests** under environmental conditions replicating those that will exist during installation.
 - 2. **Submit not fewer than nine pieces** of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. **Schedule sufficient time** for testing and analyzing results to prevent delaying the Work.

4. **For materials failing tests**, obtain joint sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
5. **Testing will not be required if** joint sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Deliver materials** to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. **Store and handle materials** in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. **Environmental Limitations:** 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.
 2. **When joint substrates are wet.**
- B. **Joint-Width Conditions:** Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. **Joint-Substrate Conditions:** Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

- A. **Special Installer's Warranty:** Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. **Warranty Period:** **Three years** from date of Substantial Completion.
- B. **Special Manufacturer's Warranty:** Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. **Warranty Period:** **Ten years** from date of Substantial Completion.
- C. **Special warranties** specified in this Article **exclude** deterioration or failure of elastomeric joint sealants from the following:
 1. **Movement of the structure** resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 2. **Disintegration of joint substrates** from natural 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 MATERIALS, 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 sealant manufacturer based on testing and field experience.
 1. Verify compatibility of sealants with roof membrane and roof warranty system when used as part of roof repair.
- B. **Colors of Exposed Joint Sealants:** As selected by Architect from manufacturer's full range for this characteristic.

2.2 ELASTOMERIC JOINT SEALANTS

- A. **Elastomeric Sealant Standard:** Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
- B. **Additional Movement Capability:** Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.
- C. **Suitability for Contact with Food:** Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.3 SOLVENT-RELEASE JOINT SEALANTS

- A. **Acrylic-Based Solvent-Release Joint-Sealant Standard:** Comply with ASTM C 1311 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.
- B. **Butyl-Rubber-Based Solvent-Release Joint-Sealant Standard:** Comply with ASTM C 1085 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.

2.4 LATEX JOINT SEALANTS

- A. **Latex Sealant Standard:** Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

2.5 JOINT-SEALANT BACKING

- A. **General:** Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. **Cylindrical Sealant Backings:** ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. **Type C:** Closed-cell material with a surface skin.
- D. **Elastomeric Tubing Sealant Backings:** Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- E. **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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 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 with joint substrates.
- C. **Masking Tape:** Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. All joints of **dissimilar materials** to receive joint sealant.
- B. **Examine joints** to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- C. **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, blast cleaning, 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 from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include concrete, masonry or unglazed surfaces of ceramic tile.
 3. **Remove laitance** and form-release agents from concrete.
 4. **Clean nonporous surfaces** with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants to metal, glass, porcelain enamel or glazed surfaces of ceramic tile.
- B. **Joint Priming:** Prime joint substrates where recommended in writing by joint sealant manufacturer, based on 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 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 of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. **Acoustical Sealant Application Standard:** Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. **Install sealant backings** of type 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.

- E. **Install bond-breaker tape** behind sealants where sealant backings are not used between sealants and back of joints.
- F. **Install sealants** by proven techniques to 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 provided for each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 4. Seal abutting joint at all dissimilar materials.
- G. **Tooling of Nonsag Sealants:** Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 sealants** from surfaces adjacent to joint.
 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 configuration** per Figure 5A in ASTM C 1193, unless otherwise indicated.
 4. **Provide flush joint configuration**, per Figure 5B in ASTM C 1193, where indicated.
 5. **Provide recessed joint configuration**, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
 - a. **Use masking tape** to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

- A. **Clean off excess sealants** or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. **Protect joint sealants** during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. **Medium-Modulus Neutral-Curing Silicone Sealant:** Where joint sealants of this type are indicated, provide products complying with the following:
 1. **Products:**
 - a. **791**; Dow Corning.
 - b. **PSI-631**; Polymeric Systems, Inc.
 - c. **Sonolastic 150**, Sonneborn
 - d. **Spectrem 2**; Tremco.
 2. **Type and Grade:** S (single component) and NS (nonsag).
 3. **Class:** 25.

4. **Use Related to Exposure:** NT (nontraffic).
 5. **Uses Related to Joint Substrates:** M (masonry), G (glass), A (aluminum), and, as applicable to joint substrates indicated, O (other).
 - a. **Use O Joint Substrates:** Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.
 6. **Stain-Test-Response Characteristics:** Nonstaining to porous substrates per ASTM C 1248.
 7. **Applications:** Exterior and interior joints in vertical surfaces of concrete; between metal and concrete and mortar; perimeter of metal frames in exterior walls; overhead or ceiling joints.
- B. **Single-Component Nonsag Urethane Sealant:** Where joint sealants of this type are indicated, provide products complying with the following:
1. **Products:**
 - a. **Vulkem 921;** Mameco International.
 - b. **Dynatrol I;** Pecora Corporation.
 - c. **DyMonic;** Tremco.
 - d. **NP1,** Sonneborn.
 2. **Type and Grade:** S (single component) and NS (nonsag).
 3. **Class:** 25
 4. **Use Related to Exposure:** NT (nontraffic).
 5. **Uses Related to Joint Substrates:** M, A, and, as applicable to joint substrates indicated, O.
 - a. **Use O Joint Substrates:** Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.
 6. **Applications:** Joints in concrete.

END OF SECTION

DIVISION 9 - FINISHES

Section 09 8433 Acoustical Ceiling Panels (Tectum)
Section 09 9100 Painting

SECTION 09 8433

ACOUSTICAL CEILING PANELS (TECTUM)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This **Section includes** the following:
 - 1. Acoustical **ceiling** panels.

1.3 SUBMITTALS

- A. **Product Data:** For each type of product indicated.
- B. **Samples:** 8-by-11-inch units of each type of acoustical panel indicated. Include samples of installation devices and accessories.
- C. **Maintenance Data:** For acoustical panels to include in maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A firm experienced in manufacturing acoustical panels similar to those indicated for this Project and with a record of successful in-service performance.
- B. **Source Limitations for Acoustical Panels:** Obtain acoustical panels from one source with resources to provide products of consistent quality in appearance and physical properties.
- C. **Fire-Test-Response Characteristics:** Provide acoustical panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical panels with appropriate markings of applicable testing and inspecting agency.
 - 1. **Flame Spread:** 25 or less.
 - 2. **Smoke Developed:** 450 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. **Protect acoustical panels** from excessive moisture when shipping, storing, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet-work, such as concrete and plaster, has been completed and cured to a condition of equilibrium. Protect panel edges from crushing and impact.

1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not install acoustical panels until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. **Air-Quality Limitations:** Protect acoustical panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. **Approved Manufacturers:**
 - 1. Tectum, Inc.

2.2 MATERIALS

- A. **Tectum Panels**
 - 1. "Tectum" wall panels shall match thickness of existing panels.
 - 2. **Panels shall be fabricated from aspen wood fibers** bonded with an inorganic hydraulic binder. Panel shall have 0-25 flame spread and 0-450 fuel contribution in accordance with ASTM E 84.

2.3 ACOUSTICAL PANELS, GENERAL

- A. **Fabricate panels** to sizes and configurations as required by installation of components for rooftop solar system.
- B. **Dimensional Tolerances of Finished Units:** Plus or minus 1/16 inch for the following:
 - 1. Thickness.
 - 2. Edge straightness.
 - 3. Overall length and width.
 - 4. Squareness from corner to corner.
 - 5. Chords, radii, and diameters.
- C. **Sound-Absorption Performance:** Provide acoustical panels with minimum noise reduction coefficients indicated, as determined by testing per ASTM C 423 for mounting type specified.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Examine substrates** and blocking, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting acoustical panel performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. **Install acoustical panels** in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, and scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's written instructions for installation of panels using type of mounting accessories indicated or, if not indicated, as recommended by manufacturer.
 - 1. **Cut units to be at least 50 percent of unit width.** Scribe acoustical panels to fit adjacent work. Butt joints tightly.
- B. **Construction Tolerances:** As follows:
 - 1. **Variation from Plumb and Level:** Plus or minus 1/16 inch.
 - 2. **Variation of Joints from Hairline:** Not more than 1/16 inch.

3.3 CLEANING

- A. **Remove surplus materials,** rubbish, and debris resulting from acoustical panel installation, on completion of the Work, and leave areas of installation in a neat and clean condition.

3.4 PROTECTION

- A. **Provide final protection** and maintain conditions, in a manner acceptable to manufacturer and Installer, and ensure acoustical panels are without damage or deterioration at time of Substantial Completion.
- B. **Replace panels** that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 09 9100

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. **Section includes** painting work, **interior only**. Work Includes, but is not limited to painting the following:
1. **Interior acoustic ceiling panels** (Tectum).
 2. **Any area of existing finished work** modified by installation of solar system.
 3. **Work includes** field painting of exposed conduits (including color coding), and of hangers, exposed interior steel and iron work, plug mold, electric panels, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.
- B. **"Paint"** as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
- C. **Surfaces to be Painted:** Except where natural finish of material is specifically noted as a surface not to be painted, paint all exposed surfaces whether or not colors are designated in "schedules". Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. **If color or finish is not designated**, Architect will select these from manufacturer's **full range** of colors and finishes.
1. **Multiple colors will be selected** by the Architect for any type of paint system.
 2. **Surface preparation**, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
 3. **If it can be seen**, paint it.
- D. **Following categories of work are not included** as part of field-applied finish work:
1. **Finished Metal Surfaces:** Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.
 2. **Operating Parts:** Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.
 3. **Labels:** Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
- E. **Related Sections:**
1. **Shop Primers:** Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.
 - a. **Unless otherwise specified**, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these specifications.
- F. **Related Documents:** Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUBMITTALS

- A. **Product Data:** Submit manufacturer's technical information including Paint label analysis and application instructions for each material proposed for use.
- B. **Samples:** Prior to beginning work, review Finish Schedule for colors to be painted. Use representative colors when preparing samples for review. Submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.
 - 1. **On surfaces,** duplicate painted finishes of prepared samples. Provide full-coat finish samples on at least 10 sq. ft. of surface, or as directed, until required sheen, color and texture is obtained; simulate finished lighting conditions for review of in-place work.
 - a. **Final acceptance of colors** will be from samples applied on the job.

1.3 QUALITY ASSURANCE

- A. **Single Source Responsibility:** Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- B. **Coordination of Work:** Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.4 DELIVERY AND STORAGE

- A. **Deliver materials** to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:
 - 1. Name or title of material.
 - 2. Fed. Spec. number, if applicable.
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Manufacturer's name.
 - 5. Contents by volume, for major pigment and vehicle constituents.
 - 6. Thinning instructions.
 - 7. Application instructions.
 - 8. Color name and number.
- B. **Store materials** not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue.
 - 1. **Protect from freezing where necessary.** Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.5 JOB CONDITIONS

- A. **Apply water-base paints** only when temperature of surfaces to be painted and surrounding air temperatures are between 50 deg. F and 90 deg. F, unless otherwise permitted by paint manufacturer's printed instructions.

- B. **Apply solvent-thinned paints** only when temperature of surfaces to be painted and surrounding air temperatures are between 45 deg. F and 95 deg. F, unless otherwise permitted by paint manufacturer's printed instructions.
- C. **Do not paint in snow, rain, fog or mist**, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.
 - 1. **Painting may be continued during inclement weather if** areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.
- D. **Determine moisture content of surfaces** to be painted by performing appropriate tests using a commercially available moisture meter. Apply paint only when surfaces are within limits specified by the paint manufacturer's printed instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. **Approved Manufacturers:**
 - 1. **Devoe** Paints.
 - 2. **ICI** Paint Stores.
 - 3. **PPG** Industries, Pittsburgh Paints (Pittsburgh).
 - 4. **Pratt and Lambert** (P & L).
 - 5. The **Sherwin-Williams** Company (S-W).
 - 6. **Benjamin Moore & Co.**
 - 7. **Kwal** Paint.

2.2 MATERIALS

- A. **Material Quality:** Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.
- B. **Proprietary names** used to designate color or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.
- C. **Federal Specifications** establish minimum acceptable quality for paint materials. Provide written certification from paint manufacturer that materials provided meet or exceed these minimums.
- D. **Manufacturer's products** which comply with coating qualitative requirements of applicable Federal Specifications, yet differ in quantitative requirements, may be considered for use when acceptable to Architect. Furnish material data and manufacturer's certificate of performance to Architect for any proposed substitutions.
- E. **Color Pigments:** Pure, non-fading, applicable types to suit substrates and service indicated.

- F. **Lead content in pigment**, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.
 - 1. This limitation is extended to interior surfaces and those exterior surfaces, such as stairs, decks, porches, railings, windows, and doors which are readily accessible to children under seven years of age.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Applicator must examine areas** and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.
- B. **Starting of painting work** will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- C. **Do not paint over dirt**, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.2 PREPARATION

- A. **General:** Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
- B. **Barrier Coats:** Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect in writing of any anticipated problems in using the specified coating systems with substrates primed by others.
- C. **Accessories Removal:** Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.
- D. **Surface Preparation:** Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
- E. **Ferrous Metals:** Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
- F. **Touch-up:** Touch-up shop-applied prime coats wherever damaged or bare, where required by other sections of these specifications. Clean and touch-up with same type shop primer.
- G. **Galvanized Surfaces:** Clean free of oil and surface contaminants with non-petroleum based solvent.

- H. **Materials Preparation:**
1. **Mix and prepare** painting materials in accordance with manufacturer's directions.
 2. **Maintain containers** used in mixing and application of paint in a clean condition, free of foreign materials and residue.
 3. **Stir materials before application** to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.3 APPLICATION

- A. **General:** Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
1. **Paint colors**, surface treatments, and finishes, are indicated in "schedules" of the contract documents.
 2. **Provide finish coats** which are compatible with prime paints used.
 3. **Apply additional coats** when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. **Omit first coat** (exterior faces) of surfaces which have been **shop-primed** and touch-up painted, unless otherwise indicated.
- B. **Scheduling Painting:** Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. **Re-coat Time:** Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
 2. **Minimum Coating Thickness:** Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.
- C. **Mechanical and Electrical Work:** Painting of mechanical and electrical work is limited to those items exposed to mechanical equipment rooms and in occupied spaces.
1. **Electrical items** to be painted include, but are not limited to, the following:
 - a. Conduit and fittings.
- D. **Prime Coats:** Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others.
1. **Recoat primed and sealed surfaces** where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- E. **Pigmented (Opaque) Finishes:** Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.
- F. **Completed Work:** Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.4 FIELD QUALITY CONTROL

- A. **The right is reserved by Owner to invoke the following material testing procedure** at any time, and any number of times during period of field painting:
1. **Owner will engage services of an independent testing laboratory** to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.
 - a. **Testing laboratory** will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.
 - b. **If test results show** that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.5 CLEAN-UP AND PROTECTION

- A. **Clean-Up:** During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.
 1. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. **Protection:** Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
 1. **Provide "Wet Paint" signs** as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
 2. **At completion of work of other trades**, touch-up and restore all damaged or defaced painted surfaces.
- C. **Extra Stock:** Deliver stock or maintenance materials to Owner. Furnish maintenance material matching products installed, packaged with protective covering for storage and identified with appropriate labels.
 1. **Paint:** Furnish not less than one (1) full gallon for each color and type of paint installed.

3.6 INTERIOR PAINT SCHEDULE

A. **General:** Provide the following **paint systems** for the various substrates as indicated below **or equivalent system** from approved manufacturers listed above.

B. **METAL** - (Interior Galvanized)

Sherwin-Williams - Vinyl Acrylic with 100% Acrylic primer:

1st Coat S-W **DTM Acrylic Primer, B66W1** Series

Finish: Flat

Sheen: (Percent at 85 deg) less than **10%**

Thickness: (Mils per coat) **10** wet - **5** dry.

2nd Coat: S-W **ProMar 200** Latex Semi-Gloss **B31W200** Series

3rd Coat: S-W **ProMar 200** Latex Semi-Gloss **B31W200** Series

Finish: Semi-Gloss

Sheen: (Percent at 60 deg) **25-35%**

Thickness: (Mils per coat) **3.5** wet - **1.3** dry.

Kwal Paints - Vinyl Acrylic with 100% Acrylic primer:

1st Coat Kwal **DTM Accu-Guard** Acrylic Primer, **5821**

Finish: Flat

Sheen: (Percent at 85 deg) less than **10%**

Thickness: (Mils per coat) **13** wet - **5** dry.

2nd Coat: Kwal **Vinyl Acrylic Stipple** Enamel, **3070** Series

3rd Coat: Kwal **Vinyl Acrylic Stipple** Enamel, **3070** Series

Finish: Eggshell

Sheen: (Percent at 60 deg) **25-35%**

Thickness: (Mils per coat) **3.5** wet - **1.3** dry.

C. **ACOUSTICAL PANELS** (Interior Tectum)

Sherwin-Williams - Vinyl Acrylic

1st Coat: S-W **PrepRite 200 Latex** Primer, **B28W200**

Finish: Non-bridging Flat

Sheen: (Percent at 85 deg) **0-5%**

Thickness: (Mils per coat) **4.3** wet - **1.2** dry.

VOC: 87 g/L

2nd Coat: S-W **ProMar 200 Latex** Flat Wall Pain **B30W200**

Finish: Non-bridging Flat

Sheen: (Percent at 85 deg) **0-2%**

Thickness: (Mils per coat) **4** wet - **1.3** dry.

VOC: 97 g/L

Kwal Paints - Vinyl Acrylic

1st Coat: Kwal **Accu-Pro Sandable** Latex Primer, **0890**

Finish: Non-bridging Flat

Sheen: (Percent at 85 deg) **0-5%**

Thickness: (Mils per coat) **4.3 wet - 1.2 dry.**

VOC: 87 g/L

2nd Coat: Kwal **Accu-Pro Interior** Latex Flat, **0900 Series**

Finish: Non-bridging Flat

Sheen: (Percent at 85 deg) **0-2%**

Thickness: (Mils per coat) **3.5 wet - 1.4 dry.**

VOC: 90 g/L

2nd Coat: Kwal **EnviroKote Zero VOC** Latex Flat, **218010**

Finish: Non-bridging Flat

Sheen: (Percent at 85 deg) **0-3%**

Thickness: (Mils per coat) **3.4 wet - 1.4 dry.**

VOC: 0 g/L

PPG - Vinyl Acrylic

a. **1st Coat:** PPG Speedhide Interior Quick Drying Latex Sealer 6-2.

1) **Finish:** Non-bridging Primer

2) **Sheen:** (Percent at 60 deg) 2 - 6

3) **Thickness:** (Mils per coat) 3.6 - 4.5 wet; 1.0 - 1.3 dry

b. **2nd Coat:** PPG Speedhide Interior Flat Latex 6-70 Series.

1) **Finish:** Non-bridging Flat

2) **Sheen:** (Percent at 60 deg) 0 - 5

3) **Thickness:** (Mils per coat) 3.2 - 4.0 wet; 1.1. - 1.3 dry

END OF SECTION

DIVISION 26 - ELECTRICAL

Section 26 0519	Low-Voltage Electrical Power Conductors and Cables
Section 26 0526	Grounding and Bonding for Electrical Systems
Section 26 0533	Raceways and Boxes for Electrical Systems
Section 26 2416	Panelboards
Section 26 2816	Enclosed Switches and Circuit Breakers
Section 26 3150	Solar Photovoltaic Systems

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2, Type XHHW-2 and Type SO.
- C. Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type SO with ground wire.

2.2 CONNECTORS AND SPLICES

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

2.3 SYSTEM DESCRIPTION

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

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- B. Exposed Branch Circuits: Type THHN-2-THWN-2, single conductors in raceway.
- C. Exposed Photovoltaic Branch Circuits: Use manufacturers recommended cable between micro-inverters.
- D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- E. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.

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

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
 - a. Test main insulation and conductivity on main feeder to solar shades prior to energizing the system.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

END OF SECTION 260519

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8 by 96 inches (16 by 2400 mm) in diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
- B. Metal Poles Supporting Photovoltaic Modules: Install grounding electrode (a concrete encased electrode or UFER at each pole support) and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit or feeder conductors.

3.3 INSTALLATION

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

- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
- C. Concrete Encased Electrode (UFER): Provide one of the following
 1. 20 feet of bare 4 AWG copper encased in concrete.
 2. Bond to steel reinforcing bars with bare 4 AWG copper if they are a minimum of 1/2" in diameter and are NOT epoxy coated.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 260526

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Boxes, enclosures, and cabinets.
4. Handholes and boxes for exterior underground cabling.

1.2 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 1. Comply with NEMA RN 1.
 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- F. EMT: Comply with ANSI C80.3 and UL 797.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:

- a. Material: Steel.
- b. Type: compression.
- 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ENT: Comply with NEMA TC 13 and UL 1653.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- H. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 3R with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Fiberglass.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- I. Cabinets:

1. NEMA 250, Type 3R galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.

- d. Gymnasiums.
- 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.

2. Arrange raceways to keep a minimum of **1 inch (25 mm)** of concrete cover in all directions.
 3. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
 4. Change from ENT to GRC or IMC before rising above floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to **1-1/4-inch (35-mm)** trade size and insulated throat metal bushings on **1-1/2-inch (41-mm)** trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- N. Surface Raceways:
1. Install surface raceway with a minimum **2-inch (50-mm)** radius control at bend points.
 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inches (1200 mm)** and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- O. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- P. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
 4. Use LFMC in damp or wet locations subject to severe physical damage.
 5. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- Q. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

- R. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.
- S. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- T. Locate boxes so that cover or plate will not span different building finishes.
- U. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than **6 inches (150 mm)** in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within **12 inches (300 mm)** of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with **3 inches (75 mm)** of concrete for a minimum of **12 inches (300 mm)** on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of **60 inches (1500 mm)** from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from **1/2-inch (12.5-mm)** sieve to **No. 4 (4.75-mm)** sieve and compacted to same density as adjacent undisturbed earth.

- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures **1 inch (25 mm)** above finished grade.
- D. Install handholes with bottom below frost line, **<Insert depth of frost line below grade at Project site>** below grade.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 262416

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 4. Directory Card: Inside panelboard door, mounted in transparent card holder.
- C. Incoming Mains Location: Bottom.
- D. Phase, Neutral, and Ground Buses: Tin-plated aluminum.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Tin-plated aluminum.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker.

- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.
 - 1. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.
- B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of trim **90 inches (2286 mm)** above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box.
- E. Install overcurrent protective devices and controllers not already factory installed.
- F. Install filler plates in unused spaces.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- B. Panelboard Nameplates: Label each panelboard with a nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.

END OF SECTION 262416

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Molded-case circuit breakers (MCCBs).
 - 3. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Lugs: Suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.2 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I^2t response.
- D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- E. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.3 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- C. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

END OF SECTION 262816

SECTION 263150

SOLAR PHOTOVOLTAIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes: Grid-connected solar photovoltaic (PV) system rated to produce **16kW** nominal AC output under peak sun conditions (1000 W/m²) including the following:
 - 1. Photovoltaic modules, including structural support systems.
 - 2. Inverters.
 - 3. Disconnect switches (both AC and DC).
 - 4. Remote monitoring provisions.
- B. Related Sections:
 - 1. Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" for conductors and cables required for PV systems and components.

1.3 DEFINITIONS

- A. CEC: California Energy Commission.
- B. DC: Direct Current
- C. PTC: Photovoltaic Test Conditions
- D. PV: Photovoltaic.
- E. STC: Standard Test Conditions.

1.4 PERFORMANCE REQUIREMENTS

- A. Energy Performance: Photovoltaic system shall produce a minimum of **24,738kWh** per year for the project site conditions.
- B. Seismic Performance: Photovoltaic components and support structures shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

- A. Product Data: Include electrical ratings and data with any optional features and accessories for the following:
1. Solar photovoltaic modules (including energy generation ratings and efficiencies). The manufacturer's product literature shall clearly indicate:
 - a. module physical dimensions;
 - b. module weight;
 - c. current-voltage curves;
 - d. short circuit current;
 - e. open circuit voltage;
 - f. maximum power current;
 - g. maximum power voltage;
 - h. temperature coefficients of module power;
 - i. power output tolerance;
 - j. maximum series fuse rating.
 2. Utility interactive inverters (including inverter operation sequences, voltage regulation and efficiencies).
 3. DC disconnect switches.
 4. DC combiner boxes
 5. Alternating current disconnect switches and distribution components.
 6. Structural support hardware.
 7. Monitoring system.
- B. Shop Drawings: Detailed electrical and structural shop drawings sufficient for a complete installation of a solar photovoltaic system, including plans, wiring diagrams and installation instructions. Shop drawings shall include performance charts, details of equipment assemblies with dimensions indicated, weights, components, location and identification of each field connection, and access, workspace, and clearance requirements.
1. Wiring and Connection Diagrams: Internal and field wiring, including power, signal, and control wiring. Include wire sizes, types and termination points.
 2. Raceway Drawings: Plans and details indicating complete raceway requirements for all wiring.
 3. Details: Elevations and details for control and indication displays.
- C. Manufacturer Seismic Qualification Certification: Submit certification that the structural support hardware and photovoltaic equipment will withstand seismic forces defined in Division 16 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the system will remain in place without separation of any parts from devices when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment System: Describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Operation and Maintenance Manuals: For all components of the solar photovoltaic system, including the solar photovoltaic modules, disconnect switches, and inverter, with respect to all operation and maintenance manuals.
1. The Operation and Maintenance manuals shall include the following:
 - a. Title page with clear plastic cover.
 - b. Front title page to include the project title.
 - c. Front title page to include the names of:
 - 1) The Owner

- 2) The Consultant
 - 3) The Designer
 - 4) The General Contractor
 - 5) The Electrical Contractor
 - 6) Any Sub-Contractors, such as a roofing contractor and/or PV array installer.
 - 7) Service representatives in case the PV system does not function.
 - 8) Provide the addresses, phone and fax numbers for the above contacts adjacent to their name.
- d. List of As-built Schematics:
- 1) Single- and triple-line electrical diagram.
 - 2) Site plan.
- e. System Description:
- 1) Describe the system design and configuration.
 - 2) Describe the operation of the PV system (how does it work), and explain the function of each sub-system (if any).
 - 3) Provide an overview of major system components (modules, array, inverters, disconnects, over-current protection) and their connections.
- f. Operator's Manual:
- 1) Procedures for operating the PV system, verifying correct system operation, normal system start up, normal shutdown, producing performance data, and changing inverter protection settings (if permitted).
 - 2) Emergency shutdown and isolation procedures.
 - 3) Start-up procedures for all major equipment, sub-systems and controls, including any alarm functions and power failure mode.
- g. Maintenance Manual:
- 1) Procedures for servicing and maintaining complete system and individual components including:
 - a) All necessary ordinary maintenance, preventive maintenance, minor repair work, and projections for equipment replacement.
 - b) Cleaning the modules and array.
 - c) A schedule of tasks (inspection, cleaning, etc.), time between tasks, and task descriptions.
 - d) How to repair or replace hardware.
 - e) Preventing module and array shading due to the growth in foliage.
 - 2) Describe how to troubleshoot module, array, and inverter problems, including:
 - a) Trouble-shooting sequences.
 - b) The voltage and current expected at various access points to allow simple operational and troubleshooting checks.
 - c) A list of checkpoints if system fails.
 - 3) Provide warning against hazards that could arise in the operation or maintenance of the system and fully describe the precautions that are to be taken to avoid these hazards.
 - 4) Include a parts list giving a sufficient description of each part for ordering a replacement.
 - 5) Provide two-page maintenance log for tracking planned and unplanned maintenance with columns for sequential entry #, date of entry, and entry description.
 - 6) List of equipment suppliers and warranties:
 - a) Provide complete list of equipment suppliers, including address and telephone number.
 - b) Provide complete original-issue manufacturer's documentation, brochures and literature, parts list (if available), installation, and maintenance information for all PV system equipment.
 - c) Provide a warranty list for all items that extend beyond the standard one-year contractor's warranty period.

- d) Provide guarantees and warranty documents for all equipment.
 - h. Test Reports, Certifications:
 - 1) Pre-operational cleaning reports.
 - 2) Identification of disconnecting means: schedule including location, service and normal position.
 - 3) Electrical inspection approval report.
 - 4) Utility approval/acceptance report.
 - 5) Start-up reports of equipment.
 - 6) Table of inverter protection settings (if user adjustable).
 - 7) Test and commissioning documentation.
 - 8) Guarantee and warranty certificates for all equipment and systems.
 - E. Qualification Data for the following:
 - 1. Manufacturer.
 - 2. Installer.
 - 3. Testing agency.
 - F. Source quality-control test reports.
 - G. Field quality-control test reports.
 - H. Utility Coordination Letter: A letter from the utility operating the electrical grid to which the system will be connected certifying that the utility has reviewed and approved the design and implementation of a solar photovoltaic system to be connected to its utility grid.
 - I. Utility Acceptance Letter: Where required by the local utility, written verification indicating that the utility has inspected and approved of the installation of the system and of the isolation-protection method provided to ensure disconnection of the solar photovoltaic system from the utility grid upon interruption of power supplied from the utility grid.
 - J. Letter of Inspection: Written verification from the authority having jurisdiction that the system has been inspected and accepted by the authority having jurisdiction.
- 1.6 QUALITY ASSURANCE
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - B. System Operation: IEEE 929.
 - C. System Interconnection: IEEE 1547.
 - D. Inverter: UL 1741 listed; IEEE 929 compliant.
 - E. PV Modules: UL 1703 listed; IEEE 1262 compliant.
 - F. IEEE 1374 – Terrestrial Photovoltaic Power System Safety
 - G. Comply with NFPA 70 and NFPA 101.
 - H. Installer Qualifications:
 - 1. Licensed in the State of Utah as a Solar Energy Systems Contractor (contractor license classification S202).

2. Have no less than five (5) years of relevant experience on at least five (5) projects in the installation of solar photovoltaic systems similar to that required for this project.

I. Source Quality Control: Manufacturers of equipment to be installed in the solar photovoltaic system shall have not less than five (5) years of continuous experience in the design and manufacture of the component the respective manufacturer is to provide.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in fully enclosed vehicles.

B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

1.8 SERVICE CONDITIONS

A. Environmental Conditions: The solar photovoltaic system shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Ambient Temperature for Electronic Components: -20 to 45 deg C (-4 to 113 deg F).
2. Relative Humidity: 0 to 95 percent, condensing.
3. Altitude: Sea level to 6000 feet.

1.9 WARRANTY

A. Special Warranty for PV System and Components: Manufacturer's standard form in which manufacturer of PV system and components agrees to repair or replace components of PV systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Include the following warranty periods, from date of Substantial Completion, including parts and labor:
 - a. Photovoltaic Modules (workmanship): 2 years
 - b. Photovoltaic Modules (peak power output): 25 years.
 - c. Inverters: 5 years.
 - d. Structural Support System: 5 years.
 - e. Disconnect Switches: 5 years.
 - f. Comprehensive System Operation: 5 years.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.

1. Fuses: One for every 10 of each type and rating, but no fewer than 4 of each.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Solar Photovoltaic Modules:
 - a. SolarWorld AG
 - b. Schott Solar
 - c. Sharp Electronics Corporation
 2. Inverters:
 - a. Fornius
 - b. SMA
 - c. Xantrex
 - d. Enphase Energy

2.2 SOLAR PHOTOVOLTAIC MODULE REQUIREMENTS

- A. General Requirements:
1. Indicate on nameplate certifying that the module meets all applicable standards:
 - a. IEC 61215
 - b. IEEE 1262
 - c. UL 1703
 2. Framed, flat-plate, non-concentrating, and employ Silicon Nitrate Coated Poly-crystalline, mono-crystalline or HIT photovoltaic technology.
 3. One or more bypass diodes installed in the module junction box.
- B. Electrical Characteristics at 1000W/m² and Cell Temperature of 25°C:
1. Minimum Peak Power, STC: 230 watts
 2. Minimum Rated Power, PTC: 200 watts
 3. Power Output Tolerance: -0 /+5.
 4. Module Efficiency: 13% or greater
- C. Photovoltaic Structural Support Equipment:
1. Support each module to be individually removed for maintenance, repair, or replacement.
 2. Allow a module to be removed without breaking the bonding of all modules.
 3. Allow for adjustment of the positioning of modules to provide even spacing between all modules.
 4. Allow for field adjustments in array tilt angle and angle of attachment;
 5. Be appropriate for the snow and wind loads applicable for the area of installation;
 6. Withstand wind loads of up to 200 km/h (124.27 mph);
 7. Be constructed of one of the following:
 - a. corrosion resistant aluminum (6061 or 6063);
 - b. hot dipped galvanized steel (as established per ASTM A123);
 - c. coated or painted steel (although only in low corrosion environments); or
 - d. stainless steel.

2.3 INVERTER REQUIREMENTS

- A. General Requirements:
1. Direct Current Side:
 - a. Compatible with the PV system array output;

- b. Capable of completely automatic, continuous, unattended and stable operation over the range of voltages, currents, and power levels for the size and type of the array to which it is connected, including at start-up, synchronization and disconnect.
 - c. Employ maximum power point tracking technology (MPPT).
 - d. DC combiner to allow connection of multiple PV strings.
 - e. Fused disconnect.
 - f. Ground fault protection.
2. Alternating Current Side:
- a. Power factor of 1.0 without using external reactive power compensation;
 - b. Alternating current output voltage that is directly compatible with the building distribution voltage without the use of an external voltage transformer.
 - c. Does not require a external isolation transformer;
 - d. Capable of operating in parallel with other inverters and the local electrical distribution system.
 - e. Employ built-in mechanisms that cause it to cease to energize the building due to conditions of over-voltage, under-voltage, over-frequency, under-frequency, and in order to prevent islanding.
 - f. Senses loss of utility voltage and automatically disconnects itself from the system until utility voltage is restored.
 - g. Fused disconnect.
3. Inverter Unit:
- a. Single-phase or 3-phase unit as indicated.
 - b. Fail-safe;
 - c. Utility-interactive;
 - d. Capable of computer-interactive performance monitoring;
 - e. Peak efficiency of 93% or higher;
 - f. Total harmonic distortion of 5% or less;
 - g. Automatically disconnects from the grid system when power quality exceeds the following range parameters (per IEEE 929):
 - 1) Voltage: +10% / -10%.
 - 2) Frequency: 59.3 – 60.5 Hz.
 - h. Permits reconnection to the utility grid after disconnection due to under or over voltage, under or over frequency, or loss of power in the utility grid, according to the time delay and power quality provisions specified in IEEE 929;
 - i. Communication port capable of remote monitoring of inverter operation from a computer or from specialized monitoring equipment;
 - j. Meet the requirements for interconnection to the local power utility;
 - k. Meet the following standards and certifications:
 - 1) IEEE 519;
 - 2) IEEE 929;
 - 3) IEEE 1547; and
 - 4) UL 1741.

2.4 ENCLOSURES

- A. Indoors: NEMA 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.
- B. Outdoor: NEMA 3R or better steel cabinets with access to components through hinged doors with flush tumbler lock and latch. All outdoor equipment shall be constructed of weather and sunlight resistant materials
- C. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

2.5 NAMEPLATES

- A. Manufacturer's original nameplates indicating service ratings and standard compliance shall be required on all photovoltaic modules, inverters, and disconnect switches.

2.6 CONTROL AND INDICATION

- A. Description: Group displays, indications, and basic system controls on common control panel adjacent to the inverter or at such other location as recommended by the equipment manufacturer.
- B. Minimum displays, indicating devices, and controls shall include those in lists below. Provide sensors, transducers, terminals, relays, and wiring required to support listed items. Alarms shall include an audible signal and a visual display.
- C. Indications: Plain-language messages on a digital LCD or LED.
 - 1. Quantitative Indications:
 - a. Inverter input voltage, each phase, line to line.
 - b. Inverter input current, each phase, line to line.
 - c. Inverter output voltage, each phase, line to line.
 - d. Inverter output current, each phase.
 - e. Inverter output frequency.
 - f. Current power output.
 - g. Total power generated.
 - 2. Basic Status Condition Indications:
 - a. Normal operation.
 - b. Grid connection status (connected or disconnected).
 - c. Alarm condition.
 - 3. Alarm Indications:
 - a. Control power failure.
 - b. Inverter output over-voltage or under-voltage.
 - c. Inverter output over-frequency or under-frequency.
 - d. Inverter power supply fault.
 - e. Inverter disconnection from grid.
 - f. System overload shutdown.
 - 4. Controls:
 - a. Inverter on-off.
 - b. Alarm silence/reset.
- D. Provisions shall be available for remote indication of the following conditions:
 - 1. Inverter on-line.
 - 2. Inverter disconnected from grid (AC disconnect open).
 - 3. Inverter autodisconnected from grid (voltage, frequency, or loss of grid power).
 - 4. Inverter in alarm condition.
 - 5. Inverter off (DC disconnect open).
- E. Enclosure: Steel, with hinged lockable doors, suitable for wall mounting. Manufacturer's standard corrosion-resistant finish.

2.7 SYSTEM MONITORING AND ALARMS

- A. Provisions for Remote Computer Monitoring: Communication module in inverter unit provides capability for remote monitoring of status, parameters, and alarms specified in Part 2 "Control

and Indication" Article. Remote computer and connecting signal wiring will be provided by Owner. Include the following features:

1. Connectors and network interface units or modems for data transmission via RS-232 or similar link.
2. Software shall be designed to control and monitor inverter functions and to provide on-screen explanations, interpretations, diagnosis, action guidance, and instructions for use of monitoring indications and development of reports. Include capability for storage and analysis of power-line transient records. Software shall be compatible [with requirements in Division 26 Section "Electrical Power Monitoring and Control" and]the operating system and configuration of Owner-furnished computers.
3. Additional monitoring functions and features shall include the following:
 - a. Measuring and recording the incoming and outgoing voltage at the inverter; providing alarm for excursions outside proper voltage range.
 - b. Measuring and recording the incoming and outgoing frequency at the inverter; providing alarm for excursions outside proper frequency range.
 - c. Measuring and recording instantaneous power output of the photovoltaic system and cumulative power output of the photovoltaic system.
 - d. Keypad on device front panel provides access to monitored data using front panel display.
 - e. Memory device to store recorded data in nonvolatile electronic memory.
 - f. RS-232 or similar port to permit downloading of data to a portable personal computer.
 - g. Modem to make measurements and recorded data accessible to remote personal computer via telephone lines.
 - h. Web box to provide connection between any computer and the inverter using 4-conductor twisted pair cables from an RS-485 output at the inverter to the web box. The web box then connects to a local area network (LAN) with an Ethernet cable or to a phone line with the modem.
 - 1) Inverter Communication: RS485 (up to 50 inverters, max. 4000' cable).
 - 2) Ethernet: 10/100 MBit, connection to LAN network.
 - 3) Internal Memory: 8 MB
 - 4) Memory Extension: up to 2 GB through SD card
 - i. Web-Based Portal: At no additional charge to the Owner, provide a web-based portal that allow storage and graphic display of system's performance data. Portal is accessible anytime from any PC computer via a web browser. Daily system data is uploaded to the portal from the system web box at intervals selected by the user. Include a minimum of 5 years of this service in the base bid.

2.8 SOURCE QUALITY CONTROL

- A. Testing: Factory test photovoltaic modules and inverters prior to shipment:
 1. Power generation test (for photovoltaic modules).
 2. Automatic disconnect and reconnect tests (for inverters in over or under voltage, over or under frequency, or utility grid power loss conditions).
 3. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 4. Full-load test.
 5. Overload test.
 6. Power failure test.
- B. Observation of Test: Give 14 days' advance notice of tests and provide access for Owner's representative to observe tests at Owner's option.
- C. Report test results. Include the following data:

1. Description of input source and output loads used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
3. List of instruments and equipment used in factory tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance.
 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Installation shall comply with the National Electrical Code (NFPA 70).
- B. Wiring: Install wiring in raceway according to Section 260533, "Raceways and Boxes for Electrical Systems."
 1. Install all direct current wiring connected to, and terminations at, modules in accordance with the module manufacture's recommendations.
 2. Install all direct current and alternating current wiring connected to, and terminations at, inverter in accordance with the inverter manufacture's recommendations.
 3. Label all source circuits within the source circuit combiner for polarity and string number (both positive and negative). Label all other wiring for polarity and/or phase.
 4. All terminations must use listed box terminal or compression type connections.
- C. Provide all overcurrent protection required for the system and install such overcurrent protection in an accessible location for servicing and maintenance.
- D. Building Envelope Penetrations:
 1. Install all roofing and building envelope penetration per the Contract Documents, and in locations approved by the Achitect.
 2. Install all connections to the roof and building envelope structure per the Contract Documents.
 3. Use only as many attachment points and roof penetrations as necessary for structural loading concerns. The number of attachment points and structural requirements of the roof must be specifically identified in the drawings.
 4. Before roof work is started, co-ordinate with the Architect/Owner regarding any roof warranty.
 5. Seal roof penetrations to suit building code requirements.
 6. Properly size all wiring penetrations of the building envelope in a neat, workmanlike manner.

7. Properly seal any roof or wall penetrations to prevent leakage with industry approved sealing methods according to standard building practices.
- E. Array Mounting:
1. For roof-mounted arrays, provide structural system that supports array off roof. Coordinate with roofing details and installer.
- F. Field Testing – Modules:
1. Upon receipt, check each individual PV module visually for signs of damage.
 2. Field-test each individual PV module prior to assembly into array to verify electrical integrity and specified performance.
 - a. Measure and record open circuit voltage (Voc) and short circuit current (Isc) and compare the results with nameplate values.
 - b. Estimate and record ambient air temperature and solar radiation conditions.
 - c. Complete the testing under good, clear weather conditions.
 3. In the event the measurements are out of the expected ranges, deem the module defective and notify the Supply Contractor.
 4. Do not install defective modules are not to be installed.
 5. Submit a copy of all testing records to the Owner.
- G. Array:
1. Coordinate the array installation with building envelope penetration or groundwork.
 2. Ensure roof area or other installation site is capable of handling the designed array size with no overhanging edges except as indicated.
 3. If roof mounted, verify that the roof is capable of handling additional weight of PV system. Augment roof structure as necessary.
 4. Install PV support structure and modules per Contract Documents and support structure manufacturer assembly instructions.
 5. Modules must fit snug against the support structure. Do not twist the module to force a fit since the glazing may shatter.
 6. This PV system is likely to be placed in a high profile and publicly visible location. As a result, the aesthetics of the overall installation are likely extremely important to the Owners. To create a uniform appearance with the array, adjust the PV module position to permit uniform spacing between individual modules.
 7. The use of ferrous metals, contact of dissimilar metals and the use of any wood or plastic components are not permitted.
 8. Avoid the effects of dissimilar metal contact and choose materials to minimize or eliminate these effects accordingly.
 9. Connect all electrical connections between modules. PV modules are instantly electrically "alive" as soon as they are removed from their shipping box and exposed to light. Use live wiring methods when assembling array.
 10. Provide lock-washers to prevent "backing out" of nuts at all bolted connections. Use stainless steel fasteners only.
- H. System
1. Install all equipment in readily accessible locations as defined by the National Electrical Code.
 2. Install system in compliance with the system component manufacturer's instructions as required to provide a neat, workmanlike, and fully integrated and operational system. Ensure that all required and recommended clearances are maintained.
 3. Connect PV system to the building's electrical distribution system.
 4. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.
 5. Properly ground the system parts to reduce the threat of shock hazards and induced surges.
 6. Notify the Owner in writing when the entire PV system is installed, and the preliminary field-testing is successfully completed.

7. The electrical utility may require that a representative be on-site at the time of the initial system turn on. Provide sufficient notice and co-ordinate work accordingly.

I. Instrumentation

1. Install equipment and wiring according to manufacturers installation instructions.
2. Make final connections to Owner's LAN network.

J. The quality of workmanship provided by each trade in the execution of its work shall be the finest and highest obtainable in that trade working with the materials specified. Workmanship shall be satisfactory to the Owner and the Owner's decision as to acceptable quality is final.

3.3 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 16 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

- A. Identify equipment and components according to Division 16 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Cleaning:

1. Clean up all debris resulting from activities daily. Remove all cartons, containers, crates, etc., under Contractor's control as soon as their contents have been removed. Collect waste and place in a designated location.
2. At the completion of work in any area, clean all work, equipment, etc., keeping it free from dust, dirt, filings, grease, tape residue, and debris, etc.
3. At the completion of work, check all equipment furnished under this Section for paint damage, and repair any factory-finished paint that has been damaged to match the adjacent areas. Replace any cabinet or enclosure that has been deformed with new material and repainted to match the adjacent areas.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Tests and Inspections:

1. Field test the array (or each sub-array when installed) in the presence of the Owner to verify electrical integrity and specified performance.
2. Inspect for integrity of mechanical and electrical connections, component type and labeling verification, and ratings of installed components.
3. Test manual and automatic operational features and system protective and alarm functions.
4. Test communication of status and alarms to remote monitoring equipment.
5. Perform each visual and mechanical inspection and electrical test stated in accordance with the requirements of the authorities having jurisdiction. Certify compliance with test parameters.

6. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
7. Measure the array (or each sub-array) Voc and Isc under good, clear weather conditions. Estimate ambient air temperature and solar radiation conditions. Record and check for consistency with the module field-test measurements.
8. Measure the voltage and current of the system when operating the building load.

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

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.
- C. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.8 DEMONSTRATION AND TRAINING

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central battery inverters. Refer to Division 01 Section "Demonstration and Training."
- B. Training:
 1. Provide a 3-hour on-site training session for personnel designated by the Owner.
 2. Train the designated personnel to enable them to do the following:
 - a. Proficiently operate the PV system, understand location of control components, turn on and off the system.
 - b. Understand system components, layout, configuration.
 - c. Understand system operation, including factors affecting its optimal operation.
 - d. Adjust and change inverter settings.
 - e. Access graphics, data reports, and logs.
 - f. Recognize malfunctions of the system by observation of visual signals.
 - g. Perform checkout and maintenance procedures for maintaining, troubleshooting, diagnosing, and repairing hardware.
 - h. Understand system drawings and Operation and Maintenance manual.
 3. The instructor shall be experienced in presenting this material.
 4. Perform demonstration and instruction on a sunny day, in the presence of the Owner using the completed O&M Manual.
 5. Instruct the building operators in the operation and preventative maintenance of each piece of equipment and system supplied and installed.
 6. Run through all control functions, operating modes and emergency procedures.

3.9 ACCEPTANCE

- A. At the end of the final start-up, testing, and commissioning, if equipment and systems are operating satisfactorily to the Owner, the Owner will sign certificates certifying that the PV system's operation has been tested and accepted in accordance with the terms of this Specification.

END OF SECTION 263150