60% Design Deliverable

San José-Santa Clara Regional Wastewater Facility

7477/7701 – Headworks Project

Volume 1 of 5

Specifications

(Division 01 through Division 20)

San José-Santa Clara Regional Wastewater Facility

August 2019

CITY PROJECT MANAGER: Dan Peters

ADDRESS: City of San José
Environmental Services Department
San José-Santa Clara Regional Wastewater Facility
700 Los Esteros Road
San José, CA 95134

PHONE: (408) 635-2066

FAX: (408) 586-8446

EMAIL: daniel.peters@sanjoseca.gov

The City of San José, California

San José – Santa Clara Regional Wastewater Facility

SPECIFICATIONS

for the Construction of the

HEADWORKS PROJECT

Project No. CIP 7477/7701

VOLUME 1
DIVISION 01 THROUGH DIVISION 20

August 2019

Douglas Nickie Cayko

Engineer of Record

C86947

Jacobs Engineering Group

San José, California

Project No. 706370 Copy No. ____

TABLE OF CONTENTS

VOLUME 1

SPECIFICATIONS

DIVISION 01—GENERAL REQUIREMENTS

DIVISION 05—METALS

DIVISION 06—WOOD, PLASTICS, AND COMPOSITES

DIVISION 07—THERMAL AND MOISTURE PROTECTION

DIVISION 08—OPENINGS

DIVISION 09—FINISHES

DIVISION 35—WATERWAY AND MARINE CONSTRUCTION

DIVISIONS 36 THROUGH 39—NOT USED

DIVISION 40—PROCESS INTERCONNECTIONS

VOLUME 4

DRAWINGS

VOLUME 5

TECHNICAL MEMORANDUMS, CALCULATIONS, AND EQUIPMENT CUTSHEETS

END OF SECTION

PULLED MASTER FROM CITY SPECS. NEED TO MODIFY FOR DB PROJECT

SECTION 01 14 00
WORK SEQUENCE AND RESTRICTIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for sequencing and scheduling Work affecting the existing site and Facility, work restrictions and coordination between construction staff and operations and maintenance (O&M) staff.

B. Related Sections: The following list of related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.

1. Section 01 31 19, Project Meetings.
2. Section 01 32 16, Construction Progress Schedule.
3. Section 01 35 23, Facility Safety Requirements.
4. Section 01 35 53, Site Security Requirements.
5. Section 01 50 00, Temporary Facilities and Controls.
6. Section 01 78 23, Operation and Maintenance Data.
7. Section 01 91 14, Equipment Testing and Facility Startup.

1.02 SUBMITTALS

A. Contractor shall develop and submit documents for all planned interruptions affecting existing treatment processes before each anticipated interruption. Documentation shall include a completed version of the Process Shutdown Request (PSR) template form attached as supplement at the end of this Section.

1.03 GENERAL CONSTRAINTS ON SEQUENCE AND SCHEDULING WORK

A. The San José-Santa Clara Regional Wastewater Facility (Facility) is the City of San José's only means of treating domestic and industrial wastewater prior to discharging into the San Francisco Bay. Impairing the operational capabilities of the Facility may result in serious environmental damage and monetary fines. Contractor shall conduct work in a manner that will not impair the operational capabilities of the essential elements of treatment process or reduce the capacity of the Facility below levels sufficient to treat the quantity of wastewater to permissible levels as specified in the Facility's permits, except as provided in this Section.

B. Contractor shall include costs in the bid price for compliance with the specific limitations and constraints pertaining to maintaining the operational capacity of the Facility, including but not limited to:

1. Reduced construction efficiency and productivity.

2. Overtime costs for performing work outside of normal work hours, if required.
3. Work related to temporary facilities needed to maintain Facility operations.
4. Preparation and revision of schedule and planned Sequence of Work.
5. Design and construction of temporary bracing, underpinning, or special sequencing necessary to support or brace existing structures.

C. Hours of Work:
1. Normal work hours are from 7:00 a.m. to 5:00 p.m. weekdays, no work during the weekend or during City-observed holidays. Obtain written approval from the Jacobs' Engineer prior to initiating work hours outside of the hours allowed by this Contract.
2. Contractor shall request work-hour variations, in writing, a minimum of 7 days prior to the start of the proposed work period.

1.04 FACILITY ACCESS

A. Limited Entrance: The proposed locations for the Project Site are within the gated and locked area. Access to the construction site is through the Facility Main Gate for ingress/egress or other gate as designated by Jacobs' Engineer. Material hauling truck ingress is through the Facility Main Gate or a gate as designated by Jacobs' Engineer.

B. Maintain restricted access to the Facility at all times through the use of gates, fences or other approved means. Contractor shall comply with all security procedures outlined in Section 01 35 53, Site Security Requirements.

C. Contractor's general construction access shall be as indicated on Drawings. Construction access via other gates or roads may be allowed for special circumstances and must receive written approval from Jacobs' Engineer before doing so.

D. Operations and Maintenance Access: Provide and maintain safe, continuous access to process control equipment and chemical deliveries for Facility operations staff and other personnel contracted to perform Work at the Facility.

E. Contractor is required to relocate or reset existing site fencing as required to perform the Work, in order to maintain the integrity of the fence and gates at all times during the contract period. Any such relocation or reset shall be pre-approved in advance by Jacobs' Engineer.

F. Contractor shall be aware that Facility operations and maintenance staff and Facility site visitors frequently travel on the Facility's roads as pedestrians, on bicycles, in carts, in cars and trucks. All work shall be planned in accordance with all restrictions indicated in the Contract Documents, all applicable Facility rules, regulations, posted signage, policies, and procedures and as necessary to accommodate safe working conditions for all on the site. Contractor shall be

aware that the rate of the material hauling operation and other transportation activities within the site may be impacted by normal activity on the site.

1.05 CONTRACTOR'S STAGING AREA

A. A designated staging area as close to the construction site as practicable, will be confirmed at the time of the pre-construction meeting for use by the Contractor for staging construction operations.

B. Maintain the staging area and construction site during construction in a manner that will not unnecessarily obstruct roads or access to other facilities. Contractor shall proceed with his work in an orderly manner, maintaining the construction site free of debris and unnecessary equipment or materials.

1.06 INTERRUPTION OF TREATMENT PROCESS

A. The Jacobs' Engineer will coordinate the approval of the PSRs based on the Facility's ability to reliably meet capacity demands.

1. Contractor shall indicate required shutdowns of existing facilities or interruptions of existing operations on the Project's Progress Schedule. Shutdowns will be permitted to the extent that existing operations of the Facility will not be jeopardized, and when constraints identified in this section have been satisfied.
2. Contractor shall submit a completed PSR form and associated documentation to the Jacobs' Engineer at least 28 days prior to the planned date of shutdown.
3. Following receipt of a notice of planned shutdown, Jacobs' Engineer will notify Contractor as to the feasibility of the requested date and duration of the activity.
4. The Jacobs' Engineer will maintain the ability to cancel a scheduled PSR on the day of the scheduled shutdown due to operational constraints.

B. Contractor shall minimize shutdown times by thorough advanced planning. Contractor shall confirm required equipment, materials and labor is on hand a minimum of 3 calendar days before commencing a shutdown.

C. Contractor shall not begin shutdowns or alterations of existing facilities until Jacobs' Engineer's written permission has been received.

D. Contractor shall provide temporary pumping, plugs, power, lighting, controls, instrumentation, and safety devices when required to minimize treatment process interruptions and comply with shutdown constraints specified in this Section.

1.07 PROCESS SHUTDOWN REQUEST (PSR)

A. Contractor shall review the instructions and template form attached at the end of this Section.

B. Contractor shall prepare and submit a PSR for the following conditions:
   1. Shutdowns, diversions, and tie-ins to the existing Facility.
   2. Power interruption and tie-ins.
   3. Switch over between temporary and permanent facilities, equipment, piping, and electrical and instrumentation systems.
   4. Process constraints requiring interruption of operating processes, roadways, or utilities.
   5. Other Work not specifically listed in the Contract Documents as determined necessary by the Contractor, Facility, and/or Jacobs' Engineer.

C. Contractor shall submit a detailed schedule for the work covered by each PSR.

D. Contractor shall create and maintain a log of all PSRs. The log should include dates of when the PSR was submitted, approved/rejected, date and duration of the proposed shutdown. This log shall be available for review during the construction progress meetings.

E. No consideration will be given to claims of additional time and cost associated to preparing PSRs required to complete Work in a manner that supports proper operation of the Facility and compliance with effluent discharge requirements.

1.08 REQUIREMENTS FOR MAINTAINING CONTINUOUS OPERATION OF EXISTING FACILITIES

A. Continuous operation of facilities is of critical importance. Contractor shall schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.

B. The Contractor shall cooperate fully with Facility's personnel for existing facilities. The Facility may restrict the time and duration of shutdowns, and other disruptions to Facility operations.

C. The Contractor shall perform all necessary Work, as detailed in these specifications, in such manner as not to interfere in any way with normal Facility operations. Wherever the Contractor finds it necessary to involve temporary operating arrangements and/or modify existing equipment in pursuit of Work required under the Contract, Contractor shall give adequate written notice as described in this Section to the Jacobs' Engineer, to allow coordination of Facility operating procedures.

D. Facilities or conditions required to keep the Facility operational include, but are not limited to, the following:
   1. Electrical power including transformers, distribution wiring, and motor control centers.

2. Piping for conveyance of wastewater, chemical, and utilities between treatment units.
3. Chemical storage, metering, conveyance, and control facilities.
4. Plant water.
5. Plant air (process air and instrument air).
6. Laboratory facilities.
7. Office, toilets, and washrooms.
8. Fencing and gates, site security.
9. Lighting.
10. Heating, ventilation, and air conditioning.
11. Distributed Control System (DCS).
12. Instrumentation, meters, controls, and telemetry equipment.
13. Safety equipment and features.
14. Parking for Facility's employees and vehicles required for operation and maintenance of the Facility.
15. Telephone system, all communication systems.
16. Sewers and Storm drainage.
17. Natural gas service, digester gas.
18. South Bay Water Recycling piping and equipment.
19. All truck deliveries for chemicals and material to the plant.
20. Septage Disposal Facilities.

E. Unless otherwise approved in writing by PSR, Contractor shall conduct the Work and provide temporary services and facilities required to keep the Facility continuously operational.

F. If construction cannot be completed according to the allowable shutdown constraints, Contractor shall provide a temporary bypass plan for review to the Jacobs' Engineer before bypass pumping is permitted to allow for uninterrupted operations.

1. For each bypass pumping operation, the Contractor shall furnish and install, ready for use, pump(s) suitable for conveying the quantity and type of flow required. The pump(s) shall be installed as a complete stand-alone system. Power for operation of the pump(s) shall be provided by the Contractor. The Contractor shall provide a minimum of 50 percent standby pumping capacity on site and be ready to operate in the event of failure of the operating temporary pump(s).
2. Contractor personnel shall be on site 24 hours per day to operate and maintain the bypass pumping system while in use. Maintenance shall include, but not limited to, refueling, de-ragging and preventative maintenance.
3. Contractor personnel shall provide all necessary support facilities including additional standby equipment and tools to ensure continuous 24-hour/7-days a week operation of temporary facilities as long as

required. Such additional equipment, materials and labor shall be in compliance with Facility policy and procedures.

G. Contractor shall not close lines, open or close valves, or take other action that would affect the operation or existing systems, except as specifically required by the Contract Documents and after authorization by Jacobs' Engineer and City.

H. Do not remove or demolish existing facilities required to keep the existing Facility operation at the capacities specified until the existing facilities are replaced by temporary, new or upgraded facilities or equipment. The replacement facilities shall have been tested and demonstrated to be operational prior to removing or demolishing existing facilities.

I. If any of the normal Facility operations listed above are rendered inoperative during construction, the Contractor shall immediately undertake emergency repair work to restore Facility operation as directed by the Jacobs' Engineer. This emergency repair work shall be completed as soon as practicably possible.

1.09 SHUTDOWN CONSTRAINTS

A. A shutdown is defined as either Major or Minor based on the impact to treatment plant operations. Most shutdowns can be categorized based on the period of time during which a normal treatment function and activity of the Facility cannot take place. However, there are various other factors that can affect the impact of a shutdown. The category of shutdown (Major versus Minor) shall be at the sole discretion of the Jacobs' Engineer.

B. All work requiring shutdown of Facility treatment processes or interruptions of Facility operations shall normally be done during low flow periods, which are between 5:00 a.m. to 8:00 a.m. on weekdays and between May 15 and October 15 unless otherwise specified by Facility.

C. Shutdown Requirements:

1. Minor Shutdowns:

   a. Minor shutdowns shall be used for localized tie-ins or isolation of utilities, electrical, and communication relocations or other work that does not interrupt treatment processes.

   b. Minor shutdowns shall not be longer than 2 hours in duration unless otherwise approved in writing by the Jacobs' Engineer.

   c. Minor shutdowns require 72 hours notification and an approved PSR.

   d. Minor shutdowns shall not be performed by the Contractor until the Contractor has received written authorization from the Jacobs' Engineer.

2. Major Shutdowns:

   a. Major shutdowns will be used where complete or partial a treatment process shutdown is required, regardless of duration.

b. Major shutdowns require a minimum of 28 calendar days advanced notification and an approved PSR.

c. Contractor shall submit a PSR and a dry run procedure for each major shutdown. PSR and a dry run procedure shall be in accordance with format and procedures attached at the end of this Section. The procedure shall include contingency measures and provisions for returning the system to service in the event that shutdown and work progress difficulties are encountered.

d. Major shutdowns shall not be performed by the Contractor until the Contractor has received written authorization from the Jacobs' Engineer.

1.10 UTILITIES

A. Contractor shall maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Contractor shall provide temporary utilities when necessary.

B. Contractor shall provide at least 2 business days advance notice to and utilize services of Underground Services Alert (USA) for location and marking of underground utilities operated by utility agencies other than the Facility. USA contact number is 811 or 1-800-227-2600.

1.11 ODOR CONTROL

A. Construction activities are not to be the source of nuisance odors, either due to the Contractor's activity or exposing noxious sources.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 COORDINATION OF WORK

A. Contractor shall maintain overall coordination of execution of Work.

B. Contractor shall obtain construction schedules from subcontractors and suppliers and assume responsibility for correctness.

C. Contractor shall incorporate schedules from subcontractors and suppliers into Progress Schedule to plan for and comply with sequencing constraints.

3.02 WORK BY OTHERS

A. Contractor shall coordinate all work with current and ongoing work at the site.

B. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects to the Jacobs' Engineer.

3.03 REQUIREMENTS FOR EXECUTION OF WORK

A. Operating processes, systems, individual equipment items or controls shall be isolated, dewatered, decommissioned, de-energized, or depressurized only by the City's Operations staff in accordance with the approved shutdown plan and schedule.

B. Any additional pumping required to perform the shutdown shall be the Contractor's responsibility. Existing piping or structures may not completely drain and the Contractor may be required to pump any remaining process fluids from pipes or structures. Any additional time required for pumping shall be coordinated with the shutdown period.

C. If the planned circumstances under which the outage was to be conducted change, the Jacobs' Engineer shall have the right to cancel or terminate an outage when the potential for a safety hazard or violation of the discharge permit exists.

D. The Jacobs' Engineer retains the authority to terminate any scheduled shutdown the day of the scheduled shutdown.

E. Pursuant to shut down requirements specified herein, the Jacobs' Engineer shall be notified in writing in advance of any planned outage in any area. If requested by the Jacobs' Engineer, the Contractor shall send a representative to a pre-outage meeting with City's Operations and Jacobs' Engineer's staff to plan activities during the requested outage.

F. Sequence, schedule, and coordinate work in and around the activities of other Contractors on the site to avoid obstruction of work access and interference with, or delay of, the work of other Contractors on the site.

G. Provide temporary pumping, piping, power (including portable generators as required), lighting, controls, instrumentation, communication systems, and safety devices required to comply with the constraints specified in this Section.

H. Confirm required equipment, materials, and labor will be on site a minimum of 3 days before commencing any work covered in a PSR.

I. Establish temporary erosion and sediment controls prior to commencing any clearing, grading, or excavation that may result in discharges to waters of the State.

J. Do not begin shutdowns or alterations of existing facilities until receiving Jacobs' Engineer's approval of the corresponding PSR.

K. Unless otherwise specified, normal daily operation and maintenance of the existing treatment facilities will be performed by Facility personnel. Whenever operational functions on existing facilities or new facilities which affect operating systems are required to permit construction operations, these functions will also be performed by Facility personnel. Contractor shall not operate valves, gates or

other operating systems in the Facility for existing or accepted Work that is part of or may affect Facility operations.

L. Locate temporary facilities in a manner that minimizes interference to City's operation and maintenance personnel.

M. Unless otherwise specified, install temporary pipelines of the same size as its connection to the existing Facility at the downstream end of the pipeline.

N. Provide piping of suitable material for the material being conveyed.

O. Provide submittals on proposed temporary pumping facilities, temporary plugs, and temporary electrical and instrumentation components necessary to maintain existing facilities.

P. Dewater and promptly clean existing structures and pipelines temporarily removed from the operation where required.

Q. Dimensions for all existing structures, piping, paving, and other nonstructural items are approximate. The Contractor shall field verify all dimensions and conditions and report any discrepancies to the Jacobs' Engineer a minimum of 14 days in advance of any construction in the area.

R. Discrepancies between coordinates, bearings and lengths and stationing shall be resolved in the following order of precedence:
   1. Coordinates.
   2. Bearing and lengths.
   3. Stationing.

3.04 WORK SEQUENCE AND CONSTRAINTS

A. General:
   1. Contractor shall utilize the description of critical events in the Work Sequence in this Section as a guideline for scheduling and completing the Work.
   2. The Work Sequence and Constraints presented herein do not include all items affecting the completion of the Work but are intended to describe in general the critical events necessary to minimize disruptions of the existing facilities.

3.05 PROCESS SHUT DOWN REQUEST (PSR)

A. General:
   1. A Process Shutdown Request (PSR) is a detailed document submitted by the Contractor for the purpose of requesting process shutdown(s), utility tie-in(s), work in areas that may risk unanticipated outages, or flow diversions to accommodate construction activities during a project. Such activities may include (but are not limited to) new tie-ins to utilities or

structures, mechanical modifications to process piping or equipment, demolition, bulkhead installation, cleaning processes, tie-ins to the distributed control system (DCS).

2. The purpose of the PSR is to provide a detailed plan for the San José-Santa Clara Regional Wastewater Facility (Facility) and Jacobs' Engineer that describes specific aspects of the work, a shutdown, diversion, or tie-in including its purpose, time of execution, and anticipated impacts on the treatment or business processes. The PSR shall include information from each trade (such as mechanical, electrical, plumbing, HVAC) associated with the particular task requiring a shutdown, diversion, or tie-in. Information within the PSR will be used by the Facility for defining operational procedures and methods to safely and successfully assist the Contractor in performing the Work activities.

B. Submittal Process and Acceptance:

1. Pre-PSR Meeting: The Contractor initiates the PSR process by requesting a pre-PSR meeting with the Jacobs' Engineer to discuss the nature of the shutdown, diversion, or tie-in, and to gather the information necessary to complete the PSR form. The requirement for a pre-PSR meeting may be waived by the Jacobs' Engineer if the nature of the work is deemed to be minor. The Contractor shall complete the Process Shutdown Request Form (attached), and submit to the Jacobs' Engineer for approval following the pre-PSR meeting. The Jacobs' Engineer will distribute the PSR to appropriate Facility staff for review and approval.

2. PSR Content:

a. The Contractor shall describe the nature of the work within the PSR form. The description will include details of all relevant trades associated with the required shutdown, diversion, or tie-in. If any of the trades are subcontracted, the Contractor shall be responsible for making the subcontractor provide and include the specific details required by that trade for the associated shutdown, diversion, or tie-in.

b. The Contractor shall provide sufficient details on process isolation, work sequencing, and safety (i.e., control of significant hazards unique to the shutdown, diversion, or tie-in) to demonstrate an understanding of the Work and how it will be completed within the associated constraints, and the Work's impact on the treatment process.

c. The PSR will be reviewed for completeness, accuracy, compliance with the construction schedule, constraints defined in Contract Documents, and confirm that the requested shutdown, diversion, or tie-in does not negatively affect the operations or other concurrent activities at the Facility. Additional information may be requested from Contractor to understand the nature of the Work and method for completing the Work activities. The Jacobs' Engineer will return the PSR to the Contractor for revision if any of these criteria are not met. Once the PSR is acceptable to all parties, the PSR will be

accepted by signature, and copies distributed by Jacobs' Engineer to the Facility staff and Contractor.

3. PSR Submittal Timing:
   a. Each Major PSR must be approved a minimum of 7 calendar days in advance of the Work activities defined in the PSR. Contractor shall allow a minimum of 21 calendar days from the time of submission to the Facility for acceptance of the PSR. Therefore, the Contractor shall submit the first/original Major PSR a minimum of 28 calendar days prior to the associated shutdown, diversion, or tie-in unless a longer period of time is specifically called out in the specifications for a particular activity.
   b. Minor PSRs shall be submitted by Contractor a minimum of 72 hours in advance.

C. Identification, Scheduling and Tracking:
   1. The Contractor shall submit a preliminary list of anticipated PSRs with the preliminary schedule submission. Within 7 calendar days of the submission of the list of anticipated PSRs, the Contractor shall attend a meeting with the Jacobs' Engineer to review and identify any major shutdowns that may require extended planning.. Scheduled PSRs shall be incorporated as tasks on the established baseline schedule, as well as the 3-week progress schedules prepared by the Contractor throughout the construction period. Scheduled PSRs shall be dated to coincide with the construction activities. Updates to this list shall be made throughout the duration of the project as new PSRs are identified.
   2. In addition to this list, the Contractor shall keep a PSR log for the purpose of tracking active PSRs. This log shall be updated weekly and available for review at the regularly scheduled construction progress meetings.

D. PSR Process Detail:
   1. STEP 1. Contractor identifies PSRs needed on Log and Baseline Schedule.
      a. Contractor submits a preliminary list of anticipated project PSRs identified but not limited to those shutdowns, diversions, or tie-ins described in the Contract Documents in a log/spreadsheet. Incorporate Major PSRs as tasks in Baseline Schedule. PSRs are scheduled to coincide with the appropriate construction activities.
      b. Contractor reviews the preliminary PSR list with the Jacobs' Engineer within 7 calendar days of submission to evaluate the number, complexity, and scale of the requested shutdowns and to identify PSRs that may require more planning lead time than the minimum 28 calendar days prescribed in Article Process Shut Down Requests, Paragraph B of this Section.
   2. STEP 2. Pre-PSR Meeting: Contractor requests a Pre-PSR Meeting with the Jacobs' Engineer to discuss the nature of each requested shutdown, diversion, or tie-in, and to gather the information necessary to complete the PSR Form. The pre-PSR meeting may be waived by the Jacobs' Engineer if the work is deemed to be minor.

3. STEP 3. Submits PSR: Contractor completes the PSR Form and submits it electronically through the DCMS system to the Jacobs' Engineer for review.
4. STEP 4. Reviews PSR: Jacobs' Engineer evaluates the completeness of the submittal and distributes a hard copy of the submitted PSR Form to the appropriate Facility staff for review and approval. Additional information may be requested from Contractor to better understand the nature of and method for completing the Work. The assigned Lead Subject Matter Expert (LSME) shall be responsible for coordinating any associated shutdown procedures for use by O&M staff.
5. STEP 5. PSR finalized: Once the PSR is agreed to by all parties, the PSR will be finalized by signature. Copies are distributed to the Facility Operations and Maintenance staff, Jacobs' Engineer, and Contractor.
6. STEP 6. Complete Readiness Checklist: Contractor verifies everything is ready for the work.
7. STEP 7. Complete Safety Checklist: Contractor completes a Job Hazard Analysis. The Job Hazard Analysis shall be summarized on a form prepared by the Contractor and reviewed by Jacobs' Engineer.
8. STEP 8. Complete work: Contractor completes the work.
9. STEP 9. Contractor updates PSR Log and Progress Schedules.

3.06 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this Specification.
   1. Process Shutdown Request.

END OF SECTION

Process Shutdown Request

Project Name | Project ID

PSR # | Task Title *(Provide <10 word title)*: | Submittal Date: *(Not less than 28 days prior to work)*

SCHEDULE OF WORK ACTIVITY START: *(Date/Time)* | END: (Date/Time)
REQUESTOR:
PRIMARY POINT OF CONTACT: | PHONE/PAGER:
SECONDARY POINT OF CONTACT: | PHONE/PAGER:
NOTIFY ☐ Control Room, Phone. Outside Entity ☐ Security, Phone
BUILDING/AREA: | LOCATION OF WORK FLOOR/LEVEL:

DESCRIPTION OF WORK: *(Provide sufficient details on process isolation, work sequencing, and safety (i.e., control of significant hazards unique to the work) to demonstrate an understanding of the work and how it will be completed within the constraints, and its impact on the processes and Facility.)*

Task Summary: _____

Processes Affected: _____

Trades Affected _____

Other Entities Affected _____

Entity Contact Info _____

WORK PLAN:

Work Sequencing: _____

Process Isolation: _____

Spill Prevention Plan: _____

Contingency Plans: _____

City Work: _____

CRITICAL EQUIPMENT/TOOLS: *(pumps and discharge hoses with correct fittings, blind flanges and pipe plugs, no-hub fittings, properly sized electrical service components, generators, portable lighting, chlorine for potable water pipe breaks, etc.)*

☐	Acoustic Ceiling/or Walls Access	☐	Excavation Permit	☐	Lock Out/Tag Out
☐	Chemical Use Approval	☐	Fire Sprinkler Impairment	☐	Life Safety Systems
☐	Confined Space Permit	☐	Flammable Materials	☐	Roof Protocol
☐	Critical Lift Plan	☐	Flush / Discharge	☐	Work After Dark
☐	Energized Electrical Work	☐	High Pressure Test	☐	
☐	Elect. Panel Schedules	☐	Hot Work/Open Flame	☐	

EXISTING SERVICE(S) AT RISK:

☐	Breathing Air	☐	Elect Normal	☐	Safety Showers	☐	VAX/DATA
☐	Chemical Distribution	☐	Fire Protection	☐	DCS / SCADA	☐	Compliance: Air
☐	Facility Water	☐	HVAC	☐	Security	☐	Compliance: NPDES
☐	Plant Water	☐	Inert Gas	☐	Solvent Drain	☐	
☐	Communication	☐	Instrument - Air	☐	Specialty Gases	☐	
☐	Domestic Drain	☐	Life Safety System	☐	Storm Drain	☐	
☐	Elect-Bus Duct	☐	Natural Gas	☐	Telephones	☐	
☐	Elect Emergency	☐	Process Access	☐	UPS	☐	

REVIEWER'S INSTRUCTIONS / COMMENTS: _____

Project Name Project ID

PSR # Task Title *(Provide <10 word title)*: Submittal Date: *(No later than 28 days prior to work)*

SCHEDULE OF WORK ACTIVITY START: *(Date/Time)* END: (Date/Time)
REQUESTOR:
PRIMARY POINT OF CONTACT: PHONE/PAGER:
SECONDARY POINT OF CONTACT: PHONE/PAGER:
NOTIFY ☐ Control Room, Phone. Outside Entity ☐ Security, Phone
BUILDING/AREA: LOCATION OF WORK FLOOR/LEVEL:

☐ PRE-JOB BRIEFING MUST BE COMPLETED PRIOR TO COMMENCING WORK:

	Full Name (printed)	Signature	Phone	Date
Contractor				
CM				
LSME				
SME (Operations)				
SME (Maintenance)				
SME (Power & Air)				
SME (Instrumentation)				
SME (Electrical)				
DIV. MGR. Facility Maintenance				
DIV. MGR. Energy & Automation				
DIV. MGR. Facility Operations				

As Applicable

Note: The PSR is considered Approved by signature of the Division Manager, Facility Operations, or his/her designee.

SECTION 01 31 13
PROJECT COORDINATION

PART 1 GENERAL

1.01 UTILITY NOTIFICATION AND COORDINATION

A. Coordinate the Work with various utilities. Prior to commencement of any work, all required utility locates must be obtained per state and local requirements.
   1. Underground Service Alert:
      a. Telephone: 811 or 1 (800) 227-2600.

B. Notify Design-Builder for coordination with applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during Work.
   1. Design-Builder:
      a. Contact Person: Enrique Ramos, Onsite Project Manager.
      b. Telephone: (619) 208-6287.

1.02 FACILITY OPERATIONS

A. Continuous operation of the City's facilities and the San José - Santa Clara Regional Wastewater Facility is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.

B. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of City's operations.

C. When necessary, plan, design, and provide various temporary services, utilities, connections, temporary piping and heating, access, and similar items to maintain continuous operations of City's facility.

D. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by City and Design-Builder. Such authorization will be considered through a process shutdown request.

E. Relocation of Existing Facilities:
   1. During construction, it is expected that minor relocations of Work will be necessary.
   2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.

3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
4. Perform relocations to minimize downtime of existing facilities.
5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by Design-Builder.

1.03 ADJACENT FACILITIES AND PROPERTIES

A. Examination:
1. After Effective Date of Subcontract and before Work at Site is started, Design-Builder, Subcontractor, and City shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:
1. Record and submit documentation of observations made on examination inspections.
2. Upon receipt, Design-Builder will review, sign, and return one record copy of documentation to Subcontractor to be kept on file in field office.
3. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Subcontractor's operations, and is for the protection of Design-Builder and City.

1.04 SUBMITTALS

A. Informational Submittals: Documentation of observations made on examination inspections.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CUTTING, FITTING, AND PATCHING

A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.

B. Obtain prior written authorization of Design-Builder before commencing Work to cut or otherwise alter:
1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.

2. Weather- or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Work of others.

C. Refinish surfaces to provide an even finish.
1. Refinish continuous surfaces to nearest intersection.
2. Refinish entire assemblies.
3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and the Work is evident in finished surfaces.

D. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown.

E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.

F. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and fill voids.

G. Remove specimens of installed Work for testing when requested by Design-Builder.

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 GENERAL

A. Design-Builder will schedule meetings throughout progress of the Work and prepare meeting agenda with regular participant input. Design-Builder will conduct meetings, record notes to include significant proceedings and decisions, and reproduce and distribute copies of notes after each meeting to participants and parties affected by meeting decisions.

1.02 QUALIFICATIONS OF MEETING PARTICIPANTS

A. Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

1.03 PRECONSTRUCTION CONFERENCE

A. Subcontractor shall be prepared to discuss the following subjects, as a minimum:
   1. Required schedules.
   2. Bonds and insurance.
   3. Sequencing of critical path work items.
   4. Progress payment procedures.
   5. Project change management.
   6. Use of Site, access, office and storage areas, security and temporary facilities.
   7. Submittal schedule and procedures.
   8. RFI and submittal procedures.
   9. Major product delivery and priorities.
   10. Subcontractor’s safety plan and representative.
   11. Subcontractor’s quality plan.
   12. Subcontractor’s staffing plan.
   13. Outstanding issues.

B. Attendees will include (as a minimum):
   1. Subcontractor’s representative with full authority to make decisions on behalf of Subcontractor.
   2. Subcontractor’s superintendent.
   3. Subcontractor’s quality control representative.
   4. Subcontractor’s safety representative.

5. Design-Builder's representatives.
6. Others as appropriate.

1.04 PRELIMINARY SCHEDULES REVIEW MEETING

A. As set forth in Section 01 32 00, Construction Progress Documentation.

1.05 DAILY COORDINATION MEETINGS

A. Design-Builder will schedule and conduct daily progress meetings to review safety, general work coordination, collection of daily reports, workforce for the day, and other matters needing discussion and resolution.

B. Attendees will include:
   1. Design-Builder.
   2. Subcontractor's representative with full authority to make decisions on behalf of Subcontractor.
   3. Others as appropriate.

1.06 PREINSTALLATION MEETINGS

A. When required in individual specification sections or as directed by Design-Builder, convene at Site prior to commencing the Work of that section.

B. Require attendance of entities directly affecting, or affected by, the Work of that section or as directed by Design-Builder.

C. Notify Design-Builder a minimum of 4 days in advance of meeting date.

D. Unless provided in advance by Design-Builder, provide suggested agenda to include reviewing conditions of installation, preparation and installation or application procedures, and coordination with related Work and work of others.

1.07 FACILITY STARTUP MEETINGS

A. Attend and participate in facility startup meetings.

B. Attendees will include:
   1. Subcontractor's representative with full authority to make decisions on behalf of Subcontractor.
   2. Subcontractor's designated quality control representative.
   3. Subcontractors and equipment manufacturer's representatives whom Design-Builder deems to be directly involved in facility startup.
   4. Design-Builder's personnel.

5. Others as required by Subcontract or as deemed necessary by Design-Builder.

1.08 SAFETY MEETINGS

A. Monthly Mass Safety Meeting:
   1. Attend monthly mass safety meetings to be held at Site or as directed by Design-Builder.
   2. Meeting agenda shall include but not be limited to:
      a. Overall site safety performance.
      b. Safety issues.
      c. Project FSI reviews as required.
      d. Safety recognitions.
      e. Upcoming medium/high risk work activities.
      f. ESP progress.
      g. Other items deemed necessary by Design-Builder.
   3. Employees working onsite shall attend.

B. Safety Committee Meetings:
   1. Subcontractor shall designate one craft level employee to participate in Project's Safety Committee.
   2. Committee shall meet monthly, or as directed by Design-Builder, to conduct Project-wide safety audits, discuss pertinent safety concerns, or other items deemed necessary for Project safety.

C. Site Safety Drills: Held at Site as directed by Design-Builder and attended by staff.

1.09 OTHER MEETINGS

A. In accordance with Subcontract and as may be required by Design-Builder.

1.10 SUBMITTALS

A. Informational Submittal: Execution Plan submitted 30 days after execution of the Subcontract or purchase order.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXECUTION PLAN

A. Execution Plan of the Work shall describe at a minimum the following:

1. What safety risks are identified and how they will be mitigated through the course of the Work in accordance with Field Safety Instructions.
2. Overview of the Work and phases of the Work.
3. Detailed description of the Work in each phase.
4. Manpower and equipment utilized to perform the Work described by areas and crafts.
5. Deliveries, lay down area, and other areas needed to perform the Work along with durations and phases.
6. Installation of the Work by areas and phases in accordance with Design-Builder project schedule.
7. Quality Control of the Work for each discipline involved with the scope of work per requirements of Section 01 45 16.13, Subcontractor Quality Control.
8. Coordination of the Subcontractors' work needed to perform the Work.
9. Design-Builder assistance in specific areas of the Work.

B. Design-Builder will determine if Execution Plan will be required to be submitted prior to performing work or in phases in addition to level of detail required.

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:
   1. Subcontractor's Supplemental Schedule: Submit to Design-Builder within 30 days after Effective Date of Agreement.
   2. Six-Week Look Ahead Schedule: Submit on weekly basis, in conjunction with weekly Schedule Progress Meeting.
   3. Schedule of values.
   4. Manpower Histogram: Within 30 days after Subcontract has been awarded.
   5. Certified Payroll: Submit no later than 10 working days after conclusion of work week.
   6. Initial Quantity Installation Histogram: Submit to Design-Builder within 30 days after Effective Date of Agreement. Applies to linear feet (LF) of yard pipe, LF of duct bank, cubic yards (CY) of concrete installed, number of pieces of process/HVAC equipment installed and number of instruments installed.
   7. Daily reports.
   8. Actual Weekly Quantity Installation Report: Submit no later than Monday close of business following the end of the previous work week. Applies to the same items as shown in Subparagraph Initial Quantity Installation Histogram of this Article.

1.02 GENERAL DEFINITIONS

A. Baseline Project Schedule: Developed by Design-Builder. It is the basis for developing the Working Project Schedule.

B. Supplemental Schedule: Developed by Subcontractor. It is directly related to Baseline Project Schedule. Many detailed activities on Supplemental Project Schedule to One Activity on Baseline Project Schedule.

C. Working Project Schedule: Developed and maintained by Design-Builder. Working Project Schedule incorporates Subcontractor's approved Supplemental Schedule and is updated and used to track project progress throughout duration of Project.

D. Six-Week Look Ahead Schedule: Subset of Working Project Schedule. Contains activities 1 week prior to Data Date and 5 weeks after Data Date.

E. Rules of Credit: Rules for taking physical progress on an activity, based on giving weighted value to different phase of work, while installing a given resources; see Article Procedures, Paragraph Quantity Reporting.

1.03 PROCEDURES

A. Design-Builder has developed Baseline Project Schedule that Subcontractor shall comply with, along with updates to Baseline, for overall direction of the Work. Official project schedules will be created, maintained, and issued by Design-Builder, exclusively.

B. Subcontractor shall, within 30 days after award of Subcontract, prepare and submit to Design-Builder for approval a Supplemental Schedule showing Baseline Project Schedule activities broken down into more detail.

1. Supplemental Schedule shall be developed on Subcontractor's scheduling tools.
2. Output that is submitted back to Design-Builder shall be a Bar Chart showing each Baseline Project Schedule activities.
   a. Under each Baseline Project Schedule activity Subcontractor shall show detailed activities that have been developed.
   b. Total duration of detailed activities shall equal duration of Baseline Project Schedule activity.
3. If Subcontractor's Supplemental Schedule is not acceptable, Design-Builder will notify Subcontractor and provide comments on unacceptable items.
   a. Subcontractor shall make corrections and resubmit within 10 days of notification.
   b. Review and revision process will continue until Supplemental Schedule is accepted by Design-Builder.
4. After approval Design-Builder will integrate Supplemental Schedule into Baseline Project Schedule. From that point forward schedule will be known as the Working Project Schedule.
   a. Working Project Schedule will become basis for measuring Subcontractor's progress and schedule compliance and will always be compared against Baseline Project Schedule.
5. If Subcontractor fails to submit Supplemental Schedule within time prescribed, Design-Builder may withhold approval of progress payments until Subcontractor submits required Schedule.

C. Subcontractor shall submit weekly to Design-Builder actual progress information as required to allow Design-Builder to update the Working Project Schedule.

1. If, in opinion of Design-Builder, Subcontractor falls behind their activities contained in Working Project Schedule, or any subsequent updates, Subcontractor shall take steps necessary to improve its progress, including those that may be required by Design-Builder, without additional cost to Design-Builder.
2. In this circumstance, Design-Builder may require Subcontractor to increase number of workers and supervision, shifts, overtime operations, days of work or amount of construction plant, and to submit for approval additional Supplementary Schedule or schedules as deemed necessary by Design-Builder to demonstrate how approved rate of progress will be regained.

D. Subcontractor shall participate in a weekly schedule meeting.
   1. Subcontractors onsite will participate in each weekly schedule meeting.
   2. Meeting will cover Work completed during previous week and the Work to be completed in next 5 weeks following meeting. Each week Design-Builder will update schedule and issue a 6-Week Look Ahead Schedule report, back to Subcontractors.
   3. In preparation for weekly meeting Subcontractor shall review and update previous week's 6-Week Look Ahead Schedule and be prepared to be an active participant in meeting discussions. One workday prior to schedule meeting, Subcontractor will informally submit their updated 6-week Look Ahead Schedule to the Design-Builder project scheduler.

E. Failure of Subcontractor to comply with requirements of Design-Builder under this clause shall be grounds for a determination by Design-Builder that Subcontractor is not prosecuting Subcontractor's Work with sufficient diligence to ensure completion within time specified in Subcontract. Upon making this determination, Design-Builder may terminate Subcontractor's right to proceed with Subcontractor's Work, or any separable part of it.

F. Quantity Reporting:
   1. Some Baseline Project Schedule activities, and subsequently the Working Project Schedule, can be resource loaded with Quantity Units of material to be installed and completed.
      a. Some typical examples would be cubic yards of concrete, linear feet of under slab piping, linear feet of aboveground piping, linear feet of yard piping, each equipment to be installed, linear feet of electrical duct bank, linear feet of under slab conduit number of pieces of electrical equipment, number of circuits for 480 volts, and number of loops for instrumentation.
      b. When a quantity unit appears on an activity and activity is progressed during the week, Subcontractor shall enter number of Units completed during previous week.
      c. A "stepped form of progress" on Quantity Units is allowed, but the "Rules of Credit" on this type of Progress reporting shall be agreed to by Subcontractor and Design-Builder, in advance. A typical example of a "Stepped form of progress" is as follows:
         1) Activity A has 550 cubic yards of concrete. Description of Activity A is "Form, Rebar, Pour Foundation Slab – Pour A – Bioreactor". Steps and percentages for this type of activity are:
            a) Step 1: Form equals 15 percent.
            b) Step 2: Rebar equals 45 percent.
            c) Step 3: Pour equals 40 percent.
         2) If Activity A doesn't get completed in 1 week then Subcontractor is allowed to take credit on the steps, such as the example below:
            a) Step 1: Form equals 15 percent * 100 percent equals 15 percent.

b) Step 2: Rebar equals 45 percent * 100 percent equals 45 percent.

c) Step 3: Pour equals 40 percent * 0 percent equals 0 percent.

3) Subcontractor is allowed to take 60 percent credit on the 550 cubic yards, which equals 330 cubic yards.

2. Subcontractor is responsible for defining and presenting the "Rules of Credit" to Design-Builder if a "stepped progress" is formally requested. Design-Builder will approve, disapprove, or negotiate, depending on review of the "Rules of Credit" submitted by Subcontractor.

G. Schedule of Values:

1. Each item on SOV shall be directly related to activities on Working Project Schedule, with the exception of General Condition items.
2. If other than a General Condition item, Subcontractor shall be able to relate one activity, or a group of activities, on Working Project Schedule, to one item on Schedule of Values.
3. An activity on Working Project Schedule cannot be related to more than one item on SOV.
4. Submit proposed SOV to Design-Builder within 30 days after award of Subcontract.
5. SOV should match, as closely as possible, activities on Baseline Project Schedule.
6. Each line item on SOV will contain a value equal to the Work being done.
7. Aggregate of all items on SOV shall equal Contract Value.
8. Design-Builder will review submitted SOV for compliance with requirements on Design-Builder Project Accounting Procedures.
   a. Deviations will be negotiated with Subcontractor and resolved.
   b. Subcontractor shall submit approved SOV as back-up to Subcontractor's Monthly Payment Request. Each line item in SOV shall list the following:
      1) Item description.
      2) Design-Builder-provided WBS accounting code.
      3) Total quantity and value of item.
      4) Total quantity and value earned as of previous payment request.
      5) Total quantity and value earned as of this payment request.
      6) Period quantity and value earned for this payment request.
   c. Sum of each "value" column shall equal value shown on monthly payment request cover sheet, i.e., monthly invoice.

H. Change Management:

1. Subcontractor shall be responsible for reporting to Design-Builder, on a bimonthly basis, pending changes that are not part of existing Contract scope between Subcontractor and Design-Builder.
    a. Design-Builder will keep a Project Issue Log of pending change items, as they work their way through the system to either become a Change Order or are mutually agreed upon to be removed from Project Issue Log.
    b. Subcontractor shall be responsible for estimating value of each item and notifying Design-Builder if estimate changes.
    c. At a mutually agreed upon time and when Project Issue Log item is approved, estimated amount will become value that is transitioned into a Change Order.
2. When multiple items on Project Issue Log are approved within same time frame, they will be combined to form a single Change Order.
    a. Each Project Issue Log item will be listed separately on Change Order and the total value of Change Order will equal the sum of Project Issue Log items.
    b. When Project Issue Log item has been approved for transition into a Change Order, item will be flagged.
    c. After Change Order is issued, item will be removed from Change Management Log.
3. As Change Orders are approved and become part of the Contract between Subcontractor and Design-Builder, the SOV will be revised by adding a line item(s) for the Change Order and/or revising existing line items:
    a. The Working Project Schedule will also be revised to show new work being performed.
    b. If Change Order or combination of Change Orders is of sufficient magnitude, there is a possibility that Baseline Project Schedule will also be revised. This is at discretion of Design-Builder.

I. Manpower Reporting:

1. Within 30 days after Subcontract has been awarded, submit manpower histogram showing number of people Subcontractor plans to have onsite for duration of Subcontract.
    a. Histogram shall show average number of personnel Subcontractor will have onsite, per month.
    b. For each month describe percentage of workers that are attributed to different types of work.
        1) An example of this would be if Subcontract was awarded to one Subcontractor for yard pipe and excavation. In this example histogram would show an average of 30 workers onsite for a given month. Subcontractor shall describe how many of the 30 workers will be working on earthwork and how many would be working on yard pipe.

2. Each week Subcontractor shall submit a certified payroll to Design-Builder showing number of hours each individual working for Subcontractor worked during previous week.
   a. Certified payroll is due to Design-Builder Field office by 10 working days after conclusion of a work week.
   b. Certified payroll shall be required for Subcontractor and their third-tier subcontractors.
   c. Certified payroll shall include both onsite staff and workers performing onsite activities.

1.04 ADJUSTMENT OF CONTRACT TIMES

A. Claims Based on Contract Times:
   1. Where Design-Builder has not yet rendered formal decision on Subcontractor's claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in Project Schedule, Subcontractor shall reflect an interim adjustment in Project Schedule acceptable to Design-Builder.
   2. It is understood and agreed that such interim acceptance will not be binding on Subcontractor or Design-Builder, and will be made only for purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.

1.05 DAILY DOCUMENTATION OF WORK

A. Subcontractor shall, on a daily basis, provide daily report showing, at a minimum, the following:
   1. Work hours. The P6 Activity ID of the Work done.
   2. Manpower onsite listed by labor type and subcontractors.
   3. Areas and activities where the Work occurred and manpower/equipment assigned to each or as requested by Design-Builder.
   4. Equipment onsite identifying time used and length not used.
   5. Deliveries of materials or equipment with quantities.
   6. Safety issues, incidents, injuries, and near misses.
   7. Weather conditions.
   8. Materials installed and quantities.
   9. Change work that was active that day listed by Project Issue Directive number.

B. Design-Builder reserves right, in its sole discretion, to require additional information be incorporated into Daily Report. Signed Daily Reports shall be provided to Design-Builder by 8:00 a.m. the following business day.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 DEFINITIONS

A. Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations that are issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product.

B. Shop Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work to illustrate some portion of the Work.

C. Product Data: Illustrations, standard schedules, performance charts, brochures, diagrams, and other information to illustrate materials or equipment for some portion of the Work. Product Data will also include engineering calculations and related information, where specified.

D. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.

E. Special Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged, and will be incorporated in the Work.

F. Preliminary Submittal Registry: Subcontractor or Supplier created list of required submittals, including: applicable specification(s), proposed grouping or packaging of individual documents, and anticipated date(s) of submission, submitted to Design-Builder for approval and incorporation into the Master Submittal Registry.

G. Master Submittal Registry: Design-Builder maintained list of required submittals, including: applicable specification(s), approved grouping or packaging of individual documents, and anticipated date(s) of submission; to provide a tracking and scheduling control logic for Work.

H. Submittal Package: Documentation, packaged in a single PDF file, pertaining to one or more specified requirements (submittals), including a completed copy of Section 01 33 00, Supplement 1, Transmittal of Contractor's Submittal Form, specification markups, or an itemized statement, indicating: 1) All submittals transmitted within the PDF file, 2) Page location of submittals transmitted, 3) Omissions, exceptions, and/or deviations from Contract Documents, and 4) Changes made between revisions.

I. Submittals: Documents required to be submitted that convey information about systems, equipment, materials, products, and administrative matters. Submittals include the following Submittal Types:

1. Action Submittal: Written and/or graphic information submitted by Subcontractor or Supplier that requires Design-Builder's approval.

2. Informational Submittal: Information submitted by Subcontractor or Supplier that requires Design-Builder's review and determination that submitted information is in accordance with the Conditions of the Subcontract or purchase order.

J. Deferred Submittals: Information in accordance with 2016 CBC, submitted for portions of design that were not provided to the Authority Having Jurisdiction (AHJ) at time of permit application and that require finalization of design, documentation of life safety equipment and systems, and other submittals for permanent construction requiring preparation by Subcontractor's registered design professional. Deferred submittals to the AHJ include Design-Builder's review documentation that submittal has been found to be in conformance with required codes and Project's design criteria. Deferred submittals are for documentation or approval by the AHJ prior to installation of that portion of the Work. Deferred Submittals include the following Submittal Types:

1. Deferred Action Submittal: Final design, prepared and stamped by Subcontractor's or Supplier's registered design professional, of systems, components, equipment, building and non-building structures, structural elements, as well as supports and anchorage, required to complete Project. Deferred action submittals shall include, but not be limited to shop drawings.
2. Deferred Informational Submittal: Final design, prepared and stamped by Subcontractor's or Supplier's registered design professional, of systems, components, equipment, structural elements, as well as supports and anchorage, required to complete the Project. Deferred informational submittals shall include, but not be limited to, calculations.

1.02 PROCEDURES

A. Preliminary Submittal Registry:

1. Within 30 days from execution of Subcontract or Purchase Order; submit Subcontractor's or Supplier's Preliminary Submittal Registry of anticipated submittals to Design-Builder.
   a. Include items of work that will require approval, review, and other required comments, decisions or input to be received from Design-Builder before materials have been procured.
   b. Design-Builder will incorporate the Subcontractor's or Supplier's approved Preliminary Submittal Registry into the Master Submittal Registry to provide a tracking and scheduling control logic for Work.
2. Formatting: Submit in MS Excel file type format.

B. Submittals:

1. Transmitting to Design-Builder: Transmit all submittals electronically via the Project's designated Records Management Software, unless specified or directed otherwise.
   a. Records Management Software: City EADOC System.
   b. Design-Builder can assist in instructing Subcontractor or Supplier personnel to use the Records Management Software.

2. Submittal Packaging:
   a. Complete the Section 01 33 00, Supplement 1, Transmittal of Contractor's Submittal Form and include as page 1 of each Submittal Package.
   b. Unless otherwise directed, multiple submittals may be packaged under a single Section 01 33 00, Supplement 1, Transmittal of Contractor's Submittal Form if the following conditions are met:
      1) Submittals are required by the same specification section.
      2) Submittals are clearly separated, marked, or delineated.
   c. Review each submittal for completeness and conformance with Contract Documents, Subcontract Agreements and/or Purchase Orders.
   d. Submittal Packages shall be revised and resubmitted until all submittals included achieve an Approved (APP) or Meets Project Criteria (MPC) review status, unless otherwise directed by Design-Builder.
3. Submittal Numbering and Naming:
   a. Number and Name submittals as follows: (A)-(B)-(C) Title.
      1) (A) equals Specification Section Number.
      2) (B) equals sequential Submittal Number.
      3) (C) equals sequential Revision Number, prefixed with "R";
      4) (Title) equals descriptive submittal title;
   b. Examples:
      1) 03 30 00-001-R2 Mix Designs: Indicates the second revision of the first submittal package submitted under Section 03 30 00, Cast-In-Place Concrete, titled "Mix Designs."
      2) 05 05 23-005-R0 NDT Procedures: Indicates the initial version of the fifth submittal package submitted under Section 05 05 23, Welding, titled "NDT Procedures."
4. Submittal Formatting:
   a. Submit documents in Portable Document Format (PDF) file type format, unless specified or requested otherwise, with the following properties:
      1) Document resolution sufficient to print legibly on 8.5-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch standard copy, as applicable.
      2) Written table of contents and PDF bookmarking to major sections of the document if greater than 20 pages in length.
      3) Open to page 1 of the PDF document in "Fit to Page" view.
      4) Open to page 1 of the PDF document with the Bookmarks Panel visible and in "Fit to Page" view if greater than 20 pages in length.
   b. Clearly indicate, by highlight, markup, or notation, each of the following:
      1) Include page(s) from specification. Highlight or note what the submittal represents.
      2) Specified data, options, deviations, and/or exceptions submitted,
      3) Corrections and/or changes made for each resubmittal.

4) Information that does not apply and is not for Design-Builder review.

c. Provide authorization to reproduce and distribute each submittal as many times as necessary for Project documentation.

5. Resubmittals:

a. Complete a new Section 01 33 00, Supplement 1, Transmittal of Contractor's Submittal Form and include as page 1 of each transmitted resubmittal.

b. Resubmittals shall replace the previous submittal in its entirety.

c. Information that has been altered, added, or removed from the previous submittal shall be clearly noted on the Section 01 33 00, Supplement 1, Transmittal of Contractor's Submittal Form and called out within the submittal document.

1) Failure to clearly identify altered, added, or removed information may result in rejection of submitted information.

2) Design-Builder will review only resubmittal information clearly identified as changed from the previous submittal.

6. Hardcopy Submittals:

a. Complete and electronically submit a Transmittal of Contractor's Submittal Form (Section 01 33 00, Supplement 1) in advance of delivery to the Design-Builder to create an electronic record of the submittal.

b. Unless otherwise specified or directed, submit five identical, single-sided, collated hardcopy sets.

1) Include a signed copy of the Transmittal of Contractor's Submittal Form (Section 01 33 00, Supplement 1) with each hardcopy set.

2) Paper size shall be 8.5-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch standard copy, as applicable.

3) Hardcopy sets shall be bound in a manner that facilitates removal and replacement of individual pages.

c. Clearly indicate, by highlight, markup, or notation, each of the following:

1) Specified data, options, deviations, and/or exceptions submitted,

2) Corrections and/or changes made for each resubmittal.

d. Provide authorization to reproduce and distribute each submittal as many times as necessary for Project documentation.

7. Furnish submittals and resubmittals in sufficient time for review and approval action without delaying the Project. No adjustment of contract time or price will be authorized due to:

a. Failure to transmit submittals sufficiently in advance of the Work to permit processing.

b. Delays in progress of Work caused by submittal processing, rejection, subsequent resubmittal(s), and/or processing of deferred submittals by the AHJ.

8. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Subcontract or Purchase Order Agreement.

9. Coordinate each submittal with fabrication, purchasing, testing, delivery of other submittals, and related activities requiring sequential activity.
10. Review each submittal and check for compliance with Contract Documents, Subcontract Agreement, and/or Purchase Order prior to transmitting to Design-Builder.

1.03 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual specification sections.

B. Shop Drawings:
   1. Identify and Indicate:
      a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
      b. Equipment and Component Title: Identical to title shown on Drawings.
      c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
      d. Project-specific information drawn accurately to scale.
   2. Provide manufacturer's standard schematic drawings and diagrams, modified as follows:
      a. Delete information that is not applicable to the Work.
      b. Supplement standard information to provide information specifically applicable to the Work.

C. Product Data:
   1. Prepare and submit product data as specified in individual specifications.
   2. Foreign Manufacturers: Unless otherwise specified in individual specifications, include names and addresses of at least two companies that maintain technical service representatives close to Project.

D. Samples:
   1. Provide two identical samples unless otherwise specified in individual specifications.
   2. Mount, display, or package samples in a manner that facilitates review of quality.
   3. Without obstructing critical elements of sample from quality review, label samples with the following information:
      a. Submittal Number.
      b. Manufacturer name.
      c. Model number.
      d. Material.
      e. Sample source.
   4. Manufacturer's Color Chart: Provide units or sections of units showing full range of colors, textures, and patterns available.

5. Full-size Samples:
   a. Provide size as indicated in individual specification section.
   b. Prepare from same materials to be used for the Work.
   c. Cure and finish samples in manner specified.
   d. Provide sample that is physically identical to product proposed for use.

1.04 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by individual specification sections.

B. Certificates:
   1. Certificates shall be signed by officer or other individual authorized to sign documents on behalf of that entity.
   2. Welding Certificates: Prepare and submit in accordance with individual specification sections.
   3. Installer Certifications: Prepare written statements, prepared by manufacturer, on manufacturer's letterhead, certifying installer complies with requirements as specified in individual specification section.
   4. Material Tests: Standard form prepared by qualified testing agency indicating and interpreting test results of material for compliance with requirements.
   5. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual specification sections.
   6. Manufacturer's Certificate of Proper Installation: In accordance with Section 01 43 33, Manufacturers' Field Services.

C. Manufacturer's Instructions: Submit written or published information that documents manufacturer's recommendations, guidelines, and procedures in accordance with individual specification section.

D. Operation and Maintenance Data: Prepare and submit in accordance with Section 01 78 23, Operation and Maintenance Data.

E. Special Guarantees: Prepare and submit supplier's written guarantee as required in individual specification sections.

F. Test, Evaluation, and Inspection Reports:
   1. Shall contain signature of person responsible for test or report.
   2. Factory Reports:
      a. Include the following information:
         1) Project Title and Number.
         2) Specification Section.
         3) Product Identification.
         4) Type of Inspection or Test with Referenced Standard or Code.
         5) Date and Time of Test.

6) Date Report Issued.
7) Name and Signature of Authorized Person.

b. Test Results: If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.

c. Interpretation of Test Results, when Requested by Design-Builder.

d. Other Items as Identified in Individual Specification Sections.

3. Field Reports:

a. Include the following information:

1) Project Title and Number.
2) Specification Section.
3) Product Identification.
4) Type of Inspection or Test with Referenced Standard or Code.
5) Date and Time of Test.
6) Record of Temperature and Weather Conditions.
7) Testing Laboratory Data:
a) Testing Laboratory Name.
b) Address.
c) Telephone Number.
d) Name and Signature of Laboratory Inspector.
8) Date Report Issued.
9) Name and Signature of Authorized Person.
10) Test Results: If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
11) Interpretation of Test Results, when Requested by Design-Builder.
12) Other Items as Identified in Individual Specification Sections.

G. Training Data: Prepare and submit in accordance with Section 01 43 33, Manufacturers' Field Services.

1.05 DEFERRED SUBMITTALS

A. See Drawings for list of deferred submittals.

B. Subcontractor or Supplier shall submit design drawings and product data related to permanent construction.

1. Written and graphic information.
2. Drawings.
3. Cut sheets.
4. Data sheets.
5. Action and informational submittals requested in individual specification section.

C. Action and informational submittals for deferred submittals shall be prepared and submitted in accordance with Articles Action Submittals and Informational Submittals listed above.

D. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit required supporting data and drawings for review and acceptance by Design-Builder. Documentation of review and approval provided on comment form, along with completed submittal, will be filed with permitting agency by Design-Builder and approved by permitting agency prior to installation.

1.06 ASSET MANAGEMENT DATA

A. Submit five paper copies and one electronic copy in the latest Excel format of the Asset Management spreadsheet for each piece of equipment, instrumentation, electrical component, and panel.

B. The Asset Management spreadsheet shall include the data shown on the blank Asset Management Forms contained in this section.

1.01 MANUFACTURER'S INSTRUCTIONS

A. Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer's instructions is required by the Specifications.

B. Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components. Submit manufacturer's instructions in accordance with requirements for Product Data.

1.07 DESIGN-BUILDER'S REVIEW

A. General:

1. Design-Builder's review of submittals shall not release Subcontractor or Supplier from Subcontractor's or Supplier's responsibility for performance or requirements of Contract Documents, Subcontract Agreements, and/or Purchase Orders.
2. Design-Builder's review shall not release the Subcontractor or Supplier from fulfilling the purpose of installation nor from the Subcontractor's or Supplier's liability to replace defective work.
3. Do not consider submittals as Contract Documents. The purpose of submittals is to demonstrate how the Subcontractor or Supplier intends to conform to the design concepts.
4. Design-Builder's review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents. Design-Builder's review does not extend to:
    a. Accuracy of dimensions, quantities, or performance of equipment and systems designed by Subcontractor or Supplier.

b. Subcontractor's or Supplier's means, methods, techniques, sequences, or procedures except when specified, indicated on Drawings, or required by Contract Documents.

B. Processing Time:

1. Time for review begins when the Design-Builder receives the submittal.
2. The Design-Builder will act upon submittals and transmit responses to the Subcontractor or Supplier not later than 30 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals or by processing of deferred submittals by AHJ.

C. Review Statuses:

1. Incomplete Submittals: Submittals not in accordance with packaging, formatting, and certification requirements shall be immediately returned to the Subcontractor or Supplier for revision without Design-Builder's review.
2. Submittals Not Subject to Review (NSR): Submittals not required by Contract Documents, and not specifically requested, will be designated Not Subject to Review (NSR) and returned without Design-Builder's review.
3. Action Submittals:
   a. Design-Builder will review, comment, stamp, and distribute as noted:
      1) Approved (APP): Subcontractor or Supplier may incorporate product(s) or implement Work covered by submittal.
      2) Approved as Noted (AAN): Subcontractor or Supplier may incorporate product(s) or implement Work covered by Submittal, in accordance with Design-Builder's notations.
      3) Revise and Resubmit (RAR): Subcontractor or Supplier may not incorporate product(s) or implement Work covered by submittal.
4. Informational Submittals:
   a. Design-Builder will review, comment, and distribute as noted:
      1) Meets Project Criteria (MPC): Subcontractor or Supplier may incorporate product(s) or implement Work covered by submittal, if applicable.
      2) Meets Project Criteria with Incorporation of Comments (MWI): Subcontractor or Supplier may incorporate product(s) or implement Work covered by submittal, if applicable, in accordance with Design-Builder's notations.
      3) Does Not Meet Project Criteria (DNM): Revise and resubmit. Subcontractor or Supplier may not incorporate product(s) or implement Work covered by submittal, if applicable.

1.08 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this specification.

1. Transmittal of Contractor's Submittal Form.
2. Asset Management Forms.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SUBMITTAL NUMBER:	*THIS LINE FOR DESIGN-BUILDER USE*
SPECIFICATION SECTION:	
TITLE / DESCRIPTION:	
REVISION NUMBER:	
REVISION DATE:	
SUBMITTED BY (CONTRACTOR):	

DESCRIPTION OF ITEM(S) SUBMITTED	SPEC / PARA #	DWG #	VARIATION TO SUBCONTRACT?	
			NO	YES
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐

Itemize all inclusions in this submittal by specification / paragraph number (e.g. 1.03.A.1 Mix Designs) or, attach a marked-up copy of the applicable specification section, clearly identifying all inclusions. Clearly indicate exceptions, deviations, and / or revision changes.

CONTRACTOR'S NOTES TO DESIGN-BUILDER:

CERTIFICATION STATEMENT

☐ CONTRACTOR certifies that this submittal: (i) complies with requirements of Contract Documents and Subcontract Agreement / Purchase Order in preparation, review, and submission, and (ii) is complete and in accordance with Contract Documents and requirements of law, regulations, and governing agencies.

CERTIFIED BY (CONTRACTOR'S REPRESENTATIVE)

NAME, TITLE: DATE:

FOR DESIGN-BUILDER USE:

REVIEW STATUS:	
RETURNED DATE:	

DESIGN-BUILDER'S ENGINEER REVIEW AND APPROVAL OF THIS SUBMITTAL ARE EXPRESSLY LIMITED AS PROVIDED IN THE CONTRACT DOCUMENTS AND ARE ONLY TO DETERMINE CONFORMANCE WITH INFORMATION GIVEN IN THE CONTRACT DOCUMENTS AND COMPATIBILITY WITH THE DESIGN CONCEPT FOR THE COMPLETED PROJECT AS A FUNCTIONING WHOLE, AS INDICATED IN THE CONTRACT DOCUMENTS. CONTRACTOR IS, AND DESIGN-BUILDER IS NOT, RESPONSIBLE FOR ALL MATTERS RELATING TO FABRICATION, SHIPPING, HANDLING, STORAGE, ASSEMBLY, INSTALLATION, CONSTRUCTION (INCLUDING ALL SAFETY ASPECTS OF PERFORMING THE WORK), AND FOR COORDINATING THE WORK.

DESIGN-BUILDER COMMENTS:

Pumps

Class Code

PMP

		Pump										Drive		
Asset ID	**Description**	**Type**	**Manufacturer**	**Serial Number**	**Model**	**Year Blt**	**HP**	**RPM**	**Capacity**	**Head**	**Stages**	**Type**	**Ratio**	**Oil Capacity**

Pumps (Continued)

Class Code

PMP

Impeller & Casing				
Impeller Dia	Shaft Dia	Casing material	Impeller material	Shaft material

Bearing			
No of Bearings	Type	Make	model

Seals					
Shaft	Type	Gear Drive	Type	Pump	Rot. ASSY

Tank

Class Code

TNK

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Built	Working Pressure	Maximum Pressure	Size	Height	Capacity	Material

Valves

Class Code

VLV

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Blt	Size	Flange Dia	Working Pressure	PCD	Holes	Material	O/C turns	ACTR Y/N	Other info

Actuator Valve Operator

Class Code

VO ACTR

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Built	Supply Amps	Supply Volts	Air Pressure	Total Turns to close

Sensors/Alarms/Indicators/Meter

Class Code

IND, TRN, ANL, FIT, PIT, LIT, FQ, ZIT

Asset ID	Description	Manufacturer	Model	Serial Number	Type	Working Pres	Working Temp	Range	Supply Amp	Output Amp

ACU AHU

Class Code

ACU AHU

Motor Info

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Blt	HP	Volts	Amps

ACU AHU

Class Code

ACU AHU

Asset ID	Description	Phase	RPM	S.F.	Frame	Filter Info		Compressor Info		
						Filter Size	Filter Type	Make	Model	Serial No.

ACU AHU

Class Code

ACU AHU

Fan Info

Asset ID	Description	Refrigrant type	Quantity	Type	Make	Model	S.No	CFM	Belts Type/N0.

ACU AHU

Class Code

ACU AHU

Asset ID	Description	Odor/Oxidant Wt	Bearings	Other Info

Motors

Class Code

MTR

Asset ID	Description	Manufacturer	Model	Serial Number	HP	PH	HZ	SIZE	FRAME	VOLTS	VOLTS AC	VOLTS DC

Motors

Class Code

MTR

Asset ID	Description	L.R. AMPS	Nom. Amps	AMPS	TYPE	DESIGN	CODE	RPM	PU END BRG	L.S BRG	BE BRG	O.S BRG

Motors

Class Code

MTR

Asset ID	Description	FR END BRG	SHAFT END BEARING	UPPER BEARING	DRIVE END BEARING	OPP D.E. BEARING	LOWER BEARING	OIL CAP. UPPER BEARING QTS.	OIL CAP. LOWER BEARING QTS.	NEMA DESIGN	LUBRICATION	POWER FACTOR

Gearbox

Class Code

GRBX

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Blt	Stages	Drive	HP	Input RPM	Output RPM	Ratio	Service Factor	Oil Capacity	Weight	Bearing Type

VFD

Class Code

VFD

							Rating						
							Frequency		Voltage		Current		
Asset ID	**Description**	**Type**	**Manufacturer**	**Serial Number**	**Model**	**Year Built**	**From**	**To**	**from**	**to**	**from**	**to**	**Enclosure**

UPS

Class Code

UPS

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Built	Supply Amps	Supply Volts	Output Amps	Output Volts	Phase	HZ	KW	KVA

Switch

Class Code

SW/SWBD

											Max Supply rating				Maximum Section ratings		
Asset ID	**Description**	**Type**	**Manufacturer**	**Serial Number**	**Model**	**Year Blt**	**Enclosure**	**Volts**	**Hertz**		**Amps**	**PF**	**W**		**Amps**	**PF**	**KW**

Positioner

Class Code

POS

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Built	Supply Press	Input	Output

Breaker

Class Code

BRK

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Built	Panel	Amps	Volts	HZ	Surge Amps

Control Panel

Class Code

LCP

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Built

Panel

Class Code

PNL

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Built

Motor Control Center

Class Code

MCC

Asset ID	Description	Type	Manufacturer	Serial Number	Model	Year Built	Supply Amps	Supply Volts	Phase	Wire	HZ	Bus Short circuit rating

SECTION 01 35 23
FACILITY SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section is a modified version of Section 7-1.09, Public Safety of the July 1992 City of San José Standard Specifications (page 7-17) which is used to address Construction Safety at the San José - Santa Clara Regional Wastewater Facility (Facility).

B. This version has been modified to reflect the delineation of responsibility between the Design-Builder and Subcontractors.

1.02 CONSTRUCTION SAFETY

A. Design-Builder and Subcontractor Responsibilities:

1. Attention is directed to Sections 7-1.01E, Trench Safety, 7-1.06, Safety & Health Provisions, 7-1.09, Public Safety, 7-1.12, Responsibility for Damage, and 7-1.121, Protection of Contractor's Work & Property, of the July 1992 City of San José Standard Specifications.
2. The Design-Builder shall be solely and completely responsible for conditions of the job site, including safety of all persons, including employees and property, during performance of the work. This requirement shall apply continuously and not be limited to normal working hours. Safety provisions shall conform to U.S. Department of Labor, the California Occupational Safety and Health Act (OSHA), and all other applicable Federal, State and local laws, ordinances, codes, the requirements set forth below, and any regulations that may be detailed in other parts of these documents. Where any of these are in conflict, the more stringent requirement shall be followed. The Design-Builder and Subcontractor's failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations and penalties set forth herein.
   a. The Design-Builder shall develop and maintain, for the duration of this Contract, a safety program that will effectively incorporate and implement all required safety provisions. The Design-Builder shall appoint an employee who is qualified and authorized to supervise and enforce compliance with the safety program.
   b. The duty of the City to conduct construction review of the Design-Builder's performance is not intended to include a review or approval of the adequacy of the Design-Builder's safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site.
   c. The Design-Builder, as part of this safety program, shall maintain at his office or other well-known place at the job site, safety equipment applicable to the work as prescribed by the aforementioned authorities, all articles necessary for giving first aid to the injured, and shall

demonstrate an understanding of the Facility procedures established for emergency care of persons who may be injured on the job site.

d. If a claim is made by anyone against the Design-Builder or any Subcontractor on account of any accident, the Design-Builder shall promptly report the facts in writing to the City, giving full details of the claim. Such notice shall be in addition to any other notice requirements which may apply to such claims.

B. Facility Safety Plan: The Design-Builder and each Subcontractor shall be required to attend a pre-construction meeting to receive a briefing by the Environmental Services Department Safety Officer regarding Facility safety issues and measures.

C. Incident or Accident Emergency at the Facility:

1. In the event of an accident or incident during construction, Design-Builder shall immediately notify the Facility Computer Room. Design-Builder or Subcontractor shall call 911 for accident involving bodily injury, fire hazard, damage to gas piping, flooding and similar occurrences, requiring an immediate emergency response. Design-Builder shall also comply with all CAL-OSHA notification requirements.
2. The Facility Emergency Control Center is in the Computer Room located inside the Administration Building. Computer Room Staff can be reached 24 hours day and night at phone number (408) 635-4000.

D. Facility Facilities Operation: Design-Builder and Subcontractor personnel shall not operate, by any means, existing Facility facilities. Design-Builder shall submit 72-hour advanced notice to the City for any required Facility change in operation including valve lockup and tagging for system shutdown for each individual project. Facility staff will execute the shutdown after the request has been approved.

E. Training and Certificates: Design-Builder and Subcontractor personnel shall have sufficient training and certificates in performing work such as confined space entry, asbestos material removal, welding, diving, heavy equipment operation, and others. Up-to-date certificates for all personnel performing such work shall be provided to the City or Facility area supervisor before the start of the work.

F. Equipment Operation: All cranes and hoists, forklifts, confined space rescue equipment, gas monitors, diving gear, and welding tools or other equipment shall be certified or verified (tested or calibrated) for their operability and rated capacity. Design-Builder shall present those certificates to the City or Facility area supervisor before the start of the work.

G. Confined Space Entry: No confined-space entry is allowed unless specifically approved by the City. All Subcontractors planning a confined-space entry on Facility grounds must submit a copy of the company's confined-space program to the Design-Builder. The Design-Builder will submit this program to the City for approval. Design-Builder and Subcontractor must be prepared to follow California Code of Regulations (CCR), Title 8, Sections 5156, 5157 and 5158 governing confined space entry, as well as the procedures followed by Facility personnel as described in the Environmental Services Department's Confined Space Program, which can be

obtained upon request from the City. Design-Builder or Subcontractor is responsible for supplying own certified rescuer and rescuing equipment at no cost to the City. Design-Builder must notify the City and the Facility Emergency Control Center of the time and date prior to confined space entry.

H. Hot Work Responsibilities: Fire resulting from hot work could significantly affect Facility operations. Hot work includes brazing, cutting, grinding, soldering, torch-applied roofing, and welding. No hot work is permitted without authorization from the Design-Builder. The Design-Builder will submit these requests to the City for approval. A signed hot work permit must be issued by the responsible Facility staff. Specific firefighting equipment and protection gear will be required at the hot work site before any work can be started. Refer to the Environmental Services Department's Hot Work Safety Program, which can be obtained upon request from the City.

I. Fall Prevention: Subcontractors working at heights, on ladders or using fall protection equipment shall submit to the Design-Builder a Fall Prevention Program that is equivalent to or more restrictive than the Environmental Services Department's Fall Prevention Program, which can be obtained upon request from the City. The Design-Builder will submit these programs to the City for record.

1.03 SUBMITTALS

A. Informational Submittals:

1. Mandatory Safety Program: Injury and Illness Prevention Program (IIPP) or Safety Work Plan.
2. Material Safety Data Sheets (MSDSs): Any hazardous material brought onto the Facility site by Design-Builder or Subcontractors.
3. Hot Work Program: For welding, torching, cutting, brazing, etc., around combustible or hazardous materials.
4. Confined Space Program: For confined space entry.
5. Fall Prevention Program: For working on ladders, at heights or using fall protection equipment.
6. Training Certificate or License: Asbestos removal, welding, diving, and heavy equipment operation (for cranes, forklifts, etc.), confined-space entry and rescue, etc.
7. Calculations: Seismic design for equipment support, shoring for deep soil excavation, adequacy check of existing floor and structures for support of moving loads, etc. All calculations shall be performed by a qualified engineer licensed in the State of California.

END OF SECTION

SECTION 01 35 25
WEB-BASED DESIGN AND CONSTRUCTION MANAGEMENT SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. This Section describes the basic requirement for the Design-Builder and Subcontractor to use the City's enterprise web-based Design and Construction Management System ("DCMS" or "the System") to manage all project communications, workflows and document submittals.

1.02 THE SYSTEM

A. The City has entered into a multi-year agreement with Bentley Systems Inc. to provide DCMS software to support its CIP Program. This software, known as 'EADOC' will be used by the Construction team for electronic submittal and receipt of all data and documents throughout the duration of the Contract. The System will provide shared access to current plans and specifications and will enable custom configuration of document sharing between various members of the project team. The web-based software is accessible 24/7 to an unlimited number of users. The DCMS will facilitate information sharing and expedite many of the City's existing work flow processes.

B. Use and Operation of the System:

1. The City's CIP Program Administrator is responsible for overall administration of the EADOC system, including project configuration at the organization level, initial training for the Project team (in conjunction with EADOC Support as necessary) and establishment of initial user accounts and settings.
2. The Design-Builder and Subcontractor shall also designate an Administrator who shall be responsible for further assignment and administration of user accounts for its organization, subcontractors and vendors. Subcontractors and suppliers will be given access to the System through the Design-Builder and Subcontractor.
3. The Design-Builder and Subcontractor shall use EADOC for electronic submittal and receipt of all data and documents throughout the duration of the Contract.
4. The System is required for use by all participants in the project including the City, the CIP Program Consultant, the construction manager, consulting engineers, Design-Builder and Subcontractor, and all other users authorized by the City.
5. There is no cost to the Design-Builder and Subcontractor or other authorized users for access to or the use of EADOC.
6. The System will operate on a proprietary system that will be administered by City. The joint use of this System will facilitate electronic exchange of information, automation of key processes, and overall management of the Contract.

7. The System shall be the primary means of Project information submission and management. When required by Jacobs' Engineer or its representatives, paper documents shall also be provided.

C. Additional Data and System Operating Requirements:

1. Document storage by authorized organizations and individual users is via an internet site.
2. User access to project information (based on permissions) is through a single login.
3. We browser access is compatible with, at a minimum, Internet Explorer 8 and newer and Google Chrome.
4. The Jacobs' Engineer will provide more specific information on user protocols as available.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 43.01
AIR QUALITY AND GREENHOUSE GAS EMISSIONS MEASURES

PART 1 GENERAL

1.01 GENERAL MEASURES

A. Design-Builder and subcontractors are informed that criminal and/or civil penalties may be imposed on any person who violates any rule, regulation, permit or Order of the State Air Resources Board or an Air Quality Control District that is adopted to control and contain air emissions.

B. Subcontractors shall submit to the Design-Builder the following on a monthly basis within five days of the start of the month:

1. The log of low-emissions tune-ups for all construction equipment.
2. Inventory of on-road diesel trucks used to transport spoils.
3. Notification of any non-compliance or corrective action should be included in the report.

1.02 BASIC CONSTRUCTION CONTROL MEASURES

A. Implement the following measures within RWF to avoid conflicting with the BAAQMD 2010 Clean Air Plan:

1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day to reduce visible dust emissions, unless otherwise approved by the City due to wet weather conditions. The City will complete this for all areas part of the construction enabling area.
2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
3. All visible mud or dirt tracked-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
4. All vehicle speeds on unpaved roads shall be limited to 15 mph.
5. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage noting that idling time shall not exceed five minutes will be provided for construction workers at all access points.
7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator.

8. The City will post a publicly visible sign with the Code Enforcement telephone number (408) 535-7770 as the contact at the CITY regarding dust complaints. The Air District's phone number shall also be visible.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 43.03
CULTURAL AND HISTORIC RESOURCES MITIGATION

PART 1 GENERAL

1.01 GENERAL MEASURES

A. Unauthorized collection of prehistoric, historic, or fossil materials is strictly prohibited.

B. Training: All Design-Builder and Subcontractor personnel shall attend training conducted by the City discussing the nature of cultural resources and potential materials that may be encountered. If new construction personnel are added to the project, the Design-Builder and Subcontractor shall ensure that new personnel receive training before they start working. Participants will be required to sign a form acknowledging their attendance and understanding of the materials presented.

1.02 ACCIDENTAL DISCOVERY OF ARCHAEOLOGICAL RESOURCES (PROJECT CUL-1)

A. If archaeological or historic resources are discovered during construction, the Design-Builder and Subcontractor shall immediately stop all activities within 100 feet of the discovery, notify Jacobs' Engineer, and install fencing or staking to prevent vehicles, equipment or personnel from entering the area. No photos shall be taken.

B. If required by the nature of the unanticipated discovery encountered and as directed by the City, the Design-Builder and Subcontractor shall relocate operations and adjust their construction schedule to allow implementation of appropriate historical, paleontological, or archaeological management procedures by the City.

C. The Design-Builder and Subcontractor shall not resume work in the affected area until authorization is received from the City.

1.03 ACCIDENTAL DISCOVERY OF HUMAN REMAINS (PROJECT CUL-2)

A. In the event of the discovery of human remains during construction, the Design-Builder and Subcontractor shall immediately stop all activities and install fencing or staking to prevent vehicles, equipment or personnel from entering the area, so no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains occurs. The Design-Builder and Subcontractor shall notify the City and the Santa Clara County Coroner. The Santa Clara County Coroner shall make a determination as to whether the remains are Native American. No photos shall be taken.

B. If no satisfactory agreement can be reached as to the disposition of the remains pursuant to State law, the Design-Builder and Subcontractor shall re-inter the human remains and items associated with Native American burials on the

property in a location identified by the City and qualified archaeologist (generally a location not subject to further subsurface disturbance).

C. The Design-Builder and Subcontractor shall not resume work in the affected area until authorization is received from the City.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 43.04
BIOLOGICAL RESOURCES MITIGATION

PART 1 GENERAL

1.01 GENERAL MEASURES

A. All personnel, equipment, project related-vehicles, and materials shall avoid designated environmentally sensitive features.

B. Smoking is restricted to designated areas or within a closed vehicle.

C. Project-related vehicles shall observe the posted speed limit on hard-surfaced roads and a 15- mile-per-hour speed limit on unpaved roads within the Regional Wastewater Facility.

D. Off-road travel by project-related vehicles and construction equipment shall be restricted to the construction work area.

E. Provide closed garbage containers for the disposal of all food-related trash items (e.g., wrappers, cans, bottles, food scraps). All garbage shall be removed from the project site and placed in a closed container from which garbage shall be removed, at minimum, weekly.

F. Personnel shall not feed or otherwise attract fish or wildlife to the project area.

G. No pets or firearms shall be allowed in the construction limits.

H. Vehicles or construction equipment maintenance shall be performed in designated staging areas. No fueling, cleaning, or maintenance of equipment and vehicles shall take place within any areas where an accidental spill or discharge could occur to any creek or storm drain inlet.

I. Training: The Design-Builder and Subcontractor personnel shall attend an environmental training program conducted by the City on biological resources potentially present. The training will include a description, representative photographs, and legal status of each special-status species and habitat, and the penalties for not complying with biological mitigation requirements. A copy of the training points will be provided to the Design-Builder and Subcontractor for use in orienting new project personnel. If new construction personnel are added to the project, the Design-Builder and Subcontractor will ensure that new personnel receive training before they start working. Participants will be required to sign an attendance form acknowledging their attendance and awareness of the materials presented.

J. The Design-Builder and Subcontractor shall not handle, disturb, move or harass any wildlife or nests. Contact the City if wildlife or nests are encountered to remove them.

K. Any Design-Builder and Subcontractor employee who inadvertently injures or kills a special-status species or finds one dead, injured, or entrapped shall immediately report the incident to the City. The City will notify the appropriate resource agencies.

L. The City shall perform pre-construction biological surveys, including inspection of protective fencing. The Design-Builder and Subcontractor shall not initiate work activities at the project site, including equipment mobilization, until the City has provided written notice to proceed (NTP).

M. The Design-Builder and Subcontractor shall provide written notice to Jacobs' Engineer prior to all fencing installation and removal to ensure that the City has the option to be present during installation and removal of all fencing.

N. The Design-Builder and Subcontractor shall inspect avoidance materials (i.e., fencing) a minimum of once per week to confirm it is secure and being properly maintained.

O. Fencing work includes the Design-Builder and Subcontractor furnishing and installing fencing, inspecting and maintaining fencing during construction, and removal of fencing when construction is complete.

P. The Design-Builder and Subcontractor shall direct all drainage from areas where chemical spills could occur away from sensitive resources.

Q. Notices: At or before the Preconstruction Conference, the Design-Builder and Subcontractor shall provide the City with the proposed date for mobilization to the site. This will allow the City time to conduct required biological surveys of the area prior to issuance of the NTP.

R. Reporting: The Design-Builder and Subcontractor shall submit site inspection logs/checklists and compliance reports on a monthly basis.

1.02 PRECONSTRUCTION SURVEYS FOR NESTING BIRDS (BIO-1)

A. The Design-Builder and Subcontractor shall remove trees, shrubs, and vegetation from September 1 through January 31 (non-nesting season) to the greatest extent possible.

B. If construction will start between February 1 and August 31 (nesting season), City will conduct a nesting-bird survey within 300 feet of the project for raptors and 100 feet for other migratory birds (access permitting) a maximum of 7 days prior to construction start. Design-Builder and Subcontractor will not start construction until Jacobs' Engineer gives written NTP.

C. If nesting birds are found during a survey, the Design-Builder and Subcontractor shall install orange barrier fencing to establish the limits of the exclusion zone at the direction of the City. At a minimum, orange plastic mesh fencing shall be

provided 3 feet to 4 feet high, with stakes or posts every 6 feet to 10 feet as required for sturdy support.

1. A minimum 300-foot no-disturbance exclusion zone shall be established around any active raptor nests (i.e., has eggs, young, or adults exhibiting breeding behavior) located during the nesting season, February 1 through August 31.
2. A minimum 100-foot no-disturbance exclusion zone shall be established around any active migratory passerine birds (other than raptor) nest (i.e., has eggs or young) located during the nesting season (February 1 through August 31).

D. Exclusion zone may be modified by City in consultation with the California Department of Fish and Wildlife and US Fish and Wildlife Service. The Design-Builder and Subcontractor will adjust fencing as directed.

1.03 MINIMIZE LIGHT POLLUTION (BIO-2)

A. Lighting during nighttime activities shall be restricted to the necessary work area to satisfy safety requirements. The Design-Builder and Subcontractor shall direct all lighting downward and provide shielding of lighting, as necessary, to avoid light spillage to adjacent natural lands.

1.04 BURROWING OWL PROTECTION MEASURES (BIO-3)

A. The Design-Builder and Subcontractor shall not disturb occupied burrows.

B. The City shall conduct up to two pre-construction burrowing owl surveys within 250 feet of construction activities. The first survey shall occur up to 14 calendar days prior to ground disturbing activities. The second survey shall begin no more than 4 calendar days prior to ground disturbing activities and shall conclude no more than 2 calendar days prior to ground disturbance. If owls are detected during the first survey, the second survey is not required.

C. If preconstruction surveys identify evidence of western burrowing owls within 250 feet of the Project area, the Design-Builder and Subcontractor shall:

1. Establish a 250-foot buffer zone around the active nest sites, as directed by Jacobs' Engineer
2. Avoid the buffer zone and all nest sites that could be disturbed by Project construction activities during the remainder of the breeding season or while the nest is occupied by adults or young.
3. Not resume construction activities within the 250-foot buffer until the City gives written NTP.

D. If avoidance of active nests is not feasible during February 1 to August 31 breeding season, construction may occur within 250 feet of the active nest sites as long as the nest is not disturbed and the City prepares and Design-Builder and Subcontractor implements a Construction Monitoring Plan which meets Habitat Conservation Plan (HCP; Condition 15) requirements and is approved by the

Planning, Building, and Code Enforcement Department (PBCE). Up to 21 calendar days shall be allowed for PBCE review and approval of the Construction Monitoring Plan.

E. If avoidance of active nests is not feasible during September 1 to January 31 non-breeding season, construction may occur within 250 feet of the overwintering burrows as long as the City monitors the owls for at least 3 days prior to Project construction and during construction and finds no change in owl foraging behavior in response to construction activities.

1.05 AVOIDANCE AND PROTECTION OF JURISDICTIONAL WATERS (BIO-4)

A. The Design-Builder and Subcontractor shall install barrier fencing to establish the limits of the exclusion zone at the direction of the City.

1. A protective barrier (such as silt fencing) shall be erected around water features adjacent to the Project at the “top of bank“ or at the feature boundary to isolate them from Project activities.
2. The Design-Builder and Subcontractor shall install signage on the fencing identifying the sensitive habitat area and restriction of construction activities.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

PART 4 ADDITIONAL REQUIREMENTS

4.01 PRECONSTRUCTION SURVEYS FOR NESTING BIRDS (BIO-1)

A. A report of findings shall be prepared by the City prior to initiation of construction during the nesting season (February 1 to August 31). The report shall either confirm absence of any active nests or should confirm that any young are located within a designated no-disturbance zone and construction can proceed. No report of findings is required if construction is initiated during the non-nesting season (September 1 to January 31) and continues uninterrupted according to the above criteria.

END OF SECTION

PULLED MASTER FROM CITY SPECS. NEED TO MODIFY FOR DB PROJECT

SECTION 01 35 43.05
HAZARDS AND HAZARDOUS MATERIALS MITIGATION

PART 1 GENERAL

1.01 GENERAL MEASURES

A. The Design-Builder and Subcontractor shall adhere to all local, state, and federal regulations related to the use, transport, handling, and disposal of hazardous materials.

B. The Design-Builder and Subcontractor shall be solely and fully responsible for compliance with all laws, rules, and regulations applicable to health and safety during the performance of the construction work.

1.02 PRE-CONSTRUCTION HAZARDOUS MATERIALS ASSESSMENT (PROJECT HAZ-1A)

A. Jacobs' Engineer shall provide any available site-specific sampling reports or analytical data to the Design-Builder and Subcontractor for review.

B. The Design-Builder and Subcontractor shall review all site-specific sampling report(s) attached to this contract and/or attached information about potential soil and groundwater contaminants anticipated to be present in the Project area, to inform appropriate materials handling procedures and to inform the creation of the Health and Safety Plan.

1.03 HEALTH AND SAFETY PLAN (PROJECT HAZ-1B)

A. The Design-Builder and Subcontractor or Design-Builder and Subcontractor's representative shall prepare and submit a site-specific Health and Safety Plan (HSP) prepared in accordance with federal OSHA regulations (29 CFR 1910.120) and Cal-OSHA regulations (8 CCR 5192) and in accordance with CITY Specifications Section 01 35 23, Facility Safety Requirements.

B. The Design-Builder and Subcontractor shall have a site health and safety supervisor fully trained pursuant to hazardous materials regulations be present during excavation, trenching, or cut and fill operations to monitor for evidence of potential soil contamination, including soil staining, noxious odors, debris or buried storage containers. The site health and safety supervisor must be capable of evaluating whether hazardous materials encountered constitute an incidental release of a hazardous substance or an emergency spill. The site health and safety supervisor shall direct procedures to be followed in the event that an unanticipated hazardous materials release with the potential to impact health and safety is encountered. These procedures shall be in accordance with hazardous waste operations and regulations and specifically include, but are not limited to, the following: immediately stopping work in the vicinity of the unknown hazardous materials release; notifying Santa Clara County Department of Environmental Health and retaining a qualified environmental firm to perform sampling, remediation, and/or disposal.

C. The Design-Builder and Subcontractor shall document that HSP measures have been implemented during construction and prepare a final compliance report for submittal to Jacobs' Engineer.

1.04 SOIL AND GROUNDWATER MANAGEMENT PLAN (PROJECT HAZ-1C)

A. Design-Builder and Subcontractor shall implement a Jacobs' Engineer-reviewed dewatering system as necessary to keep excavations reasonably free from water during construction. The dewatering system plans shall be in sufficient detail to indicate power source, sizes of pumps, piping, appurtenances, placement of wells, settlement monitoring program, and the ultimate disposal point for water. The dewatering system shall also show means of evaluating drawdown in real-time (e.g., piezometers). The dewatering system shall be consistent with the Design-Builder and Subcontractor-designed shoring and bracing method.

B. The Design-Builder and Subcontractor shall submit, prior to construction, a Soil and Groundwater Management Plan, subject to review by Jacobs' Engineer, that specifies the method for handling and disposal of contaminated soil and groundwater. The plan shall include all necessary procedures to ensure that excavated materials and fluids generated during construction are stored, managed, and disposed of in a manner that is protective of human health and in accordance with applicable laws and regulations. The plan shall include the following information:

1. Step-by-step procedures for evaluation, handling, stockpiling, storage, testing, and disposal of excavated material, including criteria for reuse and offsite disposal. All excavated materials shall be inspected prior to initial stockpiling, and spoils that are visibly stained and/or have a noticeable odor shall be stockpiled separately to minimize the amount of material that may require special handling. In addition, excavated materials shall be inspected for buried building materials, debris, and evidence of underground storage tanks; if identified, these materials shall be stockpiled separately and characterized in accordance with landfill disposal requirements. If some of the spoils do not meet the reuse criteria and/or debris is identified, these materials shall be disposed of at a permitted landfill facility.
2. Procedures to be implemented if unknown subsurface conditions or contamination are encountered, such as previously unreported tanks, wells, or contaminated soils.
3. Procedures for containment, handling and disposal of groundwater generated from construction dewatering, the method to analyze groundwater for hazardous materials likely to be encountered and the appropriate treatment and/or disposal methods.
4. The Design-Builder and Subcontractor shall provide, at a minimum, a desilting tank for treatment of groundwater from dewatering operations before discharge to the plant headworks.

C. The plan shall be reviewed by Jacobs' Engineer. The Design-Builder and Subcontractor shall not initiate work activities at the project site until Jacobs' Engineer has provided written authorization via the Notice to Proceed.

D. The City shall document that Soil and Groundwater Management Plan measures have been implemented during construction and prepare a compliance report, as necessary, post-construction for submittal to Jacobs' Engineer.

E. The measures in this section are in addition to Section 01 35 43.13, Hazardous Material Procedures.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 35 43.13
HAZARDOUS MATERIAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Procedures required when encountering hazardous materials at the Work site including all associated excavation, removal, handling and backfill as specified.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. California Health and Safety Code, Section 25117.
   2. State of California Code of Regulations (CCR):
      a. Title 8, Industrial Relations: Division 1. Department of Industrial Relations.
      b. Title 22, Social Security:
         1) Division 4, Environmental Health.
         2) Division 4.5, Environmental Health Standards for the Management of Hazardous Waste.
   3. Steel Structure Painting Council:
      a. Guide 61: Guide for containing debris generated during paint removal operations.
      b. Guide 61, Description of methods and systems.
      c. Guide 71, Guide for the disposal of lead-contaminated surface preparation debris.
      d. PA Guide 3.
   4. United States Code of Federal Regulation (CFR), Title 29 and Title 40:
      a. 29 CFR 1910.1000.
      b. 29 CFR 1910.134.

1.03 HAZARDOUS MATERIAL PROCEDURES

A. Hazardous materials are those defined by the California Health and Safety Code, Section 25117.

B. When Hazardous Materials have been found:
   1. The Design-Builder shall develop and maintain an appropriate Remediation Plan and a Health and Safety Plan (HSP).
   2. All Subcontractors shall notify the Design-Builder immediately upon discovery of material that is believed to be hazardous waste.
   3. The Design-Builder shall notify the City immediately upon notification/discovery of material that is believed to be hazardous waste.
   4. In addition, the Design-Builder shall notify, within 24 hours, Local, State and Federal agencies having jurisdiction on matters related to hazardous materials.

5. The Design-Builder shall designate a Certified Industrial Hygienist who will develop and enforce the HSP.
6. The Design-Builder shall identify and contact Subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by and in accordance with Local, State and Federal laws and regulations.
7. Employ additional health and safety measures specified by the Certified Industrial Hygienist, as necessary, for all workers in accordance with OSHA guidelines.

C. The Design-Builder shall assume full responsibility of all aspects of worker health and safety, including health and safety of Subcontractors and their workers:
   1. Instruct workers on recognition and reporting of materials that may be hazardous.

D. Subcontractors shall forward copies of reports, permits, and other related documents dealing with remedial work to the Design-Builder and the City.

E. File requests for adjustments to Contract Times and Contract Price due to the discovery of Hazardous Materials in the Work.

F. Minimize delays by continuing performance of the Work in areas not affected by hazardous material operations.

1.04 SUBMITTALS

A. Informational Submittals:
   1. Health and Safety Plan (HSP).
   2. Subcontractor qualifications for removal of lead paint.
   3. Lead Paint Removal Procedures Plan.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 HEALTH AND SAFETY PLAN

A. Health and Safety Plan (HSP):
   1. The Design-Builder shall prepare a site specific Health and Safety Plan (HSP). At the minimum, the HSP shall address the following:
      a. Design-Builder's plan to protect workers (such as providing personnel training, personal protective equipment, and respiratory protective devices) while working in the presence of contaminated or hazardous materials.
      b. Establishment of exclusionary site work zones and security measures.
      c. Implementing and conducting dust control measures, ambient air monitoring for health and safety purposes, and administering contingency plans, if necessary.

2. The HSP shall be prepared, signed, stamped by the Design-Builder's Certified Industrial Hygienist.
3. The HSP shall be reviewed and signed by the Design-Builder and all personnel, including subcontractors, who will be engaged in or overseeing Work in the contaminated construction zones.
4. A copy of the HSP shall be reviewed by all personnel working in the contaminated areas, including personnel not employed by the Design-Builder or his/her subcontractors.
5. No worker shall be allowed in these areas until he/she has signed and acknowledged receiving and understanding a copy of the HSP.
6. The Design-Builder shall be responsible to make sure that all personnel performing Work in the identified, potentially contaminated area(s) must have read and clearly understand the HSP.
7. The HSP shall be conform to the requirements of all local, state, and federal ordinances, rules, regulations, and guidelines concerning occupational health and safety issues, including OSHA Regulation 29 Code of Federal Regulations (CFR) 1910.120.
8. Prior to the start of excavation, the Design-Builder shall retain a Contamination Engineer, and incorporate any comments by the Contamination Engineer to the HSP.
9. The Design-Builder shall implement the HSP in any areas where the Contamination Engineer has observed evidence of contamination.

B. Payment for HSP:
1. The price paid for developing the HSP and its implementation shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in developing and implementing HSP complete, including hiring a Contamination Engineer and Certified Industrial Hygienist if needed by the Design-Builder, necessary training and fees as specified in these special provisions and as directed by City.
2. Payment will be lump sum.

3.02 LEAD PAINT REMOVAL AND DISPOSAL

A. Existing paint on the interior and exterior surfaces that may contain lead in concentrations which will require implementation of hazardous material compliance procedures as legislated by the following:
1. United States Code of Federal Regulations, Title 29 and Title 40.
2. State of California Code of Regulations, Title 8 and Title 22.

B. Remove samples of paint from the structures identified herein and have samples tested by a certified testing laboratory to determine lead content in samples:
1. Ensure that sufficient numbers of paint samples are removed and tested to provide adequate information regarding lead content in paint.
2. Ensure that samples contain the total thickness of the paint to the substrate where removed.
3. Ensure that each sample contains a sufficient quantity of paint to facilitate proper and adequate analyses by testing laboratory.

4. Ensure that samples are adequately identified with location from which it was removed.

C. Laboratory Testing of Paint Samples: Utilize Method 1311, Toxicity Characteristic Leaching Procedure in accordance with Appendix II of 40 Codes of Federal Regulations 261.

D. Prior to beginning work associated with the removal, containment, and disposal of lead-based paints, prepare and submit to the City for review six paper copies of the following as part of a Lead Paint Removal and Disposal Plan:
   1. Listing of lead paint removal equipment to be used.
   2. Outline of procedures to be used to remove lead paint.
   3. Data and specifications describing chemical stripping materials to be used.
   4. Data and specifications describing abrasive blast materials and grit size to be used.
   5. Plan describing lead paint removal, hazardous waste debris containment, and hazardous waste disposal methods.
   6. Health and Safety Plan consisting of a written plan of action covering operational requirements for safe removal of lead paint, safe handling and containment of waste and debris generated by the operation, and safe disposal of hazardous waste and non-hazardous waste materials, complying with the most stringent requirements of the following:
      a. Equipment and material manufacturer's safety sheets.
      b. Steel Structure Painting Council, PA Guide 3.
      c. 29 Codes of Federal Regulations 1910.1000.
      d. 29 Codes of Federal Regulations 1910.134.

E. Carry out lead paint removal, containment, and disposal work in accordance with the following steel structure painting council guidelines:
   1. Steel Structure Painting Council Guide 61: Guide for Containing Debris Generated During Paint Removal Operations.
   2. Steel Structure Painting Council Guide 71: Guide for the Disposal of Lead-Contaminated Surface Preparation Debris.

F. Comply with Code of Federal Regulations, U.S. Department of Health and Human Services NIOSH Standards, U.S. Department of Labor OSHA Standards, U.S. EPA Standards, American Conference of Government Industrial Hygienists Standards, and ANSI Standards as referenced in Steel Structure Painting Council Guide 61 and Steel Structure Painting Council Guide 71.

G. Lead paint removal methods acceptable for use as described in Steel Structure Painting Council Guide 61, Section 5, "Description of Methods and Systems," include:
   1. Open Abrasive Blast Cleaning with Expendable Abrasive.
   2. Open Abrasive Blast Cleaning with Recyclable Abrasive.
   3. Closed Abrasive Blast Cleaning with Recyclable Abrasive.
   4. Chemical Stripping.

H. Assume responsibility for the proper utilization of the paint removal method selected. When abrasive blast cleaning is selected to remove lead-based paint, comply with all applicable federal, state, and local air quality, pollution, and environmental control regulations for blast cleaning. When chemical stripping is selected to remove the lead based paint, adhere to the chemical manufacturer's recommendations for the application of the product, the removal of the paint, and the containment of the debris.

I. Lead paint removal work shall be performed by a Subcontractor having prior experience in the removal method selected and shall provide at least five references of similar products completed, three of which must have been completed within the past 12 months, documenting his/her experience.

J. Utilize a Class 3 containment and ventilation system as described in Steel Structure Painting Council Guide 61 during lead paint removal and containment procedures. Comply with the following requirements as described in Steel Structure Painting Council Guide 61:

1. Containment Materials: Type A1, Rigid or Type A2, Flexible.
2. Permeability of Containment Materials: Type 81, Air Impermeable.
3. Support Structure: Type C1, Rigid or Type C2, Flexible Support Structure.
4. Joints: Type 01, Fully Sealed Joints.
5. Entryways: Type E2, Overlapping Door Tarps.
6. Air Make-Up System: Type F1, Controlled Air Make-Up.
7. Input Air Flow System: Type G1, Forced Input Air Flow.
8. Air Flow Air Pressure: Type H2, Visual Verification.
9. Air Movement: In accordance with Type 11, Minimum Air Movement Specified.
10. Exhaust Dust Filtration System: Type J1, Air Filtration System.
11. Method for Assessing Quantity of Emissions from Site:
    a. Method A: Visible emissions with a Level 0 emissions requirement. Perform abrasive blasting inside containment structures.

K. Do not leave spent abrasive blast material, chemical stripping material, or lead paint debris uncontained on the project site overnight.

L. Test each container of paint debris, spent blast cleaning abrasive, chemical stripping debris, and other waste material generated by the operation to determine the waste material hazardous waste classification.

M. Assume responsibility for the disposal of lead paint waste and associated waste generated by the removal of the lead paint and the preparation of the surfaces for recoating. Dispose in accordance with applicable federal, state, and local requirements and regulations.

N. Accurately complete the Uniform Hazardous Waste Manifest included at the end of Steel Structure Painting Council Guide 71. Indicate on the Manifest that the City is the hazardous waste generator, and obtain the City's Environmental Protection Agency identification number for use in completing the Manifest.

3.03 ASBESTOS MATERIALS

A. It is the specific intent of these Contract Documents to exclude from the Work any and all products of materials containing asbestos. No products containing asbestos shall be incorporated in the Work.

B. If asbestos is found, a subcontractor registered by Cal-OSHA and certified by the State Contractors Licensing Board shall perform removal of existing asbestos materials. Submit paper copies of this certification to City. The Design-Builder shall be responsible for the proper removal and disposal of asbestos material.

C. Where asbestos is found, dispose of asbestos-containing waste in accordance with applicable federal, state, and local requirements and regulations. Accurately complete the Manifest as required by Title 22, Division 4.5 of the State of California Code of Regulations. Indicate on the Manifest that the City is the hazardous waste generator, and obtain the City's Environmental Protection Identification Number for use in completing the Manifest.

3.04 EXCAVATION AND SEGREGATION OF CONTAMINATED MATERIALS

A. Where Subcontractor encounters contaminated materials during his/her excavations, Design-Builder will support the Subcontractor in the field during segregation of contaminated and non-contaminated materials. Design-Builder will screen the excavated material by examining the sample for visual evidence of contamination and then screening for volatile organic vapors using a photoionization detector (PID) or other direct reading instrument. All materials that exceed the permissible limits for disposal at a Class III landfill within a 50-mile radius shall be designated as contaminated.

B. The Subcontractor shall take precautions to minimize the volume of soil classified as contaminated as a result of mixing between contaminated and noncontaminated soil during excavation. However, the excavation approach to removing the identified areas of contaminated soil shall be left to the discretion of the Subcontractor. The City shall not pay additional costs for additional contaminated soil generated by mixing or noncontaminated soils.

C. Measurement and payment of contaminated materials shall be determined prior to removal and shall be managed in accordance with Section 01 32 00, Construction Progress Documentation.

3.05 TRANSPORT AND STOCKPILING OF CONTAMINATED MATERIALS

A. Subcontractor shall transport the excavated contaminated materials to a designated stockpile area at the Facility site as directed by Design-Builder. At the conclusion of the project, Subcontractor will be responsible for disposal of the stockpiled contaminated materials.

B. The base of the stockpile area shall be prepared with a layer of asphalt, concrete, plastic, visqueen, or other impermeable material to separate the uncontaminated natural soil from the stockpiled contaminated soil.

C. Stockpiles shall be covered in accordance with Bay Area Air Quality Management District requirements, including by not limited to Regulation 8 Rule 40.

D. Stockpiles shall be placed such that they are stable in the event of natural phenomena such as earthquakes and rainstorms.

E. All construction equipment used for the handling of contaminated material shall be decontaminated prior to use for other work elements or removal from site.

3.06 HANDLING OF CONTAMINATED LIQUID

A. Subcontractor shall provide and maintain a temporary dewatering and pumping system during the duration of this Work to handle any liquid identified as contaminated liquid as a result of contact with the contaminated material during the excavation and stockpiling operation. Subcontractor shall provide all temporary holding tank(s), oil/water/solids separator(s), pumping, piping, and any other necessary equipment to collect, transport, and pre-treat the contaminated liquid from the excavation and stockpiling areas. Subcontractor shall discharge of the treated water to the existing headworks facilities at the Facility, under direction from the Design-Builder and in coordination with the City. Subcontractor will be responsible for disposal of the separated contaminated materials.

END OF SECTION

SECTION 01 35 53
SITE SECURITY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Requirements of this section apply to work at the San José - Santa Clara Regional Wastewater Facility (Facility), 700 Los Esteros Road, San José, CA.

B. The Design-Builder and all Subcontractors shall comply with the City's protocol for personnel identification, vehicle hang tags, site access control, and deliveries.

C. Design-Builder and Subcontractors shall be responsible for the security of their own equipment and materials from commencement of work through contract completion.

D. Design-Builder shall assign an on-site security representative who shall be available at all times while work is being performed ensuring that requirements of this section are met. This individual may be the Design-Builder's Superintendent.

1.02 SUBMITTALS

A. Submit name of the individual(s) designated as the on-site security representative (s) including his/her mobile phone numbers.

B. Design-Builder's on-site security representative will be responsible for providing the City and Facility's Security Supervisor a current list of deliveries including company name and personnel for inclusion in the Facility's appointment calendar. Design-Builder's on-site security representative shall be readily available to identify personnel and supervise deliveries as scheduled in the Facility's appointment calendar. The City and Security Supervisor must be notified of any delivery schedule changes as soon as possible to be included in the appointment calendar.

C. Design-Builder onsite meetings and quality inspections are required to be entered in the Facility's appointment calendar by the City. The Design-Builder will provide all pertinent information including business name, names of all attending, location in Facility and date and time to the Security Supervisor.

D. The Design-Builder is responsible for identifying all of his/her staff, the project description and location within the Facility as related to projects specified in the Special Provisions. If projects are to be in phases then the Design-Builder is responsible for providing a phase description, location and time frame per phase as needed. Design-Builder shall complete the Security Review Form CIP, with all the information as stated above, and return the form to the City for processing.

1.03 CONTRACTOR IDENTIFICATION BADGING PROCEDURE

A. All workers whose presence is required at the Facility and related to projects as specified in the Special Provisions, an ID badge must be obtained from the Facility Security Supervisor.

1. The Design-Builder's on-site security representative must provide a list of their Subcontractors and workers to the City to include in the Facility's Security Review Form CIP.
2. If a worker is not on the list, at the discretion of the Facility Security Officer, he/she will take the name, business and number of the worker and contact the Design-Builder's on-site security representative and the City to verify and escort the worker to the Facility. If approved by the City, the worker shall be added to the Security Review Form CIP and turned into the Security Supervisor.
3. Design-Builder shall complete the Contractor ID Badge Access Request Form and return the form to the City for processing.
4. Once the Contractor ID Badge Request Form has been processed, the Facility Security Supervisor will determine the type of ID Badge that will be distributed to the workers.
5. All personnel need to wear ID badge when on site at the Facility. The ID badge provides visibility and security while working at the Facility during the approved contract time frame.
6. The Design-Builder's on-site representative shall coordinate with the Facility Security Supervisor in scheduling workers needing to take a photo for their ID badge.
7. For workers who have been distributed a day use ID Badge, at the end of the workday, the Design-Builder's site security representative is responsible for having the workers sign out, return the day use ID badge and escort the workers off property.
8. All identification badges shall be collected by the Design-Builder's on-site security representative at the end of the job or assignment and returned to the City before the final payment will be made. Lost or non-returned identification badges will be charged $25.00 each at the Subcontractor's expense.

B. All cost associate with this security procedure shall be borne by the Design-Builder.

1.04 VEHICLE IDENTIFICATION - HANG TAG PROCEDURE

A. For all workers whose presence is required at the Facility related to projects as specified in the Special Provisions, a vehicle hang tag must be obtained from the Facility Security Supervisor.

1. The Design-Builder's on-site security representative must provide a list of their workers to the City to include in the Facility's Security Review Form CIP.
2. Workers who are not approved to park within the Facility will need to park in the visitor parking lot in front of the Facility's Administration building which does not require a hang tag.
3. All workers shall complete the Contractor Vehicle Hang Tag Form and return the form to the City for processing.

4. Once the Contractor Vehicle Hang Form has been processed, the Facility Security Supervisor will determine the type of vehicle hang tag that will be distributed to the workers.
5. The Design-Builder's on-site representative shall coordinate with the Facility Security Supervisor in scheduling workers to issue Contractor vehicle hang tags.
6. For workers who have been distributed a day use vehicle hang tag, at the end of the workday, the Design-Builder's on-site security representative is responsible for having the workers sign out; return the vehicle hang tag and escort the workers off property.
7. All hang tags shall be collected by the Design-Builder's on-site security representative at the end of the expiration date of hang tag(s) and returned to the City before final payment will be made. Lost or non-returned hang tags will be charged $25.00 each at the Subcontractor's expense.

1.05 FACILITY'S SECURITY POLICY REPRESENTATIVE

A. The Facility's security policy representative contact information is listed below. At any time when questions arise related to the Facility site security procedures, the Facility's Security Supervisor shall be contacted, informed of the situation and further direction shall be obtained from the Facility's Security Supervisor.

Paul Lucero
Facility Security Supervisor
San José - Santa Clara Regional Wastewater Facility
700 Los Esteros Road
San José, CA 95134
paul.lucero@sanjoseca.gov
(408) 635-2021

1.06 PRODUCTIVITY LOST AND COST INCURRED DUE TO SECURITY REQUIREMENTS

A. Time lost and/or costs incurred due to compliance with Facility Security measures (e.g., deliveries or personnel held at the gate without badges or identification, refusal of package deliveries, etc.) shall be deemed an inexcusable delay.

1.07 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this specification:
   1. Contractor ID Badge.
   2. Contractor Vehicle Hang Tag Form.
   3. Security Review Form CIP.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Contractor ID Badge

Contractor Name_____

Contractor Cell Phone Number _____

Business Name _____

Business Phone Number _____

Contract Supervisor Name _____

Contract Supervisor Telephone Number _____

Project Name and/or work to be performed:

_____

I agree to return the Contractor identification badge to the Facility Manager/Supervisor (as signed below) by the End Date. A Contractor who does not return the ID badge will be assessed a $25.00 fee payable to the City of San José. If the fee is not paid, the Contractor will not be allowed back on San José-Santa Clara Regional Wastewater Facility property.

Signature of Contractor _____

****

San José-Santa Clara Regional Wastewater Employee Authorization:

Start Date _____ End Date _____

(Required start and end date to be completed by authorized Facility employee as signed below)

The Project Manager shall collect the Contractor ID Badge at the end of the contract and return to the Security Supervisor.

Signature: _____

Print Name: _____

Facility Work Group: _____

Issue Date _____ (internal use) Issued by_____ (internal use)

Contractor Vehicle Hang Tag Form

Contractor Name_____ Hang Tag ID_____

Business Name _____ Sticker ID _____

Business Phone Number _____ Cell Phone Number _____

Vehicle #1
Make_____ Model_____ Color_____
License Plate Number _____

Vehicle #2
Make_____ Model_____ Color_____
License Plate Number _____

Passenger only (does not drive vehicle) _____
Name of co-worker that drives vehicle _____

Location vehicle will be parked _____

I agree to return the Parking Hang Tag on the End Date as shown above. A Contractor who does not return the Hang Tag will be assessed a $25.00 fee payable to the City of San José. If the fee is not paid, the Contractor will not be allowed back on San José-Santa Clara Regional Wastewater Facility San José-Santa Clara Regional Wastewater Facility property.

Signature of Contractor _____
****

San José-Santa Clara Regional Wastewater Employee Authorization:

Start Date _____ **End Date**_____
(Start and end date to be completed by authorized Facility employee as signed below)

The Project Manager shall collect the Vehicle Hang Tag at the end of the contract and return to the Security Supervisor.

Signature: _____
Print Name: _____
Facility Work Group: _____

Issue Date _____ (internal use) Issued by_____ (internal use)

Vehicle #3
Make_____ Model_____ Color_____
License Plate Number _____

Vehicle #4
Make_____ Model_____ Color_____
License Plate Number _____

Vehicle #5
Make_____ Model_____ Color_____
License Plate Number _____

Vehicle #6
Make_____ Model_____ Color_____
License Plate Number _____

Security Review Form CIP

Project Name _____

Project Manager _____ Contact Number _____

Description of Project

_____
_____
_____
_____
_____

Time Frame

_____

Phase Description and Time Frame (as needed)

Phase 1 _____
Phase 2 _____
Phase 3 _____
Phase 4 _____
Phase 5 _____

Location _____

Location per phase (as needed)

Location Phase 1 _____
Location Phase 2 _____
Location Phase 3 _____
Location Phase 4 _____
Location Phase 5 _____

Contractor Information

Contractor Business Name _____
Manager/Supervisor _____ Contact Number _____
Site Supervisor/Superintendent_____ Contact Number _____

Number of employees _____

Number of Employees per phase (as needed) and shift hours on property
Employees Phase 1 _____
Employees Phase 2 _____
Employees Phase 3 _____
Employees Phase 4 _____
Employees Phase 5 _____

Short duration partial day employees (examples - meetings only, quality inspections etc.):
_____
_____
(These employees will gain access via the appointment calendar and check in/out daily policy)

☐ Check here if this is a Subcontractor

Subcontractor's agent (Business Name) _____
Subcontractor Site Supervisor and contact number (if different than above)
_____

Other information (As needed per job specification)
_____
_____
_____
_____

Note: Contractors will be issued a photo Identification badge with the possible exception of a partial day contractor. Each contractor will fill out a "Contractor ID Badge" form which requires a start and stop date and signature from the City of San José Project Manager.

Make as many copies of Page 2 as needed to provide Contractor info

On Property Vehicle/Machinery Information

Vehicles or machinery that will be kept within the perimeter or will be here for specific phase/timeframe only:

Vehicle/Machinery Description and Location on Property
(Be specific with date and time as needed)

Phase 1 _____
_____
_____
_____

Phase 2 _____
_____
_____
_____

Phase 3 _____
_____
_____
_____

Phase 4 _____
_____
_____
_____

Phase 5 _____
_____
_____
_____

Contractor Deliveries

Contractor Business Name--Delivery Date--Delivery Time--Location:

_____
_____
_____
_____
_____
_____
_____

Note: Contractors will be issued a vehicle hang tag to gain access inside the perimeter of the Facility. A "Contractor Hang Tag" form will be completed by each Contractor.

SECTION 01 42 13
ABBREVIATIONS AND ACRONYMS

PART 1 GENERAL

1.01 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

A. Work specified by reference to published standard or specification of government agency, technical association, trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.

B. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Contract Documents to establish a higher or more stringent standard of quality than required by referenced standard.

C. Where two or more standards are specified to establish quality, product and workmanship shall meet or exceed requirements of most stringent.

D. Where both a standard and a brand name are specified for a product in Contract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.

E. Copies of standards and specifications of technical societies:
   1. Copies of applicable referenced standards have not been bound in these Contract Documents.
   2. Where copies of standards are needed by Subcontractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Subcontractor's personnel.

1.02 ABBREVIATIONS

A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.

1.	AA	Aluminum Association
2.	AABC	Associated Air Balance Council
3.	AAMA	American Architectural Manufacturers Association
4.	AASHTO	American Association of State Highway and Transportation Officials
5.	ABMA	American Bearing Manufacturers' Association

6.	ACI	American Concrete Institute
7.	AEIC	Association of Edison Illuminating Companies
8.	AGA	American Gas Association
9.	AGMA	American Gear Manufacturers' Association
10.	AI	Asphalt Institute
11.	AISC	American Institute of Steel Construction
12.	AISI	American Iron and Steel Institute
13.	AITC	American Institute of Timber Construction
14.	ALS	American Lumber Standards
15.	AMCA	Air Movement and Control Association
16.	ANSI	American National Standards Institute
17.	APA	APA – The Engineered Wood Association
18.	API	American Petroleum Institute
19.	APWA	American Public Works Association
20.	AHRI	Air-Conditioning, Heating, and Refrigeration Institute
21.	ASA	Acoustical Society of America
22.	ASABE	American Society of Agricultural and Biological Engineers
23.	ASCE	American Society of Civil Engineers
24.	ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
25.	ASME	American Society of Mechanical Engineers
26.	ASNT	American Society for Nondestructive Testing
27.	ASSE	American Society of Sanitary Engineering
28.	ASTM	ASTM International
29.	AWI	Architectural Woodwork Institute
30.	AWPA	American Wood Preservers' Association
31.	AWPI	American Wood Preservers' Institute
32.	AWS	American Welding Society
33.	AWWA	American Water Works Association
34.	BHMA	Builders Hardware Manufacturers' Association
35.	CBM	Certified Ballast Manufacturer
36.	CDA	Copper Development Association
37.	CGA	Compressed Gas Association
38.	CISPI	Cast Iron Soil Pipe Institute
39.	CMAA	Crane Manufacturers' Association of America

40.	CRSI	Concrete Reinforcing Steel Institute
41.	CS	Commercial Standard
42.	CSA	Canadian Standards Association
43.	CSI	Construction Specifications Institute
44.	DIN	Deutsches Institut für Normung e.V.
45.	DIPRA	Ductile Iron Pipe Research Association
46.	EIA	Electronic Industries Alliance
47.	EJCDC	Engineers Joint Contract Documents' Committee
48.	ETL	Electrical Test Laboratories
49.	FAA	Federal Aviation Administration
50.	FCC	Federal Communications Commission
51.	FDA	Food and Drug Administration
52.	FEMA	Federal Emergency Management Agency
53.	FIPS	Federal Information Processing Standards
54.	FM	FM Global
55.	Fed. Spec.	Federal Specifications (FAA Specifications)
56.	FS	Federal Specifications and Standards (Technical Specifications)
57.	GA	Gypsum Association
58.	GANA	Glass Association of North America
59.	HI	Hydraulic Institute
60.	HMI	Hoist Manufacturers' Institute
61.	IBC	International Building Code
62.	ICBO	International Conference of Building Officials
63.	ICC	International Code Council
64.	ICEA	Insulated Cable Engineers' Association
65.	IFC	International Fire Code
66.	IEEE	Institute of Electrical and Electronics Engineers, Inc.
67.	IESNA	Illuminating Engineering Society of North America
68.	IFI	Industrial Fasteners Institute
69.	IGMA	Insulating Glass Manufacturer's Alliance
70.	IMC	International Mechanical Code
71.	INDA	Association of the Nonwoven Fabrics Industry
72.	IPC	International Plumbing Code
73.	ISA	International Society of Automation

74.	ISO	International Organization for Standardization
75.	ITL	Independent Testing Laboratory
76.	JIC	Joint Industry Conferences of Hydraulic Manufacturers
77.	MIA	Marble Institute of America
78.	MIL	Military Specifications
79.	MMA	Monorail Manufacturers' Association
80.	MSS	Manufacturer's Standardization Society
81.	NAAMM	National Association of Architectural Metal Manufacturers
82.	NACE	NACE International
83.	NBGQA	National Building Granite Quarries Association
84.	NEBB	National Environmental Balancing Bureau
85.	NEC	National Electrical Code
86.	NECA	National Electrical Contractor's Association
87.	NEMA	National Electrical Manufacturers' Association
88.	NESC	National Electrical Safety Code
89.	NETA	InterNational Electrical Testing Association
90.	NFPA	National Fire Protection Association
91.	NHLA	National Hardwood Lumber Association
92.	NICET	National Institute for Certification in Engineering Technologies
93.	NIST	National Institute of Standards and Technology
94.	NRCA	National Roofing Contractors Association
95.	NRTL	Nationally Recognized Testing Laboratories
96.	NSF	NSF International
97.	NSPE	National Society of Professional Engineers
98.	NTMA	National Terrazzo and Mosaic Association
99.	NWWDA	National Wood Window and Door Association
100.	OSHA	Occupational Safety and Health Act (both Federal and State)
101.	PCI	Precast/Prestressed Concrete Institute
102.	PE	Professional Engineer
103.	PEI	Porcelain Enamel Institute
104.	PPI	Plastic Pipe Institute
105.	PS	Product Standards Section-U.S. Department of Commerce
106.	RMA	Rubber Manufacturers' Association

107.	RUS	Rural Utilities Service
108.	SAE	SAE International
109.	SDI	Steel Deck Institute
110.	SDI	Steel Door Institute
111.	SJI	Steel Joist Institute
112.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
113.	SPI	Society of the Plastics Industry
114.	SSPC	The Society for Protective Coatings
115.	STI/SPFA	Steel Tank Institute/Steel Plate Fabricators Association
116.	SWI	Steel Window Institute
117.	TEMA	Tubular Exchanger Manufacturers' Association
118.	TCA	Tile Council of North America
119.	TIA	Telecommunications Industry Association
120.	UBC	Uniform Building Code
121.	UFC	Uniform Fire Code
122.	UL	Underwriters Laboratories Inc.
123.	UMC	Uniform Mechanical Code
124.	USBR	U.S. Bureau of Reclamation
125.	WCLIB	West Coast Lumber Inspection Bureau
126.	WI	Wood Institute
127.	WWPA	Western Wood Products Association

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 43 33
MANUFACTURERS' FIELD SERVICES

PART 1 GENERAL

1.01 DEFINITIONS

A. Person-Day: One person for 8 hours within regular working hours.

1.02 SUBMITTALS

A. Informational Submittals:
   1. Lesson Plan: Submit, in accordance with requirements of this Specification, proposed lesson plan not less than 45 days prior to scheduled training and revise as necessary for acceptance.

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

A. Authorized representative of manufacturer, factory trained, and experienced in technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by equipment manufacturer to issue certifications required of manufacturer. Additional qualifications may be specified in individual specification section.

B. Representative subject to acceptance by Design-Builder. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Furnish manufacturers' services, when required by individual specification section, to meet requirements of this section.

B. Schedule manufacturers' services to avoid conflict with other onsite testing or other manufacturers' onsite services.

C. Only those days of service approved by Design-Builder will be credited to fulfill specified minimum services.

D. When specified in individual specification sections, manufacturer's onsite services shall include:
   1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Subcontractor's assembly, erection, installation or application procedures.

2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Providing, on a daily basis, copies of manufacturers' representatives field notes and data to Design-Builder.
4. Revisiting Site as required to correct problems and until installation and operation are acceptable to Design-Builder.
5. Resolution of assembly or installation problems attributable to or associated with respective manufacturer's products and systems.
6. Assistance during pre-operational testing, functional testing, and Acceptance Testing.
7. Training of City's personnel in operation and maintenance of respective product as required.

3.02 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. When so specified, Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by equipment manufacturer's representative.

B. Form shall certify signing party is a duly authorized representative of manufacturer, is empowered by manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to ensure equipment is complete and operational.

3.03 TRAINING

A. General:
1. Provide training such that operations and maintenance staff have the information needed to safely operate, maintain, repair, and troubleshoot the equipment and systems provided.
2. Furnish manufacturers' representatives for detailed classroom and hands-on training to City's personnel on operation and maintenance of specified product (system, subsystem, and component) and as may be required in applicable Specifications.
3. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Design-Builder, and familiar with operation and maintenance manual information specified in Section 01 78 23, Operation and Maintenance Data.
4. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
5. Furnish complete training materials at the start of the training session, to include operation and maintenance data, to be retained by each trainee. Provide 15 copies of complete training materials.

6. At the conclusion of training, submit two electronic copies and three hard copies of the final lesson plan, overhead transparencies, and handouts within 7 calendar days of training. Material shall be transmitted within 7 calendar days from the completion of the training session.
7. Design-Builder will digitally record training sessions and provide copies of the recordings to the City for future use by operations and maintenance personnel in training of equipment and systems.
8. Following each training session, class evaluation documents as provided herein will be distributed to determine overall effectiveness of the training. Sessions judged "Unsatisfactory" by a majority of the attendees shall be revised and conducted again until a satisfactory rating is achieved.

B. Training Schedule:
1. Coordinate training sessions with Design-Builder and manufacturers' representatives, and with submission of operation and maintenance manuals in accordance with Section 01 78 23, Operation and Maintenance Data.
2. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Design-Builder, and to allow full participation by manufacturers' representatives.
3. Adjust schedule for interruptions in operability of equipment.
4. Unless otherwise specified, provide a minimum of two training sessions for each type and size of equipment.
5. Provide approved preliminary (not Final Submittal) Operation and Maintenance Manual for specific pieces of equipment or systems 60 calendar days prior to training session for that piece of equipment or system.
6. Do not perform training until Lesson Plan and preliminary Operations and Maintenance Manual has been approved by the Design-Builder.

C. Lesson Plan:
1. When manufacturer or vendor training of City personnel is specified, prepare a lesson plan for each required course.
2. An agenda shall be included at the beginning of the lesson plan containing the following minimum information:
   a. Title and objectives.
   b. Recommended attendees for each session or portion of session (such as, managers, engineers, operators, maintenance personnel).
   c. Course description and goals.
   d. Outline of course content to include at a minimum:
      1) Overview of equipment and/or system.
      2) Operating function and system theory.
      3) Startup and shutdown procedures.
      4) Alternative and emergency operation.
      5) Preventative maintenance.
      6) Troubleshooting.

7) Specific safety procedures and precautions.

e. Estimated class duration for each session or portion of session.

f. Format such as, lecture, self-study, demonstration, hands-on.

g. Instruction materials and equipment requirements.

h. Resumes of instructor(s) providing training.

3. The proposed lesson plans shall include the elements presented in the outlines of the instruction lesson plans herein for each craft. Specific components and procedures shall be identified in the proposed lesson plans.

4. The proposed lesson plans should detail specific instruction topics. "Hands-on" demonstrations planned for the instructions shall be described in the lesson plans. Training aids to be utilized in the instruction shall be cross-referenced in the proposed lesson plans.

5. Training strategies such as planned whiteboard work, instructor questions, and discussion points or other planned classroom or field strategies shall be detailed in the proposed lesson plans.

6. Handouts for training shall be attached to the lesson plans, cross-referenced by section or topic in the lesson plans.

7. The outlines of the Maintenance Instruction Lesson Plan shall include the following, as applicable to each craft:

a. Equipment operation for all crafts:

1) Describe equipment's operating (process) function and system theory as well as emergency operating shut down procedures.

2) Describe equipment's fundamental operating principles and dynamics.

3) Identify equipment's mechanical, electrical, and electronic components and features.

4) Identify all support equipment associated with the operation of subject equipment.

5) Detail the relationship of each piece of equipment or component to the subsystems, systems, and process related to this project.

6) Cite all hazards associated with the operations, exposure to chemicals associated with the component, or the waste stream handled by the component.

7) Specify the appropriate and safety precautions, equipment, and procedures to eliminate, reduce, or overcome these hazards.

b. Detailed component descriptions specific for Mechanical, HVAC, Instrumentation, and Electrical:

1) Describe Preventative Maintenance inspection procedures required to be performed by operations and maintenance staff while the equipment is in operation, how to spot potential trouble symptoms (anticipate breakdowns), and forecast maintenance requirements (predictive maintenance).

2) Identify and describe in detail each component function.

3) Where applicable, group relative components into subsystems.

4) Identify and describe in detail equipment safety features, permissive and controls interlocks.
5) Review preventative maintenance frequency and task analysis table.
6) Detail procedure for each preventative maintenance activity to be performed weekly or less frequently.
7) Equipment troubleshooting specific for Mechanical, HVAC, Instrumentation, and Electrical:
   a) Define recommended systematic troubleshooting procedures.
   b) Provide component specific troubleshooting checklists.
8) Equipment Corrective Maintenance specific for Mechanical, HVAC, Instrumentation, and Electrical:
   a) Describe recommended equipment preparation requirements.
   b) Identify and describe the use of any special tools required for maintenance of the equipment.
   c) Describe component removal/installation and disassembly/ assembly procedures for repairs.
   d) Perform at least two "hands-on" demonstrations of common maintenance repairs. Additional demonstrations may be required by the Design-Builder.
   e) Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
   f) Describe recommended procedures to check/test equipment following a corrective maintenance repair.
9) "Hands-on" instruction shall be conducted according to the following descriptions:
   a) Course instructor shall present "hands-on" demonstrations of common corrective maintenance repairs for each group or craft. The manufacturer shall provide the tools and equipment to conduct the demonstrations. Requests for supplemental assistance and materials should be submitted with the proposed lesson plans.
   b) For those "hands-on" training situations where the operations or maintenance personnel will participate in disassembly or assembly of equipment, trainer shall be responsible for such disassembly or assembly and, on completion of all "hands-on" training, shall provide written certification of proper equipment operation to Design-Builder.
   c) "Hands-on" training of operations personnel will cover proper start-up, shutdown, and normal and alternative operating strategies.

3.04 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.

1. Manufacturer's Certificate of Proper Installation.
2. Training Evaluation Form.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

Owner: City of San José

Project: Headworks Project

Contract Number: _____

Specification Section: _____

Equipment System: _____

Tag Number(s): _____

Serial Number(s): _____

I hereby certify that the above-referenced equipment/system has been:

Yes	No	N/A	
☐	☐	☐	Installed in accordance with Manufacturer's recommendations.
☐	☐	☐	Serviced with proper initial lubricants.
☐	☐	☐	Electrical and mechanical connections meet quality and safety standards.
☐	☐	☐	All applicable safety equipment has been property installed.
☐	☐	☐	Operated and rotates in the proper direction.
☐	☐	☐	Properly aligned and adjusted as necessary.
☐	☐	☐	Tested for vibration and meets requirements.
☐	☐	☐	Meets specifications and is ready for startup.
☐	☐	☐	Initial Volts (V) and Amps (A) recorded:

Ph1 (A-B): V_____ A_____
Ph2 (B-C): V_____ A_____
Ph3 (A-C): V_____ A_____

Comments:

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Signature of Authorized Representative: _____

Manufacturer: _____

TRAINING EVALUATION FORM

EQUIPMENT ITEM: _____

VENDOR/MANUFACTURER: _____

DATE: _____ NAME OF REPRESENTATIVE: _____

			(Circle One)		
1.	Was representative prepared?	Acceptable	Unacceptable	or	N/A
2.	Was an overview description presented?	Acceptable	Unacceptable	or	N/A
3.	Were specific details presented for system components?	Acceptable	Unacceptable	or	N/A
4.	Were alarm and shutdown conditions clearly presented?	Acceptable	Unacceptable	or	N/A
5.	Were step-by-step procedures for starting, stopping, and trouble-shooting presented?	Acceptable	Unacceptable	or	N/A
6.	Were routine/preventative maintenance items clearly identified?	Acceptable	Unacceptable	or	N/A
7.	Was the lubrication schedule (if any) discussed?	Acceptable	Unacceptable	or	N/A
8.	Was the representative able to answer all questions?	Acceptable	Unacceptable	or	N/A
9.	Did the representative agree to research and answer unanswered questions?	Acceptable	Unacceptable	or	N/A

10. Comments:

_____

_____

_____

11.	Overall Rating:	Satisfactory	Unsatisfactory

PULLED MASTER FROM CITY SPECS. NEED TO MODIFY FOR DB PROJECT.

SECTION 01 45 00
QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Quality control requirements and procedures for products and workmanship and includes the following:
   1. Testing of equipment.
   2. Procedures and limitations of inspection.

B. Related Sections:
   1. Section 4-1.01 of the July 1992 City of San José Standard Specifications.
   2. Section 6-3 of the July 1992 City of San José Standard Specifications.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. E329, Standard for agencies engaged in the testing and/or inspection of materials used in construction.
      b. D3740, Evaluation of Agencies engaged in the testing and/or inspection of soil and rock as used in engineering design and construction.
   2. California Building Code (CBC): Chapter 17- Structural Tests and Special Inspections.

1.03 PRODUCTS AND WORKMANSHIP

A. Provide new products of specified quality, and equal to accepted samples when samples were submitted.

B. Perform and complete work in a thorough manner.
   1. Call Jacobs' Engineer's attention to apparent errors, conflicts, discrepancies, or omissions in Contract Documents and request instructions before proceeding with the Work.
   2. Jacobs' Engineer will issue written clarification or interpretation of requirements of the Contract Documents.

C. When specified, products will be tested and inspected either at point of origin or at Work site.
   1. Notify Jacobs' Engineer in writing well in advance of when products will be ready for testing and inspection at point of origin.

2. Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory tests or inspections at point of origin do not preclude retesting or re-inspection at Work site.

D. Do not ship products that require testing and inspection at point of origin prior to testing and inspection.

1.04 INSPECTION

A. Material and equipment, and workmanship shall be subject to inspection and rejection when not in conformance with Contract Documents.

B. Remove defective work and products from Work site, whether in place or not, and replace or renew with work, material or equipment in conformance with Contract Documents.

C. Questions concerning acceptability of materials, classification or materials, and execution of the Work will be decided by Jacobs' Engineer.

D. Facilitate inspection by maintaining proper facilities and providing safe access to the Work, to shops where products are in preparation, and to warehouses and storage yards where products are stored.

E. Jacobs' Engineer's observation of Work that will be covered up:
   1. When directed to allow observation of work before it is covered up, provide timely notification of work readiness and allow Jacobs' Engineer reasonable time to observe such work before covering it up.
   2. Uncover, at Design-Builder and Subcontractor's cost, work covered up for which Jacobs' Engineer was not given timely notification or reasonable time to conduct observations.
   3. Jacobs' Engineer may specify time requirements for timely notification and for performing observations.

F. Inspections may extend to entire or part of the Work and to preparation, fabrication, and manufacture of products for the Work.

G. The presence or absence of a quality assurance inspector does not relieve Design-Builder and Subcontractor from any Contract requirement.

H. City's Representative or Inspector will not:
   1. Alter or waive provisions of Contract Documents.
   2. Inspect Design-Builder and Subcontractor's means, methods, techniques, sequences, or procedures for construction.
   3. Accept portions of the Work, issue instructions contrary to intent of Contract Documents, or act as foreman for Design-Builder and Subcontractor.

4. Supervise, control, or direct Design-Builder and Subcontractor's safety precautions or programs; whether Design-Builder and Subcontractor's employees or others.

I. City's Representative or Inspector will:

1. Conduct on-site observations of the Work in progress to assist Jacobs' Engineer in determining when the Work is, in general, proceeding in accordance with Contract Documents.
2. Report to Jacobs' Engineer whenever Inspector believes that Work is faulty, defective, does not conform to Contract Documents, or has been damaged; or whenever there is defective material or equipment; or whenever Inspector believes the Work should be uncovered for observation or requires special testing.

1.05 SPECIAL INSPECTION

A. All building and structural projects must follow and comply to the 2013 California Building Codes, Chapter 17, Special Inspection requirements.

B. Special inspections and testing shall be performed in accordance with the approved plans and specifications, and CBC Sections 1704, 1705, 1706, 1707, and 1708.

C. Special inspections and testing shall be performed by one or more of the Recognized Special Inspection and Testing Agencies listed in the City of San José Special Inspection List. The current list can be found at http://www.sanjoseca.gov/documentcenter/view/19243.

D. The City's Statement of Special Inspection Form shall be completed by the Registered Design Professional in Responsible Charge and submitted to the City of San José for review and approval. All structural elements require special inspections and tests shall be specified and submitted with the Statement of Special Inspection Form.

E. All Interim Reports shall be submitted to the City of San José and the Registered Design Professional in Responsible Charge in accordance with CBC Section 1704.1.2.

F. A Final Report of Special Inspections signed by the responsible Jacobs' Engineer of the special inspection agency documenting required special inspections, testing and correction of any discrepancies noted in the inspections shall be submitted prior to issuance of a Certificate of Use and Occupancy (CBC Section 1704.1.2). The Final Report shall document the following:

1. Required special inspections performed.
2. Correction of discrepancies noted in inspections.

G. The City will retain and directly pay for the Special Inspections as required in CBC Section 1704.1.

1.06 SAMPLING AND TESTING

A. General:
   1. Prior to delivery and incorporation in the Work, submit listing of sources of materials, when specified in Sections where materials are specified.
   2. When specified in Sections where products are specified:
      a. Submit sufficient quantities of representative samples of character and quality required of materials to be used in the Work for testing or examination.
      b. Test materials in accordance with standards of national technical organizations.

B. Sampling:
   1. Furnish specimens of materials when requested.
   2. Do not use materials which are required to be tested until testing indicates satisfactory compliance with specified requirements.
   3. Specimens of materials will be taken for testing whenever necessary to determine quality of material.
   4. Assist Jacobs' Engineer in preparation of test specimens at site of Work, such as soil samples and concrete test cylinders.

C. Test Standards:
   1. Perform sampling, specimen preparation, and testing of materials in accordance with specified standards, and when no standard is specified, in accordance with standard of nationally recognized technical organization.
   2. Physical characteristics of materials not particularly specified shall conform to standards published by ASTM, where applicable.

1.07 TESTING LABORATORY SERVICES

A. Qualification of Laboratory:
   1. Meets "Recommended Requirements for Independent Laboratory Qualification", published by American Council for Independent Laboratories.
   2. Meets requirements of ASTM E329.
   3. Has authorization to operate in the State of California.
   4. Will submit copy of report of inspection of facilities made by Materials Reference Laboratory during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.
   5. Has testing equipment calibrated at reasonable intervals by devices of accuracy traceable or accepted values of natural physical constants.

B. Laboratory Duties:
   1. Cooperate with Jacobs' Engineer and Design-Builder and Subcontractor.
   2. Provide qualified personnel.

3. Notify Jacobs' Engineer and Design-Builder and Subcontractor, in writing, of response time needed to schedule testing or inspections after receipt of notice.
4. Perform specified inspections, sampling, and testing of materials and methods of construction in accordance with specified standards to ascertain compliance of materials with requirements of Contract Documents.
5. Promptly notify Jacobs' Engineer and Design-Builder and Subcontractor of observed irregularities or deficiencies of construction by telephone or email followed by a written letter.
6. Promptly submit written report of each test and inspection; one copy each to Jacobs' Engineer, City, Design-Builder and Subcontractor, and one copy to file of Project Record Documents. Each report shall include:
   a. Sequential number.
   b. Date issued.
   c. Project title and number.
   d. Testing laboratory name, address and telephone number.
   e. Name and signature of laboratory inspector.
   f. Date and time of sampling or inspection.
   g. Record of temperature and weather conditions.
   h. Date and time of test.
   i. Identification of product and specification section.
   j. Location of sample or test in project.
   k. Type of inspection or test.
   l. Results of tests and compliance with Contract Documents.
   m. Interpretation of test results, when requested by Jacobs' Engineer.
7. Store samples for a period of 1 year after testing.

C. Limitations of Authority of Testing Laboratory: Laboratory is not authorized to:
   1. Release, revoke, alter or enlarge on requirements of Contract Documents.
   2. Approve or accept portion of Work.
   3. Perform duties of Design-Builder and Subcontractor.

1.08 DESIGN-BUILDER AND SUBCONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel and provide access to construction and manufacturing operations.

B. Secure and deliver to laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.

C. Provide to laboratory preliminary mix design proposed to be used for concrete, and other materials mixes which require control by testing laboratory.

D. Furnish copies of product test reports.

E. Furnish incidental labor and facilities:
   1. To provide access to construction to be tested.
   2. To obtain and handle samples at Work site or at source of product to be tested.
   3. To facilitate inspections and tests.
   4. For storage and curing of test samples.

F. Notify laboratory in advance of when observations, inspections, and testing is needed for laboratory to schedule and perform in accordance with their notice of response time.

G. Design-Builder and Subcontractor shall pay for all quality control testing other than the Special Inspections as required in CBC Section 1704.1.

H. Correct defective work at Design-Builder and Subcontractor's expense.

1.09 ELECTRICIAN CERTIFICATION REQUIREMENTS

A. In accordance with California Labor Code Section 3099.2, the Design-Builder and Subcontractor shall use, and/or cause its electrical subcontractor to use, properly certified electricians to perform electrical work.

B. There are a number of exemptions to the "certification" requirement. For example, certification is not required for the following:
   1. Persons performing work within the scope of the C-7 contractor's license (low-voltage systems) or the C-45 contractor's license (electric signs).
   2. A registered apprentice performing electrical work as part of an approved apprenticeship program.
   3. A nonresidential lighting trainee meeting certain enumerated requirements.
   4. The person qualifying for the C-10 electrical contractor license.
   5. Persons performing electrical connections under 100 volt-amperes.
   6. Electrical work ordinarily and customarily performed by stationary engineers.
   7. Electrical work in connection with the installation, operation, or maintenance of temporary or portable electrical equipment performed by technicians in the theatrical, motion picture production, television, hotel, exhibition, or trade show industries.

C. Whenever the City becomes aware that uncertified electricians are performing electrical work, Jacobs' Engineer will prohibit the Work from proceeding until properly certified electricians are used.

D. The City will inspect any electrical work performed by uncertified electricians and – if the Work is incorrect – require the Design-Builder and Subcontractor to make the necessary corrections using certified electricians at the Design-Builder and Subcontractor's sole cost.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 16.13
SUBCONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 SQC SUBMITTALS

A. Informational Submittals:
   1. SQC Plan: Submit, not later than 30 days after receipt of Notice to Proceed.
   2. SQC Report: Submit, weekly, an original and one copy in report form.

1.02 DESIGN-BUILDER'S QUALITY ASSURANCE

A. The Work is subject to City's and Design-Builder's quality assurance inspection and testing at locations and at reasonable times before acceptance to ensure strict compliance with the terms of the Contract Documents.

B. Design-Builder's quality assurance inspections and tests are for the sole benefit of Design-Builder and do not:
   1. Relieve Subcontractor of responsibility for providing adequate quality control measures;
   2. Relieve Subcontractor of responsibility for damage to or loss of material before acceptance;
   3. Constitute or imply acceptance; or
   4. Affect continuing rights of Design-Builder after acceptance of completed Work.

C. The presence or absence of City's and Design-Builder's quality assurance inspector does not relieve Subcontractor from any Contract requirement.

D. Promptly furnish safe and convenient access, and facilities, labor, and material reasonably needed for performing inspections and tests as may be required by Design-Builder.

E. Design-Builder may charge Subcontractor for additional cost of inspection or test when Work is not ready at time specified by Subcontractor for inspection or test, or when prior rejection makes re-inspection or retest necessary.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Maintain an adequate inspection system and perform such inspections as will ensure the Work conforms to the Subcontract Agreement.

B. Maintain complete inspection records and make them available at all times to Design-Builder.

C. Quality control system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Subcontract Agreement and applicable codes and standards.

3.02 COORDINATION MEETING

A. After Preconstruction Conference, but before start of construction, and prior to acceptance of the SQC Plan, schedule a meeting with Design-Builder to discuss quality control system.

B. Develop a mutual understanding of system details, including forms for recording SQC operations, control activities, testing, administration of system for both onsite and offsite Work, and interrelationship of Subcontractor's management and control with Design-Builder's quality assurance.

C. There may be occasions when subsequent conferences may be called by either party to reconfirm mutual understandings or address deficiencies in SQC system or procedures that may require corrective action by Subcontractors.

3.03 QUALITY CONTROL ORGANIZATION

A. SQC System Manager:
   1. Designate an individual within Subcontractor's organization who will be responsible for overall management of SQC and have authority to act in SQC matters for Subcontractor.
   2. SQC System Manager shall be an experienced construction person, with a minimum of 3 years' construction experience on similar type Work.
   3. Identify an alternate for SQC System Manager to serve with full authority during SQC System Manager's absence. Requirements for the alternate shall be the same as for designated SQC System Manager.

B. SQC Staff:
   1. Designate a SQC staff, available at Site at all times during progress, with complete authority to take action necessary to ensure compliance with the Subcontract. SQC staff members shall be subject to acceptance by Design-Builder.
   2. SQC staff shall take direction from SQC System Manager in matters pertaining to QC.
   3. SQC staff must be of sufficient size to ensure adequate QC coverage of Work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities.
   4. The actual strength of SQC staff may vary during any specific Work period to cover the needs of Project. Add additional staff when necessary for a proper SQC organization.

C. Organizational Changes: Obtain Design-Builder's acceptance before replacing any member of SQC staff. Requests for changes shall include name, qualifications, duties, and responsibilities of proposed replacement.

3.04 QUALITY CONTROL PHASING

A. SQC shall include at least three phases of control to be conducted by SQC System Manager for all definable features of Work, as follows:

1. Preparatory Phase:
   a. Notify Design-Builder at least 48 hours in advance of beginning any required action of preparatory phase.
   b. Includes meeting conducted by SQC System Manager and attended by superintendent, other SQC personnel (as applicable), and foreman responsible for the definable feature. SQC System Manager shall instruct applicable SQC staff as to acceptable level of workmanship required in order to meet Contract requirements.
   c. Document results of preparatory phase meeting by separate minutes prepared by SQC System Manager and attached to QC report.
   d. Perform prior to beginning Work on each definable feature of Work:
      1) Review applicable Contract Specifications.
      2) Review applicable Contract Drawings.
      3) Verify materials and equipment have been tested, submitted, and approved.
      4) Verify provisions have been made to provide required control inspection and testing.
      5) Examine the Work area to verify required preliminary Work has been completed and is in compliance with the Contract.
      6) Perform physical examination of required materials, equipment, and sample Work to verify they are on hand, conform to approved Shop Drawing or submitted data, and are properly stored.
      7) Review appropriate activity hazard analysis to verify safety requirements are met.
      8) Review procedures for constructing the Work, including repetitive deficiencies.
      9) Document construction tolerances and workmanship standards for that phase of the Work.
      10) Check to verify plan for the Work to be performed, if so required, has been accepted by Design-Builder.
2. Initial Phase:
   a. Accomplish at the beginning of a definable feature of Work:
      1) Notify Design-Builder at least 48 hours in advance of beginning initial phase.
      2) Perform prior to beginning Work on each definable feature of Work:
         a) Review minutes of preparatory meeting.

b) Check preliminary Work to verify compliance with Contract requirements.
c) Verify required control inspection and testing.
d) Establish level of workmanship and verify it meets minimum acceptable workmanship standards. Comparison with sample panels is appropriate.
e) Resolve differences.
f) Check safety to include compliance with and upgrading of safety plan and activity hazard analysis. Review activity analysis with each worker.

3) Separate minutes of this phase shall be prepared by SQC System Manager and attached to QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.

4) Initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3. Follow-up Phase:

a. Perform daily checks to verify continuing compliance with Contract requirements, including control testing, until completion of the particular feature of Work.

b. Daily checks shall be made a matter of record in SQC documentation and shall document specific results of inspections for features of Work for day or shift.

c. Conduct final follow-up checks and correct deficiencies prior to start of additional features of Work that will be affected by the deficient Work. Constructing upon or concealing nonconforming Work will not be allowed.

4. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be conducted on the same definable features of Work as determined by Design-Builder if quality of ongoing Work is unacceptable; or if there are changes in applicable QC staff or in onsite production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.05 QUALITY CONTROL PLAN

A. General:

1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.
2. An interim plan for the first 30 days of operation will be considered.
3. Construction permitted to begin only after acceptance of SQC Plan or acceptance of an interim plan applicable to the particular feature of Work to be started.
4. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a SQC Plan or another interim plan containing the additional features of Work to be started.

B. Content:

1. Plan shall cover the intended SQC organization and shall include the following, as a minimum:

   a. Organization: Description of quality control organization, including chart showing lines of authority and acknowledgment that SQC staff will implement the three-phase control system (see Article Quality Control Phasing) for aspects of the Work specified.

   b. SQC Staff: Name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.

   c. Letters of Authority: Copy of letter to SQC System Manager signed by authorized official of firm, describing responsibilities and delegating sufficient authorities to adequately perform the functions of SQC System Manager, including authority to stop Work which is not in compliance with the Subcontract Agreement. SQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to Design-Builder.

   d. Submittals: Procedures for scheduling, reviewing, certifying, and managing submittals, including those of Sub-subcontractors, offsite fabricators, suppliers and purchasing agents.

   e. Inspection Test Plan (ITP):

      1) Provide list of required tests and inspections for Project.

      2) Identify in ITP inspection hold points, i.e., when work must stop momentarily so a required inspection can be conducted and the Work approved before the Work can continue.

   f. Testing: Control, verification and acceptance testing procedures for each specific test to include test name, frequency, specification paragraph containing test requirements, personnel and laboratory responsible for each type of test, and an estimate of number of tests required.

   g. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.

   h. Procedures for tracking deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.

   i. Reporting procedures, including proposed reporting formats; include a copy of the SQC report form.

C. Acceptance of Plan: Acceptance of Subcontractor's basic and addendum SQC plan is required prior to start of construction. Acceptance is conditional and will be predicated on satisfactory performance during construction. Design-Builder reserves the right to require Subcontractor to make changes in SQC plan and operations including removal of personnel, as necessary, to obtain quality specified.

D. Notification of Changes: After acceptance of SQC plan, notify Design-Builder, in writing, a minimum of 7 calendar days prior to a proposed change. Proposed changes are subject to acceptance by Design-Builder.

3.06 QUALITY CONTROL REPORT

A. As a minimum, prepare SQC report for every 7 calendar days. Account for all days throughout life of Subcontract. Reports shall be signed and dated by SQC System Manager. Include copies of test reports and copies of reports prepared by QC staff.

B. Maintain current records of quality control operations, activities, and tests performed, including the Work of Sub-subcontractors and Suppliers.

C. Records shall be on an acceptable form and shall be a complete description of inspections, results of inspections, daily activities, tests, and other items, including but not limited to the following:

1. Subcontractor/Sub-subcontractors and their areas of responsibility.
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed today, giving location, description, and by whom. When network schedule is used, identify each phase of Work performed each day by activity number.
4. Test and control activities performed with results and references to specification/drawing requirements. Control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
5. Material received with statement as to its acceptability and storage.
6. Identify submittals reviewed, with Subcontract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. List instructions given/received and conflicts in Drawings and Specifications.
10. Subcontractor's verification statement.
11. Indicate description of trades working on Project, number of personnel working, weather conditions encountered, and delays encountered.
12. These records shall cover both conforming and deficient features and shall include statement that equipment and materials incorporated in file work and workmanship comply with Subcontract.

3.07 SUBMITTAL QUALITY CONTROL

A. Submittals shall be as specified in Section 01 33 00, Submittal Procedures. The SQC organization shall be responsible for certifying submittals are in compliance with Subcontract requirements. Design-Builder will furnish copies of test report forms upon request by Subcontractor. Subcontractor may use other forms as approved.

3.08 TESTING QUALITY CONTROL

A. Testing Procedure:

1. Perform tests specified or required to verify control measures are adequate to provide a product which conforms to Subcontract requirements. Perform following activities and record following data:
   a. Verify testing procedures comply with Subcontract requirements.
   b. Verify facilities and testing equipment are available and comply with testing standards.
   c. Check test instrument calibration data against certified standards.
   d. Verify recording forms and test identification control number system, including test documentation requirements, have been prepared.
   e. Documentation:
      1) Record results of tests taken, both passing and failing, on SQC report for date taken.
      2) Include specification paragraph reference, location where tests were taken, and sequential control number identifying test.
      3) Actual test reports may be submitted later, if approved by Design-Builder with a reference to test number and date taken.
      4) Provide directly to Design-Builder an information copy of tests performed by offsite or commercial test facility. Test results shall be signed by an engineer registered in state where tests are performed.
      5) Failure to submit timely test reports, as stated, may result in nonpayment for related Work performed and disapproval of the test facility for Subcontract.

B. Testing Laboratories: Laboratory facilities, including personnel and equipment, utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D3740 and ASTM E329, and be accredited by American Association of Laboratory Accreditation (AALA), National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority. Personnel performing concrete testing shall be certified by American Concrete Institute (ACI).

3.09 COMPLETION INSPECTION

A. SQC System Manager shall conduct inspection of the Work at completion of Work or a milestone established by a completion time stated in Subcontract.

B. Punchlist:

1. SQC System Manager shall develop punchlist of items which do not conform to the Subcontract requirements.
2. Include punchlist in SQC report, indicating estimated date by which deficiencies will be corrected.

3. SQC System Manager or staff shall make second inspection to ascertain that deficiencies have been corrected and so notify Design-Builder.
4. These inspections and deficiency corrections required shall be accomplished within time stated for completion of entire Work or a particular increment thereof if Project is divided into increments by separate completion dates.

END OF SECTION

SECTION 01 45 33
SPECIAL INSPECTION, OBSERVATION, AND TESTING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers requirements for Special Inspection, Observation, and Testing required in accordance with 2016 CBC (California Building Code) and is in addition to and supplements requirements included in Statement of Special Inspections shown on Drawings.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
   2. California Building Standards Commission, California Building Code (CBC).
   3. International Code Council (ICC):
      a. International Building Code (IBC).
      b. Evaluation Service (ICC-ES) Reports and Legacy Reports.

1.03 SUBMITTALS

A. Informational Submittals:
   1. Subcontractor's Statement of Responsibility.
   2. Fabricator's Certificate of Compliance.

1.04 DEFINITIONS

A. Agencies and Personnel:
   1. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.
   2. Registered Design Professional in Responsible Charge: An individual who is registered or licensed to practice their respective design profession as defined by statutory requirements of professional registration laws of state or jurisdiction in which Project is to be constructed.

B. Statement of Special Inspections: Detailed written procedure contained on Drawings establishing systems and components subject to Special Inspection, Observation, and Testing during construction, type and frequency of testing, extent and duration of Special Inspection, and reports to be completed and distributed by Special Inspector.

C. Special Inspection:

1. Special Inspection: Inspection required of materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved Contract Documents and referenced standards.
2. Special Inspection, Continuous: Full-time observation of work requiring Special Inspection by an approved Special Inspector who is present in area where the Work is being performed.
3. Special Inspection, Periodic: Part-time or intermittent observation of the Work requiring Special Inspection by an approved Special Inspector who is present in area where the Work has been or is being performed, and at completion of the Work.

D. Structural Systems and Components:

1. Diaphragm: Component of structural lateral load resisting system consisting of roof, floor, or other membrane or bracing system acting to transfer lateral forces to vertical resisting elements of structure.
2. Drag Strut or Collector: Component of structural lateral load resisting system consisting of diaphragm or shear wall element that collects and transfers diaphragm shear forces to vertical force-resisting elements or distributes forces within diaphragm or shear wall.
3. Seismic-Force-Resisting System: That part of structural lateral load resisting system that has been considered in the design to provide required resistance to seismic forces identified on Drawings.
4. Shear Wall: Component of structural lateral load resisting system consisting of a wall designed to resist lateral forces parallel to plane of the wall. Unless noted otherwise on Drawings, load-bearing walls with direct in-plane connections to roof and floors shall be considered to be shear walls.
5. Wind Force Resisting System: That part of the structural system that has been considered in the design to provide required resistance to wind forces identified on Drawings.

E. Nonstructural Components:

1. Architectural Component Supports: Structural members or assemblies of members which transmit loads and forces from architectural systems or components to structure, including braces, frames, struts, and attachments.
2. Electrical Component Supports: Structural members or assemblies which transmit loads and forces from electrical equipment to structure, including braces, frames, legs, pedestals, and tethers, as well as elements forged or cast as part of component for anchorage.

3. Mechanical and Plumbing Component Supports: Structural members or assemblies which transmit loads and forces from mechanical or plumbing equipment to structure, including braces, frames, skirts, legs, saddles, pedestals, snubbers, and tethers, as well as elements forged or cast as part of component for anchorage.

1.05 STATEMENT OF SPECIAL INSPECTIONS REQUIREMENTS

A. Designated Systems for Inspection: Refer to Drawings.

B. Special Inspection and associated testing of shop fabrication and field construction will be performed by an approved accredited independent agency. Design-Builder will secure and pay for services of firm/laboratory to perform Special Inspection and associated testing.

C. Code required Special Inspection with associated testing and Professional Observation, as provided in Statement of Special Inspections Plan on Drawings and further provided in this section, is for benefit of Agency and does not:
   1. Relieve Subcontractor of responsibility for providing adequate quality control measures.
   2. Relieve Subcontractor of responsibility for damage to or loss of material before acceptance.
   3. Constitute or imply acceptance.
   4. Affect continuing rights after acceptance of completed Work.

D. The presence or absence of code required Special Inspector and Professional Observer does not relieve Subcontractor from Contract requirements.

E. Subcontractor is responsible for additional costs associated with Special Inspection and Testing and Observation when Work is not ready at time identified by Subcontractor and Special Inspectors and Professional Observer are onsite, but not able to provide services.

F. Subcontractor is responsible for associated costs for additional Special Inspection and Testing and Professional Observation by Special Inspectors and Professional Observers required because of rejection of materials of in place Work that cannot be made compliant to Contract Document without additional inspections and observation and testing.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Provide access to shop or Site for Special Inspection and Testing and Professional Observation requirements.

B. Notify Design-Builder in advance of required Special Inspection and Professional Observation no later than 48 hours prior to date of Special Inspection and Professional Observation.

C. Submit Subcontractor's Statement of Responsibility for each subcontractor constructing or installing components of the project requiring Special Inspection.

D. Submit Fabricator's Certificates of Compliance for approved fabricators.

3.02 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:
   1. Subcontractor's Statement of Responsibility.
   2. Fabricator's Certificate of Compliance.

END OF SECTION

SUBCONTRACTOR'S STATEMENT OF RESPONSIBILITY

_____
(Project)

_____
(Name of Company)

_____
(Business Address)

(_____) _____ (_____) _____
(Telephone) (Fax)

I, (We) hereby certify that I am (we are) aware of the Special Inspection and Testing requirements contained in Contract Documents for this Project for seismic force-resisting systems, and for components including architectural, mechanical, and electrical components, as listed in Statement of Special Inspections on Drawings, and that:

1. I, (We) are aware of the systems and the requirements for Special Inspection for responsible seismic force-resisting systems and acknowledge our responsibility in the implementation of the Statement of Special Inspections for the construction of the following systems/components:

Facility	Lateral Force-Resisting System/Component

2. Design-Builder will provide appropriate special inspection staff and related testing agencies as required for scheduling required Special Inspection and Testing for Project.

3. The following person is hereby identified as exercising control over requirements of this section for the Work designated above:

   Name: _____

   Qualifications: _____

   _____

   _____

(Print name and official title of person signing this form)

Signed by: _____

Date: _____

Project Name: _____

FABRICATOR'S CERTIFICATE OF COMPLIANCE

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per Section 1704.2.5 of 2016 CBC must submit Fabricator's Certificate of Compliance at the completion of fabrication.

_____
(Project)

_____
(Fabricator's Name)

_____
(Business Address)

_____
(Certification or Approval Agency)

_____
(Certification Number)

_____
(Date of Last Audit or Approval)

Description of structural members and assemblies that have been fabricated:

_____

_____

_____

_____

_____

I hereby certify that items described above were fabricated in strict accordance with approved construction documents.

_____
(Name and Title) type or print

_____
(Signature and Date)

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

SECTION 01 45 36
EQUIPMENT SEISMIC CERTIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the code required seismic certification of mechanical and electrical equipment in accordance with 2016 CBC, Chapter 17.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
   2. California Building Standards Commission, California Building Code (CBC).
   3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
      a. 344, Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations.
      b. 693, Recommended Practice for Seismic Design of Substations.
   4. International Code Council (ICC):
      a. International Building Code (IBC).
      b. Evaluation Service (ICC-ES) Reports and Legacy Reports.
   5. National Fire Protection Association (NFPA): 13, Standard for Installation of Sprinkler Systems.

1.03 DEFINITIONS

A. Agencies and Personnel:
   1. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.

B. Component Supports:
   1. Electrical: Structural members or assemblies which transmit loads and forces from electrical equipment to the structure, including braces, frames, legs, pedestals, and tethers, as well as elements forged or cast as part of component for anchorage.
   2. Mechanical: Structural members or assemblies which transmit loads and forces from mechanical equipment to the structure, including braces, frames, skirts, legs, saddles, pedestals, snubbers, and tethers, as well as elements forged or cast as part of component for anchorage.

1.04 SUBMITTALS

A. Informational Submittals:

1. Seismic Qualification of Mechanical and Electrical Equipment Certification of Compliance: Submit for mechanical and electrical components having a component importance factor of 1.5 as designated herein. Submit for other components having component importance factor of 1.0 where test results are submitted as an alternate to required calculations under 13.2.5 of ASCE 7-10. Refer to Article Supplement located at end of section.
2. If required by Engineer, submit documentation of testing results or analytical data.

1.05 STATEMENT OF SPECIAL INSPECTIONS (PLAN) REQUIREMENTS

A. Complete special inspection and testing in accordance with Section 01 45 33, Special Inspection, Observation, and Testing.

B. Architectural, mechanical, and electrical components subject to special inspection and testing under CBC Section 1705.13 for seismic resistance, as listed in table in Article Mechanical and Electrical Component Certification are in addition to requirements of Section 01 45 33, Special Inspection, Observation, and Testing.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MECHANICAL AND ELECTRICAL COMPONENT CERTIFICATION

A. Provide certificate of compliance for mechanical and electrical component testing and certification on form located at end of section. Provide certificates for equipment and components listed in the following table:

Mechanical and Electrical Components Requiring Certification of Compliance for Seismic Testing or Analysis under CBC Section 1705.13.2			
Specification Section	Component	Component Importance Factor, I_p	Component to Remain Operable?
23 18 00	Unitary Air-Conditioning Equipment	1.5	Not Required
26 12 02	Oil-Filled Pad Mounted Transformers	1.5	Yes
26 13 13	Medium-Voltage Circuit Breaker Switchgear	1.5	Yes

Mechanical and Electrical Components Requiring Certification of Compliance for Seismic Testing or Analysis under CBC Section 1705.13.2			
Specification Section	Component	Component Importance Factor, I_p	Component to Remain Operable?
26 19 23	Medium-Voltage Variable Frequency Drive System	1.5	Yes
26 22 00	Low-Voltage Transformers	1.5	Yes
26 24 16	Panelboards	1.5	Yes
26 24 19	Low-Voltage Motor Control	1.5	Yes
26 29 23	Low-Voltage Variable Frequency Drive System	1.5	Yes
26 36 23	Automatic Transfer Switches	1.5	Yes
44 31 00	Biotrickling Filter System	1.5	Not Required
44 42 30	Influent Screening System	1.5	Not Required
44 42 40	Grit Basin Equipment	1.5	Not Required
44 42 41	Grit Washer/Classifier System	1.5	Not Required
44 42 48.01	Automatic Composite Sampler (Vacuum/ Pressure Type)	1.5	Not Required
44 42 56.03	Vertical Turbine Pumps	1.5	Not Required
44 42 56.04	Submersible Pumps	1.5	Not Required
44 42 56.12	Induced Flow (Recessed Impeller) Centrifugal Pumps	1.5	Not Required

B. Certify mechanical and electrical components listed in table above on basis of tests on a shaking table, by three-dimensional shock tests, or by an analytical method using dynamic characteristics, and forces as provided in Section 01 88 15, Anchorage and Bracing. Submitted testing shall meet requirements of ASCE 7-10, Section 13.2.5.

C. Component and attachment testing and certification shall be in accordance with applicable provisions of CBC Section 1705.13.3. Seismic testing and certification is in addition to functional and performance testing required for new equipment for field quality control or start-up testing as indicated in technical specification.

D. Where equipment is required to remain operable following the design earthquake ground motion, active parts or energized components shall be certified on basis of approved shake table testing or experience only unless demonstrably similar to other equipment so qualified.

E. Where component is included in list and not required to remain operable, certification of component by analysis with forces as provided in Section 01 88 15, Anchorage and Bracing, is allowed. Component may be analyzed assuming equipment is not in operation at time of seismic event. Equipment structural members required for component stability such as frames, enclosures, casings, shafts, and connections shall be analyzed and shown to transmit seismic forces to supporting building structure without yielding or failure of component members and connections.

F. Components with hazardous contents shall be certified to contain materials under the design earthquake.

3.02 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is a part of this specification:

1. Seismic Qualification of Mechanical and Electrical Equipment Certificate of Compliance.

END OF SECTION

SEISMIC QUALIFICATION OF MECHANICAL AND ELECTRICAL EQUIPMENT CERTIFICATE OF COMPLIANCE

_____	_____
(Component under Certification)	(Name of Manufacturer)
_____	_____
(Tag Number or Equipment ID)	(Business Address)
_____	(_____)_____
(Drawing/Detail Number)	(Telephone)

This is to certify that above-referenced component meets or exceeds requirements of Section 1705.13.2, or 1705.13.3 for equipment to remain operable, of 2016 CBC for seismic qualification of equipment. Basis of qualification is by:

(Check Applicable)

☐ Shake-table Test

☐ Three-dimensional Shock Test

☐ Analytical Method (not allowed for equipment required to remain operable)

☐ Experience Data

☐ Other _____

under acceptance criteria of:

☐ ICC-ES AC156, Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems

☐ IEEE 693, IEEE Recommended Practice for Seismic Design of Substations

☐ IEEE 344, IEEE Recommended Standard Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations for experience data

☐ ASCE 7-10 Chapter 13 for analytical methods

☐ Other _____

for the following earthquake hazard rating:

IEEE Seismic Qualification Level:_____

Mapped MCE, 5 Percent Damped, Short Period Spectral Response Acceleration, S_S:_____

Design, 5 Percent Damped, Short Period Spectral Response Acceleration, S_{DS}:_____

Component Importance Factor, I_p:_____

Component Response Modification Factor, R_p:_____

Height of Point of Attachment as Factor of Average Roof Height, z/h:_____

This certification covers both the integrity of the equipment and anchorage of equipment. Required mounting and anchorage details are shown on attached Seismic Outline Drawing for the most seismically vulnerable component covered by this certification.

Manufacturer's Representative Signature: _____

Address: _____

Date: _____

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Furnishing, maintaining, and removing construction facilities and temporary controls, including temporary utilities, construction aids, security, access roads, temporary controls, field offices and sheds, and removal after construction.

1.02 SUBMITTALS

A. Informational Submittals:
   1. For products specified to be furnished under this Section, submit product data in accordance with Section 01 33 00, Submittal Procedures.
   2. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
   3. Temporary Utility Submittals:
      a. Electric power supply and distribution plans.
      b. Water supply and distribution plans.
      c. Sanitary.
   4. Temporary Construction Submittals:
      a. If requested by City and/or not on Drawings or in contract.
      b. Parking areas.
      c. Design-Builder's field office, storage yard, and storage building plans, including gravel surfaced area.
      d. Fencing and protective barrier locations and details.
      e. Staging area location plan.
      f. Traffic and Pedestrian Control and Routing Plans: As specified herein, and proposed revisions thereto.
      g. Plan for maintenance of existing Plant operations.
   5. Temporary Control Submittals:
      a. Dust control plan.
      b. Noise control plan.
      c. Plan for disposal of waste materials and intended haul.

1.03 MOBILIZATION

A. Mobilization shall include, but not be limited to, these items:
   1. Obtaining all required permits.
   2. Moving the Design-Builder's field office and equipment required for the first month of operations onto site.

3. Install temporary construction power, wiring, and lighting facilities.
4. Provide onsite communications facilities, including telephones.
5. Providing onsite sanitary facilities and potable water facilities as specified and as required by all applicable laws and regulations.
6. Providing sedimentation and erosion control measures.
7. Arranging for and construction of the Design-Builder's work and storage yard.
8. Posting OSHA required notices and establishing safety programs and procedures.
9. Having the Design-Builder's superintendent at site full time.

1.04 TEMPORARY UTILITIES

A. Temporary Electrical Power:

1. Subject to the City's approval, temporary electric power for use during construction may be obtained from City's electric system where adequate capacity and switching are available, and where the normal operation of any of the City's facilities will not be adversely affected. In such cases, no charge will be made by the City for electric power.
2. Where use of the City's power system is not possible or is not allowed, Design-Builder shall be responsible for obtaining a source of electric power for construction. Design-Builder shall use temporary power generators or arrange with local utility to provide adequate temporary electrical service. Cost of electric power in this case shall be borne by the Design-Builder.
3. Provide and maintain adequate jobsite power distribution facilities conforming to applicable Laws and Regulations.

B. Temporary Electrical Lighting:

1. In work areas, provide temporary lighting sufficient to maintain lighting levels during working hours, not less than lighting levels required by OSHA and state agency which administers OSHA regulations where Project is located.
2. When available, permanent lighting facilities may be used in lieu of temporary facilities.

C. Temporary Heating, Cooling and Ventilating:

1. Heat and ventilate work areas to protect the Work from damage by freezing, high temperatures, weather and to provide safe environment for workers.
2. Permanent heating system may be utilized when sufficiently completed to allow safe operation.

D. Temporary Water:

1. Subject to the City's approval, temporary water for use during construction may be obtained from City's water systems where adequate capacity and pumping are available, and where the normal operation of any of the City's

facilities will not be adversely affected. In such cases, no charge will be made by the City for water.

2. Design-Builder construct facilities necessary to furnish potable water for human consumption and nonpotable water for use during construction.
3. Design-Builder shall remove temporary piping and connections and restore affected portions of the facility to original condition before Substantial Completion.
4. City will provide water used for testing. Excessive water use deemed by City will need to be paid for by Design-Builder.
5. Development of Potable Water Supply:
   a. If requested, install a City approved metering device and pay for any potable water used at the current rate.
6. Nonpotable Water Supply:
   a. Nonpotable water is available from hydrants or hose valves within the Facility without cost.
   b. When combined demand of the Work and Plant exceeds Facility supply capacity, provide additional temporary supply capacity.
   c. Post ample signs throughout the Work area warning that Facility water is not potable.

E. Temporary Sanitary Facilities:
1. Design-Builder shall provide suitable and adequate sanitary facilities for his/her employees and his/her subcontractors that are in compliance with applicable Laws and Regulations. Use of City's sanitary facilities will not be permitted.
2. At completion of the Work, remove sanitary facilities and leave site in neat and sanitary condition.
3. Connections to sanitary system need to be reviewed and approved.

F. Telephone Service:
1. Design-Builder shall arrange and provide onsite telephone service for use during the period of construction of the Contract.
2. The costs of installation and monthly bills for Design-Builder's telephone services shall be borne by the Design-Builder.

1.05 CONSTRUCTION AIDS

A. Provide railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.

B. Use construction shoring and similar temporary facilities of ample size and capacity to adequately support and move loads.

C. Accident Prevention:
   1. Exercise precautions throughout construction for protection of persons and property.
   2. Observe safety provisions of applicable Laws and Regulations.
   3. Guard machinery and equipment, and eliminate other hazards.
   4. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.
   5. Before commencing construction Work, take necessary action to comply with provisions for safety and accident prevention.

D. Signs and Equipment:
   1. Traffic Cones: Provide cones to delineate traffic lanes to guide and separate traffic movements.
   2. Provide signs at obstructions and hazards, such as material piles and equipment.
   3. Provide barricades and light in order to protect existing facilities and adjacent properties from potential damage.
   4. Design-Builder shall locate all barricades temporary and light in a manner which enable access by facility operators.

E. Above-Grade Protection: On multi-level structures, provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where Project is located.

1.06 SITE SECURITY

A. Design-Builder shall make adequate provision for protection of the Work area against fire, theft, and vandalism, and for protection of public against exposure to injury.

1.07 STORAGE YARDS AND BUILDING

A. Temporary Storage Yards: Each Subcontractor shall construct temporary storage yards for storage of products that are not subject to damage by weather conditions.

B. Temporary Storage Buildings:
   1. Subcontractor shall provide environmental control systems that meet the recommendations of Vendors and manufacturers of equipment and materials stored.
   2. Subcontractor shall arrange for security of contents and ready access for inspection and inventory.
   3. Subcontractor shall store combustible materials (paints, solvents, fuels) in a well ventilated and remote building meeting all applicable safety standards.

1.08 ACCESS ROADS

A. On-Site Access Roads:

1. Design-Builder and Subcontractors shall utilize existing roads where shown on Drawings. Alignments for new routes must receive prior approval by the City.
2. Maintain access roads to storage areas and other areas to which frequent access is required.
3. Maintain similar roads to existing facilities on site of the Work to provide access for maintenance and operation.
4. Protect buried vulnerable utilities under temporary roads with steel plates, wood planking, or bridges.
5. Maintain on-site access roads free of mud. Under no circumstances shall vehicles leaving the site track mud off the site onto the public right-of-way.
6. Upon completion of the Work, restore any ground surface disturbed by access road Construction to original grade or per Drawings and specifications.

1.09 PARKING AREAS

A. Design-Builder shall control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, City's operations or construction operations.

B. Design-Builder shall provide parking facilities for personnel working on site. No Subcontractor employee or equipment parking will be permitted elsewhere other than areas specifically designated by Design-Builder.

C. Design-Builder and Subcontractors shall not use public roads or undesignated areas for parking.

1.10 TEMPORARY CONTROLS

A. Dust Control:

1. Control dust by sprinkling water, use of dust palliatives, modification of operations, or other means acceptable to the Design-Builder and City.
2. Provide dust control in accordance with Section 10 of the July 1992 City of San José Standard Specifications.

B. Noise Control: Near office areas, perform Work in a manner to minimize noise.

C. Mud Control: Prevent mud nuisance caused by construction operations, unpaved roads, excavation, backfilling, demolition or other activities.

1.11 FIELD OFFICES AND SHEDS

A. Subcontractor's Field Office:

1. Maintain on Project site weather tight space in which to keep copies of Contract Documents, progress schedule, shop drawings, and other project relevant documents.
2. Provide field office with adequate space to examine documents, and provide lighting and telephone service in that space.

1.12 REMOVAL

A. Remove temporary buildings and furnishings before inspection for Substantial Completion or when directed.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Restore existing facilities used during construction to specified or original condition.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This section covers Work to implement structural and nonstructural Best Management Practices (BMP) to control soil erosion by wind or water and keep eroded sediments and other construction-generated pollutants from moving off project sites. Requirements described in this specification and shown on Drawings are part of the project Stormwater Pollution Prevention Plan (SWPPP) and are the minimum for all project construction sites and conditions. This specification covers all project activities, including material sources, disposal sites, and offsite mitigation areas unless specific project activities are excluded elsewhere in this specification or in other Contract Documents controlling the Work.

B. Runoff from the Headworks 3 project site work area will be covered under the SWPPP Plan and shall comply with the requirements set forth in the most recent version of the Erosion Control and Sediment Control Field Manual for California and the California Stormwater Quality Association (CASQA) Best Management Practice (BMP) Handbook, Construction. In the event of a conflict, the more stringent requirement shall apply.

C. Areas disturbed north of the bridge drain to an existing pump station and then to the plant for treatment and will not be part of the SWPPP.

D. A region in the northwest portion of the plant will be used for permanent storage of excavated earthfill from the Headworks 3 project. The earthfill placed here will be graded to allow runoff from it to drain westward toward a wetland area located to the southwest. Runoff is not captured and sent back to the plant. No impervious area will be added therefore no increase in runoff volume is expected. The work area here will be covered under the SWPPP.

E. The SWPPP shall ensure the project site is protected during all storm events for the entire duration of the project by implementing and maintaining temporary erosion and sediment control including, but not limited to, the following:
   1. Construction of any and all necessary systems required to eliminate contaminants from entering the storm system.
   2. Clean up and control of work site materials, spoils and debris.
   3. Removal of contaminants produced by equipment used for the construction of the project.
   4. Prohibition of illicit discharge (non-rain water) into the storm system.
   5. Provisions for all labor, materials, equipment and apparatus not specifically mentioned herein or noted on the plans, which are incidental and necessary to complete the work.

1.02 REFERENCES

A. Erosion Control and Sediment Control Field Manual for California and the California Stormwater Quality Association (CASQA) Best Management Practice (BMP) Handbook, Construction. and Drawings.

B. Use this specification in conjunction with the provisions of Section 7-1.01G, "Water Pollution" of the City of San José Standard Specifications, July 1992.

C. The following is a list of standards that may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): M252, Standard Specification for Corrugated Polyethylene Drainage Pipe.
2. ASTM International (ASTM):
   a. D638, Standard Test Method for Tensile Properties of Plastics.
   b. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
   c. D3776/D3776M, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
   d. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
   e. D4397, Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
   f. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
   g. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
   h. D4632/D4632M, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
   i. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile
   j. D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
   k. D6459, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Hillslopes from Rainfall-Induced Erosion.
   l. D6460, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion.
   m. D6475, Standard Test Method for Measuring Mass Per Unit Area of Erosion Control Blankets.
   n. D7322, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Ability to Encourage Seed Germination and Plant Growth Under Bench-Scale Conditions.

o. D7367, Standard Test Method for Determining Water Holding Capacity of Fiber Mulches for Hydraulic Planting.

3. California Stormwater Quality Associate (CASQA): Construction BMP Handbook, 2009.
4. National Weather Service:
   a. Precipitation-Frequency of the United States by State/Territory, 2012.
   b. Precipitation Frequency Data Server, 2012.
5. North American Weed Management Association (NAWMA).
6. U.S. Department of Agriculture, Natural Resources Conservation Service: Urban Hydrology for Small Watersheds; 1986. Technical Release 55.
7. U.S. Environmental Protection Agency:
   a. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, 2007. EPA-833-R-06-004.
   b. National Menu of BMPs, 2012.

1.03 SYSTEM DESCRIPTION

A. Erosion and Sediment Control:
   1. Provide, maintain, and operate temporary facilities to control erosion and sediment releases during construction period.
   2. Size temporary stormwater conveyances based on procedures presented in U.S. Department of Agriculture, Natural Resources Conservation Service: Urban Hydrology for Small Watersheds, 1986. Technical Release 55.

B. Qualified SWPPP Developer/Practitioner (QSD/QSP):
   1. Identify the QSD and/or the QSP at the preconstruction discussions and in the SWPPP. The QSD and/or QSP shall have certification in construction site erosion and sediment control from a course approved by the CASQA or be self-certified through the State Water Resources Control Board with the appropriate certifications.
   2. The QSD shall prepare the SWPPP. The QSP shall implement the SWPPP, including, but not limited to:
      a. Inspecting all temporary erosion and sediment control Best Management Practices (BMPs) included in the SWPPP to assure continued performance of their intended function. Damaged or inadequate SWPPP BMP maintenance and repair shall be initiated within 72 hours of notice.
      b. Updating the SWPPP to reflect current field conditions.
      c. Prepare Ad-Hoc reports for spills and leaks.
      d. Sample storm water discharge if the Risk Level increases to a Level 2 or there is non-storm water discharge from impoundments.
      e. Prepare Annual Reports.
      f. Terminate the SWPPP.

3. QSP shall also inspect all areas disturbed by construction activities, all onsite erosion and sediment control BMPs, all storm water discharge points, and all temporarily stabilized inactive sites per schedule in the approved SWPPP and as directed by Design-Builder. Complete erosion and sediment control inspection form provided in the SWPPP and for each inspection and submit a copy to Design-Builder no later than end of the next working day following inspection.

C. Personnel Training: Prior to commencement of construction, applicable personnel must have an understanding of the SWPPP's requirements and their specific responsibilities. At a minimum, personnel must be trained to understand the following as it relates to the scope of their job duties:
   1. The location of all stormwater controls and how to maintain them.
   2. Procedures for complying with the pollution prevention requirements.
   3. Procedures for conducting inspections, recording findings, and taking corrective action.

D. SWPPP:
   1. Subcontractor shall select and implement BMPs as needed to control erosion and sediment control as part of the SWPPP that will be shown on Drawings.
   2. A schematic BMP Plan is furnished as part of Drawings. This initial BMP Plan, when adopted by the Subcontractor, may be used as the basis of the construction for the SWPPP. Additional or revised erosion and sediment control features, not shown on the initial BMP Plan, may be required depending on Subcontractor's methods of operation and schedule.
   3. For each phase of the scheduled work, the SWPPP will indicate the BMPs' proposed and installed for erosion and sediment control to minimize clearing, stabilize exposed soil, divert or temporarily store flows, limit runoff from exposed areas, and filter transported sediment. Include all temporary slopes, constructed for staging or other reasons, which may not have been identified in the original Contract plans. Refer to the current local jurisdiction's erosion and sediment control manual.
   4. Required Elements in accordance with the SWPPP:
      a. Narrative Site Description:
         1) Nature of construction activity planned for the Site.
         2) Estimates of total site area and the areas of the Site expected to be disturbed.
         3) Soil types found onsite and their erosion potential.
         4) The types of fill materials to be used.
         5) Timetable for sequence of major construction events.
      b. Site Map:
         1) All areas of development.
         2) Drainage patterns.

3) Areas of soil disturbance, including pre-development and post-development elevation contours.
4) Areas used for storage of soils or wastes.
5) Areas where vegetative practices are to be implemented.
6) Location of all erosion and sediment control BMP or structures.
7) Location of all impervious structures and surfaces after project is completed.
8) Springs, wetlands, and other surface waters located onsite.
9) Boundaries of the 100-year floodplain, if determined.
10) Ordinary High-Water line, if determined.
11) Location of storm drainage outfalls to receiving waters, if applicable.
12) Details of sediment and erosion controls.

c. Required BMPs and Procedures for Erosion Prevention, Runoff Control, and Sediment Control in accordance with the SWPPP:
1) Construction entrances and parking areas.
2) Hauling saturated soils from the Site.
3) Water washed from concrete trucks.
4) Correct installation of erosion and sediment control BMPs.
5) Prompt maintenance and repair of BMPs.
6) Clearing and grading practices to minimize area of exposed soil throughout life of the Project.
7) Schedule of phased clearing operations to limit soils to what can be stabilized.
8) Vegetative practices, including preservation of existing vegetation, seeding, mulching, and buffer strips.
9) Preventing erosion of exposed areas.
10) Diverting flows from exposed slopes.
11) Limiting sediment transport within work sites and keeping it from moving off of project areas.
12) Perimeter controls for all clearing and grubbing, both planned and installed.
13) Additional controls for wet season work and temporary work suspensions.
14) Offsite material source and waste areas.
15) Dust.
16) Emergency materials stockpiled onsite.
17) Permanent and Temporary Soil stockpiles.

5. Subcontractor's construction implementation schedules must be prepared by a competent individual. Furnish a signed copy of the SWPPP with individual's name, title, state certifications, and employing firm if different than Subcontractor's firm.
6. Do not begin any Site activities that have potential to cause erosion or sediment movement until the SWPPP and implementation schedules are approved by Design-Builder.
7. Keep a copy of the approved SWPPP with updated changes onsite during all construction activities. During inactive periods longer than 7 calendar days, keep the SWPPP onsite or provide a copy to Design-Builder to retain.
8. Continually update the SWPPP and schedules as needed for unexpected storm or other events to ensure that sediment-laden water does not leave the construction site. Add approved changes to the SWPPP no later than 1 week after implementation.

E. Install high visibility fence along the Site work areas shown on Drawings or as instructed by the Design-Builder. Space posts and attach fence fabric to posts as shown on Drawings. Do not fasten fence to trees. Throughout the life of the Project, preserve and protect delineated area, acting immediately to repair or restore any fencing damaged or removed.

F. Preventing erosion, and controlling runoff, sedimentation, and non-stormwater pollution, requires Subcontractor to perform temporary Work items including, but not limited to:
1. Select, install, and maintain BMPs including ditches, berms, culverts, and other measures to control surface water.
2. Select, install, and maintain BMPs including check dams, energy dissipaters, and other measures, to control downstream flows.
3. Select, install, and maintain BMPs used to prevent erosion from discharge of underground water found during construction.
4. Covering or otherwise protecting slopes until permanent erosion control measures are working.

G. To the degree possible, coordinate this temporary Work with permanent drainage and erosion control work the Contract requires.

H. Design-Builder may require additional temporary control measures if it appears pollution or erosion may result from weather, nature of materials, or progress on the Work.

I. When natural elements rut or erode the slope, restore and repair damage with eroded material where possible, and remove and dispose of any remaining material found in ditches and culverts. When Design-Builder orders replacement with additional or other materials, unit Contract prices will cover quantities needed.

J. Select, install, and maintain all sediment control devices necessary to trap sediment on site prior to any ground disturbing activity. Do not expose more erodible earth than necessary during clearing, grubbing, excavation, borrow, or fill activities without written approval by the Design-Builder. Design-Builder may increase or decrease the limits based on project conditions. Erodible earth is defined as any surface where soils, grindings, or other materials may be capable of being displaced and transported by rain, wind, or surface water runoff. Cover inactive areas of erodible earth, whether at final grade or not, within 1 day using an approved soil covering practice. Phase clearing and grading to maximum extent practical to prevent exposed inactive areas from becoming a source of erosion.

K. Water Management:

1. Manage site water in accordance with the conditions of the waste discharge permit from a local permitting authority. If site water management is not subject to permit, manage as follows:

   a. Groundwater: When uncontaminated groundwater is encountered in an excavation, provide erosion control BMPs to control erosion at the discharge point or coordinate discharge into Plant system.

   b. Process Water: Do not discharge high pH process water or wastewater (nonstormwater) that is generated onsite, including water generated during concrete grinding, rubblizing, washout, hydrodemolition and other construction and washing activities offsite.

   c. Offsite Water: Prior to disruption of normal watercourse, intercept offsite stormwater and pipe it either through or around the Project Site. This water shall not be combined with onsite stormwater. Discharge offsite water at its preconstruction outfall point preventing an increase in erosion below the site. Submit proposed method for performing this Work for Design-Builder's approval.

L. Dispersion: Convey water only to dispersion areas designated in the SWPPP or to sites approved by Design-Builder and City. Water shall be conveyed to designated dispersion areas at a rate such that, when runoff leaves the area, turbidity standards have been achieved.

M. Temporary Detention Pond Construction: Construct as needed before beginning other grading and excavation work in the area that drains into that pond. Install temporary conveyances concurrently with grading in accordance with the BMP Plan and SWPPP so that newly graded areas drain to the pond as they are exposed.

N. Pollution Control: Use BMPs to prevent or minimize stormwater exposure to pollutants from spills; vehicle and equipment fueling, maintenance, and storage; other cleaning and maintenance activities; and waste handling activities. These pollutants include fuel, hydraulic fluid, and other oils from vehicles and machinery, as well as debris, leftover paints, solvents, and glues from construction operations. Implement the following BMPs when applicable:

1. Written spill prevention and response procedures.
2. Employee training on spill prevention and proper disposal procedures.
3. Spill kits in all vehicles.
4. Regular maintenance schedule for vehicles and machinery.
5. Material delivery and storage controls.
6. Training and signage.
7. Covered storage areas for waste and supplies.

O. If Design-Builder orders the Work suspended, continue to control erosion, pollution, and runoff during the shutdown.

P. Nothing in this section shall relieve Subcontractor from complying with other Contract requirements.

1.04 SUBMITTALS

A. Informational Submittals:

1. Adopt or modify the schematic BMP Plan included on Drawings and submit Subcontractor's BMP Plan for review if changes are approved. Provide a schedule for BMP Plan implementation and incorporate it into Contractor's progress schedule. Obtain Engineer's approval of the BMP Plan and schedule before any Work begins. Provide in accordance with the SWPPP.
2. Modified BMP Plans shall meet all requirements of the applicable jurisdictions and SWPPP.
3. The BMP Plan and SWPPP shall cover all areas that may be affected inside and outside the limits of the Project (including all Owner-provided sources, disposal sites, and haul roads, and all nearby land, streams, and other bodies of water).
4. BMP Plan and SWPPP: Allow at least 10 working days for Design-Builder to review any original BMP Plan and 5 working days for revised BMP Plans and SWPPP. Failure to approve all or part of any such Plan shall not make Design-Builder or City liable to Subcontractor for any Work delays.

PART 2 PRODUCTS

2.01 BMP PRODUCTS

A. BMP Products shall be as specified in Erosion Control and Sediment Control Field Manual for California and the California Stormwater Quality Association (CASQA) Best Management Practice (BMP) Handbook, Construction.

2.02 EROSION CONTROL BLANKET (MATTING)

A. Excelsior mat, coconut blanket, or straw blanket; staples as recommended by matting manufacturer.

B. Manufacturers and Products:
   1. Akzo Industries, Asheville, NC; Curlex Mat.
   2. Tensar | North American Green, Evansville, IN; S150 blanket.

2.03 GEOTEXTILE

A. Geotextiles shall consist only of long chain polymeric fibers or yarns formed into a stable network such that the fibers or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the material shall be polyolefins or polyesters. The material shall be free from defects or tears. Geotextile shall also be free of any treatment or coating which might adversely alter its hydraulic or physical properties after installation. Geotextile properties shall be as specified in Section 31 32 19.16, Geotextile (as included in Balance of Plant Project), or as described in Table 1.

Table 1
Geotextile for Temporary Silt Fence

Geotextile Property	ASTM Test Method	Geotextile Property Requirements	
		Unsupported Between Posts	Supported Between Posts with Wire or Polymeric Mesh
AOS	D4751	U.S. No. 30 max. for silt wovens, U.S. No. 50 for all other geotextile types, U.S. No. 100 min.	
Water Permittivity	D4491	0.2 sec^{-1} min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/ D4632M	180 lb min. in machine direction, 100 lb min. in x-machine direction	100 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/ D4632M	30% max. at 180 lb or more	
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device	

2.04 HIGH VISIBILITY FENCING

A. High Visibility Fence: UV stabilized, orange, high-density polyethylene or polypropylene mesh.

B. Height: 4 feet minimum.

C. Support Posts: Wood or steel with sufficient strength and durability to support the fence through the life of the Project.

2.05 MULCH

A. Wood Cellulose Fiber Mulch:
   1. Specially processed wood fiber containing no growth or germination inhibiting factors.
   2. Dyed suitable color to facilitate inspection of material placement.
   3. Manufactured such that after addition and agitation in slurry tanks with water, material fibers become uniformly suspended to form homogenous slurry.
   4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.

B. Straw:
   1. Clean salt hay or threshed straw of oats, wheat, barley, or rye, free from seed of noxious weeds. Suitable for spreading with mulch blower equipment.
   2. Average Stalk Length: 6 inches.
   3. Seasoned before baling or loading.

2.06 PLASTIC COVERING

A. Clear plastic meeting requirements of ASTM D4397 for polyethylene sheeting having a minimum thickness of 6 mils.

2.07 SEEDING

A. See Section 32 92 00, Turf and Grasses.

2.08 SILT (SEDIMENT) FENCE, SE-1

A. Geotextile: As specified in Article Geotextile.

B. Reinforcing: Welded wire fabric, 14-gauge minimum with 2-inch by 4-inch mesh.

C. Support Posts: As recommended by manufacturer of geotextile.

D. Fasteners: Heavy-duty wire staples at least 1-inch long, tie wires, or hog rings, as recommended by manufacturer of geotextile.

2.09 STABILIZED CONSTRUCTION ENTRANCE, TC-1

A. Construct a pad from stone as shown on Drawings.

B. Provide aggregate free of extraneous materials that may cause or contribute to track out.

C. Place separation geotextile under the rock to prevent fine sediment from pumping up into the rock pad. See Article Geotextile for required geotextile properties.

D. Use of constructed or constructed/manufactured steel plates with ribs (such as, shaker/rumble plates or corrugated steel plates) for entrance/exit access is allowable.

2.10 STREET CLEANING

A. Use self-propelled pickup street sweeper(s). Mechanical broom sweepers are not allowed where environmental concerns exist about storm water pollution or air quality.

2.11 BIOFILTER BAGS

A. Bags of biodegradable plant material such as weed-free straw, coir, compost, wood chips, excelsior, or wood fiber or shavings encased within biodegradable netting.

B. Netting Material: Clean, evenly woven, and free of encrusted concrete or other contaminating material such as preservatives. Also free from cuts, tears, or weak places with a minimum lifespan of 6 months.

C. Posts for Bags: 2-inch by 2-inch untreated wood or commercially manufactured metal posts.

PART 3 EXECUTION

3.01 PREPARATION

A. Design-Builder's acceptance of the SWPPP is required prior to starting earth disturbing activities.

B. Include proposed stockpile areas and installation of temporary erosion control devices, ditches, or other facilities in Work phasing plans.

C. Areas designated for Subcontractor's use during Project may be temporarily developed as specified to provide working, staging, and administrative areas. Include control of sediment from these areas in the SWPPP.

D. Erosion Control Blanket (Matting)): Place on seeded slopes 3H:1V and steeper, staple/stake in place and with the appropriate overlap in accordance with manufacturer's instruction.

E. High Visibility Fencing: Install high visibility fencing in accordance with Drawings.

F. Mulch: Furnish, haul, and evenly apply at rates indicated and spread on seeded areas within 48 hours after seeding unless otherwise specified.
   1. Distribute straw mulch material with an approved mulch spreader that uses forced air to blow mulch material on seeded areas.
   2. Apply wood strand mulch by hand or by straw blower on seeded areas.
   3. Hydraulically apply Mulch at the minimum rate of 2,500 pounds per acre. Mulch may be applied with seed and fertilizer. Provide mulch suitable for application with a hydroseeder.
   4. Cover temporary seed applied outside application windows established in Section 32 92 00, Turf and Grasses, with mulch.
   5. Mulch areas not accessible by mulching equipment by approved hand methods.

G. Plastic Covering: Use clear plastic covering to promote seed germination when seeding is performed outside of specified dates. Use black plastic covering for stockpiles or other areas where vegetative growth is unwanted. Place plastic with at least a 12-inch overlap of all seams. Install and maintain plastic cover to prevent water from cutting under the plastic and to prevent cover from blowing open in the wind.

H. Seeding: See Section 32 92 00, Turf and Grasses.

I. Silt (Sediment) Fence:
   1. Silt fence shall be installed in accordance with Drawings.
   2. Attach geotextile to posts and support system using staples, wire, or in accordance with manufacturer's recommendations. Geotextile shall be sewn together at the point of manufacture, or at a location approved by Design-Builder, to form geotextile lengths as required.
   3. Provide wood or steel support posts at sewn seams and overlaps and as shown on Drawings and necessary to support fence.
   4. Wood Posts: Minimum dimensions of 1-1/4-inch by 1-1/4-inch by the minimum length shown on Drawings.
   5. Steel Posts: Minimum weight of 0.90 lb/ft.
   6. When sediment deposits reach approximately one-third the height of the silt fence, remove and stabilize deposits.

J. Stabilized Construction Entrance: Construct temporary stabilized construction entrance in accordance with Drawings, prior to beginning any clearing, grubbing, earthwork, or excavation. When stabilized entrance no longer prevents track out of sediment or debris, either rehabilitate existing entrance to original condition or construct a new entrance.

K. Street Cleaning: Use self-propelled pickup street sweepers whenever required by Design-Builder to prevent transport of sediment and other debris off Project Site. Provide street sweepers designed and operated to meet air quality standards. Street washing with water is not allowed. Intentional washing of sediment into

storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

L. Biofilter Bags: Place and install as shown on Drawings and as needed for erosion control.

3.02 MAINTENANCE

A. The SWPPP measures described in this specification are minimum requirements for anticipated Site conditions. During the construction period, upgrade these measures as needed to comply with all applicable local, state, and federal erosion and sediment control regulations.

B. Maintain erosion and sediment control BMPs so they properly perform their function until QSP determines they are no longer needed.

C. Construction activities must avoid or minimize excavation and creation of bare ground during wet weather.

D. The intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

E. Inspect BMPs in accordance with the schedule in approved SWPPP or as directed by Design-Builder.

F. Complete an inspection report within 24 hours of an inspection. Each inspection report shall be signed and identify corrective actions. Document that corrective actions are initiated within 72 hours of notification. Keep a copy of all inspection reports at the Site or at an easily accessible location.

G. Unless otherwise specified, remove deposits before the depth of accumulated sediment and debris reaches approximately one-third height of BMP. Dispose of debris or contaminated sediment at approved locations. Clean sediments may be stabilized onsite using BMPs as approved by Design-Builder.

H. Sediment Fence: Remove trapped sediment before it reaches one-third of the above ground fence height and before fence removal.

I. Other Sediment Barriers (such as biobags): Remove sediment before it reaches 2 inches depth above ground height and before BMP removal.

J. Catch Basins: Clean before each storm.

K. Sediment Basins and Sediment Traps: Remove trapped sediments before each storm and at completion of Project.

L. Initiate repair or replacement of damaged erosion and sediment control BMPs immediately, and work completed by end of next work day. Significant replacement or repair must be completed within 7 days, unless infeasible.

M. Within 24 hours, remediate any significant sediment that has left the construction site. Investigate cause of the sediment release and implement steps to prevent a recurrence of discharge within same 24 hours. Perform in-stream cleanup of sediment according to applicable regulations.

N. At end of each work day, stabilize or cover soil stockpiles or implement other BMPs to prevent discharges to surface waters or conveyance systems leading to surface waters.

O. Temporarily stabilize soils at end of shift before holidays and weekends, if needed. Ensure soils are stable during rain events at all times of year.

P. Initiate stabilization by no later than end of next work day after construction work in an area has stopped permanently or temporarily.

Q. Within 14 days of initiating stabilization or as specified in permit, either seed or plant stabilized area (see Section 32 92 00, Turf and Grasses); or apply nonvegetative measures and cover all areas of exposed soil. Seed dry areas as soon as Site conditions allow. Ensure that vegetation covers at least 70 percent of stabilized area. In areas where Subcontractor's activities have compromised erosion control functions of existing grasses, overseed existing grass. Nonvegetative measures may include blown straw and a tackifier, loose straw, or an adequate covering of compost mulch.

R. During rainy season, erodible soils must be covered within 24 hours.

S. Provide permanent erosion control measures on all exposed areas. Do not remove temporary sediment control practices until permanent vegetation or other cover of exposed areas is established. However, do remove all temporary erosion control measures as exposed areas become stabilized, unless doing so conflicts with local requirements. Properly dispose of construction materials and waste, including sediment retained by temporary BMPs.

3.03 EMERGENCY MATERIALS

A. Emergency erosion and sediment control shall consist of any measure not addressed in the approved SWPPP that the Design-Builder deems necessary to prevent degradation of water quality after the start of construction

B. Work under Emergency Erosion and Sediment Control shall be considered as extra work paid for on a force account basis as indicated in Section 9-1.03 and Section 4-1.03.1(D) of the City of San José Standard Specifications, July 1992.

C. Provide, stockpile, and protect the following emergency erosion and sediment control materials on the Project Site for unknown weather or erosion conditions. Emergency materials are in addition to other erosion control materials required to implement and maintain the SWPPP. Replenish emergency materials as they are used. Remove all unused emergency materials from the Project Site at completion of the Project.

Item	Quantity
Silt (sediment) fence	100 ft
Plastic sheeting	260 sq. ft.
Sand bags (empty, to be filled as needed)	50
Straw bales	10
Biofilter bags (with stakes)	10

3.04 REMOVAL

A. When project is completed and site is stabilized, remove BMPs and all associated construction equipment from the Project limits. When materials are biodegradable, Design-Builder may approve leaving temporary BMP in place.

B. Permanently stabilize all bare and disturbed soil after removal of erosion and sediment control BMPs. Dress sediment deposits remaining after BMPs have been removed to conform to existing grade. Prepare and seed graded area. If installation and use of erosion control BMPs have compacted or otherwise rendered soil inhospitable to plant growth, such as construction entrances, take measures to rehabilitate soil to facilitate plant growth. This may include, but is not limited to, ripping the soil, incorporating soil amendments, or seeding with specified seed.

END OF SECTION

SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Products:

1. New items for incorporation in the Work, whether purchased by Subcontractor or Design-Builder for the Project.
2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
3. Items identified by manufacturer's product name, including make or model designation, indicated in manufacturer's published product literature, that is current as of date of Contract Documents.

1.02 DESIGN REQUIREMENTS

A. Where Subcontractor design is specified, design of installation, systems, equipment, and components, including supports and anchorage shall be in accordance with provisions of the 2016 CBC (California Building Code). Subcontractor shall provide sealed and signed drawings and calculations by PE licensed in the State of California. These Subcontractor final designs are deferred submittals per Section 01 33 00, Submittal Procedures.

B. See "General Structural Notes" sheets on Drawings for design criteria requirements for loadings such as wind, seismic, soil properties, groundwater table, deflection, settlement, and related design parameters.

C. Refer to Section 01 88 15, Anchorage and Bracing, for code and/or project specific required seismic anchorage and bracing requirements and provide for CBC required load cases that include seismic loads.

D. Provide anchorage and bracing design for components subject to wind pressures for components and their anchorage for CBC required load cases that include wind loads. Certification, warranty, or guarantee submittal is an acceptable alternate to design drawings and calculations for items such as roofing and flashing. At door and window systems and frames, louvers, and similar exterior components subject to wind forces, anchorage design to structural system and/or test results shall be provided even if component unit is certified.

E. Provide anchorage and bracing design for self weight and lateral loads for components and distribution systems of mechanical, building mechanical, electrical, fire suppression, architectural, and other building systems exceeding the exemption weights provided in Section 01 88 15, Anchorage and Bracing.

F. Provide design for components and their anchorage as required by other specification sections for equipment induced loads and code required load combinations that are applicable to component.

G. Provide for design of structural buildings, nonbuilding structures, partial systems, and components as specified in the Contract Documents. Provide design for temporary construction loads applied by Subcontractor's operation that will affect capacity requirements of permanent structural systems.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 35 feet above sea level.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of plus 24 degrees F to plus 106 degrees F.

C. For equipment and devices with digital displays installed outdoors, provide sunshades or UV resistant displays.

1.04 PREPARATION FOR SHIPMENT

A. When practical, factory assemble products. Mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.

B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Include complete packing list and bill of materials with each shipment.

C. Mark or tag outside of each package or crate to indicate the following:
   1. Purchase order number.
   2. Bill of lading number.
   3. Contents by name.
   4. Name of Project and Subcontractor.
   5. Equipment number.
   6. Approximate weight.

D. Extra Materials, Special Tools, Test Equipment, and Expendables:

1. Furnish as required by individual Specifications.
2. Schedule:
   a. Ensure shipment and delivery occur concurrent with shipment of associated equipment.
   b. Transfer to Design-Builder shall occur immediately subsequent to Subcontractor's acceptance of equipment from Supplier.
3. Packaging and Shipment:
   a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.
   b. Prominently displayed on each package, the following:
      1) Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
      2) Applicable equipment description.
      3) Quantity of parts in package.
      4) Equipment manufacturer.
4. Deliver materials to Site.
5. Notify Design-Builder upon arrival for transfer of materials.
6. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Design-Builder.

E. Request a minimum 7-day advance notice of shipment from manufacturer. Upon receipt of manufacturer's advance notice of shipment, promptly notify Design-Builder of anticipated date and place of equipment arrival.

F. Factory Test Results: Reviewed and accepted by Design-Builder before product shipment as required in individual specification sections.

1.05 DELIVERY AND INSPECTION

A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.

B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.

C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

D. Remove damaged products from Site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.06 HANDLING, STORAGE, AND PROTECTION

A. Handle and store products in accordance with manufacturer's written instructions and in a manner to prevent damage. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Design-Builder.

B. Provide manufacturer's instructions for material requiring special handling, storage, or protection prior to delivery of material.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to ensure products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.

D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 degrees F and below 104 degrees F, unless other temperature limits are specified by manufacturer. Protect electrical, instrumentation, and control products, and insulate against moisture, water, and dust damage. Connect and operate continuously space heaters furnished in electrical equipment.

E. Store fabricated products above ground on blocking or skids; prevent soiling or staining. Store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.

G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.

H. Hazardous Materials: Prevent contamination of personnel, storage area, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide manufacturer's standard materials suitable for service conditions, unless otherwise specified in the individual Specifications.

B. Where product specifications include a named manufacturer, with or without model number, and also include performance requirements, named manufacturer's products shall meet performance specifications.

C. Like items of products furnished and installed in the Work shall be end products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.

D. Provide interchangeable components of the same manufacturer for similar components, unless otherwise specified.

E. Equipment, Components, Systems, and Subsystems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and comply with applicable OSHA, state, and local health and safety regulations.

F. Regulatory Requirement: Coating materials shall meet federal, state, and local requirements limiting emission of volatile organic compounds and for worker exposure.

G. Safety Guards:
   1. Provide for belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides.
   2. Design for easy installation and removal.
   3. Use 16-gauge or heavier galvanized steel, aluminum coated steel, or galvanized or aluminum coated 1/2-inch mesh expanded steel.
   4. Provide galvanized steel accessories and supports, including bolts.
   5. For outdoors application, prevent entrance of rain and dripping water.

H. Authority Having Jurisdiction (AHJ):
   1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC).
   2. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.

3. Materials and equipment manufactured within scope of standards published by UL shall conform to those standards and have applied UL listing mark.

I. Equipment Finish:

1. Provide manufacturer's standard finish and color, except where specific color is indicated.
2. If manufacturer has no standard color, provide equipment with finish as approved by Design-Builder.

J. Lubricant: Provide initial lubricant recommended by equipment manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Design-Builder.

2.02 TOOLS AND SPARE PARTS

A. All special tools and the manufacturer's standard set of spare parts required for the normal operation and maintenance of respective items of equipment shall be furnished with those items of equipment by the manufacturer. This includes special tools, instruments, accessories required for proper "in-plant" adjustment, maintenance, overhaul, and operation. Tools shall be high-grade, smooth, forged, alloy tool steel or other appropriate material required for service conditions. Accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, handwheels, chain operators, special tools, and other spare parts as required for maintenance

B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment, whether identified in the manufacturer's standard manual or not.

C. All spare parts shall be carefully packed in sealed, weather-resistant cartons and all tools packed in metal tool boxes with locking clasps, each labeled with indelible markings, and shall be adequately treated for a long period of storage. Complete ordering information including manufacturer's name and address, part ordering information including manufacturer, part number, part name, and equipment name and number(s) for which the part is to be used shall be supplied with the required spare parts. The tools and spare parts shall be delivered and stored in a location directed by the Jacobs no later than 30 days prior to scheduled field-testing. A list of spare parts, respectively, shall be placed in each storage container and a duplicate list included in the operations and maintenance manuals.

D. Additional and specific spare parts and tools for certain equipment provided have been specified in the pertinent Sections of the Specifications. All spare parts shall be provided to the Jacobs with an inventory listing all spare parts, the equipment they

are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of the actual invoice for each item shall be furnished with inventory to substantiate the delivery.

E. Special tools and spare parts shall be new and shall not be utilized by the Subcontractor.

2.03 FABRICATION AND MANUFACTURE

A. General:
   1. Manufacture parts to U.S.A. standard sizes and gauges.
   2. Two or more items of same type shall be identical, by same manufacturer, and interchangeable.
   3. Design structural members for anticipated shock and vibratory loads.
   4. Modify standard products as necessary to meet performance specifications.

B. Lubrication System:
   1. Require no more than weekly attention during continuous operation.
   2. Convenient and accessible; oil drains with bronze or stainless steel valves and fill plugs easily accessible from normal operating area or platform. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
   3. Provide constant-level oilers or oil level indicators for oil lubrication systems.
   4. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.04 SOURCE QUALITY CONTROL

A. Where Specifications call for factory testing to be witnessed by Design-Builder, notify Design-Builder not less than 30 days prior to scheduled test date, unless otherwise specified.

B. Calibration Instruments: Bear seal of reputable laboratory certifying instrument has been calibrated within previous 12 months to standard endorsed by the National Institute of Standards and Technology (NIST).

C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects.

1. Remove damaged material or equipment from Site and expedite delivery of identical new material or equipment.
2. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Subcontractor's control.

3.02 INSTALLATION

A. Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. No shimming between machined surfaces is allowed.

C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Repaint painted surfaces that are damaged prior to equipment acceptance.

E. Do not cut or notch structural member or building surface without specific approval of Design-Builder.

F. Handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's instructions, and as may be specified. Retain copy of manufacturers' instructions at Site, available for review.

3.03 ADJUSTMENT AND CLEANING

A. Perform required adjustments, tests, operation checks, and other startup activities.

3.04 LUBRICANTS

A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Design-Builder.

END OF SECTION

SECTION 01 64 00
DESIGN-BUILDER FURNISHED PRODUCTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Supplier: The party under separate contract with Design-Builder to furnish the products or special services specified herein.

B. Subcontractor: Party under contract with Design-Builder to inspect, offload, store, maintain, and install the Design-Builder-furnished products.

1.02 LIST OF DESIGN-BUILDER FURNISHED PRODUCTS

A. Products:
   1. Fabricated slide gates.
   2. Valves.
   3. Horizontal Wince Hoists.
   4. Biotricking Filter System.
   5. Influent Screening System.
   6. Grit Basin Equipment.
   7. Grit Washer Classifier.
   8. Vertical Turbine Pumps.
   9. Submersible Pumps.
   10. Induced Flow Recessed Impeller Centrifugal Pumps.
   11. Belt Conveyor System.
   12. Other Products as determined by the Design-Builder, including but not limited to:
      a. Division 10, Specialties.
      b. Division 22, Plumbing.
      c. Division 23, Heating, Ventilating, and Air-Conditioning (HVAC).
      d. Division 26, Electrical.
      e. Division 40, Process Interconnections.

B. The Design-Builder-Furnished Products Service Agreement and Shop Drawings are available to the Subcontractor as Reference Documents. These Reference Documents include the complete scopes of Work for the Suppliers of the Design-Builder-furnished products, including manufacturer's field services.

C. Point of Receipt: At the site as designated by Design-Builder in San José, California.

D. Estimated Date of Arrival: As determined by Design-Builder and CPM Schedule.

E. Equipment or Facility Necessary for Receipt and Unloading of Product: Provided by the Subcontractor.

F. Estimated Weight of Products: Refer to data sheets provided by the Suppliers in Reference Documents.

G. Special Handling or Storage Instructions: The Subcontractor shall be responsible for the offloading, handling, storage, and the maintenance needed prior to installation of the equipment once it arrives at the jobsite.

H. Associated Special Services to be provided by Suppliers:
   1. Installation assistance.
   2. Certification of Proper Installation.
   3. Functional testing assistance.
   4. Performance testing assistance.
   5. Training of Jacob's personnel.

I. Parts of the Instrumentation and Control for Process Systems applications software programming will be performed by Design-Builder. Refer to Section 01 31 13, Project Coordination.

1.03 INFORMATION FURNISHED BY DESIGN-BUILDER

A. The following information relating to Design-Builder-furnished products will be provided to Subcontractor for use in performing the Work under this section:
   1. Supplier contact information.
   2. Supplier Shop Drawings.
   3. Storage and maintenance instructions.
   4. Installation instructions.
   5. Operation and Maintenance Manual.

B. The Drawings prepared by Design-Builder and Shop Drawings prepared by Suppliers are required to complete the Work and are to be considered together. The Supplier Shop Drawings indicate work and equipment to be provided or performed by others. The reference to others on Supplier-prepared Shop Drawings shall be understood to mean Subcontractor.

C. In cases where the Work shown on Supplier Shop Drawings is also shown or indicated to be done differently on Design-Builder's Drawings and Specifications all such Work shall be in accordance with the Supplier Shop Drawings. Subcontractor is responsible for installation of equipment and materials regardless of the source of the supply.

1.04 SUBCONTRACTOR'S RESPONSIBILITY FOR COMPLETE SYSTEM

A. Subcontractor shall have complete responsibility for receiving, handling, storing, installing, adjusting, cleaning, maintaining, lubricating, documenting and weather protection of Design-Builder-furnished products. Refer to information furnished by Design-Builder that will assist in determining requirements.

B. Design-Builder will provide and coordinate construction of interconnecting structures, equipment, piping, piping support systems, electrical and instrumentation work, and appurtenances to achieve installation and operation of Design-Builder-furnished products as shown and specified and as required to provide a complete and functional system.

1.05 TRANSFER OF PRODUCTS

A. Unless indicated otherwise, items will be furnished delivery duty paid (DDP) to Project Site.

B. Upon delivery, conduct with Design-Builder a joint inspection for the purpose of identifying product, general verification of quantities, and observation of apparent condition. Such inspection will not be construed as final or as receipt of a product that, as a result of subsequent inspections and tests, is determined to be nonconforming.

C. Damaged or incomplete products to be returned for replacement will not be unloaded, except as necessary to expedite return shipment. Design-Builder will submit claims for transportation damage and expedite replacement of damaged, defective, or deficient items.

D. Indicate signed acceptance of delivery on a copy of the invoice.

E. If Subcontractor is not prepared to accept delivery of Design-Builder-furnished products by either the specified Estimated Date of Arrival or such Design-Builder-confirmed delivery date, as specified herein, associated costs incurred by Design-Builder shall be borne by Subcontractor. Such costs may include, but not be limited to, demurrage, interest, insurance costs, additional administrative and engineering costs, additional factory and field technical support, additional storage and reshipping costs, cost escalation, and extended warranty costs due.

1.06 UNLOADING, STORAGE, AND MAINTENANCE

A. Subsequent to transfer, Subcontractor shall have complete responsibility for unloading Design-Builder-furnished products. Unload product in accordance with manufacturers' instructions or as specified.

B. Store products onsite in accordance with Suppliers' written storage and maintenance instructions. Be prepared to store products for minimum durations determined by Design-Builder for each set of Design-Builder-furnished products.

C. Store, protect, and maintain product to prevent damage until final acceptance of completed Work. Damage to or loss of products after date of transfer to Subcontractor shall be repaired to original condition, or replaced with new identical products, at discretion of Design-Builder.

D. After transfer to Subcontractor, maintain complete inventory of Design-Builder-furnished products.

1.07 SCHEDULING AND SEQUENCING

A. Include sequencing constraints specified herein as part of Progress Schedule.

B. Design-Builder will keep Subcontractor informed of probable delivery date changes.

C. Design-Builder will confirm delivery date with Subcontractor 5 days prior to scheduled delivery, and within 24 hours of expected delivery time.

D. Where a preinstallation meeting is required by this section, provide a minimum of 30 days' advance written notice to Design-Builder of proposed date for starting installation.

E. Provide a minimum of 30 days' notice to Design-Builder that Design-Builder-furnished product is ready for special services listed herein to be furnished by Design-Builder through its contract with Supplier. Subcontractor shall bear cost of all damages assessed to Design-Builder by Supplier resulting from delays caused by Subcontractor.

1.08 EXTRA MATERIALS

A. Inspect, inventory, secure/house, protect extra materials and special tools until turned over to Design-Builder. Provide inventory list and updates when requested by Design-Builder.

1.09 PREINSTALLATION MEETING

A. Arrange and attend a preinstallation meeting with Design-Builder to review general procedures, erection and installation instructions, and installation sequence.

B. Additional meetings prior to installation may be required, as determined by Design-Builder, to transmit Design-Builder's installation instructions to Subcontractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in conformance with Design-Builder-furnished product Shop Drawings and installation instructions.

B. Provide interconnecting structures, equipment, piping, electrical and instrumentation work, finish painting, and appurtenances to achieve a complete and functional system.

C. Provide foundation pads for Design-Builder-furnished products as shown. Verify exact dimensions and configuration of pads, including penetrations, with Design-Builder-furnished product Shop Drawings.

D. Anchor Bolts:
   1. Where required, provide anchor bolts, fasteners, washers, and templates needed for installation of Design-Builder-furnished product.
   2. Size and locate anchor bolts in accordance with Design-Builder-furnished product Shop Drawings and installation instructions.

E. Mechanical and electrical equipment shall be properly aligned, plumb and level, with no stresses on connecting piping or conduit.

F. Verify direction of motor rotation before starting equipment drives.

G. Verify operability and safety of electrical system needed to operate equipment. Check electrical system for continuity, phasing, grounding, and proper functions.

3.02 FIELD FINISHING

A. Products will be delivered with prime coat(s) applied.
   1. Touch up or repair damage to coatings resulting from unloading, storage, installation, testing, and startup.
   2. If finish coats are damaged extensively after transfer, completely repaint.
   3. Touch up, repair, or complete repainting shall match color of original paint, and shall be fully compatible with applied primers and finish.

3.03 PRODUCT PROTECTION

A. Immediately after installation, lubricate components in accordance with manufacturer's instructions.

B. Follow manufacturer's instructions for protection and maintenance during storage, after installation but prior to testing and startup, and after startup but prior to acceptance.

C. Furnish incidental supplies including lubricants, cleaning fluids, and similar products as needed for protecting and maintaining the Design-Builder-furnished products.

END OF SECTION

SECTION 01 71 23
FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Field Engineering to establish lines and grades for the Work.

B. Related Section: Section 01 77 00, Closeout Procedures.

1.02 SUBMITTALS

A. Informational Submittal: Qualifications of Surveyor or Engineer: Registered professional Civil Engineer or Land Surveyor in the State of California.

1.03 UTILITY NOTIFICATION AND COORDINATION

A. Design-Builder will coordinate all utility Work with the City. The City will contact the Plant's Subsurface Utility Locating and Designating Team.

B. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during Work.

1.04 SURVEY MONUMENT PRESERVATION

A. It is the sole responsibility of the Design-Builder and Subcontractors to save and protect any existing survey monuments which are not identified for removal and replacement on the project plans.

B. In the event that disturbance or destruction of any survey monument is imminent, regardless of whether removal and replacement is indicated on the project plans, the Design-Builder shall contact the City and City Survey Section at (408) 975-7310 at least 72 hours in advance.

C. If the specified notice is not given to the City Survey Section and/or the survey monument is disturbed or destroyed without reference points having been set, the City Survey Section will re-establish the original position of the survey monument and the associated land surveying costs will be at the Design-Builder's expense and will be deducted from the Design-Builder's pay letter.

1.05 SURVEY MONUMENT REMOVAL AND REPLACEMENT

A. Survey monuments shall conform to the provisions of Section 81, "Monuments," and Section 1301-1.4, "Survey Monuments and Points," of the City of San José Standard Specifications, Details R-16, R-17, and R-18 of the City of San José Standard Details, and these Special Provisions.

B. The City Survey Section will set reference points for survey monuments which are identified for removal and replacement on the project plans, or which are otherwise threatened by construction activities associated with this project. If such referenced survey monuments are disturbed or destroyed, they shall be replaced according to the following procedure:

1. When construction in the vicinity of the original monument is substantially complete (finished grade is achieved), the City Survey Section will set reference points (typically four 2-foot cross-ties) from which the approximate centerpoint of the new survey monument box can be located.
2. Based on the reference points, the Design-Builder shall position and construct a new Standard City Monument in accordance with Detail R-16 of the Standard Details.
3. The Design-Builder shall obtain a monument box frame and cover (and riser ring, if necessary) which conforms to Detail R-18 (Type I Monument Box) of the Standard Details. The City Survey Section will provide the Design-Builder with a stamped brass marker disc to be set in concrete at the intersection of the cross-ties within the survey monument box in accordance with Detail R-16 of the Standard Details.
4. Upon completion of the construction of the survey monument box by the Design-Builder, the City Survey Section will punch the brass marker disc with the exact location of the original point.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONSTRUCTION STAKES, LINES AND GRADES

A. Execute Work in accordance with the lines and grades indicated on project plans.

B. Make distances and measurements on horizontal plans, except elevations and structural dimensions.

3.02 SURVEY REFERENCE POINTS

A. Basic reference line, a beginning point on basic reference line, and a benchmark will be provided, by City.

B. From these reference points, establish other control and reference points as required to properly layout the Work.

C. Locate and protect control points prior to starting sitework, and preserve permanent reference points during construction.

1. Make no changes or relocations without prior written notice.
2. Replace Project control point, when lost or destroyed, in accordance with original survey control.
3. It is the Design-Builder's sole responsibility to save and protect these surveying points. Any and all re-staking will be done at the Design-Builder's expense.

D. In the event of discrepancy in data or staking provided by City, request clarification before proceeding with Work.

3.03 PROJECT SURVEY REQUIREMENTS

A. Establish a minimum of two permanent benchmarks on site referenced to data established by survey control points.

B. Record permanent benchmark locations, including horizontal and vertical data, on Project Record Documents.

C. Assume responsibility for accuracy of stakes, alignments, and grades by performing verifications and checking in accordance with standard surveying practice.

D. Perform a pre-construction survey to verify the elevations shown on the demolition drawings.

E. Construction surveys shall be performed throughout the work to confirm that the locations and elevations of the new gas holder tank meet the contract requirements.

3.04 QUALITY ASSURANCE

A. Accuracy of stakes, alignments, and grades may be checked randomly by City.
   1. Notice of when checking will be conducted will be given.
   2. When notice of checking is given, postpone parts of the Work affected by stakes, alignments, or grades to be checked until checked.
   3. Do not assume that City's check substitutes or complements required field quality control procedures.
   4. Provide competent employee(s), tools, stakes and other equipment and materials as City may require to:
      a. Establish control points, lines and easement boundaries.
      b. Check layout, survey, and measurement Work performed by others.

3.05 RECORD DOCUMENTS

A. Prepare and submit Record Documents as specified in Section 01 77 00, Closeout Procedures.

B. Maintain complete, accurate log of control points and survey.

C. Affix Professional Civil Engineer's or Land Surveyor's signature and registration number to Record Drawing to certify accuracy of information shown.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous construction waste.
   2. Recycling nonhazardous construction waste.
   3. Disposing of nonhazardous construction waste.

1.02 DEFINITIONS

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

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

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

D. LEED: Leadership in Energy Efficient Design; USGBC sustainable building design/construction rating system.

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

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

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

H. USGBC: United States Green Building Council.

1.03 PERFORMANCE REQUIREMENTS

A. Prepare a Construction Waste Management Plan: Comply with California Green Building Standard construction waste reduction 5.408.

B. Divert a minimum 75 percent of construction waste from landfill.

C. Practice efficient waste management in use of materials in course of the Work.

D. Use reasonable means to divert construction and demolition waste from landfills and incinerators.

E. Facilitate recycling and salvage of materials.

F. Unless otherwise noted in Contract Documents, construction waste management and disposal offsite is responsibility of Design-Builder and will be done at Design-Builder's expense. Subcontractors shall comply with requirements of this section or as directed by Design-Builder.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PLAN IMPLEMENTATION

A. Implement waste management plan as approved by Design-Builder.
   1. Comply with Section 01 50 00, Temporary Facilities and Controls, for operation, termination, and removal requirements.
   2. Comply with California Green Building Standard construction waste reduction 5.408.

B. Subcontractor's Waste Management Coordinator: Engage waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, Sub-subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Site.

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

3.02 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by onsite workers.

B. Recycling Receivers and Processors: Design-Builder will locate and arrange services of receivers and processors.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Design-Builder.

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

E. Procedures:
   1. Separate recyclable waste from other waste materials, trash, and debris.
   2. Separate recyclable waste by type at Site to maximum extent practical according to approved construction waste management plan.
   3. Use Design-Builder-provided appropriately marked containers or bins for controlling recyclable waste until they are removed from Site.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   4. Stockpile processed materials onsite without intermixing with other materials.
   5. Place, grade, and shape stockpiles to drain surface water; cover to prevent windblown dust.
   6. Store components off ground and protect from weather.

3.03 RECYCLING CONSTRUCTION WASTE

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

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

C. Gypsum Board:
   1. Stack large clean pieces on wood pallets or in container and store in dry location.
   2. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Submit prior to application for final payment.
   a. Record Documents.
   b. Special bonds, Special Guarantees, and Service Agreements.
   c. Consent of Surety to Final Payment.
   d. Releases or Waivers of Liens and Claims.
   e. Releases from Agreements.
   f. Final Application for Payment: Submit in accordance with procedures and requirements stated in Subcontract and/or Purchase Order.
   g. Spare parts.
   h. Warranties.
   i. Final approved O&M Manuals.

1.02 RECORD DOCUMENTS

A. Quality Assurance:

1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
2. Accuracy of Records:
   a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
   b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
3. Make entries within 24 hours after receipt of information that a change in the Work has occurred.
4. Prior to submitting each request for progress payment, request Design-Builder's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents will result in a deferral or rejection by Design-Builder to recommend whole or any part of Subcontractor's Application for Payment, either partial or final.

1.03 RELEASES FROM AGREEMENTS

A. Furnish Design-Builder written releases from property owners or public agencies where side agreements or special easements have been made, or where Subcontractor's operations have not been kept within City's construction right-of-way.

B. In the event Subcontractor is unable to secure written releases:
   1. Inform Design-Builder of the reasons.
   2. Design-Builder or its representatives will examine Site, and Design-Builder will direct Subcontractor to complete the Work that may be necessary to satisfy terms of side agreement or special easement.
   3. Should Subcontractor refuse to perform this Work, Design-Builder reserves right to have it done by separate contract and deduct cost of same from Contract Price, or require Subcontractor to furnish a satisfactory bond in a sum to cover legal claims for damages.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. General:
   1. Promptly following commencement of Contract Times, secure from Design-Builder at no cost to Subcontractor, one complete set of Contract Documents.
   2. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:
   1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
   2. Make documents and Samples available at all times for observation by Design-Builder.
   3. Design-Builder will review record documentation biweekly.

C. Making Entries on Drawings:
   1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
      a. Color Coding:
         1) Green when showing information deleted from Drawings.
         2) Red when showing information added to Drawings.

3) Blue and circled in blue to show notes.

2. Date entries.
3. Call attention to entry by “cloud” drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction, including, but not limited to:
   a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
   b. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
   c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
   d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
   e. Changes made by Addenda, Change Order, and Requests For Information and Clarification using consistent symbols for each and showing appropriate document tracking number.

3.02 FINAL CLEANING

A. At completion of the Work or of a part thereof and immediately prior to Contractor’s request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor’s notice of completion, clean entire Site or parts thereof, as applicable.
   1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Design-Builder.
   2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
   3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
   4. Clean all windows.
   5. Clean and wax wood, vinyl, or painted floors.
   6. Broom clean exterior paved driveways and parking areas.
   7. Hose clean sidewalks, loading areas, and others contiguous with principal structures.
   8. Rake clean all other surfaces.
   9. Replace air-handling filters and clean ducts, blowers, and coils of ventilation units operated during construction.

10. Leave water courses, gutters, and ditches open and clean.

B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Preparation and submittal of paper and electronic operation and maintenance manuals. Operation and maintenance information shall be provided for each piece of equipment, equipment assembly, or subassembly and material provided or modified under this contract.

B. Section includes providing information for all new assets provided under this contract to populate the RWF computerized maintenance management system (CMMS) in accordance with Standard Operating Procedure (SOP) AM.100, Asset Tagging Convention, and Section 01 78 23.01. SOP AM.100 may be obtained from Engineer upon request.

1.02 DEFINITIONS

A. Preliminary Data: Initial and subsequent submissions for Design-Builder's review.

B. Final Data: Design-Builder-accepted data, submitted as specified herein.

C. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

D. Asset Data: Compliant with asset management requirements.

1.03 SEQUENCING AND SCHEDULING

A. O&M Data:
   1. Preliminary Data:
      a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Design-Builder.
      b. Submit within 30 days following approval of Shop Drawing for equipment of system.
   2. Final Data: Submit 30 days prior to shipment and installation.

B. Asset Data: Submit preliminary and final Asset Data concurrent with operation and maintenance data.

1.04 DATA FORMAT

A. Prepare preliminary and final data in the electronic form.

B. Format:

1. Cover Page: Identify manual with typed or printed title "OPERATION AND MAINTENANCE DATA" and list:
   a. Project title.
   b. Designate applicable system, equipment, material, or finish.
   c. Identity of separate structure as applicable.
   d. Identify volume number if more than one volume.
   e. Identity of general subject matter covered in manual.
   f. Identity of equipment name, equipment number, and specification section.
2. Title Page:
   a. Subcontractor or Supplier name, address, and telephone number.
   b. Sub-subcontractor, Supplier, installer, or maintenance contractor's name, address, and telephone number, as appropriate.
      1) Identify area of responsibility of each.
      2) Provide name and telephone number of local source of supply for parts and replacement.
3. Table of Contents:
   a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
   b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
4. Equipment List: Provide list of all tagged equipment with description.
5. Text: Manufacturer's printed data, or neatly typewritten.
6. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.
7. Manual to follow section organization in Electronic Document Requirements found in Article Supplements following end of section.

C. Electronic Requirements:

1. Portable Document Format (PDF):
   a. Submit Operation and Maintenance data in PDF format on CD.
   b. Arrange by specification number and name.
   c. Link TOC sections to major sections in manual or create PDF bookmarks to each section.
   d. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

e. PDF File Document Properties:
   1) Initial View: Page only.
   2) Page Number: One.
   3) Magnification: Fit width.
   4) Page Layout: Single page.
   5) Window Options: Resize to initial.
   6) Window Options: Searchable PDF.
   7) Window Options: "Linked" Table of Contents.
f. Microsoft Office Documents:
   1) Maintenance Summary Form: Excel form provided by Design-Builder.
   2) Operating Procedures: Word format.
   3) Asset Management Data Format:
      a) Electronic format only in template prepared by Design-Builder.
      b) Submit in Excel.
g. Manual to follow section organization in Electronic Document Requirements found in Article Supplements following end of section.
h. File to be completely text searchable (OCR).

1.05 SUBMITTALS

A. Informational:
   1. Preliminary Data:
      a. Submit electronic copy for Design-Builder's review.
      b. If data meets conditions of the Contract:
         1) Design-Builder's comments will be returned to Subcontractor or Supplier.
         2) Subcontractor or Supplier must prepare and submit Final Data as specified.
      c. If data does not meet conditions of the Contract:
         1) Design-Builder's comments will be returned to Subcontractor or Supplier.
         2) Subcontractor or Supplier must resubmit.
   2. Final Data: Submit one electronic copy in format specified herein.

1.06 O&M DATA FOR EQUIPMENT AND SYSTEMS

A. Content for Each Unit (or Common Units) and System:
   1. Product Data:
      a. Include only those sheets that are pertinent to specific product.
      b. Clearly annotate each sheet to:
         1) Identify specific product or part installed.

2) Identify data applicable to installation.
3) Delete references to inapplicable information.

c. Function, normal operating characteristics, and limiting conditions.
d. Performance curves, engineering data, nameplate data, and tests.
e. Complete nomenclature and commercial number of replaceable parts.
f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
g. Spare parts ordering instructions.
h. Where applicable, identify installed spares and other provisions for future work (for example, reserved panel space, unused components, wiring, and terminals).

2. As-installed, color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
   a. Format:
      1) Provide reinforced, punched, binder tab; bind in with text.
      2) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
      3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
      4) Identify Specification section and product on Drawings and envelopes.
   b. Relations of component parts of equipment and systems.
   c. Control and flow diagrams.
   d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
   a. Format:
      1) Organize in consistent format under separate heading for each different procedure.
      2) Provide logical sequence of instructions for each procedure.
      3) Provide information sheet for Design-Builder's personnel, including:
         a) Proper procedures in event of failure.
         b) Instances that might affect validity of equipment warranty.
   b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
   c. Operating Procedures:
      1) Startup, break-in, routine, and normal operating instructions.
      2) Test procedures and results of factory tests where required.

3) Regulation, control, stopping, and emergency instructions.
4) Description of operation sequence by control manufacturer.
5) Shutdown instructions for both short and extended duration.
6) Summer and winter operating instructions, as applicable.
7) Safety precautions.
8) Special operating instructions.

d. Maintenance and Overhaul Procedures:
1) Routine maintenance.
2) Guide to troubleshooting.
3) Disassembly, removal, repair, reinstallation, and re-assembly.
4) Required maintenance for long-term storage and/or shutdown.

e. Client equipment tag name list with description.

B. Content for Each Electric or Electronic Item or System:
1. Description of Unit and Component Parts:
a. Function, normal operating characteristics, and limiting conditions.
b. Performance curves, engineering data, nameplate data, and tests.
c. Complete nomenclature and commercial number of replaceable parts.
d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit Directories of Panelboards.
3. Electrical service.
4. Control requirements and interfaces.
5. Communication requirements and interfaces.
6. List of electrical relay settings, and control and alarm contact settings.
7. Electrical interconnection wiring diagram, including as applicable, single-line, three-line, schematic and internal wiring, and external interconnection wiring.
8. As-installed control diagrams by control manufacturer.
9. Operating Procedures:
a. Routine and normal operating instructions.
b. Startup and shutdown sequences, normal and emergency.
c. Safety precautions.
d. Special operating instructions.
10. Maintenance Procedures:
a. Routine maintenance.
b. Guide to troubleshooting.
c. Adjustment and checking.
d. List of relay settings, control and alarm contact settings.
11. Manufacturer’s printed operating and maintenance instructions.
12. List of original manufacturer’s spare parts, manufacturer’s current prices, and recommended quantities to be maintained in storage.

C. Maintenance Summary:
   1. Compile individual Maintenance Summary Forms for each applicable equipment item, respective unit or system, and for components or sub-units. Fill out sections completely.
   2. Format:
      a. Use Maintenance Summary Form bound with this section.
      b. Each Maintenance Summary may take as many pages as required.
      c. Use only 8-1/2-inch by 11-inch size paper.
      d. Complete using Excel on form provided.
   3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
   4. Recommended Spare Parts:
      a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
      b. "Unit" is the unit of measure for ordering the part.
      c. "Quantity" is the number of units recommended.
      d. "Unit Cost" is the current purchase price.
   5. Provide pertinent nameplate data for each piece of equipment; include specific serial numbers and tag numbers.

1.07 ASSET DATA FOR EQUIPMENT AND SYSTEMS

A. Asset Data in accordance with Asset Management Information found in Article Supplements following end of section.

B. Complete the Asset Management Information Form for each piece of equipment, filling in applicable information.

1.08 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.
   1. Maintenance Summary Form.
   2. Electronic Document Requirements.
   3. Electronic Asset Management Information.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

MAINTENANCE SUMMARY FORM

PROJECT: _____ CONTRACT NO.: _____

1. EQUIPMENT ITEM_____

2. MANUFACTURER _____

3. EQUIPMENT/TAG NUMBER(S) _____

4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)_____

5. NAMEPLATE DATA

   a. hp: _____

   b. Voltage: _____

   c. Speed: _____

   d. Amperage: _____

   e. Service Factor: _____

   f. Speed: _____

   g. Enclosure Type: _____

   h. Capacity: _____

   i. Other: _____

6. MANUFACTURER'S LOCAL REPRESENTATIVE _____

   a. Name _____ Telephone No. _____

   b. Address _____

   c. E-mail Address _____

7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	Frequency	Lubricant (If Applicable)
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

8. LUBRICANT LIST

Reference Symbol	Shell	Exxon Mobile	Chevron Texaco	BP Amoco	"Or-Equal"
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				

Reference Symbol	Shell	Exxon Mobile	Chevron Texaco	BP Amoco	"Or-Equal"

9. RECOMMENDED SPARE PARTS FOR INVENTORY

Part No.	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this Contract with two asterisks.				

10. COMMENTS

ELECTRONIC DOCUMENT REQUIREMENTS

Description	File Contents
General Information	Cover Page Information
	Title page Information
	Table of Contents
	Specifications
	Design Criteria
	Warrantee
	Bond Information
	Service Contracts
	Bill of Materials
Installation Instructions	All Datasheets
	All Catalog Cuts
	Installation Drawings
	Installation Details & Procedures
Initial Settings & Calibration	Calibration Datasheet
	Final Calibration Settings
	Testing & Certification Data
	Calibration Procedures
Operating Strategies	Process Procedures
	Startup Procedures
	Shutdown Procedures
	Abnormal Conditions
	Control Modes

Description	File Contents
	Standard Operating Procedures
Maintenance & Troubleshooting	Equipment Checklists
	Spare Part Lists
	Inspection Procedures
	Lubrication Procedures
	Maintenance Procedures
	I&C Documentation & Configuration
	Software manuals
Figures, Drawings, & Misc	All Drawings
	Diagrams
	Charts
Safety & Emergency Information	Safety Procedures
	Emergency Procedures
	MSDS Information
	OSHA Regulations

ELECTRONIC ASSET MANAGEMENT INFORMATION

Notes:
1. Enter information electronically on form provided by Design-Builder.
2. Enter information separately (e.g., one entry for motor, one entry for driven unit).

1	Asset Description (Equipment/ Tag Number(s))	TO BE COMPLETED BY DESIGN-BUILDER
2	Added to Hierarchy?	TO BE COMPLETED BY DESIGN-BUILDER
3	Depreciable?	TO BE COMPLETED BY DESIGN-BUILDER
4	Asset Record Type	TO BE COMPLETED BY DESIGN-BUILDER
5	Asset ID Number	TO BE COMPLETED BY DESIGN-BUILDER
6	Added to MAXIMO?	TO BE COMPLETED BY DESIGN-BUILDER
7A	Asset Location?	TO BE COMPLETED BY DESIGN-BUILDER
7B	Association with other Asset (part of another asset)?	TO BE COMPLETED BY DESIGN-BUILDER
7C	SCADA Tag #	
8	Purchasing Information	
9	Method of Acquisition	TO BE COMPLETED BY DESIGN-BUILDER
10	Source of Funding (i.e., Grants, Bonds, etc.)	TO BE COMPLETED BY DESIGN-BUILDER
11	Purchase Document Number	
12	Stationary or Mobile	TO BE COMPLETED BY DESIGN-BUILDER
13A	Purchase or Replacement (Book) Value	
13B	Warranty Expiration Date	
13C	Vendor	
14	Manufacturer’s Information	
15	Manufacturer's Name	
16	Model Number	
17	Serial Number	
18	Make	

19	Motor/Electrical Information	
20	Voltage	
21	Amperage	
22	Frequency	
23	Phases	
24	HP	
25	Frame	
26	RPM	
27	Power Factor	
28	Max KVAR	
29	Nominal Efficiency	
30	Rating	
31	Design	
32	Enclosure	
33	Code	
34	Insulation Class	
35	Max Ambient Temp	
36	Service Factor	
37	Grease	
38	DE Bearing	
39	OE Bearing	
40	Type	
41	Pump Information	
42	GPM	
43	Pump Type	
44	Pump Size	
45	Number of Stages	
46	Impeller Diameter	
47	Rotation	
48	Seal Type	
49		

50	Valve Information	
51	Valve Rebuild Kit No.	
52	Valve Size	
53	Valve Body	
54	Valve Plug Type	
55	Valve Plug Face Type	
56	Valve Seat Type	
57	Valve Temperature Rating	
58	Valve Flange Type	
59	Valve Flange Material	
60	Valve Material	
61	Valve Liner	
62	Valve Type	
63	Instrument Information	
64	Instrument Measurement Type	
65	Instrument Unit of Measure	
66	Instrument Element Type	
67	Instrument Range	
68	Instrument Proof Pressure	
69	Instrument Maximum Measurement	
70	Instrument Material	
71	Instrument Deadband	
72	Instrument Output	
73	Instrument Software Revision	
74	Instrument Flange Type	
75	Instrument Flange Material	
76	Instrument Liner	
77	Instrument Accuracy	
78	Instrument Readability	
79	Instrument Type	

80	Fans	
81	Type	
82	Size	
83	CFM	
84		
85	HVAC	
86	Compressor Volts	
87	Compressor Phase	
88	Compressor HZ	
89	Compressor RLA	
90	Compressor LRA	
91	Refrigerant	
92	Fan Motor Volts	
93	Fan Motor Phase	
94	Fan Motor Hz	
95	Fan FLA	
96	Fan HP	
97	Test Pressure Gauge Low	
98	Test Pressure Gauge High	
99		
100	Transformers	
101	Primary Voltage	
102	Secondary Voltage	
103	Hertz	
104	Phases	
105	Imp	

SECTION 01 88 15
ANCHORAGE AND BRACING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers design and performance requirements for anchorage and bracing for equipment and nonstructural components required in accordance with the 2016 California Building Code (CBC).

B. This section also covers design and performance requirements for anchorage and bracing of general equipment and nonstructural components not necessarily required by the California Building Code but required by these Specifications.

C. Equipment supplier shall provide code required attachments, braces, and anchors to the structure for elements of the architectural, mechanical, and electrical systems included in the Work in accordance with this section unless a design is specifically provided within the Contract Documents.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

A. The equipment or component supplier may choose either of the following methods for design of anchorage:
   1. Equipment or component supplier may self-perform the anchorage and bracing calculations, as noted in Paragraph Method 1.
   2. Equipment or component supplier may supply sufficient information regarding the equipment or component anchorage and bracing, such that Design-Builder can adequately perform the required anchorage and bracing calculations, as noted in Paragraph Method 2. If Method 2 is selected, the equipment or component supplier shall provide Design-Builder a credit for associated engineering costs associated with providing anchorage calculations.

B. Method 1: Provide support and anchorage calculations stamped by an engineer registered in the State of California. Support and anchorage design criteria shall meet supplier's requirements, design loads provided herein, and all applicable codes and standards. Provide International Code Council ICC-ES or IAPMO-UES report and special inspection requirements for any post installed anchors in concrete and masonry. Anchor calculations shall account for edge distance, concrete thickness and other existing conditions which shall be field verified by the Subcontractor and identified in the calculations and any related Drawings.

C. Method 2: Provide equipment geometry, weight, center of mass, and anchorage locations along with operating loading including but not limited to torque, overturning, thermal loading, etc., to allow Design-Builder to design the anchorage and bracing of the equipment or component for all applicable codes and standards. Design-Builder will be responsible only for the physical anchorage of the equipment or component to the supporting structure. Design of the equipment or component

itself to withstand the imposed loading is the responsibility of the equipment supplier.

D. CBC Code Design Criteria: 2016 California Building Code.

E. Concrete Strength: Concrete structures will be designed with a minimum 28-day compressive strength of 4,500 psi.

F. Concrete Masonry Units: Coordinate areas for anchorage with Design-Builder to allow for solid grouting of cells.

G. Provide supplementary framing where required to transfer anchorage and bracing loads to structure.

H. Design Loads:
   1. Components shall be designed for all dead, live, operational, seismic, wind, and thrust loads per the CBC load combinations.
   2. Facility Risk Category: IV.
   3. Seismic Loads: In accordance with the requirements of 2016 CBC, Section 1613, Earthquake Loads, with design parameters listed below:
      a. Design, 5 percent damped, spectral response acceleration parameter at short periods: S_{DS} equals 1.000 g.
      b. Design, 5 percent damped, spectral response acceleration parameter at a period of 1 second: S_{D1} equals 0.60 g.
      c. Seismic Component Importance Factor for Anchorage of Mechanical and Electrical Equipment, I_p equals 1.5, in accordance with ASCE 7-10 Section 13.1.3.
      d. Seismic Design Category: D.
      e. Component Amplification Factor, a_p: In accordance with Table 13.5-1 and 13.6-1 of the ASCE 7-10.
      f. Component Response Modification Factor, R_p: In accordance with Table 13.5-1 and 13.6-1 of ASCE 7-10.
      g. Load Combinations: In accordance with 2016 CBC.
         1) Section 1605.2, Load combinations using strength design; or
         2) Section 1605.3.1, Basic load combinations using allowable stress design.
      h. Hydraulic: Design of anchorage for submerged gates and other mechanical equipment shall include hydrostatic and hydrodynamic loads determined in accordance with Section 15.7 of ASCE 7-10.
   4. Wind Loads: In accordance with 2016 CBC, Section 1609 – Wind Loads, with design parameters listed below:
      a. Ultimate Design Wind Speed: 115 miles per hour.
      b. Wind Exposure: C.
      c. Wind Importance Factor, I: 1.00.

d. Load Combinations: In accordance with 2016 CBC.
   1) Section 1605.2, Load combinations using strength design; or
   2) Section 1605.3.1, Basic load combinations using allowable stress design.

5. Operational Loads: In accordance with 2016 CBC and equipment manufacturer's product data.
6. Live Loads: In accordance with 2016 CBC.
7. Other Loads: In accordance with 2016 CBC.

1.03 SUBMITTALS

A. General: Anchorage drawings and calculations are identified as CBC deferred submittals and will be submitted to and accepted by permitting agency prior to installation of component, equipment or distribution system. Submittals shall comply with Section 01 33 00, Submittal Procedures, and as described below.

B. Action Submittals:
   1. Shop Drawings:
      a. Submit Shop Drawings with supporting calculations (Method 1) or design criteria (Method 2) for review and acceptance in advance of installation of component, equipment, or distribution system to be anchored to structure.
      b. List of architectural, mechanical, and electrical equipment requiring anchorage and bracing.
      c. For Method 1:
         1) Reference drawings shall include plans, sections, details and component, equipment, or distribution system information as necessary for seismic calculations. Indicate the location of the component, equipment, or distribution system on plan including anchorage locations, edge distance, embedment, diameter and material which is used for load calculations
         2) Each drawing sheet shall be sealed by the same engineer that sealed the calculations document for that element.
         3) Submittals will be rejected if proposed anchorage method would create an overstressed condition of supporting member. Revise anchorages and strengthening of structural support so there is no overstressed condition.

C. Informational Submittals:
   1. Anchorage and Bracing Calculations (Method 1): For attachments, braces, and anchorages, include CBC and project specific criteria as noted herein, sealed by a civil or structural engineer registered in the State of California.
   2. Supplier Provided Information (Method 2): Supplier provided design information noted herein.

PART 2 PRODUCTS

2.01 GENERAL

A. Anchors shall comply with Section 05 05 19, Anchor Bolts.

B. Attachments and supports transferring loads to structure shall be constructed of materials and products suitable for the application and be designed and constructed in accordance with the design criteria and nationally recognized standards.

C. Size of anchor bolts and anchors, and required minimum embedment and spacing shall be based on calculations submitted for Method 1.

D. Powder actuated fasteners and sleeve anchors shall not be used for attachments and anchorage where resistance to tension loads is required. Expansion anchors, other than undercut anchors or specifically approved anchor, shall not be used for non-vibration-isolated mechanical equipment rated over 10 hp.

E. Cast-in-place anchor bolts shall be used for equipment rated over 50 hp unless otherwise approved by Design-Builder.

F. Seismic loads must be resisted by welded connection plates, and anchor bolts or bolts fastened to structural steel frames. All steel assemblies, anchor bolts and fasteners shall be of Type 316 stainless steel, unless otherwise indicated.

PART 3 EXECUTION

3.01 GENERAL

A. Make attachments, bracing, and anchorage in such a manner that component force is transferred to the lateral force resisting system of the structure through a complete load path. Provide narrative description of load path.

B. Overall anchorage system shall provide restraint in all directions, including vertical, for each component or system so anchored.

C. Components mounted on vibration isolation systems shall have snubbers in each horizontal direction and vertical restraints where required to resist overturning.

D. Anchor piping in such a manner as to ensure piping system has adequate flexibility and expansion capabilities at flexible connections and expansion joints. Piping and ductwork suspended more than 12 inches below the supporting structure shall be braced for seismic effects to avoid significant bending of the hangers and their attachments, unless high-deformability piping is used per ASCE 7-10, or HVAC ducts have a cross-sectional area of less than 6 square feet.

E. Tall and narrow equipment such as motor control centers and telemetry equipment shall be anchored at the base and within 12 inches from the top of the equipment, unless approved otherwise by Design-Builder.

F. Architectural, mechanical, or electrical components shall not be attached to more than one element of a building structure at a single restraint location where such elements may respond differently. Such attachments shall also not be made across building expansion and contraction joints.

3.02 INSTALLATION

A. Do not install components or their anchorages or bracing prior to review and acceptance by Design-Builder and permitting agency.

END OF SECTION

SECTION 01 91 14
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 GENERAL

1.01 DESCRIPTION

A. Design-Builder will establish requirements for and coordinate testing and startup activities for the Facility. Subcontractors and Suppliers shall integrate testing and startup activities through Design-Builder and shall assist Design-Builder in conducting final Acceptance Test. Except as described elsewhere, Subcontractors and Suppliers shall supply labor, materials, and support equipment necessary for testing and startup activities.

1.02 DEFINITIONS

A. Facility: Entire Project, or an agreed-upon portion, including all of its unit processes.

B. Acceptance Test: Test conducted by Design-Builder and Suppliers to demonstrate and document performance of operating Facility, both manually and automatically. Such demonstration is for purposes of (i) verifying to Design-Builder and City that Facility performs as specified, and (ii) documenting baseline performance characteristics of completed Facility for City's records.

C. Commissioning: Test or tests conducted by Design-Builder and Supplier of discrete, contained sections of the process and control system under conditions as close as possible to the actual operating conditions in order to demonstrate that the systems function as intended. Commissioning will confirm all software systems and subsystems for the Project, including full Distributed Control System (DCS) interface checking. Commissioning tests will be performed with the intended process fluid.

D. Functional Tests: Test or tests conducted by Design-Builder in conjunction with Subcontractor and/or Supplier in presence of Design-Builder to demonstrate installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified. Functional Testing includes, at a minimum, mechanical testing (verifying noise, vibration, alignment, speed, mechanical connections, proper rotation, thrust restraint), input/output checks, instrumentation adjustments, electronic signal and control hardware installation, and obtaining Manufacturer's Certificates of Proper Installation. In general, Functional Testing is not conducted with process fluid (for example, using clean water in lieu of wastewater); however, in some cases, the actual process fluid may be required to demonstrate functionality of equipment or systems.

E. Pre-Operational Tests: Inspections and preliminary testing conducted by Design-Builder in conjunction with Subcontractor and/or Supplier to ensure that equipment and systems are ready for functional testing.

F. Startup: Has the meaning of all testing and encompasses Pre-Operational Testing, Functional Testing, and Acceptance Testing.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Facility Startup Meetings: Attend Design-Builder Startup Meetings, in accordance with requirements of Section 01 31 13, Project Coordination, to discuss safety protocol, scheduling, test methods, materials, chemicals and liquids required, operations interface, and Subcontractor and Supplier involvement.

B. Subcontractor's Testing and Startup Representative:
   1. Designate and furnish one or more personnel to coordinate and expedite testing and facility startup. Designated personnel are subject to approval of Design-Builder prior to commencing Work at the Facility.
   2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.

C. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.

D. Provide sufficient personnel for Subcontractor and equipment manufacturers to support Project schedule to not cause project delays. Schedule all other ongoing work by Subcontractor or Supplier to not interfere with or delay testing and startup.

E. Design-Builder will:
   1. Provide test water, power, chemicals, and other items as required for startup, unless otherwise indicated.
   2. Provide labor and materials as required for laboratory analyses, unless otherwise indicated.
   3. Furnish assistance of manufacturer's representative(s) for Design-Builder-furnished equipment.
   4. Make available spare parts, special tools, and operation and maintenance information for Design-Builder-furnished equipment.
   5. Coordinate with City for any support required by operations staff.

3.02 PRE-OPERATIONAL TESTING

A. Pre-Operational Testing may be performed on defined areas or processes or sub-processes within the Facility (i.e., unit processes).

B. Preparation:
   1. Complete installation before Pre-Operational Testing.
   2. Furnish qualified manufacturers' representatives, when required by individual Specification sections.
   3. Cleaning and Checking: As part of Pre-Operational testing, Subcontractors shall, with assistance from Design-Builder where required, complete a Pre-Startup Checklist. In addition, the following minimum activities shall be completed during Pre-Operational Testing:
      a. Calibrate testing equipment in accordance with manufacturer's instructions.
      b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
      c. Remove rust preventatives and oils applied to protect equipment during construction.
      d. Inspect bearings, clean and remove foreign matter, and verify alignment.
      e. Flush lubrication systems and dispose of flushing oils. Lubricate equipment in accordance with manufacturer's instructions.
      f. Turn rotating equipment by hand when possible to confirm that equipment is not bound.
      g. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
      h. Check power supply to electric-powered equipment for correct voltage.
      i. Adjust clearances and torque.
      j. Test piping for leaks and flush.
      k. Set protective measures and devices.

3.03 FUNCTIONAL TESTING

A. Functional Testing may be performed on specific equipment or defined areas for processes or sub-processes within the Facility (i.e., unit processes) after Pre-Operational testing on that equipment, process, or sub-process has been successfully completed.

B. Ready-to-test determination will be by Design-Builder based at least on the following:
   1. Completion of Pre-Operational Testing and sign-off of Pre-Startup Checklist.
   2. Acceptable Operation and Maintenance Data.

3. Notification by Subcontractor and/or Supplier of equipment readiness for testing.
4. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
5. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
6. Satisfactory fulfillment of other specified manufacturer's responsibilities.
7. Equipment and electrical tagging complete to the extent necessary to perform testing.
8. Delivery of spare parts and special tools.

C. Furnish qualified manufacturers' representatives, when required by individual Specification sections.

D. Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper connection and operation.

E. Demonstrate to the Design-Builder proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions when required.

F. Immediately correct defects in material, workmanship, or equipment which became evident during functional test.

G. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Proper Installation Form, in accordance with Section 01 43 33, Manufacturers' Field Services, when required by individual Specification sections.

H. After specified Functional Testing, each equipment or system shall be required to operate for 3 continuous days with the entire Facility using clean water. The Design-Builder will perform the 3-day test with support from Subcontractor and Suppliers to address any issues that may arise.

3.04 ACCEPTANCE TESTING

A. Prior to commencing Acceptance Testing, the Design-Builder will prepare an Acceptance Testing Plan for City approval. Supplier will provide information to support development of the plan.

B. After successful completion of Pre-Operational Testing and Functional Testing of the Facility unit processes, Design-Builder will conduct the Acceptance Testing for the Facility in accordance with a City-approved Acceptance Test Plan. Acceptance Testing will require uninterrupted operation of the Facility for 28 continuous days while maintaining performance requirements throughout the duration of the test.

Acceptance Testing may consist of multiple distinct tests of various Facility unit processes as indicated in the City-approved Acceptance Test Plan.

C. Subcontractor and Supplier will assist Design-Builder in performance of the Acceptance Test(s). Assistance will include equipment adjustments and modifications, as necessary, to maintain uninterrupted operation during the Acceptance Test or corrective actions should a significant interruption be experienced.

3.05 SIGNIFICANT INTERRUPTION

A. During Acceptance Testing, Subcontractor and/or Supplier shall assist Design-Builder in corrective actions of minor and catastrophic failures.

B. Minor Failures:

1. A minor failure is any event or failure of a Facility component, support system, or ancillary item which does not impact the overall performance of the unit processes.
   a. In the event of a minor failure of a component, or system process, Acceptance Testing may continue on the remaining redundant piece of equipment or process and will be allowed to suspend, or 'pause', the Acceptance Test.
   b. Defective components shall be repaired or replaced in a period not to exceed 72 hours.

C. Catastrophic Failures:

1. A catastrophic failure is any event or failure of a Facility component, support system, or ancillary item which impacts the overall performance of the unit processes, either by a single component or as an overall system, that cannot be corrected within 6 hours.
2. Defective components shall be repaired or replaced in a period not to exceed 72 hours.

3.06 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this specification.

1. Pre-Startup Checklist.

END OF SECTION

Pre-Startup Checklist

Item	Yes	No	N/A	Initials	Date
General Verifications					
Construction complete according to the P&IDs as required to commence testing: concrete complete, piping installed, pipe supports installed, equipment installed and powered, and instruments installed and powered. Note architectural components or other features that do not impact startup do not have to be completed.	☐	☐	☐		
Leak testing completed satisfactorily for all water holding basins.	☐	☐	☐		
Applicable preliminary O&M manuals reviewed, complete, and available onsite.	☐	☐	☐		
Area clean and safe for work.	☐	☐	☐		
Grating, safety rails, and walkways installed.	☐	☐	☐		
Lock-Out-Tag-Out is in place per FSI if required for mechanical or electrical isolation.	☐	☐	☐		
Mechanical Verifications					
Utilities are properly connected to commence testing:					
- Utility water	☐	☐	☐		
- Potable water	☐	☐	☐		
- Service air	☐	☐	☐		
- HVAC	☐	☐	☐		
- Safety showers	☐	☐	☐		
- Natural gas	☐	☐	☐		
Equipment is set on its foundation, grouted, aligned, and earthed	☐	☐	☐		
Leak and pressure testing completed satisfactorily for all piping systems.	☐	☐	☐		
Leak testing completed for pneumatic controls and instrument air piping.	☐	☐	☐		
Flanges and gaskets tight and checked for leakage. Inspect screwed joints for leakage.	☐	☐	☐		
Screwed joints and mating devices checked for leakage.	☐	☐	☐		
Pipe supports and seismic bracing installed.	☐	☐	☐		
Downstream piping reviewed for potential water hammer during initial startup.	☐	☐	☐		

Low point drains connected to drain piping and routed to appropriate drainage collection system.	☐	☐	☐		
Hand valves in place, positioned for proper flow direction, and freely open/close by hand.	☐	☐	☐		
Motor valves in place, positioned for proper flow direction, and freely open/close by hand.	☐	☐	☐		
Air release valves and blowoff vents installed.	☐	☐	☐		
Rust preservatives, oils, and temporary protective coverings removed from equipment.	☐	☐	☐		
Lubrication/coolant flushed and recharged. Recharge only with lubricant recommended by manufacturer.	☐	☐	☐		
Fuel flushed, filled, and available.	☐	☐	☐		
Packing installed loose, seals, O-rings, and miscellaneous seals checked and adjusted.	☐	☐	☐		
Rotation direction arrows installed and pointing in correct direction.	☐	☐	☐		
Alignment to manufacturer's tolerances of equipment complete (only if alignment <u>not</u> completed by vendors).	☐	☐	☐		
Adjust V-belt tension and variable pitch sheaves.	☐	☐	☐		
Mounting apparatus, bolts, etc. properly installed and tightened. Temporary supports and other foreign objects removed.	☐	☐	☐		
Shaft guards installed (or available for installation during startup with manufacturer).	☐	☐	☐		
Safety devices and equipment are installed, fully functional, adjusted, and tested (or available for installation during startup with manufacturer).	☐	☐	☐		
Electrical/I&C Verifications					
Power is available to equipment and instruments.	☐	☐	☐		
PLCs installed, wired, pulled, and terminated.	☐	☐	☐		
Fiber-optic Network installed and tested.	☐	☐	☐		
Insulation resistance tests on wiring except 120-volt lighting, wiring, and control wiring inside electrical panels.	☐	☐	☐		
Continuity tests on grounding systems.	☐	☐	☐		
Direct current (DC) high potential tests on all cables that will operate at more than 2,000 volts.	☐	☐	☐		
Test and set switchgear and circuit breaker relays for proper operation.	☐	☐	☐		

Third party electrical tests and adjustments have been completed.	☐	☐	☐		
Pneumatic controls and instrument air piping leak tested.					
Point to point checks have been satisfactorily completed from the equipment/device to the PLC.	☐	☐	☐		
Startup Verifications					
Walkthrough with Startup Team has been completed.	☐	☐	☐		
Startup punch list items have been documented.	☐	☐	☐		
If any of the above are marked "NO", provide explanation or comment and details of any agreed action:					
Comments:					
Certification: This document certifies that the construction and installation of the area/system and its associated equipment complies with the Specifications and Design-Build Agreement documents and that this area/system is ready to commence commissioning.					

Verified by Subcontractor:	Name:
Date:	Signature:
Approved by Design-Builder:	Name:
Date:	Signature:

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this Section:
   1. Air-Conditioning, Heating, and Refrigeration Institute (AHRI): Guideline K, Containers for Recovered Non-flammable Fluorocarbon Refrigerants.
   2. American National Standards Institute (ANSI): A10.6, Safety Requirements for Demolition Operations.
   3. Environmental Protection Agency (EPA), U.S. Code of Federal Regulations (CFR), Title 40:
      a. Part 61—National Emission Standards for Hazardous Air Pollutants.
      b. Part 82—Protection of Stratospheric Ozone.
      c. Part 273—Standards for Universal Waste Management.
   4. Occupational Safety and Health Administration (OSHA), U.S. Code of Federal Regulations (CFR) Title 29 Part 1926—Occupational Safety and Health Regulations for Construction.

1.02 DEFINITIONS

A. ACM: Asbestos-containing material.

B. Demolition: Dismantling, razing, destroying, or wrecking of any fixed building or structure or any part thereof. Demolition also includes removal of pipes, manholes tanks, conduit, and other underground facilities, whether as a separate activity or in conjunction with construction of new facilities.

C. Modify: Provide all necessary material and labor to modify an existing item to the condition indicated or specified.

D. Relocate: Remove, protect, clean and reinstall equipment, including electrical, instrumentation, and all ancillary components required to make the equipment fully functional, to the new location identified on Drawings.

E. Renovation: Altering a facility or one or more facility components in any way.

F. Salvage/Salvageable: Remove and deliver, to the specified location(s), the equipment, building materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of City. Unless otherwise specified, title to items identified for demolition shall revert to Subcontractor.

G. Universal Waste Lamp: In accordance with 40 CFR 273, the bulb or tube portion of an electric lighting device, examples of which include, but are not limited to, fluorescent, high-intensity discharge, neon, mercury vapor, high-pressure sodium, and metal halide lamps.

H. Universal Waste Thermostat: A temperature control device that contains metallic mercury in an ampule attached to a bimetal sensing element, and mercury-containing ampules that have been removed from these temperature control devices in compliance with the requirements of 40 CFR 273.

1.03 SUBMITTALS

A. Informational Submittals:
   1. Submit proposed Demolition/Renovation Plan, in accordance with requirements specified herein, for approval before such Work is started.
   2. Submit copies of any notifications, authorizations and permits required to perform the Work.
   3. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped.
   4. Submit a shipping receipt or bill of lading for all containers of ACM shipped.
   5. Submit a shipping receipt or bill of lading for all universal waste shipped.

1.04 REGULATORY AND SAFETY REQUIREMENTS

A. When applicable, demolition Work shall be accomplished in strict accordance with 29 CFR 1926-Subpart T.

B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the Contract Documents, Subcontractor's safety requirements shall conform to ANSI A10.6.

C. Furnish timely notification of this demolition project to applicable federal, state, regional, and local authorities in accordance with 40 CFR 61-Subpart M.

1.05 DEMOLITION/RENOVATION PLAN

A. Demolition/Renovation Plan shall provide for safe conduct of the Work and shall include:
   1. Detailed description of methods and equipment to be used for each operation.
   2. Drawings and photos showing areas to be demolished.
   3. Narrative describing Work to be done step by step.
   4. The Subcontractor's planned sequence of operations, including coordination with other work in progress.
   5. Procedures for removal and disposition of materials specified to be salvaged.
   6. Disconnection schedule of utility services.

B. Include statements affirming Subcontractor inspection of the existing roof deck, floors, walls, and framing members, and their suitability to perform as a safe working platform or, if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the Work.

1.06 SEQUENCING AND SCHEDULING

A. The Work of this Specification shall not commence until Subcontractor's Demolition/Renovation Plan has been approved by Design-Builder.

B. Include the Work of this Specification in the progress schedule, as specified in Section 01 32 00, Construction Progress Documentation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXISTING FACILITIES TO BE DEMOLISHED OR RENOVATED

A. Facilities: Portions of buildings and other areas scheduled for selective demolition, partial demolition, and renovation Work are as shown on Drawings.

B. Utilities and Related Equipment:

1. All process shutdown requests must be approved. Notify Jacobs or appropriate utilities to turn off affected services at least 48 hours before starting demolition activities.
2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by Jacobs.
3. When utility lines are encountered that are not indicated on Drawings, notify Jacobs prior to further work in that area.
4. Remove meters and related equipment and deliver to a location as determined by the Jacobs.
5. Provide a permanent leak-proof closure for water and gas lines.

C. Manholes, Vaults and Containment Vessels: Remove in entirety.

D. Irrigation Systems:

1. Coordinate sprinkler modifications and relocations with City.
2. Remove irrigation system where it conflicts with proposed work.
3. Modify irrigation system so that it remains operational.
4. Install sprinkler heads to keep as much grass as possible.
5. Document where all sprinkler pipes, sprinkler heads, valves, valve boxes, and wiring have been removed. Submit to City.
6. Protect existing sprinkler system so that it remains operational.

E. Paving and Slabs:
   1. Remove concrete and asphaltic concrete paving and slabs as indicated down to top of base course.
   2. Provide neat sawcuts at limits of pavement removal as indicated.

F. Concrete:
   1. Core drill corners of new opening to avoid overcutting adjacent reinforcing in existing concrete to remain. Saw concrete along straight lines to a depth of not less than 2 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished Work, and the remaining concrete is sound.
   2. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Repair exposed rebar ends and embeds as shown on Drawings.
   3. Where new concrete adjoins existing concrete, thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 3/16 inch. Rebar and small embeds at existing concrete may be required to be left to engage new concrete. Saturate surface with water for 24 hours prior to placing new concrete. The new Work shall tie into the existing construction as shown on Drawings.

G. Patching:
   1. Where removals leave holes and damaged surfaces exposed in the finished Work, patch and repair to match adjacent finished surfaces as to texture and finish.
   2. Where new Work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new Work.

H. Electrical:
   1. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 3/4 inch below final finished surface.
   2. When removing designated equipment, conduit and wiring may require rework to maintain service to other equipment.
      a. Fiber communications and power at EBOS and Ferric Chloride must be maintained.
   3. Demolition of Duct Banks:
      a. Remove conductors back to the source.
      b. Provide temporary power and communications to facilities and equipment as noted on the Contract Documents.
      c. Demolish duct banks up to the handhole/manhole locations shown on the Contract Documents.
      d. Preserve existing manholes/handholes during demolition of duct banks, unless manhole/handhole is shown to be demolished.

e. Confirm which circuits in to be demolished duct banks need to be maintained with Owner. Inform Jacobs' Engineer in writing of any circuits associated with demolition of duct banks that are not noted on the Contract Documents.

4. Rework existing circuits, or provide temporary circuits as necessary during renovation to maintain service to existing lighting and equipment not scheduled to be renovated. Existing equipment and circuiting shown are based upon limited field surveys. Verify existing conditions, make all necessary adjustments, and record the Work on the Record Drawings. This shall include, but is not limited to, swapping and other adjustments to branch circuits and relocation of branch circuit breakers within panelboards as required to accomplish the finished work.
   a. Coordinate rework of interference of communications system, including fiber, with Owner.
5. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated.
6. Raceways and cabling not scheduled for reuse.
7. Inaccessibly Concealed: Cut off and abandon in place.
8. Exposed or Concealed Above Accessible Ceilings: Remove.
9. Raceways and Cabling Scheduled for Future Use: Cap/seal and tag.
10. Relocating Equipment: Extend existing wiring or run new wiring from the source.
11. Where the existing raceway is concealed, the outlet box shall be cleaned, and a blank cover plate installed.
12. Where the concealed raceway is uncovered remove raceway (or extended to new location if appropriate).
13. Provide new typewritten panelboard circuit directory cards.

I. Universal Waste Lamps and Thermostats: Manage, contain, package, and label in strict accordance with 40 CFR 273.

3.02 PROTECTION

A. Dust and Debris Control:
   1. Prevent the spread of dust and debris to occupied portions of the building or site and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.
   2. Vacuum and dust interior work areas daily.
   3. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicular traffic.

B. Traffic Control Signs: Where pedestrian and driver safety is endangered in the area of removal Work, use traffic barricades with flashing lights.

C. Existing Work:

1. Survey the site and examine Drawings and Specifications to determine the extent of the Work before beginning any demolition or renovation.
2. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain the property of City; any Subcontractor-damaged items shall be repaired or replaced as directed by Design-Builder.
3. Provide temporary weather protection during interval between removal of existing exterior surfaces and installation of new to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
4. Ensure that structural elements are not overloaded as a result of or during performance of the Work. Responsibility for additional structural elements or increasing the strength of existing structural elements as may be required as a result of any Work performed under this Contract shall be that of the Subcontractor. Repairs, reinforcement, or structural replacement must have Design-Builder's Engineer approval.
5. Do not overload pavements to remain.

D. Weather Protection: For portions of the building scheduled to remain, protect building interior and materials and equipment from weather at all times. Where removal of existing roofing is necessary to accomplish the Work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent loss.

E. Trees: Protect trees within the Site that might be damaged during demolition and are indicated to be left in place by a 6-foot-high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the Work shall be replaced in kind, as approved by the Design-Builder.

F. Facilities:

1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.
2. Floors, roofs, walls, columns, pilasters, and other structural elements that are designed and constructed to stand without lateral support or shoring, and are determined by Subcontractor to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Design-Builder.
3. Protect all facility elements not scheduled for demolition.
4. Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities.

G. Protection of Personnel:

1. During demolition, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.
2. Provide temporary barricades and other forms of protection to protect City's personnel and the general public from injury due to demolition Work.
3. Provide protective measures as required to provide free and safe passage of City's personnel and the general public to occupied portions of the structure.

3.03 BURNING

A. The use of burning at the Site for the disposal of refuse and debris will not be permitted. Where burning is permitted, adhere strictly to federal, state, and local regulations.

3.04 RELOCATIONS

A. Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Clean all items to be relocated prior to reinstallation, to the satisfaction of Design-Builder. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by Design-Builder.

3.05 BACKFILL

A. Do not use demolition debris as backfill material.

B. Fill excavations and other hazardous openings to existing ground level or foundation level of new construction in accordance with Section 31 23 23, Fill and Backfill.

3.06 TITLE TO MATERIALS

A. Title to equipment and materials resulting from demolition is vested in the Subcontractor upon approval by Design-Builder of Subcontractor's Demolition/Renovation Plan, and the resulting authorization by Design-Builder to begin demolition.

3.07 DISPOSITION OF MATERIAL

A. Do not remove equipment and materials without approval of Subcontractor's Demolition/Renovation Plan by Design-Builder.

B. Repair or replace, at the discretion of Design-Builder, items damaged during removal or storage.

C. Design-Builder will not be responsible for the condition or loss of, or damage to, property scheduled to become Subcontractor's property after Design-Builder's authorization to begin demolition. Materials and equipment shall not be viewed by prospective purchasers or sold on the site.

D. City will not be responsible for the condition or loss of, or damage to, such property after Design-Builder's authorization to begin demolition.

3.08 REUSE OF MATERIALS AND EQUIPMENT

A. Remove and store materials and equipment listed in Article Title To Materials to be reused or relocated to prevent damage, and reinstall as the Work progresses.

B. Properly store and maintain equipment and materials in same condition as when removed.

C. Store equipment and material designated to be reused in a location designated by Design-Builder.

D. Equipment and material designated to be reused shall be cleaned, serviced and checked for proper operability before being put back into service.

E. Design-Builder will determine condition of equipment and materials prior to removal.

3.09 SPECIALIZED SALVAGE

A. Ozone Depleting Substances (ODS):
   1. Class I and Class II ODS are defined in Section 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling.
   2. Dispose of all Class I and Class II ODS refrigerants in accordance with the Clean Air Act Amendment of 1990.
   3. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g., residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.

B. Fire Suppression Containers: Fire suppression system cylinders and canisters with electrical charges or initiators shall be deactivated prior to shipment. Also, safety caps shall be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

3.10 UNSALVAGEABLE MATERIAL

A. Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of off the site.

B. Combustible material shall be disposed of off the Site.

C. Universal Waste Lamps and Thermostats: Dispose of in strict accordance with 40 CFR 273.

3.11 CLEANUP

A. Debris and rubbish shall be removed from all areas. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION

SECTION 03 01 32
REPAIR OF VERTICAL AND OVERHEAD CONCRETE SURFACES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 301, Specifications for Structural Concrete.
   b. 506.2, Specification for Shotcrete.
2. ASTM International (ASTM):
   a. A1064/A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   b. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   c. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   d. C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   e. C78/C78M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
   f. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
   g. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   h. C293/C293M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading.
   i. C348, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
   j. C496/C496M, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
   k. C531, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
   l. C596, Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
   m. C666/C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
   n. C882/C882M, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
   o. C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

p. C1583/C1583M, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).

q. D4258, Standard Practice for Surface Cleaning Concrete for Coating.

r. D4259, Standard Practice for Abrading Concrete.

s. E699, Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.

1.02 DEFINITIONS

A. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.

B. Defective Area: As defined in Section 03 30 00, Cast-in-Place Concrete.

C. High-Pressure Water Blasting: Sometimes referred to as hydro-demolition. Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.

D. Low-Pressure Spray Mortar: Mortar suitable to be applied by low-pressure spraying, and in small areas may be applied by hand troweling.

E. New Concrete: As defined in Section 03 30 00, Cast-in-Place Concrete.

F. Rebound: Shotcrete material, mostly aggregates, that bounce off a surface against which shotcrete was projected.

G. Shotcrete: Mortar pumped through hose and projected at high velocity.

1.03 SUBMITTALS

A. Action Submittals:

1. Product data sheets for each material supplied.
2. Drawings supplemented by photographs indicating location, size, estimated quantity, and proposed repair mortar for each repair location in existing concrete.

B. Informational Submittals:

1. Repair Mortar System: Manufacturer’s preparation and installation instructions.

2. Written description of equipment proposed for concrete removal and surface preparation.
3. Certificates:
   a. Shotcrete Nozzleman: Current ACI Certification for each proposed nozzleman.
   b. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, that proposed repair mortar systems are prepackaged, shrinkage compensated, specially designed for use on vertical and overhead surfaces that are exposed to weather.
   c. Mortar Manufacturer's Certificate of Proper Installation.
4. Statements of Qualification:
   a. Repair mortar system applicator.
   b. Independent Testing Laboratory.
5. Field and laboratory test reports.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Repair Mortar System Applicator:
      a. For Repair System A – Shotcrete Mortar, trained and experienced applicator recognized or certified by repair mortar system manufacturer.
      b. For Repair System B – Low-Pressure Spray Mortar, in lieu of recognition or certification, demonstrate application of repair mortar manufacturer's system and obtain Certification of Proper Installation, in accordance with Article Manufacturer's Services.
   2. Repair Mortar System Manufacturer's Representative: Knowledgeable and experienced on technical data and application requirements for specified products.

B. Independent Testing Laboratory: Meet criteria stated in ASTM E699.

C. Pre-repair Conference:
   1. Required Meeting Attendees:
      a. Contractor.
      b. Repair Subcontractor.
      c. Jacob's Engineer.
   2. Schedule and conduct prior to conducting mockups and incorporation of respective products into Project. Notify Jacobs' Engineer of location and time.
   3. Agenda shall include, but not limited to:
      a. Review of field conditions. Conduct field observations of Work to be performed.

b. Based on above observations, confirm material selection and make Project-specific repair method recommendations.

c. Review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.

d. Other specified requirements requiring coordination.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer's printed instructions.

PART 2 PRODUCTS

2.01 REPAIR SYSTEM A – SHOTCRETE MORTAR

A. Mortar Materials:

1. Blend of selected portland cements, microsilica, and specially graded aggregates and fibers applicable for vertical and overhead surfaces.
2. Materials shall not contain asbestos, chlorides, nitrates, added gypsum, added lime, or high aluminum cements.
3. Noncombustible before and after cure.
4. Furnish in factory proportioned unit.
5. Workability from 1/4 inch in depth and greater.

B. Mixed Mortar Properties:

1. Working Time: 5 minutes to 10 minutes.
2. Finishing Time: 10 minutes to 20 minutes.
3. Color: Dark gray.

C. Cured Mortar Properties:

1. Compressive strength for 2-inch cubes in accordance with ASTM C109/C109M, or 3-inch cubes in accordance with manufacturer's modification to ASTM C109/C109M:
   a. 7 Days: 6,000 psi minimum.
   b. 28 Days: 7,000 psi minimum.
2. Flexural Strength (Modulus of Rupture), ASTM C78/C78M or ASTM C348 (Modified) at 28 Days: 1,100 psi minimum.
3. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 400 psi minimum.
4. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 800 coulombs maximum.

5. Mortar shall not produce a vapor barrier.

D. Manufacturers and Products:
1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 211SP.
2. Sika Corp., Lyndhurst, NJ; SIKACEM 103F.
3. Euclid Chemical Co., Cleveland, OH; Eucoshot F.

2.02 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR

A. One or two-component, cement based, fiber reinforced, shrinkage compensated, gray in color, with a minimum 30-minute working time.

B. Cured materials mixed in accordance with manufacturer's instructions shall conform to the following criteria:
1. Compressive Strength, ASTM C109/C109M at 28 Days: 6,000 psi minimum.
2. Flexural Strength, ASTM C348 at 28 Days: 1,100 psi minimum.
3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent, at 28 Days: 3,000 psi minimum.
4. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 psi minimum.
5. Drying Shrinkage, ASTM C157/C157M Modified at 28 Days or ASTM C531: 0.1 percent maximum.
6. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 1,000 coulombs maximum.
7. System shall not produce a vapor barrier.
8. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only addition of water.
9. Free of chlorides and other chemicals causing corrosion.

C. Manufacturers and Products:
1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 488CI.
2. Sika Corp., Lyndhurst, NJ; SikaRepair 224.
3. Euclid Chemical Co., Cleveland, OH; Tamms Structural Mortar.

2.03 REPAIR SYSTEM C – POLYMER-MODIFIED REPAIR MORTAR

A. Polymer-modified, one- or two-component, cementitious based, chloride resistant, flowable, gray in color, working time of 20 minutes minimum, surface renovation mortar.

B. Cured Mortar Properties:
1. Compressive Strength, ASTM C109/C109M at 28 Days: 7,000 psi minimum.

2. Flexural Strength, ASTM C348 at 28 Days: 1,200 psi minimum.
3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent at 28 Days: 2,000 psi minimum.
4. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 500 psi minimum.
5. Drying Shrinkage, ASTM C596 at 28 Days: 0.12 percent maximum. Not required for small repair areas approximately 1 square foot in area or less.
6. Freeze Thaw Resistance, ASTM C666/C666M, at 300 Cycles: 90 percent RDM.
7. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 800 coulombs maximum for liquid holding and belowgrade repairs.

C. Manufacturers and Products:
1. Sika Corp., Lyndhurst, NJ; SikaTop 123 PLUS.
2. Euclid Chemical Co., Cleveland, OH; DuralTop Gel.

2.04 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards, as specified in Section 03 30 00, Cast-in-Place Concrete.

2.05 REINFORCEMENT

A. Deformed Steel Reinforcement: Per Section 03 21 00, Steel Reinforcement.

B. Mesh Reinforcement: Welded wire fabric flat sheets with spacing of wires and wire size in accordance with ASTM A1064/A1064M, wire 75 ksi minimum tensile strength per ASTM A1064/A1064M.

C. Tie Wire: 16-gauge, galvanized.

D. Mesh Anchors:
1. Manufacturers and Products:
a. Powers Fastening, Inc., Brewster, NY; Tie Wire Version of Power-Stud.
b. Hilti Fastener Systems, Tulsa, OK; Kwik Bolt II HHDCA, 1/4-inch ceiling hanger.

2.06 CEMENTITIOUS BONDING AGENT AND REINFORCEMENT COATING

A. Cementitious adhesive, specifically formulated for bonding plastic portland cement concrete or mortar to hardened portland cement concrete.
1. Mixed Bonding Agent Properties:
a. Pot Life: 75 minutes to 105 minutes.
b. Contact Time: 24 hours.

2. Cured Cementitious Adhesive Properties:
   a. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 500 psi minimum.
   b. Flexural Strength, ASTM C348: 1,000 psi minimum.
      1) Slant Shear Bond Strength, ASTM C882/C882M at 14 Days:
      2) 2-Hour Open Time: 2,500 psi minimum.
      3) 24-Hour Open Time: 2,000 psi minimum.
3. Bonding agent shall not produce a vapor barrier.
4. Compatible with and from same manufacturer as the repair system used.

B. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco P 124.
   2. Sika Corp., Lyndhurst, NJ; Sika Armatec 110 EpoCem.
   3. Euclid Chemical Co., Cleveland, OH: Dural Prep AC.

2.07 EVAPORATION RETARDANT

A. As specified in Section 03 39 00, Concrete Curing.

2.08 CURING COMPOUND

A. As specified in Section 03 39 00, Concrete Curing.

PART 3 EXECUTION

3.01 GENERAL

A. New Concrete Work: Repair deficiencies in new concrete structures constructed under this Contract with applicable repair system. Refer to Section 03 30 00, Cast-in-Place Concrete.

B. Existing Concrete Work: Repair concrete as identified in Contract Documents.

3.02 PREPARATION

A. Identify unsound and deteriorated concrete by sounding techniques, or as directed by Jacobs' Engineer, and review proposed extent of repair with Jacobs' Engineer.

B. Remove unsound, honeycombed, deteriorated, or otherwise defective areas of concrete from work areas.
   1. Use 8,000 psi minimum high-pressure water or abrasive blasting machine as required for Site conditions.
   2. Remove concrete to abrade substrate concrete surfaces to a minimum amplitude roughness of 3/16 inch measured between high and low points with a 3-foot-long straightedge, in accordance with ASTM D4259.

3. Where final surface is required to be flush with existing adjacent surface remove existing concrete depth as required for application of minimum thickness of repair mortar.

C. Do not use power-driven jackhammers, chipping hammers, or scabblers unless water blasting is not permitted or practical because of Site conditions, or may cause other damage to equipment or facilities. In such cases where chipping hammers are required, limit size of chipping hammer to 16 pounds or lighter, or use small electric chipping hammer, to reduce formation of micro-fractures in substrate concrete surface.

D. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of chipping hammer.

E. Remove unsound concrete to satisfaction of Jacobs' Engineer.

F. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw-cut edge.

G. Remove concrete adjacent to steel reinforcement to a minimum of 1-inch clearance around steel reinforcement for application and bonding of new repair mortar to circumference of exposed steel reinforcement if one or more of the following surface conditions exist:
   1. 50 percent or more of circumference around steel reinforcement is exposed during concrete removal.
   2. 25 percent or more of circumference around steel reinforcement is exposed during concrete removal and corrosion is present to extent that more than 25 percent loss of section has occurred.
   3. Otherwise evident that bond between existing concrete and steel reinforcement has been destroyed or has deteriorated as determined by Jacobs' Engineer.

H. Clean exposed steel reinforcement of loose rust and concrete splatter per recommendations of repair material manufacturer and in accordance with ASTM D4258.

I. Keep areas from which concrete has been removed free of dirt, dust, and water blasting waste slurry. Remove laitance and other bond inhibiting contaminates from prepared areas.

J. Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar as required by and in accordance with repair mortar manufacturer's printed instructions.

K. Collect and dispose of spent water and concrete debris from removal operations offsite in manner and location acceptable to Owner.

3.03 REINFORCEMENT INSTALLATION

A. Provide steel reinforcement when existing reinforcement is not exposed, and when mortar application is more than 3 inches deep, unless otherwise shown on Drawings.

B. Replace deteriorated steel reinforcement with new steel reinforcement equivalent in cross-sectional area to original steel reinforcement.

C. Install mesh anchors in accordance with mesh manufacturer's instructions.

D. Fasten steel reinforcement to mesh anchors with tie wire to prevent from moving during placement of repair mortar.

E. Lap reinforcement mesh a minimum of one mesh spacing and securely fasten mesh to mesh anchors, or to reinforcement fastened to mesh anchors, with tie wire at intervals no more than 12 inches to prevent movement during application of repair mortar.

F. Coat exposed new and existing steel reinforcement and reinforcement mesh with cementitious reinforcement coating at same time as substrate concrete is coated, as specified below, per repair mortar and cementitious reinforcement coating manufacturers' printed instructions.

3.04 PROTECTION

A. If cementitious coating or bonding agent is used, protect adjacent surfaces from over application. Promptly remove bonding agent applied beyond repair area.

B. Protect adjacent surfaces, and equipment, from being damaged by overshooting, rebound, and dust, as applicable for repair mortar system used.

3.05 REPAIR SYSTEM A – SHOTCRETE MORTAR PLACEMENT

A. Apply shotcrete mortar in accordance with manufacturer's instructions.

B. Do not reuse rebound materials.

C. Apply mortar using dry mix process, in accordance with ACI 506.2.

D. Shotcrete mortar shall emerge from nozzle in a steady, uninterrupted flow. If flow becomes intermittent, direct flow away from the Work until flow of mortar becomes constant.

E. Applied Shotcrete Mortar: Minimum thickness of 2 inches of cover over existing reinforcement, or to level of surrounding concrete surface, whichever results in thicker coat.

F. Nozzle Position: Hold nozzle approximately at right angles to and at a distance from surface in accordance with shotcrete repair mortar system manufacturer's instructions for type of application, nozzle, and air pressure used.

G. Steel Reinforcement Encasement:
   1. Modify procedure of shooting shotcrete mortar to better direct material around reinforcement bars.
   2. Prevent shotcrete mortar from building up on reinforcement steel when shooting on, around, through, and behind steel to eliminate voids.
   3. Provide dense void-free encasement of reinforcement steel.

H. Shotcreting More than One Layer: In accordance with shotcrete repair mortar system manufacturer's printed instructions.

I. Slice off excess material with a wire screed approximately 5 minutes to 10 minutes after initial set.

J. Apply finish to exposed shotcrete mortar surface to match existing surface and in accordance with manufacturer's instructions. Rebound Removal: Continuously throughout shotcrete mortar application, remove rebound, sand, and miscellaneous debris, and dispose off Site at an approved disposal facility.

K. Cure as specified in Article Curing.

3.06 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer's printed instructions.

B. After priming prepared substrate concrete surface per manufacturer's recommendations, apply mortar by low-pressure spraying equipment, unless noted otherwise.

C. Bonding Agent:
   1. Use bonding agent when manufacture required for hand applied areas, in accordance with repair mortar manufacturer's instructions.
   2. Application of repair mortar over bonding agent shall be completed within time frame recommended by bonding agent manufacturer.
   3. Consult with manufacturer for optimum and minimum acceptable degrees of surface tackiness of coat.

D. Work mortar firmly and quickly into repair area.

E. Finish repair mortar to match adjacent concrete surface.

F. Cure as specified in Article Curing.

3.07 REPAIR SYSTEM C – POLYMER-MODIFIED REPAIR MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer's printed instructions.

B. Bond Coat: Apply to prepared substrate concrete surface before application of mortar in accordance with repair mortar manufacturer's printed instructions. Do not apply more bond coat than can be covered with mortar before bond coat dries. Do not retemper bond coat.

C. Place mortar by hand or low-pressure spray and trowel to specified surface finish, in accordance with requirements of repair material's printed instructions.

D. Finish repair mortar to smooth even surface to match adjacent concrete surface.

E. Cure as specified in Article Curing, and in accordance with manufacturer's printed instructions.

3.08 CURING

A. Prior to curing, apply water fog to repair mortar system in accordance with repair mortar system manufacturer's printed instructions.

B. Cure in accordance with repair mortar manufacturer's printed instructions.

C. Where permitted by repair mortar manufacturer's printed instructions, commence water curing after repair mortar system application and when curing will not cause erosion of mortar.

D. Continuously cure repair mortar system for a period of 7 days.

E. Do not cure using curing compound or membrane, unless method is part of repair mortar system manufacturer's printed instructions and approval is obtained from Jacobs' Engineer.

F. Cure intermediate layers of repair mortar in accordance with repair mortar manufacturer's printed instructions.

G. Where curing compound is permitted by repair mortar system manufacturer, apply curing compound in accordance with Section 03 39 00, Concrete Curing.

3.09 FIELD QUALITY CONTROL

A. Sounding for Hollow Areas:
   1. Light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
   2. Mark hollow areas for removal and replacement.

B. Compression Strength Test:
   1. Test in accordance with ASTM C109/C109M, except modified by making samples using repair mortar.
   2. Obtain production samples of mixed wet mortar materials from nozzle, or mixer, during construction for compliance with Specifications for testing at 7 days, and 28 days.
   3. Provide a minimum of three samples for each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing.
   4. Record location where repair mortar is being applied at time production samples are obtained.

C. Direct Tension Bond Test:
   1. Testing only required where indicated by Engineer for specific locations as identified in the Pre-Repair Conference.
   2. In Situ Bond Testing: Perform tension bond test in accordance with ASTM C1583/C1583M.
   3. Record locations on in situ bond tests on each type of applied repair mortar.

D. Retest mortar repairs that do not meet test requirements.

E. Repair and fill holes using same repair mortar where core samples have been removed.

3.10 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge. Remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Failed Bond Tests: Remove affected areas of repair mortar represented by failed bond test results. Prepare substrate surface and reapply repair mortar as specified herein above.

E. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

3.11 CLEANING

A. Remove overshot shotcrete, Repair System A and low-pressure spray, Repair System B repair mortar and rebound materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of repair areas, finishing, and curing, and dispose offsite at an approved disposal site.

END OF SECTION

SECTION 03 01 33
REPAIR OF HORIZONTAL CONCRETE SURFACES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): T277, Standard Method of Test for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
2. ASTM International (ASTM):
   a. A1064/A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   b. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   c. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   d. C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   e. C78/C78M, Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
   f. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
   g. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   h. C348, Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars.
   i. C469, Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression.
   j. C496/C496M, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
   k. C666/C666M, Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
   l. C779/C779M, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
   m. C882/C882M, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
   n. C928/C928M, Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
   o. C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
   p. C1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

q. C1583/C1583M, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).

r. D638, Standard Test Method for Tensile Properties of Plastics.

s. D695, Standard Test Method for Compressive Properties of Rigid Plastics.

t. D4258, Standard Practice for Surface Cleaning Concrete for Coating.

u. D4259, Standard Practice for Abrading Concrete.

v. E699, Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components.

1.02 DEFINITIONS

A. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.

B. Defective Area: As defined in Section 03 30 00, Cast-in-Place Concrete.

C. High-Pressure Water Blasting (sometimes referred to as hydro-demolition): Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.

D. New Concrete: As defined in Section 03 30 00, Cast-in-Place Concrete.

1.03 SUBMITTALS

A. Action Submittals:

1. Product data sheets for each material supplied.
2. Drawings supplemented by photographs indicating location, size, estimated quantity, and proposed repair mortar system for each repair location.
3. Drawings indicating results of sounding for hollow areas including location, size, estimated quantity, of hollow-sounding areas for each repair location.

B. Informational Submittals:

1. Repair Mortar System: Manufacturer's preparation and installation instructions.
2. Written description of equipment proposed for concrete removal and surface preparation.

3. Certificates:
   a. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, that repair mortar systems are prepackaged, shrinkage compensated, specially designed for use on horizontal surfaces for intended exposure conditions.
   b. Mortar Manufacturer's Certificate of Proper Installation.
4. Statements of Qualification:
   a. Repair mortar system applicator.
   b. Independent Testing Laboratory.
5. Field and laboratory test results.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Repair Mortar System Applicator: Trained and experienced applicator endorsed by repair mortar system manufacturer.

B. Independent Testing Laboratory: Meet criteria stated in ASTM E699.

C. Pre-repair Conference:
   1. Required Meeting Attendees:
      a. Contractor.
      b. Repair Subcontractor.
      c. Jacobs' Engineer.
   2. Schedule and conduct prior to incorporation of respective products into Project. Notify Jacobs' Engineer of location and time.
   3. Agenda shall include, but not limited to:
      a. Review of field conditions. Conduct field observations of the Work to be performed.
      b. Based on above observations, confirm material selection and make Project specific repair method recommendations.
      c. Review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
      d. Other specified requirements requiring coordination.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer's printed instructions.

PART 2 PRODUCTS

2.01 REPAIR MORTAR SYSTEM NO. 3—SHRINKAGE COMPENSATED REPAIR MORTAR

A. One or two-component cement-based, flowable, shrinkage compensated repair mortar system.

B. Compressive Strength, ASTM C109/C109M:
   1. 1 Day: 2,500 psi minimum.
   2. 7 Days: 6,000 psi minimum.
   3. 28 Days: 8,000 psi minimum.

C. Flexural Strength, ASTM C348 at 28 Days: 770 psi minimum.

D. Modulus of Elasticity, ASTM C469 at 28 Days: 5.9 by 10^6 psi minimum.

E. Slant Shear Bond Strength, ASTM C882/C882M Modified:
   1. 7 Days: 2,150 psi minimum.
   2. 28 Days: 3, 000 psi minimum.

F. Freeze-thaw Resistance, ASTM C666/C666M, Procedure A, at 300 Cycles: 97.0 percent RDM.

G. Chloride Ion Permeability Based on Charge Passed, ASTM C1202 at 28 Days: 650 coulombs maximum.

H. Sulfate Resistance, ASTM C1012/C1012M after 6 Months: 0.01 percent length change maximum.

I. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 466 CI.
   2. Euclid Chemical Co., Cleveland, OH; Eucocrete Supreme.

2.02 REPAIR MORTAR SYSTEM NO. 4—METALLIC AGGREGATE REPAIR MORTAR

A. One or two-component cement-based, flowable, metallic-aggregate repair mortar system.

B. Compressive Strength, ASTM C109/C109M:
   1. 1 Day: 5,000 psi minimum.
   2. 7 Days: 8,800 psi minimum.
   3. 28 Days: 12,000 psi minimum.

C. Abrasion Resistance, ASTM C779/C779M, Procedure A: Eight times more wear resistance than plain concrete, 0.017 inch maximum.

D. Density: 215 pound per cubic foot.

E. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; Master T 300.
   2. Euclid Chemical Co. (The), Cleveland, OH; Super Euco-Top.

2.03 REPAIR MORTAR SYSTEM NO. 5—POLYMER MODIFIED REPAIR MORTAR

A. One or two-component, fast-setting, polymer modified cementitious based repair mortar system.

B. Compressive Strength, ASTM C109/C109M:
   1. 1 Day: 2,500 psi minimum.
   2. 7 Days: 5,000 psi minimum.
   3. 28 Days: 7,000 psi minimum.

C. Flexural Strength, ASTM C348 at 28 Days: 1,500 psi minimum.

D. Slant Shear Bond Strength, ASTM C882/C882M Modified at 28 Days: 2,000 psi minimum.

E. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 psi minimum.

F. Abrasion Resistance Depth of Wear, ASTM C779/C779M, Procedure A, at 60 Minutes: 0.033 inch maximum.

G. Drying Shrinkage, ASTM C157/C157M Modified, at 28 Days: 0.09 percent maximum.

H. Rapid Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 28 Days: Under 850 coulombs maximum.

I. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco T 310 CI.
   2. Euclid Chemical Co., Cleveland, OH; Duraltop Flowable Mortar.
   3. Sika Corp., Lyndhurst, NJ; SikaTop 122 PLUS.

2.04 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards, as specified in Section 03 30 00, Cast-in-Place Concrete.

2.05 REINFORCEMENT

A. Deformed Steel reinforcement: Per Section 03 21 00, Steel Reinforcement.

B. Mesh Reinforcement: Welded wire fabric flat sheets with spacing of wires and wire size in accordance with ASTM A1064/A1064M, wire 75 ksi minimum tensile strength per ASTM A1064/A1064M.

C. Tie Wire: 16-gauge, galvanized.

D. Mesh Anchors:
   1. Manufacturers and Products:
      a. Powers Fastening, Inc., Brewster, NY; Tie Wire Version of Power-Stud.
      b. Hilti Fastener Systems, Tulsa, OK; Kwik Bolt II HHDCA, 1/4-inch ceiling hanger.

2.06 CEMENTITIOUS BONDING AGENT AND REINFORCEMENT COATING

A. Cementitious adhesive, specifically formulated for bonding plastic portland cement concrete or mortar to hardened portland cement concrete.
   1. Mixed Bonding Agent Properties:
      a. Pot Life: 75 minutes to 105 minutes.
      b. Contact Time: 24 hours.
   2. Cured Cementitious Adhesive Properties:
      a. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 psi minimum.
      b. Flexural Strength, ASTM C348: 1,000 psi minimum.
      c. Slant Shear Bond Strength, ASTM C882/C882M:
         1) 2-Hour Open Time: 2,500 psi minimum.
         2) 24-Hour Open Time: 2,000 psi minimum.
   3. Bonding agent shall not produce a vapor barrier.
   4. Compatible with, and from same manufacturer as the, repair mortar system used.

B. Manufacturers and Products:
   1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco P 124.
   2. Sika Corp., Lyndhurst, NJ; Sika Armatec 110 EpoCem.
   3. Euclid Chemical Co., Cleveland, OH; Dural Prep AC.

2.07 EPOXY BONDING AGENT

A. Two-component, moisture insensitive, 100 percent solids epoxy resin.

B. Tensile Strength, ASTM D638, at 14 Days: 4,400 psi minimum.

C. Elongation at Break, ASTM D638: 1.49 percent minimum.

D. Compressive Strength, ASTM D695, at 28 Days for Application Temperature of 73 Degrees F to 77 Degrees F: 8,000 psi minimum.

E. Bond Strength, ASTM C882/C882M, at 14 Days: 1,800 psi minimum.

F. Pot Life, at 73 Degrees F to 77 Degrees F: 75 minutes minimum.

G. Manufacturer and Product: BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco ADH 326 when ambient temperature is 73 degrees F or higher.

2.08 EVAPORATION RETARDANT

A. As specified in Section 03 39 00, Concrete Curing.

2.09 CURING COMPOUND

A. As specified in Section 03 39 00, Concrete Curing.

PART 3 EXECUTION

3.01 GENERAL

A. New Concrete Work: Repair deficiencies in new concrete structures constructed under this Contract with applicable repair system.

B. Existing Concrete Work: Repair concrete as identified in Contract Documents.

3.02 APPLICATION

A. General:
   1. Repair Mortar System No. 3: Patches, joints, or overlays 1 inch thick or greater. Return to service in 7 days or more.
   2. Repair Mortar System No. 4: Heavy-duty joints or overlays 2 inches thick or greater. Return to service in 7 days or more.
   3. Repair Mortar System No. 5:
      a. Patches and Overlays: 1/4 inch to 3 inches thick.
      b. Return to service for foot traffic in 4 hours; wheel traffic in 7 days.
      c. Working Time: 30 minutes at 70 degrees F.
      d. Application Temperature Range: 45 degrees F to 90 degrees F.

3.03 PREPARATION

A. Identify unsound and deteriorated concrete by sounding techniques, or as directed by Jacobs' Engineer. Review proposed extent of repair with Jacobs' Engineer.

B. Remove unsound, deteriorated, or otherwise defective areas of concrete from Work areas.
   1. Use 8,000 psi minimum high-pressure water or abrasive blasting machine, as appropriate to suit Site conditions.
   2. Remove concrete to abrade substrate concrete surface to a minimum amplitude roughness of 3/16 inch measured between high and low points with a 3-foot-long straightedge, in accordance with ASTM D4259.
   3. Where final surface is required to be flush with existing adjacent surface, remove existing concrete depth as required for application of minimum thickness of repair mortar.

C. Do not use power-driven jackhammers, chipping hammers, scabblers, or scarifiers unless water blasting is not permitted or practical because of Site conditions, or may cause other damage to equipment or facilities. In such cases where chipping hammers are required, limit size of chipping hammer to 16 pounds or lighter, or use small electric chipping hammer, to reduce formation of micro-fractures in substrate concrete surface.

D. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of chipping hammer.

E. Remove unsound concrete to satisfaction of Jacobs' Engineer.

F. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw-cut edge.

G. Remove concrete adjacent to steel reinforcement to a minimum of 1-inch clearance around steel reinforcement for application and bonding of new repair mortar to entire circumference of exposed steel reinforcement if one or more of the following surface conditions exist:
   1. 50 percent or more of circumference around steel reinforcement is exposed during concrete removal.
   2. 25 percent or more of circumference around steel reinforcement is exposed during concrete removal and corrosion is present to extent that more than 25 percent loss of section has occurred.
   3. Otherwise evident that bond between existing concrete and steel reinforcement has been destroyed or has deteriorated as determined by Jacobs' Engineer.

H. Clean exposed steel reinforcement of loose rust and concrete splatter per recommendations of repair material manufacturer and in accordance with ASTM D4258.

I. Keep areas from which concrete has been removed free of dirt, dust, and water blasting waste slurry. Remove laitance and other bond inhibiting contaminates from prepared areas.

J. Preparation of Substrate Concrete Surface in Areas to Receive Repair Mortar System Nos. 3 and 5: Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar, as required by and in accordance with repair mortar manufacturer's printed instructions.

K. Preparation of Substrate Concrete Surface in Areas to Receive Repair Mortar System No. 4 Repair Mortar: Dry, in accordance with material manufacturer's printed instructions.

L. Spalled Joints:
   1. Saw cut edge 1 inch deep and 6 inches back from old joint.
   2. Remove unsound concrete and concrete between saw cut and joint.
   3. Place wood or fiber spacer to thickness of joint at joint line.

M. Overlays:
   1. Square cut edges to a minimum of 1/4 inch deep.
   2. Do not feather edge area.
   3. Perform special preparation recommended by mortar manufacturer.

N. Collect and dispose of spent water and concrete debris from removal operations offsite in manner and location acceptable to Owner.

3.04 REINFORCEMENT INSTALLATION

A. Replace deteriorated steel reinforcement with new steel reinforcement equivalent in cross-sectional area to original steel reinforcement.

B. Install mesh anchors in accordance with mesh manufacturer's instructions.

C. Fasten steel reinforcement to chairs or mesh anchors with tie wire to prevent from moving during placement of repair mortar.

D. Lap reinforcement mesh a minimum of one mesh spacing and securely fasten mesh to mesh anchors, or to steel reinforcement fastened to mesh anchors, with tie wire at intervals no more than 12 inches to prevent movement during application of repair mortar.

E. Coat exposed new and existing steel reinforcement with cementitious reinforcement coating at the same time as substrate concrete is coated, as specified below, per repair mortar and cementitious reinforcement coating manufacturers' printed instructions.

3.05 PROTECTION

A. If cementitious coating or bonding agent is used, protect adjacent surfaces from over application. Promptly remove bonding agent applied beyond repair area.

B. Protect adjacent surfaces, and equipment from spillage of repair mortar and dust, as applicable for repair mortar system used.

3.06 PLACEMENT

A. Repair Mortar System Nos. 3 and 5:
   1. Remove standing and free water from prepared area.
   2. Apply bond scrub coat of mortar to prepared surface in accordance with manufacturer's instructions. Do not apply more scrub coat of mortar than can be covered with repair mortar before scrub coat begins drying.
   3. Immediately place mixed repair mortar into prepared area from one side to the other side.
   4. Work material firmly into bottom and sides of patch to ensure a good continuous bond.
   5. Level repair mortar and screed to elevation of existing concrete.
   6. Finish to same texture as existing concrete around patch.
   7. Repair Mortar System No. 5 screed or use self-leveling mixture to obtain a uniform and plane surface.

B. Repair Mortar System No. 4:
   1. Remove free water from prepared area.
   2. Apply bonding agent to prepared surface in accordance with manufacturer's instructions. Do not apply more bonding agent than can be covered with mortar before bonding agent cures, past tacky to the touch.
   3. Immediately place mixed repair mortar into prepared area from one side to the other side.
   4. Work material firmly into bottom and sides of patch to ensure a good continuous bond.
   5. Level repair mortar and screed to elevation of existing concrete.
   6. Finish to same texture as existing concrete around patch.

C. Joint Repair:
   1. Remove joint spacer when repair mortar is hard enough that a pointed trowel will penetrate surface less than 1/2 inch.
   2. When repair mortar is cured and ready for use, fill joint in accordance with repair mortar system manufacturer's instructions.

3.07 FINISHING

A. Spray full strength evaporation retardant on fresh concrete to prevent rapid drying during hot and windy weather.

3.08 CURING

A. Repair Mortar System Nos. 3, 4, or 5: Apply curing compound in accordance with Section 03 39 00, Concrete Curing.

3.09 FIELD QUALITY CONTROL

A. Sounding for Hollow Areas:
   1. Chain drag or light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
   2. Mark hollow areas for removal and replacement.

B. Compression Strength Test:
   1. Test in accordance with ASTM C109/C109M, except modified by making samples using repair mortar.
   2. Obtain production samples of mixed materials from mixer during construction for compliance with Specifications.
   3. Provide minimum of three samples for each 200 square feet of mortar repair, and a minimum of three samples in total, whichever is greater for testing.
   4. Record location where repair mortar is being applied at time production samples are obtained.

C. Direct Tension Bond Test:
   1. Testing only required where indicated by Engineer for specific locations as identified in the Pre-Repair Conference.
   2. In Situ Bond Testing: Perform tension bond test in accordance with ASTM C1583/C1583M.
   3. Record locations on in situ bond tests on each type of applied repair mortar.
      a. Two core samples will be obtained and tested for each 2,000 square feet of repair work.
      b. Cores will be 2-1/2-inch or 3-inch diameter to a total depth equal to at least 2.5 times repair mortar thickness.

D. Retest mortar repairs that do not meet test requirements.

E. Repair and fill holes using same repair mortar where core samples have been removed.

3.10 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge, remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Failed Bond Tests: Remove affected areas of repair mortar represented by failed bond test results. Prepare substrate surface and reapply repair mortar as specified herein above.

E. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

3.11 CLEANING

A. Remove excess repair mortar materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of repair areas, finishing, and curing, and dispose offsite at approved disposal site.

END OF SECTION

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI):
      a. 117, Specification for Tolerances for Concrete Construction and Materials.
      a. 301, Specifications for Structural Concrete.
      b. 318, Building Code Requirements for Structural Concrete,
      c. 350, Code Requirements for Environmental Engineering Concrete Structures.

1.02 DEFINITIONS

A. Architectural Concrete: See definition in Section 03 30 00, Cast-in-Place Concrete.

B. Defective Areas: See definition in Section 03 30 00, Cast-in-Place Concrete.

C. Exposed Concrete: See definition in Section 03 30 00, Cast-in-Place Concrete.

1.03 DESIGN REQUIREMENTS

A. Design formwork in accordance with ACI 301 and ACI 318 to provide concrete finishes specified in Section 03 30 00, Cast-in-Place Concrete.

B. Unless otherwise specified, limit deflection of facing materials for concrete surfaces to comply with ACI 301. Limit deflection of facing materials to comply with tolerance limits established by Contract Documents and with tolerances required by equipment manufacturers. Coordinate tolerance requirements with equipment manufacturers.

1.04 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Formwork drawings signed and sealed by a licensed professional engineer in the state of the Project.
   2. Product Data:
      a. Form release agent.
      b. Form ties.
      c. Products to be used for sealing tie holes.

B. Informational Submittals: Statement of qualifications for formwork designer.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Formwork Designer: Formwork, falsework, and shoring design shall be designed by an engineer licensed in the state of Project.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Wall Forms and Underside of Slabs and Beams:
   1. Materials: Plywood, hard plastic finished plywood, overlaid waterproof particle board, or steel in “new and undamaged” condition, of sufficient strength and surface smoothness to produce specified finish.
   2. Where steel forms are used, treat steel surfaces to prevent rusting using products approved for use on steel forms.
   3. Circular Structure:
      a. Wall forms shall conform to circular shape of structure.
      b. Straight panels may be substituted for circular forms provided panels do not exceed 2 feet in horizontal width and angular deflection is no greater than 3-1/2 degrees per joint.

B. Column Forms:
   1. Rectangular Columns: As specified for walls.
   2. Circular Columns: Fabricated steel or fiber-reinforced plastic with bolted sections or spirally wound laminated fiber form. Internally treat with release agent for full height of column.

C. Sandblasted Surface Forms: Medium-density overlay plywood for flat concrete surfaces to be sandblasted.

D. Painted Surface Forms: High-density overlay plywood for flat concrete surfaces to be painted.

E. All Other Forms: Materials as specified for wall forms.

2.02 ACCESSORIES

A. Form Release Agent:
   1. Material:
      a. Shall not bond with, stain, or adversely affect concrete surfaces.
      b. Shall not impair subsequent treatments of concrete surfaces when applied to forms.
      c. Ready-to-use water-based material formulated to reduce or eliminate surface imperfections.

d. Contain no mineral oil or organic solvents.

2. Manufacturers and Products:
   a. BASF, Shakopee, MN; MBT MasterFinish RL 211.
   b. Cresset Chemical Company; Crete-Lease 20-VOC-Xtra.
   c. Atlas Tech Products; Atlas Bio-Guard.
   d. Dayton Superior; Clean Strip J1EF.
   e. Hill and Griffith Company; Grifcote LV-50-Plus.

B. Rustication Grooves and Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

C. Form Snap-Ties:
   1. Material: Steel.
   2. Spreader Inserts:
      a. Conical or spherical type.
      b. Design to maintain positive contact with forming material.
      c. Furnish units that will leave no metal closer than 1.5 inches to concrete surface when forms, inserts, and tie ends are removed.
   3. Wire ties not permitted.
   4. Flat bar ties for panel forms; furnish plastic or rubber inserts with minimum 1.5-inch depth and sufficient dimensions to permit patching of tie hole.

D. Form Snap-Ties with Water Stop:
   1. For water-holding structures, basements, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
      a. Integral steel waterstop 0.103-inch thick and 0.625-inch diameter tightly and continuously welded to tie.
      b. Neoprene water stop 3/16-inch thick and 15/16-inch diameter whose center hole is one-half diameter of tie, or molded plastic water stop of comparable size.
      c. Orient waterstop perpendicular to tie and symmetrical about center of tie.
      d. Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.

E. Through-Bolts:
   1. At Contractor's option, may be used as alternate to form snap-tie or form snap-tie with water stop.
   2. Tapered minimum 1-inch diameter at smallest end.
   3. Elastic Vinyl Plug for Through-Bolt Tie Holes:
      a. Design and size of plug to allow insertion with tool to enable plug to elongate and return to original length and diameter upon removal; forms watertight seal.

b. Manufacturers and Products:
   1) Dayton Superior, Miamisburg, OH; A58 Sure Plug.
   2) Greenstreak Group, Inc., St Louis, MO; X-Plug.

PART 3 EXECUTION

3.01 FORM SURFACE PREPARATION

A. Prior to coating surface, thoroughly clean form surfaces that will be in contact with concrete or that have been in contact with previously cast concrete, dirt, and other surface contaminants.

B. Exposed Wood Forms in Contact with Concrete: Apply form release agent as recommended by manufacturer.

C. Steel Forms: Apply form release agent as soon as they are cleaned to prevent discoloration of concrete from rust.

3.02 ERECTION

A. General: In accordance with ACI 301, unless otherwise specified.

B. Beveled Edges (Chamfer):
   1. Form 3/4-inch bevels at concrete edges, unless otherwise shown.
   2. Where beveled edges on existing adjacent structures are other than 3/4 inch, obtain Jacobs' Engineer's approval of size prior to placement of beveled edge.

C. Wall Forms:
   1. Do not reuse forms with damaged surfaces.
   2. Locate form ties and joints in uninterrupted uniform pattern.
   3. Inspect form surfaces prior to installation to ensure conformance with specified tolerances.

D. Form Tolerances:
   1. Provide forms in accordance with ACI 117 and ACI 318, and the following tolerances for finishes specified:
      a. See the Schedule of Concrete Finishes in Section 03 30 00, Cast-in-Place Concrete, for beam, column, and wall types related to required form tolerances.
      b. Wall Tolerances:
         1) Straight Vertical or Horizontal Wall Surface: Flat planes within tolerance specified.
         2) Wall Type W-A:
            a) Plumb within 1/4 inch in 10 feet or within 1 inch from top to bottom for walls over 40 feet high.

b) Depressions in Wall Surface: Maximum 5/16 inch when 10-foot straightedge is placed on high points in all directions.

3) Wall Type W-B:
   a) Plumb within 1/8 inch in 10 feet or within 1/2 inch from top to bottom for walls over 40 feet high.
   b) Depressions in Wall Surface: Maximum 1/8 inch when 10-foot straightedge is placed on high points in all directions.

4) Thickness: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.

5) Form Offset: Between adjacent pieces of formwork, facing material shall not exceed 1/4 inch.

c. Beams and Columns Tolerances:

1) Exposed Straight Horizontal and Vertical Surfaces: Flat planes within tolerances specified.

2) Lateral Alignment:
   a) Centerlines shall be within plus or minus 1/2 inch from dimensions shown.
   b) At intersections, centerlines shall intersect within plus or minus 1/2 inch of dimensions shown.

3) Beam Type B-A:
   a) Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
   b) Elevations: Within plus or minus 1/2 inch, except where tops of beams become part of finished slab. In this case refer to slab tolerances.

4) Column Type C-A:
   a) Physical Dimensions: Maximum 1/4 inch minus or 1/2 inch plus from dimension shown.
   b) Plumb within 1/4 inch in 10 feet in all directions with maximum 1/2 inch out-of-plumb at top with respect to bottom.

3.03 FORM REMOVAL

A. Nonsupporting forms, sides of beams, walls, columns, and similar parts of Work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement if:

1. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
2. Curing and protection operations are maintained.

B. Elevated Structural Slabs or Beams: In accordance with ACI 318, Chapter 6, and at such time as concrete has reached compressive strength equal to 80 percent of specified 28-day compressive strength as determined by test cylinders.

C. Form Ties: Remove conical inserts or through bolts and plug holes as specified in Section 03 30 00, Cast-in-Place Concrete.

3.04 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with CBC Chapter 17 requirements, is provided in Statement of Special Inspections Plan on Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Subcontractor Quality Control.

END OF SECTION

SECTION 03 15 00
CONCRETE JOINTS AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A36/A36M, Specification for Carbon Structural Steel.
   b. A615/A615M, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   c. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   d. A767/A767M, Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   e. C920, Specification for Elastomeric Joint Sealants.
   f. D226, Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   g. D227, Specification for Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing.
   h. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
   i. D1056, Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
   j. D1171, Standard Guide for Evaluating Nonwoven Fabrics.
   k. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
   l. D1752, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
   m. D2240, Standard Test Method for Rubber Property – Durometer Hardness.
2. Corps of Engineers (COE): CRD-C-572, Corps of Engineers Specifications for Polyvinylchloride Waterstop.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Waterstop: Details of splices, method of securing and supporting waterstop in forms to maintain proper orientation and location during concrete placement.

b. Construction Joints, Expansion Joints and Control Joints: Layout and location for each type. Include joints locations shown on Drawings, additional required joint locations and any proposed alternate locations.

2. Product Data:
   a. Waterstops.
   b. Bond breaker.
   c. Premolded joint fillers.
   d. Pourable joint fillers.
   e. Preformed control joints.
   f. Epoxy-coated dowels.
   g. Roofing felt.
   h. Accessories not specified in other sections.
3. Samples: PVC waterstop splice, joint, and fabricated cross of each size, shape, and fitting of waterstop.

B. Informational Submittals:
1. Certification:
   a. Letter stating compatibility between liquids being contained and materials used for:
      1) Waterstops.
      2) Joint fillers.
   b. Manufacturer's application instructions for:
      1) Bonding agent.
      2) Bond breaker.
2. Manufacturer's written instructions for product shipment, storage, handling, installation/application, and repair for:
   a. Waterstops.
   b. Bond breaker.
   c. Bonding agent.
   d. Premolded joint fillers.
   e. Pourable joint fillers (sealant proportions not required as products used only as a filler).
   f. Preformed control joints.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Verify delivered materials are in accordance with Specifications, regulatory agencies, and Manufacturer's product data sheets prior to unloading and storing onsite.

B. Storage: Store materials under tarps to protect from oil, dirt, and sunlight or as required by Manufacturer.

PART 2 PRODUCTS

2.01 PLASTIC WATERSTOP

A. Extruded from elastomeric plastic compound of which basic resin shall be prime virgin polyvinyl chloride (PVC). Compound shall not contain scrapped material, reclaimed material, or pigment.

B. Specific Gravity: Approximately 1.37.

C. Shore Durometer Type A Hardness: Approximately 80.

D. Performance Requirements: COE Specification CRD-C-572.

E. Type Required in All Expansion, Contraction, and Control Joints: 6 inches wide or 9 inches wide with center bulb and parallel longitudinal ribs or protrusions on each side of strip center, as indicated on Drawings.

F. Type Required in Construction Joints: Flat ribbed, 6 inches wide or 9 inches wide with parallel longitudinal ribs or protrusions on each side of strip center. Center bulb is optional.

G. Corrugated or tapered type waterstops are not acceptable.

H. Thickness: Constant from bulb edge (or center of waterstop) to outside stop edge.

I. Minimum Weight per Foot of Waterstop:
   1. 1.60 pounds for 3/8 inch by 6 inches.
   2. 2.30 pounds for 3/8 inch by 9 inches.

J. Factory Fabrications: Use only factory fabrications for intersections, transitions, and changes of direction.

K. Manufacturers and Products for Center Bulb Type:
   1. Use same manufacturers for flat ribbed profile:
      a. JP Specialties Inc., Earth Shield, Murrieta CA; PVC638 (6 inches by 3/8 inch), PVC938 (9 inches by 3/8 inch).
      b. Vinylex Corp., St Louis, MO; No. RB638H (6 inches by 3/8 inch) and No. RB938H (9 inches by 3/8 inch).
      c. Sika-Greenstreak, St. Louis, MO; Style 732 (6 inches by 3/8 inch) and Style 735 (9 inches by 3/8 inch).
      d. Durajoint, Garrettsville, OH; Type 9 (6 inches by 3/8 inch), and Type 10 (9 inches by 3/8 inch).
      e. BoMetals, Carrollton, GA: No. RCB-638LB (6 inches by 3/8 inch) and No. RCB-938NT (9 inches by 3/8 inch).
      f. Dacon Plastics LLC, Jacksonville, TX; No. RCB17 (6 inches by 3/8 inch) and No. RCB18 (9 inches by 3/8 inch).

2.02 WIRE LOOPED PLASTIC WATERSTOP

A. Furnish as alternative to plastic waterstops.

B. Same material and geometry as plastic waterstops.

C. Furnish with continuous galvanized wire looping at edge for convenience in positioning and securing stop in place in forms.

D. Manufacturer and Product: Paul Murphy Plastics, Roseville, MI; “Wire Stop Waterstop”; geometry numbers ACR 6380, ACR 9380, as shown on Paul Murphy Plastics Co. Drawing No. CCP-120-12M.

2.03 HYDROPHILIC WATERSTOP

A. For use at construction joints only, where new concrete is placed against existing concrete and as shown on Drawings.

B. Material shall be a nonbentonite hydrophilic rubber compound.

C. Manufacturers and Products:
   1. Greenstreak Plastic Products, St. Louis, MO; Hydrotite CJ-1020-2K with Leakmaster LV-1 adhesive and sealant.
   2. Adeka Ultra Seal, JLM Associates, Spearfish, SD; MC-2010M with 3M-2141 adhesive and P-201 sealant.

2.04 INJECTION-TYPE WATERSTOP

A. Reinjectable waterstop hose system for use where shown on Drawings.

B. Reinjectable Water Stop Hose:
   1. Fabricated of polyvinyl chloride (PVC) compound.
   2. Contain discharge openings to allow for disbursement of an injection material into expansion joint.
      a. Discharge openings designed to be sealed tight during concreting operation to prevent entry of mixing water and cement slurry.
   3. Allows free and uniform discharge of injection material over entire length of hose during injection process.
   4. Able to be internally cleaned by using water and vacuum pressure.

C. Injection Material: Hydrophilic or hydrophobic resin grout for use in expansion joints as recommended by reinjectable waterstop hose manufacturer.

D. Manufacturers and Products:
   1. Sika-Greenstreak, St. Louis, MO; SikaFuko VT Injection Hose System with Sika Inject 306.

2. Deneef Construction Chemicals, Inc., Houston, TX.; TRIOject Injection Hose System with Hydro Active Grout.

2.05 RETROFIT PVC WATERSTOP

A. Material: See Article Plastic Waterstop.

B. Factory Fabrications: Use only factory fabrications for intersections, transitions, and changes of direction

C. Stainless Steel Batten Bar: AISI Type 304. Size and configuration in accordance with manufacturer's instructions.

D. Manufacturers and Products:
   1. Vinylex Corp., St Louis, MO; No. RET638 (6 inches by 3/8 inch) and No. RET912 (9 inches by 3/8 inch).
   2. Sika-Greenstreak, St. Louis, MO; Style 609 (6 inches by 3/8 inch) and Style 667 (9 inches by 1/2 inch).
   3. BoMetals, Carrollton, GA; No. RF-912 (9 inches by 1/2 inch).

2.06 BOND BREAKER

A. Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape. Same width as joint that will adhere to premolded joint material or concrete surface.

B. Use bond prevention material as specified in Section 03 30 00, Cast-in-Place Concrete, except where bond breaker tape is specifically called for on Drawings.

2.07 PREMOLDED JOINT FILLER

A. Bituminous Type: ASTM D994 or ASTM D1751.

B. Sponge Rubber:
   1. Neoprene, closed-cell, expanded; ASTM D1056, Type 2C5, with compression deflection, 25 percent deflection (limits), 119 kPa to 168 kPa (17 psi to 24 psi) minimum. Use in joints for potable and nonpotable water containment structures.
   2. Manufacturer and Product: Monmouth Rubber and Plastics, Corp, Long Branch, NJ; Durafoam DK5151.

2.08 POURABLE JOINT FILLERS

A. General: Although product is a sealant, it is being specified as a filler to prevent debris accumulation and allow expansion and contraction under shrinkage and thermal loads. It does not need to meet proportional sealant geometry requirements.

B. Filler for Potable or Non-Potable Water Containment Structures:
   1. Multicomponent sealant, self-leveling or nonsag as required for level, sloping, or vertical joints.
   2. Color: White.
   3. Manufacturer and Product: Sika Corp., Lyndhurst, NJ; Sikaflex-2c SL.

C. Filler for Nonpotable Water Containment Structures Only:
   1. Pourable, two-component, cold-applied compound meeting ASTM C920, Type M, Grade P, Class 25, Use T.
   2. Color: Black.
   3. Manufacturer and Product: W.R. Meadows, Inc., Elgin, IL; Gardox.

2.09 STEEL EXPANSION JOINT DOWELS

A. Dowels: ASTM A36/A36M round smooth steel bars.

B. Bar Coating: As specified in Section 09 90 00, Painting and Coating, with factory-applied epoxy coating and factory or field applied lubrication coating.

2.10 ACCESSORIES

A. Joint Sealant: Polyurethane as specified in Section 07 92 00, Joint Sealants.

B. Roofing Felt: ASTM D226, Type II, 30-pound asphalt-saturated or equal weight of ASTM D227 coal-tar saturated felt.

C. Steel Reinforcement: As specified in Section 03 21 00, Steel Reinforcement.

D. Nails: Galvanized, as required for securing premolded joint filler.

E. Galvanized Rebar at Control Joints: ASTM A767/A767M and ASTM A615/A615M Grade 60 prior to galvanizing.

F. Ties for PVC Waterstop: “Hog Rings” or grommets for each edge at 12-inch maximum spacing.

PART 3 EXECUTION

3.01 GENERAL

A. Commence concrete placement after joint preparation is complete.

B. Time Between Concrete Pours: As specified in Section 03 30 00, Cast-in-Place Concrete.

3.02 SURFACE PREPARATION

A. Construction Joints: Prior to placement of abutting concrete, clean contact surface.
   1. Remove laitance and spillage from steel reinforcement and dowels.
   2. Roughen surface to minimum of 1/4-inch amplitude:
      a. Sandblast after concrete has fully cured.
      b. Water blast after concrete has partially cured.
      c. Green cut fresh concrete with high-pressure water and hand tools.
   3. Perform cleaning so as not to damage waterstop, if one is present.

B. Expansion Joint:
   1. Use wire brush or motorized device to mechanically roughen and thoroughly clean concrete surfaces on each side of joint from plastic waterstop to top of joint.
   2. Use dry, high-pressure air to remove dust and foreign material, and dry joint.
   3. Prime surfaces as required before placing joint filler.
   4. Avoid damage to waterstop.

C. Contraction Joint and Control Joint:
   1. Coat concrete surfaces above and below plastic waterstop with bond breaker.
   2. Do not damage or coat waterstop.

D. Construction Joint with Hydrophilic Waterstop:
   1. Follow hydrophilic waterstop manufacturer's written instructions.
   2. Clean debris, dirt, dust, and foreign material from concrete surface. Concrete surface must be smooth, clean, and dry. Grind concrete as required.

3.03 INSTALLATION OF WATERSTOPS

A. General:
   1. Continuous waterstop shall be installed in all construction joints in walls and slabs of water holding basins and channels and in walls of belowgrade structures, unless specifically noted otherwise.
   2. Join waterstop at intersections to provide continuous seal.
   3. Center waterstop on joint.
   4. Secure waterstop in correct position. Tie waterstop to steel reinforcement using grommets, "Hog Rings," or tiewire at maximum spacing of 12 inches. Do not displace waterstop during concrete placement.
   5. Repair or replace damaged waterstop.
   6. Place concrete and vibrate to obtain impervious concrete in vicinity of joints.

7. Joints in Footings and Slabs:
   a. Ensure that space beneath horizontal waterstop is completely filled with concrete.
   b. During concrete placement, make visual inspection of waterstop area.
   c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift ribbed waterstop to confirm full consolidation without voids, then place remaining concrete to full height of slab.

B. Plastic Waterstops:
   1. Install in accordance with manufacturer's written instructions.
   2. Splice in accordance with waterstop manufacturer's written instructions using Teflon-coated thermostatically controlled heating iron at approximately 380 degrees F.
      a. Allow at least 10 minutes before new splice is pulled or strained in any way.
      b. Finished splices shall provide cross section that is dense and free of porosity with tensile strength of not less than 80 percent of unspliced materials.
      c. Use only factory made waterstop fabrications for all intersections, changes of directions and transitions.
      d. Field splice permitted only for straight butt welds.
   3. Wire looped plastic waterstop may be substituted for plastic waterstop.

C. Hydrophilic Waterstop:
   1. Install in accordance with manufacturer's written instructions.
   2. Provide minimum of 2-1/2 inches of concrete cover over waterstop. When structure has two layers of steel reinforcement, locate centered between layers of steel or as shown.
   3. Apply adhesive to concrete surface and allow to dry for specified time before applying waterstop strip.
   4. Lap ends of waterstop strip together at splices and corners and join with sealant.
   5. Verify that waterstop is anchored firmly in place before placing concrete. Do not allow vibrator to come into contact with waterstop.
   6. Lap hydrophilic waterstop 2 feet minimum with intersecting plastic waterstops.

D. Injection-Type Waterstop:
   1. Install reinjectable waterstop hose in accordance with manufacturer's instructions.
   2. After concrete has been placed and cured for a minimum of 28 days, inject specified injection material into reinjectable waterstop hose in accordance with manufacturer's instructions.

3. Upon completion of injection process, clean out remaining injection material in hose in accordance with manufacturer's instructions to allow for future injections.

E. Retrofit PVC Waterstop:

1. Install retrofit PVC waterstop in accordance with manufacturer's instructions.
2. Prepare surface of existing concrete in accordance with manufacturer's instructions. Apply a bed of epoxy, approximately 1/8 inch thick and slightly wider than waterstop base, to concrete surface.
3. Place the retrofit waterstop in place prior to the curing of the epoxy, securing waterstop with stainless steel batten bars and stainless steel post-installed anchors. Fasten one side at a time, making sure retrofit profile is positioned to eliminate any air pockets or voids between waterstop and existing concrete.
4. Butt splice by thermally fusing the free ends together prior to attaching to wall in accordance with manufacturer's instructions.

3.04 EXPANSION JOINT INSTALLATION

A. Premolded Joint Filler:

1. Sufficient in width to completely fill joint space where shown.
2. Install per manufacturer's written instructions.
3. If waterstop is in joint, cut premolded joint filler to butt tightly against waterstop and concrete face.
4. Precut premolded joint filler to required depth at locations where joint filler or sealant is to be applied.
5. Form cavities for joint filler with either precut, premolded joint filler, or smooth removable accurately shaped material. Entire joint above waterstop, in slabs, shall be formed and removed so that entire space down to waterstop can be filled with the pourable joint filler.
6. Vibrate concrete thoroughly along joint form to produce dense, smooth surface.

B. Bituminous Type Premolded Joint Filler:

1. Drive nails approximately 1 foot 6 inches on center through filler, prior to installing, to provide anchorage embedment into concrete during concrete placement.
2. Secure premolded joint filler in forms before concrete is placed.

C. Sponge Rubber Joint Filler: Install per manufacturer's written instructions.

D. Pourable Joint Filler:
   1. General:
      a. Install in accordance with the manufacturer's written instructions, except as specified below:
         1) Apply primer prior to pouring joint filler.
         2) Fill entire joint above the waterstop with joint filler as shown.
         3) Use masking tape on top of slabs at sides of joints; clean spillage. Remove masking tape afterwards.
         4) Sealant products used as fillers need not meet sealant geometry parameters. Do not use backing rods.

E. Steel Expansion Joint Dowels:
   1. Install coated and lubricated bars parallel to wall or slab surface and in true horizontal position perpendicular to joint in both plan and section view, so as to permit joint to expand or contract without bending dowels.
   2. Secure dowels tightly in forms with rigid ties.
   3. Install steel reinforcement in concrete as shown.

3.05 CONTRACTION JOINT INSTALLATION

A. Place bond breaker above and below waterstop.

B. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface. Do not roughen surface.

3.06 CONTROL JOINT INSTALLATION

A. Locate galvanized steel reinforcement as shown.

B. Install waterstop.

C. Vibrate concrete thoroughly along the joint form to produce a dense, smooth surface. Do not roughen surface.

D. Install bond breaker to concrete surfaces above and below waterstop.

3.07 PREFORMED CONTROL JOINTS

A. Use only where specifically shown; do not use in water-holding basins.

B. Locate slightly below top of slab.

C. Install in accordance with manufacturer's written instructions in straight, full-length pieces.

D. Steel Strip Type with Preformed Groove: Brace to withstand pressure of concrete during and after placement using only approved stakes and other secondary installation materials.

3.08 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site for installation assistance, inspection, and certification of proper installation for products specified.

3.09 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with CBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Subcontractor Quality Control.

END OF SECTION

SECTION 03 21 00
STEEL REINFORCEMENT

PART 1 GENERAL

1.01 GENERAL

A. Steel reinforcement shall comply with ACI 301 and as modified in the following.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI):
      a. 117, Specification for Tolerances for Concrete Construction and Materials.
      b. 301, Specifications for Structural Concrete.
      c. SP-66, Detailing Manual.
   2. American Welding Society (AWS): D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
   3. ASTM International (ASTM):
      a. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      b. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
      c. A767/767M, Standard Specification for Zinc-Coated (Galvanized) Steel bars for Concrete Reinforcement
      d. A775/A775M, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
      e. A1064/A1064M, Standard Specification for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   4. Concrete Reinforcing Steel Institute (CRSI):
      a. Placing Reinforcing Bars.
      b. Manual of Standard Practice.
   5. International Code Council (ICC): Evaluation Services Report.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings prepared in accordance with ACI 301 and ACI SP-66:
      a. Bending lists.
      b. Placing drawings.
   2. Welded, metallic sleeve splice, and mechanical threaded connection.

B. Informational Submittals:
   1. Lab test reports for steel reinforcement showing stress-strain curves and ultimate strengths.
   2. Mechanical Threaded Connections:
      a. Current ICC Evaluation Services Report or equivalent code agency report listing findings to include acceptance, special inspection requirements, and restrictions.
      b. Verification device threads have been tested and meet requirements for thread quality, in accordance with manufacturer's published methods.
      c. Manufacturer's instructions.
   3. Welding Qualification: Prior to welding, submit welder qualifications and nondestructive testing procedures in accordance with Section 05 05 23, Welding.
   4. Test results of field testing.

1.04 QUALITY ASSURANCE

A. Welder Qualifications: Certified in accordance with AWS D1.4/D1.4M.

1.05 DELIVERY, STORAGE, AND HANDLING

A. In accordance with ACI 301 and recommendations of CRSI Placing Reinforcing Bars.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars:
   1. Includes stirrups, ties, and spirals.
   2. ASTM A615/A615M, Grade 60, where welding is not required.
   3. ASTM A706/A706M, Grade 60, for reinforcing to be welded.
   4. ASTM A767/767M, Grade 60, for galvanized bars.

B. Mechanical Splices and Connections:
   1. Metal Sleeve Splice:
      a. Furnish with cast filler metal, capable of developing, in tension or compression, 125 percent of minimum tensile strength of bar.
      b. Manufacturer and Product: Erico Products, Inc., Cleveland, OH; Cadweld T-Series.
   2. Mechanical Threaded Connections:
      a. Furnish metal coupling sleeve with internal threads engaging threaded ends of bars developing in tension or compression 125 percent of yield strength of bar.

b. Manufacturers and Products:
   1) Erico Products, Inc., Cleveland, OH; Lenton Reinforcing Steel Couplers.
   2) Erico Products, Inc., Cleveland, OH; Lenton Lock Mechanical Rebar Splicing System.
   3) Richmond Screw Anchor Co., Inc., Fort Worth, TX; Richmond DB-SAE Dowel Bar Splicers.

C. Welded Wire Fabric:
   1. ASTM A1064, using wire of 75 ksi minimum tensile strength.
   2. Furnish flat sheets only, rolled sheets not permitted.

2.02 ACCESSORIES

A. Tie Wire:
   1. Black, soft-annealed 16-gauge wire.
   2. Nylon-, epoxy-, or plastic-coated wire.

B. Bar Supports and Spacers:
   1. Use precast concrete bar supports and side form spacers, unless noted otherwise. Do not use other types of supports or spacers.
   2. Bar supports shall have sufficient strength and stiffness to carry loads without failure, displacement, or significant deformation. Space bar supports so minimum concrete cover is maintained for reinforcing between supports.
   3. Use only precast concrete bar supports where concrete surfaces are exposed to weather, earth, water, chloride intrusion, or corrosive chemicals. Bar supports shall be nonconductive and have geometry and bond characteristics that deter movement of moisture from the surface to the reinforcement.
   4. Precast concrete supports shall have same minimum strength and shall be made from same materials as that of the concrete in which they are to be embedded. Precast concrete supports shall be cast and properly cured for at least 7 days before use and shall have a wire or other device cast into each block for the purpose of attaching them securely to steel reinforcement.
   5. In Beams, Columns, Walls, and Slabs Exposed to View after Form Removal: Use small precast concrete blocks made of same color as concrete in which they are embedded. All-plastic bar supports and side form spacers may be used, except where surface is exposed as described above.
   6. Design and fabricate special bar supports for top reinforcing bars in slabs where standard bar supports do not possess necessary geometry, strength, or stiffness.
   7. Plastic Bar Supports: Manufactured by Aztec Concrete Accessories, Bloomington, CA.

8. Precast Concrete Supports:
   a. Total bond precast, high-performance concrete bar supports as supplied by:
      1) Dayton Superior, Miamisburg, OH, Dobies.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify Jacobs' Engineer when reinforcing is ready for inspection and allow sufficient time for inspection prior to placing concrete.

B. Clean reinforcing bars of loose mill scale, oil, earth, and other contaminants.

3.02 INSTALLATION

A. Bundle or space bars, instead of field bending where construction access through reinforcing is necessary.

B. Splicing:
   1. Minimum length of lap splices shall comply with table in Contract Documents.
   2. Use lap splices, unless otherwise shown or permitted in writing by Jacobs' Engineer.
   3. Welded Splices: Accomplish by full penetration groove welds and develop a minimum of 125 percent of yield strength of bar.
   4. Stagger splices in adjacent bars where indicated.

C. Mechanical Splices and Connections:
   1. Use only in areas specifically approved in writing by Jacobs' Engineer.
   2. Install threaded rods as recommended by manufacturer with threads totally engaged into coupling sleeve and in accordance with ICC Evaluation Services Report or equivalent code agency report.
   3. For metal sleeve splice, follow manufacturer's installation recommendations.
   4. Maintain minimum edge distance and concrete cover.

D. Tying Reinforcing Bars:
   1. Tie every other intersection on mats made up of Nos. 3, 4, 5, and 6 bars to hold them firmly at required spacing.
   2. Bend tie wire away from concrete surface to provide clearance of 1 inch from surface of concrete to tie wire.

E. Reinforcement Around Openings: On each side and above and below pipe or opening, place an equivalent area of steel bars to replace steel bars cut for opening. Extend steel reinforcing a standard lap length beyond opening at each end.

F. Welding Reinforcement:
   1. Only ASTM A706/A706M bars may be welded.
   2. Do not perform welding until welder qualifications are approved.

G. Straightening and Rebending: Field bending of steel reinforcement bars is not permitted.

H. Unless permitted by Jacobs' Engineer, do not cut reinforcing bars in field.

3.03 WELDED WIRE FABRIC INSTALLATION

A. Use only where specifically shown.

B. Extend fabric to within 2 inches of edges of slab and lap splices at least 1-1/2 courses of fabric or minimum 8 inches.

C. Tie laps and splices securely at ends and at least every 24 inches with tie wire.

D. Place welded wire fabric on concrete blocks and rigidly support equal to that provided for reinforced bars. Do not use broken concrete, brick, or stone.

E. Do not use fabric that has been rolled. Install flat sheets only.

3.04 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with CBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on Drawings. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Subcontractor Quality Control.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 117, Specification for Tolerances for Concrete Construction and Materials.
   b. 301, Specifications for Structural Concrete.
   c. 305.1, Specification for Hot Weather Concreting.
   d. 306.1, Standard Specification for Cold Weather Concreting.
   e. 350.1, Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures.
   f. CP-1, Technical Workbook for ACI Certification of Concrete Field Testing Technician – Grade 1.
2. ASTM International (ASTM):
   a. C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   b. C33/C33M, Standard Specification for Concrete Aggregates.
   c. C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   d. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   e. C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens).
   f. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
   g. C150/C150M, Standard Specification for Portland Cement.
   h. C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
   i. C227, Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
   j. C231/C231M, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   k. C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
   l. C494/C494M, Standard Specification for Chemical Admixtures for Concrete.

m. C595/C595M, Standard Specification for Blended Hydraulic Cements.

n. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

o. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

p. C979/C979M, Standard Specification for Pigments for Integrally Colored Concrete.

q. C989, Standard Specification for Slag Cement for Use in Concrete and Mortars.

r. C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.

s. C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

t. C1074, Standard Practice for Estimating Concrete Strength by the Maturity Method.

u. C1077, Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.

v. C1218/C1218M, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.

w. C1240, Standard Specification for Silica Fume Used in Cementitious Mixtures.

x. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).

y. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.

z. C1567, Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).

aa. C1582/C1582M, Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete.

bb. C1602/C1602M, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

cc. D4580, Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.

dd. E329, Standard Specification for Agencies Engaged in Construction Inspection, Special Inspection, or Testing Materials Used in Construction.

3. National Ready Mixed Concrete Association (NRMCA).

1.02 DEFINITIONS

A. Basin Train: Series of interconnected basins that operate as a unit with same water level.

B. Cold Weather: When ambient temperature is below 40 degrees F or is approaching 40 degrees F and falling.

C. Contractor's Licensed Design Engineer: Individual representing Contractor who is licensed to practice engineering as defined by statutory requirements of professional licensing laws in state or jurisdiction in which Project is to be constructed.

D. Defective Area: Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than 3/4 inch in diameter, cracks in liquid containment structures and below grade habitable spaces with visible leakage or that are 0.005-inch wide and wider, and cracks in other structures that are 0.010-inch wide and wider, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.

E. Exposed Concrete: Concrete surface that can be seen inside or outside of structure regardless of whether concrete is above water, dry at all times, or can be seen when structure is drained.

F. Hot Weather: As defined in ACI 305.1.

G. Hydraulic Structure: Liquid containment structure.

H. New Concrete: Less than 60 days old.

I. Slurry Mixture: Mixture of sand, 3/8-inch maximum nominal aggregate size, cement, and water for wall construction joints with waterstop.

1.03 SUBMITTALS

A. Action Submittals:

1. Mix Designs:

a. Contain proportions of materials and admixtures to be used on Project, signed by mix designer.

b. Documentation of average strength for each proposed mix design in accordance with ACI 301.

c. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, for the following:
   1) Portland cement.
   2) Fly ash.
   3) Slag cement.
   4) Aggregates, including specified class designation for coarse aggregate.
   5) Admixtures.
   6) Concrete producer has verified compatibility of constituent materials in design mix.

d. Test Reports:
   1) Cement: Chemical analysis report.
   2) Supplementary Cementitious Materials: Chemical analysis report and report of other specified test analyses.
   3) Water-Soluble Chloride-Ion Content in Hardened Concrete: Unless otherwise permitted, in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.
   4) Shrinkage Test Results: In accordance with ASTM C157/ C157M as modified herein.

e. Aggregates:
   1) Coarse Aggregate Gradation: List gradings and percent passing through each sieve.
   2) Fine Aggregate Gradation: List gradings and percent passing through each sieve.
   3) Percent of fine aggregate weight to total aggregate weight.
   4) Deleterious substances in fine aggregate per ASTM C33/C33M, Table 2.
   5) Deleterious substances in coarse aggregate per ASTM C33/C33M, Table 4.
   6) Test Reports:
      a) Alkali Aggregate Reactivity: Aggregate shall be classified as nonpotentially reactive in accordance with Article Concrete Mix Design. Include documentation of test results per applicable standards.

f. Admixtures: Manufacturer's catalog cut sheets and product data sheets for each admixture used in proposed mix designs.

2. Product Data: Specified ancillary materials.

3. Detailed plan for curing and protection of concrete placed and cured in cold weather. Details shall include, but not be limited to, the following:
    a. Procedures for protecting subgrade from frost and accumulation of ice or snow on reinforcement, other metallic embeds, and forms prior to placement.
    b. Procedures for measuring and recording temperatures of reinforcement and other embedded items prior to concrete placement.
    c. Methods for temperature protection during placement.
    d. Types of covering, insulation, housing, or heating to be provided.
    e. Curing methods to be used during and following protection period.
    f. Use of strength accelerating admixtures.
    g. Methods for verification of in-place strength.
    h. Procedures for measuring and recording concrete temperatures.
    i. Procedures for preventing drying during dry, windy conditions.
4. Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F. Plan shall include, but not be limited to, the following:
    a. Procedures for measuring, and recording temperatures of reinforcement and other embedded items prior to concrete placement.
    b. Use of retarding admixture.
    c. Methods for controlling temperature of reinforcement and other embedded items and concrete materials before and during placement.
    d. Types of shading and wind protection to be provided.
    e. Curing methods, including use of evaporation retardant.
    f. Procedures for measuring and recording concrete temperatures.
    g. Procedures for preventing drying during dry, windy conditions.
5. Thermal Control Plan: For concrete sections with a minimum specified dimension that is greater than 3 feet.

B. Informational Submittals:
1. Preinstallation Conference minutes.
2. Manufacturer's application instructions for bonding agent and bond breaker.
3. Manufacturer's Certificate of Compliance to specified standards:
    a. Bonding agent.
    b. Bond breaker.

4. Statement of Qualification:
   a. Batch Plant: Certification as specified herein.
   b. Mix designer.
   c. Installer.
   d. Testing agency.
5. Field test reports.
6. Recorded temperature data from concrete placement where specified.
7. Tightness test results.
8. Concrete Delivery Tickets:
   a. For each batch of concrete before unloading at Site.
   b. In accordance with ASTM C94/C94M, including requirements 14.2.1. through 14.2.10.
   c. Indicate amount of mixing water withheld and maximum amount that may be permitted to be added at Site.

1.04 QUALITY ASSURANCE

A. Concrete construction shall conform to requirements of ACI 117 and ACI 301, except as modified herein.

B. Qualifications:
   1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.
   2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of the Work. Requirement may be waived if individual is Contractor's Licensed Design Engineer.
   3. Testing Agency: Unless otherwise permitted, an independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
      a. Where field testing is required of Contractor, personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
      b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Thermal Control Plan:

1. When required, shall include the following minimum requirements:

a. Calculated or measured adiabatic temperature rise of concrete.

b. Upper limit for concrete temperature at time of placement.

c. Description of specific measures and equipment that will be used to ensure maximum temperature in placement will not exceed specified maximum temperature limit.

d. Calculated maximum temperature in placement based on expected conditions at time of placement and use of proposed measures to control temperatures.

e. Description of specific measures and equipment that will be used to ensure temperature difference will not exceed specified temperature difference limit.

f. Calculated maximum temperature difference in placement based on expected conditions at time of placement and use of proposed measures to control temperature differences.

g. Description of equipment and procedures that will be used to monitor and log temperatures and temperature differences.

h. Drawing showing locations for temperature sensors in placement.

i. Description of format and frequency of providing temperature data to Jacobs' Engineer.

j. Description of measures to address and reduce excessive temperatures and temperature differences, if they occur.

k. Description of curing procedures, including materials and methods, and curing duration.

l. Description of formwork removal procedures to ensure temperature difference at temporarily exposed surface will not exceed temperature difference limit, and how curing will be maintained.

m. Alternate temperature limits when permitted by Jacobs' Engineer.

1) Determination of alternate temperature limits shall be based on detailed thermal and crack analyses.

2) Analyses shall be stamped by Contractor's Licensed Design Engineer.

n. If concrete design mixture is changed, thermal control plan must be updated.

D. Preinstallation Conference:

1. Required Meeting Attendees:

a. Contractor, including pumping, placing and finishing, and curing subcontractors.

b. Ready-mix producer.
c. Admixture representative.
d. Testing and sampling personnel.
e. Jacobs' Engineer.

2. Schedule and conduct prior to incorporation of respective products into Project. Notify Jacobs' Engineer of location and time.
3. Agenda shall include:
   a. Admixture types, dosage, performance, and redosing at Site.
   b. Mix designs, test of mixes, and Submittals.
   c. Placement methods, techniques, equipment, consolidation, and form pressures.
   d. Slump and placement time to maintain slump.
   e. Finish, curing, and water retention.
   f. Thermal control plan.
   g. Protection procedures for weather conditions.
   h. Other specified requirements requiring coordination.
4. Conference minutes as specified in Section 01 31 19, Project Meetings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cementitious Materials:
1. Cement:
   a. Portland Cement: Unless otherwise specified, conform to requirements of ASTM C150/C150M.
   b. Blended Hydraulic Cement:
      1) Unless otherwise specified, conform to requirements of ASTM C595/C595M.
      2) Portland cement used in blended hydraulic cement, conform to requirements of ASTM C150/C150M.
   c. Furnish from one source.
2. Supplementary Cementitious Materials (SCM):
   a. Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618, except as modified herein:
      1) Shall not be produced from process that has utilized hazardous or potentially hazardous materials.
      2) ASTM C618, Table 1, Loss on Ignition: Unless permitted otherwise, maximum 3 percent.

b. Slag Cement: In accordance with ASTM C989, Grade 100 or Grade 120.

1) Shall not be produced from process that has utilized hazardous or potentially hazardous materials.

B. Aggregates: Unless otherwise permitted, furnish from one source for each aggregate type used in a mix design.

1. Normal-Weight Aggregates:

a. In accordance with ASTM C33/C33M, except as modified herein.

1) Class Designation: 4S, unless otherwise specified.

b. Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.

c. Alkali Silica Reactivity: See Article Concrete Mix Design.

2. Fine Aggregates:

a. Clean, sharp, natural sand.

b. ASTM C33/C33M.

c. Limit deleterious substances in accordance with ASTM C33/C33M, Table 2 and as follows:

1) Limit material finer than 75-µm (No. 200) sieve to 5 percent mass of total sample.

2) Limit coal and lignite to 1.0 percent.

3. Coarse Aggregate:

a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).

b. Limit deleterious substances in accordance with ASTM C33/C33M, Table 4 for specified class designation.

C. Admixtures: Unless otherwise permitted, furnish from one manufacturer.

1. Characteristics:

a. Compatible with other constituents in mix.

b. Contain at most, only trace amount chlorides in solution.

c. Furnish type of admixture as recommended by manufacturer for anticipated temperature ranges.

2. Air-Entraining Admixture: ASTM C260/C260M.

3. Water-Reducing Admixture: ASTM C494/C494M, Type A or Type D.

4. Retarding Admixture: ASTM C 494/C 494M, Type B.

5. Accelerating Admixture: ASTM C 494/C 494M, Type C.

6. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F or Type G.
7. Shrinkage Reducing Admixture:
   a. Manufacturers and Products:
      1) BASF Admixtures Inc., Shakopee, MN; Tetraguard AS20.
      2) Euclid Chemical Co., Cleveland, OH; Eucon SRA Series.
      3) W. R. Grace & Co., Cambridge, MA; Eclipse Series.
8. Do not use calcium chloride as an admixture.
9. Admixtures with no standard, ASTM or other, designation may be used where permitted.

D. Water and Ice: Mixing water for concrete and water used to make ice shall be potable water, unless alternative sources of water are permitted.
   1. Water from alternative sources shall comply with requirements of ASTM C1602/C1602M, and concentration of chemicals in combined mixing water shall be less than:
      a. Chloride Content: 1,000.
      b. Sulfate Content as SO_4: 3,000 ppm.
      c. Alkalis as (Na_2O + 0.658 K_2O): 600 ppm.
      d. Total Solids by Mass: Less than 50,000 ppm.

2.02 ANCILLARY MATERIALS

A. Bonding Agent: Unless otherwise specified, in accordance with the following:
   1. ASTM C881/C881M, Type V.
   2. Two-component, moisture insensitive, 100 percent solids epoxy.
   3. Consult manufacturer for surface finish, pot life, set time, vertical or horizontal application, and forming restrictions.
   4. Manufacturers and Products:
      a. BASF Building Systems Inc., Shakopee, MN; MasterEmaco ADH 326.
      b. Euclid Chemical Co., Cleveland, OH; Euco # 352 Epoxy System LV.
      c. Prime Resins, Conyers, GA; Prime Bond 3000 to 3900 Series.
      d. Sika Chemical Corp., Lyndhurst, NJ; Sikadur 32 Hi-Mod.

B. Bond Breaker:
   1. Nonstaining type, providing positive bond prevention.
   2. Manufacturers and Products:
      a. Dayton Superior Corporation, Kansas City, KS; EDOCO Clean Lift Bond Breaker.

b. Nox-Crete Products Group, Omaha, NE; Silcoseal Select.

C. Repair Material:

1. In accordance with requirements of Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces.
2. In accordance with requirements of Section 03 01 33, Repair of Horizontal Concrete Surfaces.

D. Crack Repair: In accordance with requirements of Section 03 64 23, Epoxy Resin Injection Grouting.

2.03 CONCRETE MIX DESIGN

A. General:

1. See Supplement at the end of this section for mix design requirements for each class of concrete used on Project.
2. Prepare design mixtures for each type and strength of concrete, selecting and proportioning ingredients in accordance with requirements of ACI 301, unless otherwise specified.
3. Selection of constituent materials and products in mix design are optional, unless specified otherwise.
4. Unless otherwise permitted, use water-reducing admixture or water-reducing admixture and high-range, water-reducing admixture in pumped concrete, in concrete with a water-cementitious materials ratio below 0.50, and in concrete that is part of a liquid-containment structure.
5. Unless otherwise permitted, use water-reducing admixture and high-range, water-reducing admixture in columns, piers, pilasters, and walls.
6. Use water-reducing admixture or high-range, water-reducing admixture to achieve fresh properties that facilitate handling, placing, and consolidating of concrete, and specified hardened properties.
7. Use water-reducing and retarding admixture when anticipated high temperatures, low humidity, or other adverse placement conditions can adversely affect fresh properties of concrete.
8. Unless otherwise specified, desired fresh properties of concrete shall be determined by Contractor, and coordinated with concrete producer. Fresh properties of concrete shall remain stable to satisfaction of Contractor, for duration of placement and consolidation, and shall remain in conformance with requirements of Contract Documents.
9. Contractor is encouraged to consider using environmentally sustainable concrete mix design technologies such as use of supplementary cementitious materials and aggregate packing.

B. Potential alkali-aggregate reactivity of concrete:

1. Do not use aggregates known to be susceptible to alkali-carbonate reaction (ACR).
2. Aggregates shall have been tested to determine potential alkali-aggregate reactivity in concrete in accordance with ASTM C1260 or ASTM C1567.
   a. Aggregates that indicate expansion greater than 0.10 percent at 16 days after casting shall not be used unless they have been shown to be nondeleteriously reactive in accordance with ASTM C227 or ASTM C1293, with less than 0.04 percent expansion at 1 year for cement-aggregate combinations or less than 0.04 percent expansion at 2 years for combinations with pozzolan or slag.
   b. Alkali content of cement used in proposed concrete mixture shall not be greater than alkali content of cement used in test for potential alkali-aggregate reactivity.
   c. Use low-alkali cement or incorporate pozzolans into concrete mixture as necessary to satisfy testing for potential alkali reactivity.

C. Proportions:

1. Design mix to meet aesthetic, durability, and strength requirements.
2. Where fly ash is included in mix, minimum fly ash content shall be a minimum of 15 percent of weight of total cementitious materials.

D. Concrete Shrinkage Limits:

1. Where shrinkage limits are specified, design mix for following shrinkage limits and test in accordance with ASTM C157/C157M, with the following modifications:
   a. Prisms shall be moist cured for 7 days prior to 28-day drying period.
   b. Comparator reading at end of 7-day moist cure shall be used as initial length in length change calculation.
   c. Reported results shall be average of three prisms.
   d. If shrinkage of a specimen departs from average of that test age by more than 0.004 percent, disregard results obtained from that specimen.
   e. Unless otherwise specified, results at end of 28-day drying period shall not exceed 0.040 percent if 3-inch prisms are used, or exceed 0.038 percent if 4-inch prisms are used. Aggregate will be rejected if test values exceed these limits.

E. Slump Range at Site:

1. Prior to submitting mix design, consult with concrete producer and select a target slump value at point of delivery, for each application of each design mix. Unless otherwise permitted, target slump value will then be enforced for duration of Project.
2. Design mixes that include a high-range, water-reducing admixture shall have a minimum slump of 2 inches prior to addition of admixture. Unless otherwise permitted, slump shall be 8 inches maximum at point of delivery, for concrete with a high-range, water-reducing admixture.
3. Slump tolerance shall meet requirements of ACI 117.

F. Combined Aggregate Gradation:

1. Combined Gradation Limits: Fine aggregate shall be in range of 36 percent to 40 percent of total aggregate weight.

2.04 CONCRETE MIXING

A. General: In accordance with ACI 301, except as modified herein.

B. Truck Mixers:

1. For every truck, test slump of samples taken per ASTM C94/C94M, paragraph 12.5.1.
2. Where specified slump is more than 4 inches, and if slump tests differ by more than 2 inches, discontinue use of truck mixer, unless causing condition is corrected and satisfactory performance is verified by additional slump tests.

2.05 TEMPERATURE LIMITS

A. For concrete sections with a minimum specified dimension that is greater than 3 feet, and unless otherwise permitted:

1. Provide documentation that maximum concrete temperature in structure will not exceed 158 degrees F, and maximum temperature differential between center of section and external surfaces of concrete will not exceed 35 degrees F.

2.06 SOURCE QUALITY CONTROL

A. Source Quality Control Inspection: Jacobs' Engineer shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in this section.

PART 3 EXECUTION

3.01 PLACING CONCRETE

A. Preparation: Meet requirements ACI 301, except as modified herein.

B. Inspection: Notify Jacobs' Engineer and Special Inspector at least 1 full working day in advance before starting to place concrete.

C. Placement into Formwork:

1. Where vapor retarder or barrier is required, coordinate subgrade preparation with requirements in Division 07, Thermal and Moisture Protection, of Specifications.
2. Reinforcement: Secure in position before placing concrete.
3. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs which shall be placed full depth. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
4. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
5. Use placement devices, for example chutes, pouring spouts, and pumps as required to prevent segregation.
6. Vertical Free Fall Drop to Final Placement:
   a. Forms 8 Inches or Less Wide: 5 feet.
   b. Forms Wider than 8 Inches: 8 feet, except as specified.
7. For placements where drops are greater than specified, use placement device such that free fall below placement device conforms to required value.
   a. Limit free fall to prevent segregation caused by aggregates hitting steel reinforcement.
8. Do not use aluminum conveying devices.
9. Provide sufficient illumination in the interior of forms so concrete deposition is visible, permitting confirmation of consolidation quality.
10. Joints in Footings and Slabs:
    a. Ensure space beneath plastic waterstop completely fills with concrete.
    b. During concrete placement, make visual inspection of entire waterstop area.

c. Limit concrete placement to elevation of waterstop in first pass, vibrate concrete under waterstop, lift waterstop to confirm full consolidation without voids, and place remaining concrete to full height of slab.

d. Apply procedure to full length of waterstop.

11. Trowel and round off top exposed edges of walls with 1/4-inch radius steel edging tool.

12. Cure concrete as specified in Section 03 39 00, Concrete Curing.

D. Conveyor Belts and Chutes:

1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.

2. Do not use chutes longer than 50 feet.

3. Minimum Slopes of Chutes: Angled to allow concrete to readily flow without segregation.

4. Conveyor Belts:

a. Approved by Jacobs' Engineer.

b. Wipe clean with device that does not allow mortar to adhere to belt.

c. Cover conveyor belts and chutes.

E. Retempering: Not permitted for concrete where cement has partially hydrated.

F. Pumping of Concrete:

1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.

2. Minimum Pump Hose (Conduit) Diameter: 4 inches.

3. Replace pumping equipment and hoses (conduits) that are not functioning properly.

G. Concrete sections with a minimum specified dimension that is greater than 3 feet:

1. Cure and protect concrete in accordance with accepted thermal control plan and as follow:

a. Minimum curing period shall be 14 days.

b. Unless otherwise permitted, preserve moisture by maintaining forms in place.

2. Strength measurement shall be representative of in-place concrete within 2 inches of concrete surface.

3. Concrete strength shall be verified through correlation of concrete temperature and compressive strengths established by cylinder compressive tests and in accordance with ASTM C1074.
4. Unless otherwise specified, control concrete temperatures to within specified limits from time concrete is placed until time internal temperature has cooled from its maximum, such that difference between average daily ambient and maximum internal concrete temperature at time of protection removal, is less than specified temperature difference limit.
5. Unless otherwise specified, place one temperature sensor at center of mass of placement and one temperature sensor at a depth 2 inches from center of nearest exterior surface. Place additional sensor at each location to serve as a backup in event that other temperature sensor fails. In addition, provide temperature sensor in shaded location for monitoring ambient onsite temperature.
    a. Unless otherwise specified, monitor temperatures hourly using electronic sensors capable of measuring temperature from 32 degrees F to 212 degrees F to an accuracy of 2 degrees F.
    b. Ensure temperature sensors are operational before placing concrete.
    c. Unless otherwise specified, provide data from sensors to Engineer on a daily basis, until requirements are met.
    d. Compare temperatures and temperature differences with maximum limits specified in Article Temperature Limits every 12 hours, unless otherwise permitted. If either exceeds specified limits, take immediate action as described in accepted thermal control plan to remedy situation. Do not place additional mass concrete until cause of excessive temperature or temperature difference has been identified and corrections are accepted.

H. Maximum Size of Concrete Placements:
1. Limit size of each placement to allow for strength gain and volume change as a result of shrinkage.
2. Locate expansion, control, and contraction joints where shown on Drawings.
3. Construction Joints: Unless otherwise shown or permitted, locate construction joints as follows:
    a. Locate construction joints as shown on Drawings or where approved in joint location submittal required in Section 03 15 00, Concrete Joints and Accessories.
    b. Provide vertical construction joints in walls and slabs at maximum spacing of 40 feet, unless shown or approved otherwise.

c. When vertical expansion, contraction, or control joint spacing does not exceed 60 feet, intermediate construction joints are not required.

d. Uniformly space vertical construction joints within straight sections of walls and slabs, avoiding penetrations.

4. Consider beams, girders, brackets, column capitals, and haunches as part of floor or roof system and place monolithically with floor or roof system.

5. Should placement sequence result in cold joint located below finished water surface, install waterstop in joint.

I. Minimum Time between Adjacent Placements:

1. Construction or Control Joints: 7 days unless otherwise specified.

2. Construction joint between top of footing or slab, and column or wall: As soon as can safely be done without damaging previously cast concrete or interrupting curing thereof, but not less than 24 hours.

3. Expansion or Contraction Joints: 1 day.

4. For columns and walls with a height in excess of 10 feet, wait at least 2 hours before depositing concrete in beams, girders, or slabs supported thereon.

5. For columns and walls 10 feet in height or less, wait at least 1 hour prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon.

J. Consolidation and Visual Observation:

1. Consolidation Equipment and Methods: ACI 301.

2. Provide at least one standby vibrator in operable condition at Site prior to placing concrete.

3. Provide sufficient windows in forms or limit form height to allow for concrete placement through windows and for visual observation of concrete.

4. Vibrate concrete in vicinity of joints to obtain impervious concrete.

K. Hot Weather:

1. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:

a. Maintain concrete temperature below 90 degrees F at time of placement, or furnish test data or other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.

b. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.

2. Concrete Curing: As specified in Section 03 39 00, Concrete Curing.

L. Cold Weather Placement:

1. Unless otherwise permitted, shall be in accordance with requirements of ACI 306.1 and as follows:

a. Cold weather requirements shall apply when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling.

b. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of Engineer.

c. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees F; requirement is applicable to all surfaces including reinforcement and other embedded items.

d. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.

e. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.

f. Cure concrete as specified in Section 03 39 00, Concrete Curing.

1) Protect concrete from freezing until end of curing period and until concrete has attained a compressive strength of 3,500 psi or design compressive strength if less than 3,500 psi.

2. Provide maximum and minimum temperature sensors placed on concrete surfaces spaced throughout Work to allow monitoring of concrete surface temperatures representative of Work. Unless otherwise permitted, record surface temperature of concrete at least once every 12 hours during specified curing period.

3. External Heating Units: Do not exhaust heater flue gases directly into enclosed area as it causes concrete carbonation as a result of concentrated carbon dioxide.

4. Maintain curing conditions as specified in Section 03 39 00, Concrete Curing.

3.02 CONCRETE BONDING

A. Construction Joints in New Concrete Members:

1. Prepare surface of construction joint as specified in Section 03 15 00, Concrete Joints and Accessories.

2. Horizontal Construction Joints Containing Waterstop in New Concrete Walls:
   a. Unless otherwise permitted, place slurry mixture 4-inch maximum thickness, 2-inch minimum thickness in horizontal construction joints containing waterstops.
   b. Use positive measuring device such as bucket or other device that will contain only enough slurry mixture for depositing in visually measurable area of wall to ensure that portion of form receives appropriate amount of slurry mixture to satisfy placement thickness requirements.
   c. Do not deposit slurry mixture from pump hoses or large concrete buckets, unless specified placement thickness can be maintained and verified through inspection windows close to joint, or by other means.
   d. Limit concrete placed immediately on top of slurry mixture to 12 inches thick. Thoroughly vibrate to mix concrete and slurry mixture together.

B. Construction Joints at Existing Concrete:
   1. Thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 1/4 inch.
   2. Saturate surface with water for 24 hours prior to placing new concrete.

3.03 REPAIRING CONCRETE

A. General:
   1. Inject cracks that leak with crack repair epoxy as specified in Section 03 64 23, Epoxy Resin Injection Grouting.
   2. Repair defective areas of concrete.
   3. Repair horizontal concrete surfaces in accordance with Section 03 01 33, Repair of Horizontal Concrete Surfaces.
   4. Repair vertical and overhead concrete surfaces in accordance with Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces.
   5. Develop repair techniques with material manufacturer on surface that will not be visible in final construction prior to starting actual repair work and show how finish color will blend with adjacent surfaces. Obtain approval from Engineer.
   6. Obtain quantities of repair material and manufacturer's detailed instructions for use to provide repair with finish to match adjacent surface or apply sufficient repair material adjacent to repair to blend finish appearance.

7. Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.

B. Tie Holes:
1. Unless otherwise specified, fill with specified repair material.
a. Prepare substrate and mix, place, and cure repair material per manufacturer's written recommendations.

C. Alternate Form Ties, Through-Bolts:
1. Mechanically roughen entire interior surface of through hole.
2. Apply bonding agent to roughened surface and drive elastic vinyl plug to half depth.
3. Dry pack entire hole from both sides of plug with nonshrink grout, as specified in Section 03 62 00, Grouting.
4. Use only enough water to dry pack grout.
5. Dry pack while bonding agent is still tacky.
6. If bonding agent has dried, remove bonding agent by mechanical means and reapply new coat of bonding agent.
7. Compact grout using steel hammer and steel tool to drive grout to high density.
8. Cure grout with water.

D. Exposed Metal Objects:
1. Remove metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, by chipping back concrete to depth of 1 inch and then cutting or removing metal object.
2. Repair area of chipped-out concrete as specified for defective areas.

E. Blockouts at Pipes or Other Penetrations: Where shown install in accordance with requirements of Drawings.

3.04 CONCRETE WALL FINISHES

A. Type W-1 (Ordinary Wall Finish):
1. Patch tie holes.
2. Knock off projections.
3. Repair defective areas.
4. Inject cracks in accordance with requirements of Section 03 64 23, Epoxy Resin Injection Grouting.

B. Type W-2 (Smooth Wall Finish):
   1. Patch tie holes.
   2. Grind off fins and other projections.
   3. Repair defective areas to provide smooth uniform appearance.
   4. Inject cracks in accordance with requirements of Section 03 64 23, Epoxy Resin Injection Grouting.

C. Type W-4 (Finish for Cementitious Coatings):
   1. In accordance with requirements for Type W-2 except as follows:
      a. Leave surface ready for cementitious coating as specified.

D. Type W-5 (Finish for Painting):
   1. In accordance with requirements for Type W-2 except as follows:
      a. Leave surface ready for painting as specified in Section 09 90 00, Painting and Coating.

E. Type W-9 (Grout Cleaned Wall Finish):
   1. Meet requirements for Type W-7, except that finish must be accomplished within 7 days of placement.
   2. Grout: Mixed with one part portland cement and one and one half parts fine sand and bonding agent to produce grout with consistency of thick paint. White portland cement shall be substituted for part of gray portland cement in order to produce color matching color of surrounding concrete, as determined by trial patch.
   3. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly with brushes or spray gun.
   4. Immediately after applying grout, scrub surface vigorously with cork float or stone to coat surface and fill air bubbles and holes.
   5. While grout is still plastic, remove excess grout by working surface with rubber float, burlap, or other means. After surface whitens from drying, about 30 minutes at 70 degrees F, rub vigorously with clean burlap. Continue to water cure wall until curing period of 7 days is complete.
   6. Latex bonding admixture may be used.

3.05 CONCRETE SLAB FINISHES

A. General:
   1. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.

2. Do not use “jitterbugs” or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
3. Finish slab in accordance with specified slab finish.
4. Do not dust surfaces with dry materials nor add water to surfaces.
5. Cure concrete as specified in Section 03 39 00, Concrete Curing.

B. Type S-1 (Steel Troweled Finish):
1. Finish by screeding and floating with straightedges to bring surfaces to required finish elevation.
2. Wood float to true, even plane with no coarse aggregate visible.
3. Use sufficient pressure on wood floats to bring moisture to surface.
4. After surface moisture has disappeared, hand steel trowel concrete to produce smooth, smooth dense surface, free from trowel marks.
5. Provide light steel-troweled finish (two trowelings) at air-entrained slabs. Provide hard steel-troweled finish (ringing sound from the trowel) for nonair-entrained slabs.
6. Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
7. Power Finishing:
   a. Approved power machine may be used in lieu of or in addition to hand finishing in accordance with directions of machine manufacturer.
   b. Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.
   c. Do first steel troweling for slab S-1 finish by hand.

C. Type S-2 (Wood Float Finish):
1. Finish slab to receive fill and mortar setting bed by screeding with straightedges to bring surface to required finish plane.
2. Wood float finish to compact and seal surface.
3. Remove laitance and leave surface clean.
4. Coordinate with other finish procedures.

D. Type S-3 (Underside Elevated Slab Finish):

1. When forming is removed, grind off projections on underside of slab and repair defective areas, including small shallow air pockets where schedule of concrete finishes requires:

a. Prepare surfaces to match adjacent wall finish.

E. Type S-5 (Broomed Finish):

1. Finish as specified for Type S-1 floor finish, except use only a light-steel troweled finish, and then finish surface by drawing fine-hair broom lightly across surface.
2. Broom in same direction and parallel to expansion joints, or, in case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

F. Type S-6 (Sidewalk Finish):

1. Slope walks down 1/4 inch per foot away from structures, unless otherwise shown.
2. Strike off surface by means of strike board and float with wood or cork float to true plane, then flat steel trowel before brooming.
3. Broom surface at right angles to direction of traffic or as shown.
4. Lay out sidewalk surfaces in blocks, as shown or as directed by Engineer, with grooving tool.

G. Concrete Curbs:

1. Float top surface of curb smooth, and finish all discontinuous edges with steel edger.
2. After concrete has taken its initial set, remove front form and give exposed vertical surface an ordinary wall finish, Type W-1.

3.06 CONCRETE SLAB TOLERANCES

A. Slab Tolerances:

1. Exposed Slab Surfaces: Comprise of flat planes as required within tolerances specified.
2. Slab Finish Tolerances and Slope Tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow block of twice the tolerance in thickness to pass under supported 10-foot straightedge.
3. Slab Type S-A: Steel gauge block 5/16 inch thick.
4. Slab Type S-B: Steel gauge block 1/8 inch thick.

5. Slab Type S-A and S-B:
   a. Finish Slab Elevation: Slope slabs to floor drain and gutter, and shall adequately drain regardless of tolerances.
6. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2 inch plus.

B. Slab Elevation and Thickness:
   1. Finish Slab Elevation: Slope slabs to floor drains and gutter. Slabs shall adequately drain regardless of tolerances.
   2. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2 inch plus.

3.07 BEAM AND COLUMN FINISHES

A. Type B-1: Match wall Type W-1.

B. Type B-2: Match wall Type W-2.

C. Type B-3:
   1. Repair rock pockets.
   2. Fill air voids.
   3. Match wall Type W-5.

D. Type C-1: Match wall Type W-1.

E. Type C-2: Match wall Type W-2.

F. Type C-3:
   1. Fill air pockets.
   2. Match wall Type W-5.

3.08 BACKFILL AGAINST STRUCTURES

A. Do not backfill against walls until concrete has obtained specified 28-day compressive strength.

B. Refer to General Structural Notes on Drawings for additional requirements, including elevated slab and diaphragm completion prior to backfill.

C. Unless otherwise permitted, place backfill simultaneously on both sides of structure, where such fill is required, to prevent differential pressures.

3.09 FIELD QUALITY CONTROL

A. General:

1. Provide adequate facilities for safe storage and proper curing of concrete test specimens onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
2. Unless otherwise specified, sample concrete for testing for making test specimens, from point of delivery.
3. When concrete is pumped, sample and test air content at point of delivery and at point of placement.
   a. For Each Concrete Mixture: Provided results of air content tests for first load of the day are within specified limits, testing need only be performed at point of delivery for subsequent loads of that concrete mixture except that testing should be performed at point of placement every 4 hours.
4. Evaluation will be in accordance with ACI 301 and Specifications.
5. Test specimens shall be made, cured, and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.
6. Frequency of testing may be changed at discretion of Engineer.
7. Pumped Concrete: Take concrete samples for slump, ASTM C143/C143M, and test specimens, ASTM C31/C31M and ASTM C39/C39M, at placement (discharge) end of line.
8. If measured air content at delivery is greater than specified limit, check test of air content will be performed immediately on a new sample from delivery unit. If check test fails, concrete has failed to meet requirements of Contract Documents. If measured air content is less than lower specified limit, adjustments will be permitted in accordance with ASTM C94/C94M, unless otherwise specified. If check test of adjusted mixture fails, concrete has failed to meet requirements of Contract Documents. Concrete that has failed to meet requirements of Contract Documents shall be rejected.

B. Concrete Strength Test:

1. Unless otherwise specified, one specimen at age of 7 days for information, and two 6-inch diameter or when permitted three 4-inch diameter test specimens at age of 28 days for acceptance.
2. Concrete with specified 56-day strength, test one specimen at age of 7 days for information, two 6-inch diameter or when permitted three 4-inch diameter test specimens at age of 28 days for acceptance, and two 6-inch diameter or when permitted three 4-inch diameter test specimens at age of 56 days for acceptance. Should results of 28-day tests meet specified requirement for 56-day strength, 56-day tests will not be required.

3. If result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing specified in Section 03 39 00, Concrete Curing, by 7 additional days.
4. Provide a minimum of one spare test specimen per sample. Test spare cylinder as directed by Engineer.

C. High-Range, Water-Reducer (Superplasticizer) Admixture Segregation Test: Test each truck prior to use on Project.
1. Segregation Test Objective: Concrete with 4-inch to 8-inch slump shall stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump test.
2. Test Procedure: Make slump test and check for excessive slump and observe to see if mortar or moisture flows from slumped concrete.
3. Reject concrete if mortar or moisture separates and flows out of mix.

D. Cold Weather Placement Tests:
1. During cold weather concreting, cast cylinders for field curing as follows. Use method that will produce greater number of specimens:
a. Six extra test cylinders from last 100 cubic yards of concrete.
b. Minimum three specimens for each 2 hours of placing time or for each 100 cubic yards.
2. These specimens shall be in addition to those cast for lab testing.
3. Protect test cylinders from weather until they can be placed under same protection provided for concrete of structure that they represent.
4. Keep field test cylinders in same protective environment as parts of structure they represent to determine if specified strength has been obtained.
5. Test cylinders in accordance with applicable sections of ASTM C31/C31M and ASTM C39/C39M.
6. Use test results to determine specified strength gain prior to falsework removal or for prestressing.

E. Tolerances:
1. Walls: Measure and inspect walls for compliance with tolerances specified in Section 03 10 00, Concrete Forming and Accessories.
2. Slab Finish Tolerances and Slope Tolerances:
a. Make floor flatness measurements day after floor is finished and before shoring is removed to eliminate effects of shrinkage, curing, and deflection.

b. Support 10-foot long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.

c. Compliance with designated limits in four of five consecutive measurements is satisfactory, unless defective conditions are observed.

F. Liquid Tightness Tests:

1. Purpose: To determine integrity and liquid-tightness of finished exterior and interior concrete surfaces of liquid containment structures.
2. Test the following structures and individual basin train for liquid-tightness:
   a. All water-holding concrete structures.
3. Water for initial tightness test will be provided by Owner.
4. Water source will be provided onsite by Owner.
   a. Provide means to transport water to structure to be tested.
   b. If additional tightness tests are required because of failure to meet criteria, provide water for subsequent tests.
5. After testing has been completed, dispose of test water in a manner approved by Owner.
6. Liquid-Tightness Test Requirement:
   a. Perform tightness tests in accordance with ACI 350.1 and as specified herein.
   b. Do not place backfill or install brick facing, grout topping slab, coatings, or other work that will cover concrete surfaces until tightness testing has been completed and approved.
   c. Measure evaporation, precipitation, and temperature as specified.
7. Measure water surface at two points 180 degrees apart when possible where attachments, such as ladders exist, at 24-hour intervals.
8. Acceptance Criteria:
   a. Acceptance of the containment structure shall be based on criteria for both Part 1 and Part 2. Containment structures shall be retested until they meet the required Part 1 and Part 2 criteria.
   b. Part 1, Qualitative: If any water is observed on the containment structure surfaces, exterior to the contained liquid, where moisture can be picked up on a dry hand, the containment structure shall be considered to have failed Part 1 of the test.
   c. Part 2, Quantitative:
      1) Volume loss shall not exceed 0.050 percent of contained liquid volume per 24-hour period, adjusted for evaporation, precipitation, and temperature.

2) Acceptance that structure has passed Part 2 of the tightness test shall be based on total volume loss at end of specified test period.

9. Repairs When Test Fails:
   a. Dewater structure; fill leaking cracks with crack repair epoxy as specified in Section 03 64 23, Epoxy Resin Injection Grouting.
   b. Patch areas of damp spots previously recorded, and repeat water leakage test in its entirety until structure successfully passes test.

3.10 MANUFACTURER'S SERVICES

A. Provide representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection, and certification of proper installation for concrete ingredients, mix design, mixing, and placement.
   1. Concrete Producer Representative:
      a. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project, including instructions for redosing.
      b. Establish control limits on concrete mix designs.
      c. Provide equipment for control of concrete redosing for air entrainment or high-range, water-reducing admixture, superplasticizers, at Site to maintain proper slump and air content if needed.
   2. Admixture Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.
   3. Bonding Agent Manufacturer's Representative: Available for consultations as required to ensure proper installation and performance of specified products.

3.11 PROTECTION OF INSTALLED WORK

A. After curing as specified in Section 03 39 00, Concrete Curing, and after applying final floor finish, cover slabs with plywood or particle board or plastic sheeting or other material to keep floor clean and protect it from material and damage as a result of other construction work.

B. Repair areas damaged by construction, using specified repair materials and approved repair methods.

3.12 SCHEDULE OF CONCRETE FINISHES

A. Form Tolerances: As specified in Section 03 10 00, Concrete Forming and Accessories.

B. Special Floor Finishes: As specified in Section 03 35 00, Concrete Finishing.

C. Provide concrete finishes as scheduled:

Area	Type of Finish	Required Form Tolerances
Exterior Wall Surfaces		
Abovegrade/exposed (above point 6" below finish grade)	W-2	W-B
Abovegrade/covered with brick veneer or other finish material	W-1	W-A
Backfilled/waterproofed (below point 6" below finish grade)	W-1	W-A
Backfilled/not waterproofed (below point 6" below final grade)	W-1	W-A
Walls to receive cementitious coatings	W-4	W-B
Interior Wall Surfaces		
Open top water-holding tanks and basins/not painted or coated	W-2	W-A
Covered water-holding tanks and basins/not painted or coated	W-1	W-A
Water-holding tanks, channels, and basins/painted or coated	W-5	W-A
Buildings, pipe galleries, and other dry areas/not painted or coated	W-2	W-A
Buildings, pipe galleries, and other dry areas/painted or coated	W-5	W-A
Exterior Slabs		
Roof slab/exposed	S-5	S-B
Roof slab/covered with roofing material	S-1	S-A

Area	Type of Finish	Required Form Tolerances
Water-holding tanks and basins/top of wall	S-5	S-B
Top of footing	S-2	S-A
Other water-holding tanks and basins	S-1	S-A
Stairs and landings	S-5	S-B
Sidewalks	S-6	S-B
Other exterior slabs	S-5	S-A
Interior Slabs		
Buildings, pipe galleries, and other dry areas	S-1	S-B
Slabs to receive mortar setting bed for tile	S-2	S-A
Slabs to receive resilient flooring or carpet	S-1	S-A
Hydraulic channels	S-1	S-A
Underside of elevated slabs	S-3	S-A
Beams and Columns		
Beams/coated	B-3	B-A
Beams/not coated	B-2	B-A
Columns/coated	C-3	C-A
Columns/not coated	C-2	C-A

3.13 SUPPLEMENTS

A. Requirements of concrete mix designs following "End of Section," are a part of this Specification and supplement requirements of Part 1 through Part 3 of this section:

1. Concrete Mix Design, Class 5000F0S1W1C2.
2. Concrete Mix Design, Class SM00F0S1W1C2.
3. Concrete Mix Design, Class 4000F0S1W0C1.

END OF SECTION

CONCRETE MIX DESIGN, CLASS 5000F0S1W1C2

A. Mix Locations: Typical, unless otherwise specified.

B. Exposure Categories and Classifications: F0S1W1C2.

C. Mix Properties:

1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.40.
2. Minimum concrete compressive strength (f'c) shall be 4,500 psi at 28 days and 5,000 psi at 56 days.
3. Designed to conform to shrinkage limits.
4. Air-entraining admixtures are prohibited in concrete mixtures and total air content shall not be greater than 3 percent, for the following:
   a. Slabs to receive hard-troweled finish.
   b. Slabs to receive dry shake floor hardener.
   c. Slabs to receive topping placed monolithically as two-course floor on top of plastic concrete.
5. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.	Air Content (%)*
3/4	6.0
1	6.0
1-1/2	5.5
*Tolerance of air content is +/- 1-1/2 percent.	

6. Limit supplementary cementitious materials measured as a percent of weight of total cementitious materials in mix design, as follows:
   a. Fly Ash and other Pozzolans: 25 percent.
   b. Slag Cement: 50 percent.
   c. Combined Fly Ash and other Pozzolans and Slag Cement: 50 percent, with fly ash and other pozzolans not exceeding 25 percent.
   d. Total cementitious materials include ASTM C150/C150M and ASTM C595/C595M cement.
      1) Fly ash and other pozzolans in Type IP, blended cement, ASTM C595/C595M.

2) Slag used in the manufacture of an IS blended cement, ASTM C595/C595M.

7. Provide cementitious materials in accordance with one of the following:
   a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.
   b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
      1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.
      2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
   c. ASTM C595/C595M Type IP or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).
      1) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
8. Unless otherwise permitted, minimum cementitious materials content in mix design shall be as follows:
   a. 515 pounds per cubic yard for concrete with 1-1/2-inch nominal maximum size aggregate.
   b. 535 pounds per cubic yard for 1-inch nominal maximum size aggregate.
   c. 560 pounds per cubic yard for 3/4-inch nominal maximum size aggregate.
   d. Unless otherwise permitted, limit cementitious materials content to 100 pounds per cubic yard greater than specified minimum cementitious materials content in mix design.
9. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent, unless otherwise specified.
   a. Limits are stated in terms of chloride ions in percent by weight of cement.
   b. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.

D. Refer to Part 1 through Part 3 of this section for additional requirements.

CONCRETE MIX DESIGN, CLASS SM00F0S1W1C2

A. Mix Locations: Slurry mixture at horizontal construction joints with waterstop in wall.

B. Exposure Categories and Classifications: F0S1W1C2.

C. Mix Properties:
   1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.40.
   2. Minimum concrete compressive strength (f'c) shall be same as concrete mix for wall.
   3. Maximum Nominal Aggregate: 3/8 inch.
   4. Unless otherwise specified, provide 7.5 percent air content.
      a. See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations.
      b. Tolerance of air content is plus or minus 1.5 percent.
   5. Provide cementitious materials in accordance with one of the following:
      a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.
      b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
         1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.
         2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
      c. ASTM C595/C595M Type IP or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).
         1) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
   6. Unless otherwise permitted, minimum cementitious materials content in mix design shall be 600 pounds per cubic yard for 3/8-inch nominal maximum size aggregate.

7. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent, unless otherwise specified.
   a. Limits are stated in terms of chloride ions in percent by weight of cement.
   b. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.

D. Refer to Part 1 through Part 3 of this section for additional requirements.

CONCRETE MIX DESIGN, CLASS 4000F0S1W0C1

A. Mix Locations:
   1. Electrical duct banks.
   2. Pipe encasements that are not cast monolithically with concrete base mats or slabs.
   3. Sidewalks and curbs.
   4. Concrete Fill.
   5. Where specified in Contract Documents.

B. Exposure Categories and Classifications: F0S1W0C1.

C. Mix Properties:
   1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.50.
   2. Minimum concrete compressive strength (f'c) shall be 3,500 psi at 28 days and 4,000 psi at 56 days.
   3. Air-entraining admixtures are prohibited in concrete mixtures and total air content shall not be greater than 3 percent, for the following:
      a. Slabs to receive hard-troweled finish.
   4. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in.	Air Content (%)*
3/4	5.0
1	4.5
1-1/2	4.5
*Tolerance of air content is +/- 1-1/2 percent.	

   5. Provide cementitious materials in accordance with one of the following:
      a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.
      b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
         1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.

2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.

3) ASTM C595/C595M Type IP or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).

a) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.

6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent, unless otherwise specified.

a. Limits are stated in terms of chloride ions in percent by weight of cement.

b. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.

D. Refer to Part 1 through Part 3 of this section for additional requirements.

SECTION 03 39 00
CONCRETE CURING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing concrete.
      b. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

1.02 SUBMITTALS

A. Action Submittals:
   1. Manufacturers' data for the following products:
      a. Evaporation retardant.
      b. Curing compound.
      c. Wet curing blanket.
      d. Clear sealer.
      e. Clear floor hardener.
   2. Curing methods proposed for each type of element such as slab, walls, beams, and columns in each facility.

B. Informational Submittals:

   1. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, for the following:
      a. Curing compound showing moisture retention requirements.
   2. Where curing compounds are proposed, identify method of application, rate of application, and time of application following form removal or slab finishing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Curing Compound:

1. Water-based, high solids content nonyellowing curing compound meeting requirements of ASTM C1315 Type 1, Class A.
   a. Moisture Loss: 0.40 kg/square m/72 hours maximum.
   b. Capable of meeting moisture retention at manufacturer's specified application rate.
2. Manufacturers and Products:
   a. WR Meadows, Inc., Hampshire, IL; VOCOMP-30.
   b. Vexcon Chemical, Inc.; Philadelphia, PA; Starseal 1315.
   c. Dayton Superior; Safe Cure and Seal 1315 EF.
   d. BASF Construction Chemicals., Shakopee, MN; MasterKure CC 1315.

B. Evaporation Retardant:

1. Optional: Fluorescent color tint that disappears completely upon drying.
2. Manufacturers and Products:
   a. BASF Construction Chemicals, Shakopee, MN; MasterKure ER 50.
   b. Euclid Chemical Co., Cleveland, OH; Eucobar.

C. Clear Sealer (One-Component Penetrating Silane Sealer):

1. Manufacturers and Products:
   a. BASF Construction Chemicals, Shakopee MN; MasterProtect H 400.
   b. Euclid Chemical Co.; Baracade WB 244.

D. Clear Hardener:

1. Colorless, aqueous solution containing silicate.
2. Manufacturers and Products:
   a. BASF Construction Chemicals, Shakopee, MN; MasterKure HD 200WB.
   b. Euclid Chemical Co., Cleveland, OH; Euco Diamond Hard.
   c. W.R. Meadows, Inc., Hampshire, IL; Liqui-Hard.

E. Wet Curing Blankets:

1. Single-use wet curing blankets consisting of white reflective polyethylene vapor barrier and cellulose fabric.
2. Manufacturer and Product: Sika Chemical Corp., Lyndurst, NJ; Sika UltraCure DOT.

F. Water: Clean and potable, containing less than 500 ppm of chlorides.

PART 3 EXECUTION

3.01 CURING OF CONCRETE

A. General:
   1. Cure all concrete in accordance with project specifications and ACI 308.1.
   2. Water curing procedures shall be applied to all hydraulic water-holding structure concrete.
   3. Where surfaces are to receive coatings, painting, cementitious material, or other similar finishes, use only water curing procedures. Refer to Interior Finish Schedule for surfaces to receive coatings.
   4. All curing methods and locations shall be agreed upon by Jacobs' Engineer prior to placing concrete.
   5. As required in Section 03 30 00, Cast-in-Place Concrete, if result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing specified below, by 7 additional days.

B. Use one of the following methods as approved by Design-Builder:
   1. Vertical Surfaces:
      a. Method 1: Leave concrete forms in place and keep entire surfaces of forms and concrete wet for 7 days.
      b. Method 2: Continuously sprinkle with water 100 percent of exposed surfaces for 7 days starting immediately after removal of forms.
      c. Method 3: Apply curing compound, where allowed, immediately after removal of forms.
   2. Horizontal Surfaces:
      a. Method 1: Protect surface by water ponding for 7 days.
      b. Method 2:
         1) Cover with burlap or cotton mats and keep continuously wet for 7 days.
         2) Cover with wet curing blankets in accordance with manufacturer's directions for minimum of 7 days.
      c. Method 3: Cover with 1-inch layer of wet sand, earth, or sawdust, and keep continuously wet for 7 days.
      d. Method 4: Continuously sprinkle exposed surface for 7 days.
      e. Method 5: Apply curing compound, where allowed, immediately after final finishing when surface will no longer be damaged by traffic.

3.02 WET CURING BLANKET INSTALLATION

A. Install per manufacturer's written recommendations.

3.03 EVAPORATION RETARDANT APPLICATION

A. Use on flatwork when environmental conditions are anticipated to cause rapid drying of the concrete surface.

B. Spray onto surface of fresh flatwork concrete immediately after screeding to react with surface moisture.

C. Reapply as needed to ensure a continuous moist surface until final finishing is completed.

3.04 CLEAR SEALER APPLICATION

A. Apply where indicated in Architectural Interior Finish Schedule on Drawings unless otherwise noted.

B. Before application, water cure concrete walls and floors to receive sealer for a minimum of 28 days, keep clean, unpainted, free from membrane curing compounds, with Work above them completed.

C. Apply per manufacturer's recommendations utilizing low pressure airless spray equipment.

1. Actual coverage and number of coats to be determined by field test sample application and water absorption testing. Final approval by Owner is required.

D. Apply at a coverage rate of 125 square feet per gallon to 200 square feet per gallon. Cure penetrating sealer on slabs for the minimum time recommended by manufacturer prior to allowing foot or vehicular traffic.

3.05 CLEAR HARDENER APPLICATION

A. Apply where indicated in Architectural Interior Finish Schedule on Drawings unless otherwise noted.

B. Before application and with Work above completed, water cure concrete walls and floors for a minimum of 28 days to receive sealer, keep clean, unpainted, and free from membrane curing compounds.

C. Apply hardener evenly, using three coats, allowing 24 hours between coats:
   1. First coat 1/3 strength, second coat 1/2 strength, and third coat 2/3 strength, mix with water.
   2. Apply each coat so as to remain wet on surfaces for 15 minutes.
   3. Apply approved hardeners in accordance with manufacturer's instructions.
   4. After final coat is completed and dry, remove surplus hardener from surface by scrubbing and mopping with water.

3.06 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection, and certification of proper installation for products specified.

END OF SECTION

SECTION 03 62 00
GROUTING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):

a. C230, Standard Specification for Flow Table for Use in Tests of Hydraulic Cement.

b. C307, Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.

c. C531, Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

d. C579, Standard Test Methods for Compressive Grout Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

e. C621, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrinkable).

f. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear.

g. C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).

h. C940, Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

i. C1107/C1107M, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

j. C1181, Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

k. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

1.02 SUBMITTALS

A. Action Submittals:

1. Product data of grouts.
2. Forming method for fluid grout placements.
3. Curing method for grout.

B. Informational Submittals:
   1. Manufacturer's Written Instructions:
      a. Adding fiber reinforcing to batching.
      b. Cement-water ratio of grout topping.
      c. Mixing of grout.
   2. Manufacturer's proposed training schedule for grout work.
   3. Manufacturer's Certificate of Compliance in accordance with Section 01 61 00, Common Product Requirements.
      a. Grout free from chlorides and other corrosion-causing chemicals.
      b. Nonshrink grout properties of Category II and Category III, verifying expansion at 3 days or 14 days will not exceed the 28-day expansion and nonshrink properties are not based on gas or gypsum expansion.
   4. Manufacturer's Certificate of Proper Installation.
   5. Statements of Qualification: Grout manufacturer's representative.
   6. Test Reports:
      a. Test report for 24-hour evaluation of nonshrink grout.
      b. Test results and service report from demonstration and training session.
      c. Field test reports and laboratory test results for field-drawn Samples.
   7. List of Contractor's equipment installation staff trained by grout manufacturer's representative in:
      a. Nonshrink grout installation and curing.
      b. Epoxy grout installation and curing.

1.03 QUALIFICATIONS

A. Nonshrink Grout Manufacturer's Representative: Authorized and trained representative of grout manufacturer. Minimum of 1-year experience that has resulted in successful installation of grouts similar to those for this Project.

B. For grout suppliers not listed herein, provide completed 24-hour Evaluation of Nonshrink Grout Test Form, attached at the end of this section. Provide independent testing laboratory to certify that testing was conducted within last 18 months.

1.04 GUARANTEE

A. Manufacturer's guarantee shall not contain disclaimer on the product data sheet, grout bag, or container limiting responsibility to only the purchase price of products and materials furnished.

B. Manufacturer guarantees participation with Subcontractor in replacing or repairing grout found defective as a result of faulty materials, as determined by industry standard test methods.

PART 2 PRODUCTS

2.01 NONSHRINK GROUT AND EPOXY SCHEDULE

A. Furnish grout for applications as indicated in the following schedule:

Application	Temperature Range	Max. Placing Time	
	40 deg F to 100 deg F	20 Min.	Greater Than 20 Min.
Blockouts for gate guides	I or II		II
Column baseplates single-story	I or II		II
Machine bases 25 hp or less	II	II	II
Baseplates for columns over one story	II	II	II
Through-bolt openings	II	II	II
Machine bases 26 hp and up	III or Epoxy Grout	III or Epoxy Grout	III or Epoxy Grout
Baseplates and/or soleplates with vibration, thermal movement, etc.	III or Epoxy Grout	III or Epoxy Grout	III or Epoxy Grout

2.02 NONSHRINK GROUT

A. Category I:
1. Nonmetallic and nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in accordance with ASTM C1107/C1107M:
   a. Grout shall have flowable consistency.
   b. Flowable for 15 minutes.
4. Grout shall not bleed at maximum allowed water.

5. Minimum strength of flowable grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
6. Manufacturers and Products:
    a. BASF Building System, Inc., Shakopee, MN; MasterFlow 100.
    b. Euclid Chemical Co., Cleveland, OH; NS Grout.
    c. Dayton Superior Corp., Kansas City, KS; 1107 Advantage Grout.
    d. US MIX Co., Denver, CO; US Spec GP Grout.
    e. Five Star Products Inc., Fairfield, CT; Five Star Grout.

B. Category II:
1. Nonmetallic, nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C1107/C1107M, Grade B:
    a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
    b. Temperatures of 40 degrees F, 80 degrees F, and 100 degrees F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.
7. Maintain fluid consistency when mixed in 1-yard to 9-yard loads in ready-mix truck.
8. Manufacturers and Products:
    a. BASF Building Systems, Inc., Shakopee, MN; MasterFlow 928.
    b. Five Star Products Inc., Fairfield, CT; Five Star Fluid Grout 100.
    c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
    d. Dayton Superior Corp., Kansas City, KS; Sure Grip High Performance Grout.

C. Category III:
1. Metallic and nongas-liberating.
2. Prepackaged aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C1107/C1107M, Grade A:
    a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.

b. Temperatures of 40 degrees F and 100 degrees F.

5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.
7. Maintain fluid consistency when mixed in 1-yard to 9-yard loads in ready-mix truck.
8. Manufacturers and Products:
   a. BASF Building Systems, Inc., Shakopee, MN; MasterFlow 885.
   b. Euclid Chemical Co, Cleveland, OH; Hi-Flow Metallic Grout.

2.03 EPOXY GROUT

A. High-strength, nonshrink, high-temperature epoxy grouting material developed for the support of heavy equipment with vibratory loads.

B. Three-component mixture of a two-component epoxy resin system (100 percent solids) with a graded, precision aggregate blend.

C. Premeasured, prepackaged system.

D. Flowable.

E. Minimum compressive strength in accordance with ASTM C579 Method B, 9,500 psi at 75 degrees F at 7 days, 11,000 psi at post cure.

F. Maximum creep resistance in accordance with ASTM C1181 at 600 psi, 140 degrees F; 6.0 by 10^{-3} in/in.

G. Minimum bond strength in accordance with ASTM C882, 2,000 psi.

H. Minimum tensile strength in accordance with ASTM C307, 2,000 psi.

I. Maximum coefficient of thermal expansion in accordance with ASTM C531 at 73 degrees F to 210 degrees F, 23.0 by 10^{-6} in/in/degrees F.

J. Working Time: Minimum 2 hours at 50 degrees F; 1.5 hours at 70 degrees F; 50 minutes at 90 degrees F.

K. Noncorrosive.

L. Moisture insensitive.

M. Modify resin and aggregate content where recommended by epoxy grout manufacturer to provide desired epoxy grout flow properties.

N. Manufacturers and Products:
   1. BASF Building System, Inc., Shakopee MN; MasterFlow 648.
   2. Euclid Chemical Co., Cleveland, OH; E^3-G.
   3. Dayton Superior Corp., Miamisburg, OH; Pro-Poxy 2000 Normal Set.
   4. Five Star Products Inc., Fairfield, CT; DP Epoxy Grout.

PART 3 EXECUTION

3.01 GROUT

A. General: Mix, place, and cure nonshrink grout in accordance with grout manufacturer's representative's training instructions.

B. Epoxy Grout: Concrete slab shall be fully cured for 28 days to ensure excess water has evaporated. Test concrete surface for moisture in accordance with ASTM D4263 before epoxy grout is placed.

C. Form Tie or Through-Bolt Holes: Provide nonshrink grout, Category I and Category II, fill space with dry pack dense grout hammered in with steel tool and hammer. Through-bolt holes; coordinate dry pack dense grout application with vinyl plug in Section 03 10 00, Concrete Forming and Accessories, and bonding agent in Section 03 30 00, Cast-in-Place Concrete.

3.02 GROUTING MACHINERY FOUNDATIONS:

A. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material.

B. Clean metal surfaces of all paint, oil, grease, loose rust, and other foreign material that will be in contact with grout.

C. Sandblast to bright metal all metal surfaces in contact with epoxy grout in accordance with manufacturer's written instructions.

D. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts.

E. Form with watertight forms at least 2 inches higher than bottom of plate.

F. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's representative's training instructions.

G. If grout cannot be placed from one edge and flowed to the opposite edge, air vents shall be provided through the plate to prevent air entrapment.

H. Radius all corners of grout pad.

I. Install expansion joints for epoxy grout placement in accordance with manufacturer's written instructions.

3.03 TANK FOUNDATIONS:

A. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material. Surface roughness in accordance with manufacturer's written instructions.

B. Clean metal surfaces of all oil, grease, loose rust, and other foreign material that will be in contact with grout.

C. Set tank in position and wedge to elevation with steel wedges, or use cast-in leveling bolts. Remove wedges after grout is set and pack void with grout.

D. Form with watertight forms at least 2 inches higher than bottom of plate.

E. Fill space between bottom of tank base and original concrete in accordance with manufacturer's representative's training instructions.

3.04 FIELD QUALITY CONTROL

A. Evaluation and Acceptance of Nonshrink Grout:

1. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.
2. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of nonshrink grout used. Use restraining caps for cube molds in accordance with ASTM C1107/C1107M.
3. For large grout applications make three additional cubes and one more flow cone test. Include bleed test for each additional 25 cubic feet of nonshrink grout placed.
4. Consistency: As specified in Article Nonshrink Grout. Grout with consistencies outside range requirements shall be rejected.
5. Segregation: As specified in Article Nonshrink Grout. Grout when aggregate separates shall be rejected.
6. Nonshrink grout cubes shall test equal to or greater than minimum strength specified.

7. Strength Test Failures: Nonshrink grout work failing strength tests shall be removed and replaced.
8. Perform bleeding test to demonstrate grout will not bleed.
9. Store cubes at 70 degrees F.
10. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C1107/C1107M.

B. Evaluation and Acceptance of Epoxy Grout:

1. Inspect ambient conditions during various phases of epoxy grouting installation for conformance with the epoxy grout manufacturer's requirements.
2. Inspect the surface preparation of concrete substrates onto which epoxy grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.
3. Inspect the surface preparation of the metallic substrates onto which the epoxy primer is to be applied.
4. Inspect the epoxy-primed metallic substrate for coverage and adhesion.
5. Inspect preparation and application of epoxy grout form work for conformance to the manufacturer's recommendation.
6. Verify consistency obtained is sufficient for the proper field placement at the installed temperatures.
7. Inspect and record that the "pot life" of epoxy grout materials is not exceeded during the installation.
8. Inspect epoxy grout for cure.
9. Inspect and record that localized repairs made to grout voids are in conformance with the specification requirements.
10. Conduct a final review of completed epoxy grout installation for conformance to these Specifications.
11. Compression tests and fabrication of specimens for epoxy grout shall be made in accordance to ASTM C579, Method B, at intervals during construction as selected by the Project representative. A set of three specimens shall be made for testing at 7 days, and each earlier time period as appropriate.
12. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C579.

3.05 MANUFACTURER'S SERVICES

A. General:

1. Coordinate demonstrations, training sessions, and applicable Site visits with grout manufacturer's representative.
2. Provide and conduct onsite demonstration and training sessions for bleed tests, mixing, flow cone measurement, cube testing, application, and curing for each category and type of nonshrink grout.
3. Necessary equipment and materials shall be available for demonstration.

B. Nonshrink Grout Training:

1. Training is required for all Type III grout installations.
2. Provide nonshrink grout installation training by the qualified grout manufacturer's representative for Contractor's workers that will be installing nonshrink grout for baseplates and equipment mounts. Schedule training to allow Engineer's attendance.
3. Mix nonshrink grouts to required consistency, test, place, and cure on actual Project, such as, baseplates and form tie-through bolt holes to provide actual on-the-job training.
4. Use minimum of two bags for each grout Category III. Mix grout to fluid consistency and conduct flow cone and two bleed tests, make a minimum of six cubes for testing of two cubes at 1 day, 3 days, and 28 days. Use remaining grout for final Work.
5. Include recommended grout curing methods in the training.
6. Mix and demonstrate patching through-bolt holes and blockouts for gate guides, and similar items.
7. Transport test cubes to independent test laboratory and obtain test reports.
8. Training by manufacturer's representative does not relieve Contractor of overall responsibility for this portion of the work.
9. Submit a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

C. Epoxy Grout Training:

1. Provide epoxy grout installation training by the qualified epoxy grout manufacturer's representative for Contractor's workers that will be installing epoxy grout for equipment mounts. Schedule training to allow Engineer's attendance.
2. Include training in:
   a. Performance testing such as compressive strength testing of the epoxy grout.
   b. All aspects of using the products, from mixing to application.
3. Transport test cubes to independent test laboratory and obtain test reports.

4. Training by manufacturer's representative does not relieve Contractor of overall responsibility for this portion of the work.
5. Submit a list of attendees that have been satisfactorily trained to perform epoxy grout installation for equipment mounting.

3.06 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this Specification.
   1. 24-hour Evaluation of Nonshrink Grout Test Form and Grout Testing Procedures.

END OF SECTION

_____
(Test Lab Name)

_____
(Address)

_____
(Phone No.)

24-HOUR EVALUATION OF NONSHRINK GROUT TEST FORM

OBJECTIVE: Define standard set of test procedures for an independent testing laboratory to perform and complete within a 24-hour period.

SCOPE: Utilize test procedures providing 24-hour results to duplicate field grouting demands. Intent of evaluation is to establish grout manufacturer's qualifications.

PRIOR TO TEST: Obtain five bags of each type of grout.

1. From intended grout supplier for Project.
2. Five bags of grout shall be of same lot number.

ANSWER THE FOLLOWING QUESTIONS FOR GROUT BEING TESTED FROM LITERATURE, DATA, AND PRINTING ON BAG:

A. Product data and warranty information contained in company literature and data? Yes_____ No_____

B. Literature and bag information meet specified requirements? Yes_____ No_____

C. Manufacturer guarantees grout as specified in Article Guarantee? Yes_____ No_____

D. Guarantee extends beyond grout replacement value and allows participation with Subcontractor in replacing and repairing defective areas? Yes_____ No_____

E. Water demands and limits printed on bag? Yes_____ No_____

F. Mixing information printed on the bag? Yes_____ No_____

G. Temperature restrictions printed on bag? Yes_____ No_____

*Rejection of a grout will occur if one or more answers are noted NO.

GROUT TESTING PROCEDURES

A. Bagged Material:

1. List lot numbers. _____
2. List expiration date. _____
3. Weigh bags and record weight. _____

Design Builder will disqualify grout if bag weights have misstated measure plus or minus 2 pounds by more than one out of five bags. (Accuracy of weights is required to regulate amount of water used in mixing since this will affect properties.)

B. Mixing and Consistency Determination:

1. Mix full bag of grout in 10 gallon pail.
2. Use electric drill with a paddle device to mix grout (jiffy or jiffler type paddle).
3. Use maximum water allowed per water requirements listed in bag instructions.
4. Mix grout to maximum time listed on bag instructions.
5. In accordance with ASTM C939 (flow cone) determine time of mixed grout through the flow cone. _____ seconds
6. Add water to attain 20 to 30 second flow in accordance with ASTM C939.
7. Record time of grout through cone at new water demand. _____ seconds
8. Record total water needed to attain 20 to 30 second flow. _____ pounds
9. Record percent of water. _____ percent

C. When fluid grout is specified and additional water is required beyond grout manufacturer's listed maximum water, ASTM C1107/C1107M will be run at new water per grout ratio to determine whether grout passes using actual water requirements to be fluid. Use new water per grout ratio on remaining tests.

D. Bleed Test:

1. Fill two gallon cans half full of freshly mixed grout at ambient temperatures for each category and at required consistency for each.
2. Place one can of grout in tub of ice water and leave one can at ambient temperature.
3. Cover top of both cans with glass or plastic plate preventing evaporation.
4. Maintain 38 degrees F to 42 degrees F temperature with grout placed in ice and maintain ambient temperature for second container for 1 hour.
5. Visually check for bleeding of water at 15-minute intervals for 2 hours.

6. Perform final observation at 24 hours.

If grout bleeds a small amount at temperatures specified, grout will be rejected.

E. Extended Flow Time and Segregation Test (for Category II and Category III):

1. Divide the remaining grout into two 3 gallon cans. Place the cans into the 40-degree F and 100-degree F containers and leave for 20, 40, and 60 minutes. Every 20 minutes remove and check for segregation or settlement of aggregate. Use a gloved hand to reach to the bottom of the can, if more than 1/4-inch of aggregate has settled to the bottom or aggregate has segregated into clumps reject the grout.

2. Right after the settlement test mix the grout with the drill mixer for 10 seconds. Take a ASTM C939 flow cone test of grout and record flow time. Maintain this process for 1 hour at ambient temperatures of 40 degrees F and 100 degrees F.

   a. 20 min _____, sec. @ 40 degrees F.

   b. 40 min _____, sec. @ 40 degrees F.

   c. 60 min _____, sec. @ 40 degrees F.

   d. 20 min _____, sec. @ 100 degrees F.

   e. 40 min _____, sec. @ 100 degrees F.

   f. 60 min _____, sec. @ 100 degrees F.

All Category II and Category III grout that will not go through the flow cone with continuous flow after 60 minutes will be disqualified.

_____	_____
Qualified	Disqualified

F. 24-hour Strength Test:

1. Using grout left in mixing cans in accordance with ASTM C1107/C1107M for mixing and consistency determination test and for extended time flow test, make minimum of nine cube samples.

2. Store cubes at 70 degrees F for 24 hours.

3. Record average compressive strength of nine cubes at 24 hours.

Grout will be disqualified if 24-hour compressive strengths are under 2,500 psi for grouts claiming fluid placement capabilities.

Grouts that have not been disqualified after these tests are qualified for use on the Project for the application indicated in Nonshrink Grout Schedule.

_____	_____
Signature of Independent Testing Laboratory	Date Test Conducted

SECTION 03 63 00
CONCRETE DOWELING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:
   1. American National Standards Institute (ANSI).
   2. ASTM International (ASTM):
      a. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
      b. E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
   3. 2016 California Building Code (CBC).
   4. International Association of Plumbing and Mechanical Officials Uniform ES (IAPMO-UES): Evaluation Reports for Concrete and Masonry Anchors.
   5. International Code Council (ICC):
      a. 2015 International Building Code (IBC).
      b. Evaluation Services Reports.

1.02 DEFINITIONS

A. ICC Evaluation Services Report: Published by ICC for products provided by concrete adhesive anchor manufacturers.

B. Special Inspection: As defined in the CBC and indicated on the Statement of Special Inspection (Plan) on Drawings.

1.03 SUBMITTALS

A. Action Submittals:
   1. Product Data: Manufacturer's catalog information.

B. Informational Submittals:
   1. Manufacturer's instructions for preparation, placement, drilling of holes, installation of anchors and adhesive, and handling of cartridges, nozzles, and equipment.
   2. Manufacturer's written letter of certification identifying installer's qualifications to install products.
   3. ICC Evaluation Services Report: Specific to proposed doweling system manufacturer.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Installer: Trained and certified by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Container Markings: Include manufacturer's name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

B. Store adhesive components in accordance with manufacturer's written instructions.

C. Dispose of when:
   1. Shelf life has expired.
   2. Stored other than per manufacturer's instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Adhesive:
   1. Approved by an ICC Evaluation Services Report for conformance to 2016 CBC requirements for doweling of steel reinforcing bars in cracked concrete.
   2. Suitable for long-term loads as well as for wind and seismic loads.
   3. Meet requirements of ASTM C881/C881M.
   4. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
   5. Disposable, Self-Contained Cartridge System:
      a. Capable of dispensing both components in proper mixing ratio.
      b. Fit into manually or pneumatically operated caulking gun.
   6. Mixed Adhesive: Nonsag, light paste consistency with ability to remain in a 1-inch diameter overhead drilled hole without runout.
   7. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
   8. Manufacturers and Products:
      a. Hilti, Inc., Tulsa, OK; HIT-RE 500-V3 (ESR-3814) or HIT-HY 200 (ESR-3187) Adhesive Anchors.
      b. Powers Fasteners, Brewster, NY; Power PURE110+ Epoxy Adhesive Anchor System (ESR-3298).

c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-XP Epoxy Adhesive Anchors (ESR-2508) or AT-XP Adhesive Anchors (IAPMO UES-263).

B. Mixing Nozzles:
1. Disposable, manufactured in several sizes to accommodate size of reinforcing dowels.
2. Nonremovable internal static mixer required to ensure proper blending of components.

C. Reinforcing Dowels: As specified in Section 03 21 00, Steel Reinforcement.

PART 3 EXECUTION

3.01 INSTALLATION

A. Drilling Equipment:
1. Drilling Hammers for Dowel Holes:
a. Electric or pneumatic rotary type with medium or light impact.
b. Hollow drills with flushing air systems are preferred.
2. Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.

B. Hole Diameter: Use drill bit diameter meeting ICC Evaluation Services Report requirements and as recommended by manufacturer.

C. Locate existing reinforcing with Ground Penetrating Radar or other method approved by Design-Builder prior to drilling. Coordinate with Design-Builder to adjust dowel locations where installation would result in hitting reinforcing.

D. Obstructions in Drill Path: When existing steel reinforcement is encountered during drilling, obtain Design-Builder approval for proposed fix.

E. Doweling:
1. Install per details shown on Drawings and in accordance with adhesive manufacturer's instructions.
2. When using epoxy anchors, dowels may be prebent prior to installation to 15 degrees to align with other bars. Do not heat dowels to bend.
3. Bent Bar Dowels: Where edge distances are critical, and intersection with steel reinforcement is likely, drill hole at 10-degree angle or less and use prebent reinforcing bars.

F. Adhesive:
   1. Install in accordance with written manufacturer's instructions.
   2. Dispense components through specially designed static mixing nozzle that thoroughly mixes components and places mixed adhesive at base of predrilled hole.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Special Inspection shall be provided in accordance with the Statement of Special Inspection (Plan) on Drawings and Section 01 45 33, Special Inspection, Observation, and Testing.
   1. Special inspection will be performed by the Special Inspector in accordance with ICC-ESR requirements and as specified in Section 01 45 33, Special Inspection, Observation, and Testing.
   2. Continuous inspection required where noted on Drawings and where concrete dowels are installed in overhead applications.
   3. Periodic inspection required where continuous inspection is not specified.
   4. Special Inspector will observe installation in accordance with requirements of the ICC Evaluation Services Report and will submit report including the following:
      a. Product Description: Product name, rod diameter, and length.
      b. Drill bit compliance.
      c. Hole diameter, diameter, and depth and cleanliness.
      d. Adhesive expiration date.
   5. Verification of dowel installation in accordance with manufacturer's published instructions

B. Subcontractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Subcontractor Quality Control.

END OF SECTION

SECTION 03 64 23
EPOXY RESIN INJECTION GROUTING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. C882, Standard Specification for Test Method for Bond Strength of Epoxy Resin System Used with Concrete by Slant Shear.
      b. D570, Standard Test Method for Water Absorption of Plastics.
      c. D638, Standard Test Method for Tensile Properties of Plastics.
      d. D648, Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edgewise Position.
      e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
      f. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
   2. National Sanitation Foundation (NSF): Standard 60, Standard for Drinking Water Treatment and Chemicals – Health Effects.

1.02 DEFINITIONS

A. Crack: Complete or incomplete separation of concrete into two or more parts produced by breaking or fracturing.

B. Defective Area: As defined in Section 03 30 00, Cast-in-Place Concrete.

C. Hydraulic Structure: Liquid containment structure and/or structure designed to mitigate liquid infiltration.

D. Injection: Method of bonding together, addressing or eliminating leakage through cracks or joints by installing resin under pressure to fill the void in crack or joint.

E. Joint: A planned and formed discontinuity in concrete structure at junction of adjacent and sequential concrete placements and may contain embedded waterstops.

F. Leak or Leakage: Crack or joint exhibiting presence of moisture, sign of efflorescence, intermittently wet to touch, or continuous flow of liquid.

G. Narrow Cracks: Width equal to or less than 0.015 inch.

H. Wide Cracks: Wider than 0.015 inch.

1.03 SUBMITTALS

A. Action Submittals:
   1. Physical and chemical properties for epoxy resin.
   2. Technical data for metering, mixing, and injection equipment.
   3. Depth of penetration, length, material used, and procedures where epoxy is approved for use.
   4. Marked up drawings of proposed epoxy injection repair crack locations, widths, and lengths and direction on structure.
   5. Sample bottle.
   6. Pot Life Test.
   7. Slant Shear Test (Bond Strength).

B. Informational Submittals:
   1. Manufacturer's recommended surface preparation procedures and application instructions for epoxy resins.
   2. Manufacturer's Certificate of Compliance in accordance with Section 01 61 00, Common Product Requirements. Certified test results for each batch of epoxy resin.
   3. Certificate for NSF 60 conformance.
   4. Statements of Qualification for Epoxy Resin:
      a. Manufacturer's Site representative.
      b. Injection applicator.
      c. Injection pump operating technician.
   5. Sample of epoxy resin two component ratio and injection pressure test records for concrete crack repair work.
   6. Test results of epoxy resin bond tests.
   7. Epoxy resin two component ratio and injection pressure test records for concrete crack repair work.

1.04 QUALITY ASSURANCE

A. Qualifications for Injection Staffs:
   1. Manufacturer's Site Representative:
      a. Capable of instructing successful methods of epoxy injection process for concrete structure.
      b. Understands and is capable of explaining technical aspects of correct material selection and use.
      c. Experienced in operation, maintenance, and troubleshooting of application equipment.

2. Injection Crew and Job Foreman:
   a. Provide written and verifiable evidence showing compliance with the following requirements:
      1) Licensed or certified by epoxy resin material manufacturer.
      2) Minimum 3 years' experience in successful epoxy injection for at least 10,000 linear feet of successful crack injection, including 2,000 linear feet of wet crack injection to stop water leakage.

B. Injected Epoxy Resin: Fill cracks and joints with minimum resin depth penetration no less than 90 percent of:
   1. Full thickness of concrete section for cracks or joints.
   2. Depth between waterstop and inside or outside face of structure for joints with an embedded waterstop.

C. Injected cracks and joints which leak shall be considered deficient work irrespective of depth of penetration. Reinjection of deficient work or, with approval of Engineer, provide other repairs to eliminate leakage.

D. Bond Strength Test for Epoxy Resin:
   1. Concrete failure before resin failure.
   2. 1,500 psi minimum bond strength per ASTM C882 test requirements with no failure of either concrete or epoxy resin.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:
   1. Package resin material in new sealed containers and label with following information:
      a. Manufacturer's name.
      b. Product name and lot number.

B. Storage and Protection: Store epoxy resin material containers in accordance with manufacturer's printed instructions and at ambient temperatures below 110 degrees F and above 45 degrees F.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials and accessories specified in this section shall be products of:
   1. BASF Construction Chemicals, LLC-Building Systems, Shakopee, MN; MasterInject Series products that meet properties indicated in sub-section 2.2.B.
   2. Sika Corp., Lyndhurst, NJ; Sikadur Series products that meet properties below.

3. Euclid Chemical Co., Cleveland, OH; Euco Series (#452) products that meet properties below.

2.02 EPOXY INJECTION RESIN

A. Two-component A and B structural epoxy resin for injection into cracks or joints or other voids in concrete structures for bonding or grouting.

B. Uncured Resin Properties:

1. When mixed in ratio specified on resin container label:

	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Pot Life (60-gram mass) @ 77, plus or minus 4 deg F	As specified in Article Source Quality Control	13 to 25 minutes	15 to 30 minutes
Pot Life (60-gram mass) @ 100, plus or minus 4 deg F	As specified in Article Source Quality Control	3 to 10 minutes	10 to 20 minutes
Viscosity @ 40, plus or minus 3 deg F	Brookfield RVT Spindle No. 4 @ 20 rpm	4,400 cps	600 cps
Viscosity @ 75 to 77 deg F	Brookfield RVT Spindle No. 2 @ 20 rpm	375 to 350 cps	175 to 140 cps

C. Epoxy Resin Properties: When cured for 7 days at 77 degree F, plus or minus 3 degrees F and conditioned at test temperature 12 hours prior to test, unless otherwise specified.

	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Ultimate Tensile Strength, psi	ASTM D368	8,000 min.	5,000 min.
Tensile Elongation @ Break, percent	ASTM D638	4.2 max.	3.0 max.
Flexural Strength, psi	ASTM D790	10,000 min.	10,000 min.
Flexural Modulus, psi	ASTM D790	5.5×10^5 min.	4.5×10^5 min.

	Test Method	Wide Cracks or Joints	Narrow Cracks or Joints
Compressive Yield Strength, psi	ASTM D695*	15,000 min.	12,000 min.
Compressive Modulus, psi	ASTM D695*	4.0×10^5 min.	4.0×10^5 min.
Heat Deflection Temperature	ASTM D648*	130 deg F min.	140 deg F min.
Cured 3 days @ 40 deg F – Wet Concrete		3,500 psi min.	3,500 psi min.
Cured 1 day @ 77 deg F – Dry Concrete		5,000 psi min.	5,000 psi min.
Cured 3 days @ 77 deg plus or minus 3 deg F		5,000 psi min.	5,000 psi min.

*Cure test specimens so that peak exothermic temperature of resin does not exceed 100 degrees F.

Note: See referenced specifications for preparation method of test specimens.

2.03 SURFACE SEAL

A. Sufficient strength and adhesion for holding injection fittings firmly in place and to resist pressures preventing leakage during injection.

B. Capable of removal after injection resin has cured.

2.04 ACID FLUSHING SOLUTION

A. Pre-mixed solution of food grade phosphoric acid diluted to a 5 percent plus or minus 0.5 percent of the volume of the bottle.

B. Meets ANSI/NSF Standard 60 requirements.

2.05 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal ANSI/NSF Standard 60 drinking water standards.

2.06 SAMPLE BOTTLE

A. Five-inch natural wide mouth HDPE bottle or 4-ounce clear PVC cylinder bottle; supplied with caps.

2.07 SOURCE QUALITY CONTROL

A. Test Requirements: Perform tests for each batch of epoxy resin.

B. Pot Life Test:
   1. Condition Component A and Component B to required temperature.
   2. Measure components in ratio of Component B as stated on manufacturer's label into an 8-fluid ounce paper cup.
   3. Mix components for 60 seconds using non-metallic stirring instrument. Scrape sides and bottom of cup periodically.
   4. Probe mixture once with non-metallic stirring instrument every 30 seconds, starting 2 minutes prior to minimum specified pot life.
   5. Pot Life Definition: Time at which a soft stringy mass forms in center of cup.

C. Slant Shear Test: Prepare specimens and perform tests in accordance with ASTM C882.

PART 3 EXECUTION

3.01 GENERAL

A. Unless permitted otherwise, structurally repair cracks or joints listed below:
   1. Cracks considered to be defective as defined in Section 03 30 00, Cast-in-Place Concrete.

B. Structurally repair cracks or joints in existing concrete structures where shown on Drawings.

C. Do not proceed with injection work until submittals have been reviewed and approved by Jacobs' Engineer.

D. Perform cracks or joints injection work after removing defective surface materials and after performing surface preparation, but prior to applying surface repair material unless otherwise noted. See Section 03 01 32, Repair of Vertical and Overhead Concrete Surfaces, and Section 03 01 33, Repair of Horizontal Concrete Surfaces, for concrete surface repair system.

E. Width of cracks may vary along length and through thickness of concrete section.

F. Remove all excess, unused epoxy resin materials on concrete surfaces exposed to view prior to end of Work.

3.02 EQUIPMENT

A. Portable, positive displacement type pumps with in-line metering to meter and mix two epoxy resin components and inject mixture into cracks or joints.

B. Pumps:
   1. Electric or air powered with interlocks providing positive ratio control of proportions for the two components at nozzle.
   2. Primary injection pumps for each material of different mix ratio, including a standby backup pump of similar ratio.
   3. Capable of immediate compensation for changes in resins.
   4. Do not use batch mix pumps.

C. Discharge Pressure: Automatic pressure controls capable of discharging mixed epoxy resin at pressures in accordance with epoxy resin manufacturer's printed instruction and able to maintain pressure.

D. Automatic Shutoff Control: Provide sensors on both Component A and Component B reservoirs for stopping machine automatically when only one component is being pumped to mixing head.

E. Proportioning Ratio Tolerance: Maintain epoxy resin manufacturer's prescribed mix ratio within a tolerance of plus or minus 5 percent by volume at discharge pressure up to 160 psi.

F. Ratio/Pressure Check Device:
   1. Two independent valve nozzles capable of controlling flow rate and pressure by opening or closing valve to restrict material flow.
   2. Pressure gauge capable of sensing pressure behind each valve.

3.03 PREPARATION

A. Free cracks or joints from loose matter, dirt, laitance, oil, grease, efflorescence, salt, and other contaminants.

B. Clean cracks or joints in accordance with epoxy resin manufacturer's instructions.

C. Clean surfaces adjacent to cracks or joints from dirt, dust, grease, oil, efflorescence, and other foreign matter detrimental to bond of surface seal system and to expose the full extent of cracks and joints in accordance with manufacturer's printed instruction.

D. Do not use acids and corrosives for cleaning, other than those specified herein unless neutralized prior to injecting epoxy resin.

E. During installation and curing of materials, if ambient temperature is expected to drop below manufacturer's recommended minimum temperature, provide enclosures and heat as required.

F. Provide work platforms as required.

G. Dry out cracks or joints if required by manufacturer's instructions.

3.04 APPLICATION

A. All liquid is to be removed from hydraulic structure prior to commencing with epoxy injection, unless approved otherwise.

B. Entry Ports:

1. Establish openings for epoxy resin entry in surface seal along crack.
2. Determine space between entry ports equal to thickness of concrete member to allow epoxy resin to penetrate to the full thickness of the member.
3. Unless otherwise directed by written manufacturer recommendations, drill injection holes at an angle between 45 degrees and 60 degrees from surface of concrete and perpendicular to alignment of cracks or joints, to intersect crack or joint at midpoint of concrete section, and intersect joints at midpoint between waterstop and interior or exterior concrete surface, except as noted otherwise.
4. Locate drill holes on alternate sides of crack or joint where possible, unless orientation of crack or joint is known or has been verified by non-destructive testing techniques or core drilling.
5. Drill Hole Spacing: Do not to exceed concrete thicknesses or 12 inches maximum, except as noted otherwise.
6. Adjust location and angle of drill holes to suit orientation of crack or joint and at commencement of drilling holes for injection and at beginning of each subsequent shift.
7. Take measures to prevent drilling holes for injection too shallow or too deep, or damaging existing waterstop in joints.
8. Remove dust and debris in drill holes and on surface of structure resulting from drilling operation, by flushing with water prior to installing the injection packers or ports.
9. Space entry ports closer together to allow adjustment of injection pressure to obtain minimum loss of epoxy to soil at locations where:
   a. Cracks or joints extend entirely through concrete element.
   b. Backfill of walls on one side.
   c. Slab-on-grade.
   d. Difficult to excavate behind wall to seal both surfaces of crack.
10. Install injection packers or ports in drill holes in accordance with manufacturer's printed instructions with zerk coupling or other one-way ball or check valve, to permit testing for watertightness and acid flushing of cracks and joints.

C. Acid Flushing of Cracks and Joints:

1. Where it is determined that existing conditions do not allow for required bod of epoxy resin material, flush cracks and joints with acid flushing solution in accordance with manufacturer's printed instructions. at high pressure or resin injection pressure. Apply acid flushing solution for a

sufficient duration to permit solution to penetrate full depth and length of cracks and joints or to waterstop in joints.

2. Following acid flushing, flush cracks and joints with copious quantities of potable water in accordance with manufacturer's printed instructions until no evidence of acid flushing solution is visible in flush water.
3. As a minimum, identify worker conducting acid flushing by wearing a reflective safety vest and signs indicating "Acid Flushing". Also, clearly identify Work area where acid flushing is underway by signs and isolate by placing orange pylons or other temporary barrier, and signs indicating "Acid Flushing". As work progresses, move pylons or barriers and signs to maintain a safe zone.

D. Application of Surface Seal along Cracks and Joints:

1. Apply surface seal in accordance with manufacturer's instructions to designated cracks and joints face prior to injection. Seal surface of cracks or joints to contain and prevent escape of injection epoxy.
2. Cure surface seal in accordance with manufacturer's printed instructions before commencing inject work.

E. Epoxy Injection:

1. Ensure zerk coupling is not installed in ports or packers next to the one being injected.
2. Start injection into each crack or joint at lowest elevation entry port or packer along vertical or diagonal crack or joint, and at one end of horizontal crack or joint.
3. Where injection entry ports or packers are used, continue injection at first port or packer until resin begins to flow out of port or packer at next highest elevation. Plug first port or packer and start injection at second port or packer until resin flows from next port or packer.
4. Inject entire crack or joint with same sequence.
5. At no time inject more than 6 feet length of first vertical crack or joint before verifying resin in sample bottle has start to set and cure.
6. Prior to commencing injection work along a horizontal crack or joint in structure when processed using ports or packers with zerk couplings are used, remove zerk couplings from injection ports or packers except for two ports or packers located where injection work will commence. Commence injection work in first two ports or packers. Once clean resin is vented from third injection port or packer, cease injection at first port or packer, and install zerk coupling and commence injection at third port or packer. Repeat process for fourth and subsequent ports or packers until full length of crack or joint has been injected.

F. Finishing:

1. Allow epoxy resin to cure in accordance with manufacturer's instruction after cracks or joints have been completely injected to allow surface seal removal without draining or runback of uncured epoxy resin material from cracks or joints.
2. Remove surface seal and injection packers or ports from cured injection resin along crack.
3. Finish crack or joint faces flush with adjacent concrete.
4. Indentations or protrusions caused by placement of entry ports, packers, drill holes, or damage from removal of surface seal is not acceptable.
5. Grind off protrusions and patch indentations and holes from injection packers and entry ports with a suitable patch material to satisfaction of Jacobs' Engineer.
6. Remove surplus surface seal material splatters and injection resin material runs and spills from concrete surfaces.

3.05 FIELD QUALITY CONTROL

A. Epoxy Resin Two Component Ratio Tests:

1. Disconnect mixing head and pump two resin components simultaneously through ratio check device.
2. Adjust discharge pressure to 160 psi for both resin components.
3. Simultaneously discharge both resin components into separate calibrated containers.
4. Compare amounts simultaneously discharged into calibrated containers during same time period to determine mix ratio.
5. Complete test at 160 psi discharge pressure and repeat procedure for 0 psi discharge pressure.
6. Run ratio test for each injection unit at beginning and end of each injection work day, and when injection work has stopped for more than 1 hour.
7. Document and maintain complete accurate records of ratios and pressure checks.

B. Injection Pressure Test:

1. Disconnect mixing head of injection equipment and connect two resin component delivery lines to pressure check device.
2. Pressure Check Device:
   a. Two independent valved nozzles capable of controlling flow rate and pressure by opening or closing of valve.
   b. Pressure gauge capable of sensing pressure buildup behind each valve.
3. Close valves on pressure check device and operate equipment until gauge pressure on each line reads 160 psi.

4. Stop pumps and observe pressure; do not allow pressure gauge to drop below 150 psi within 3 minutes.
5. Run pressure test for each injection equipment unit:
   a. Beginning and end of each injection work day.
   b. When injection work stop for more than 45 minutes.
6. Check tolerance to verify equipment capable of meeting specified ratio tolerance.

C. Bottled Sample Tests:
1. During injection operation, provide at least one sample of mixed epoxy resin for each injection pump per shift per injection work day in a sample bottle.
2. Provide sufficient sample to demonstrate sample material epoxy resin will set and cure correctly.
3. Label each bottled sample with Contractor's name, date, and time sample was taken, and location in structure where sample was taken. Record details of bottle sample tests.
4. Place filled sample bottle upright in a container and allow sample to cure.
5. After sample has been allowed to cure, cut bottled sample open and visually inspect contents to verify that epoxy resin material has completely reacted and cured.
6. Evaluation and Assessment of Test:
   a. Should bottled sample(s) indicate a problem; such as epoxy resin not cured or foreign liquid in sample bottle, take verifying core sample immediately from cracks or joints, where material was used.
   b. Should above-referenced bottle sample(s) and core sample(s) indicate a problem with epoxy resin, arrange to have a Technical Representative of the epoxy resin manufacturer come to Site to review bottled sample(s) and core drilled sample(s) with Jacobs' Engineer and provide technical advice on corrective measures.
   c. Carry out further investigation work or corrective measures recommended by Technical Representative of epoxy resin manufacturer.

END OF SECTION

SECTION 04 22 00
CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A1064/A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   c. C33, Standard Specification for Concrete Aggregates.
   d. C90, Standard Specification for Loadbearing Concrete Masonry Units.
   e. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   f. C144, Standard Specification for Aggregate for Masonry Mortar.
   g. C150, Standard Specification for Portland Cement.
   h. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
   i. C270, Standard Specification for Mortar for Unit Masonry.
   j. C404, Standard Specification for Aggregates for Masonry Grout.
   k. C476, Standard Specification for Grout for Masonry.
   l. C618 12, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   m. C744, Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units.
   n. C979, Pigments for Integrally Colored Concrete.
   o. C989, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
   p. C1314, Standard Test Method for Compressive Strength of Masonry Prisms.
   q. C1403, Standard Test Method for Rate of Water Absorption of Masonry Mortars.
   r. C1611/C1611M, Standard Test Method for Slump Flow of Self-Consolidating Concrete.
   s. E514/E514M, Standard Test Method for Water Penetration and Leakage through Masonry.
2. 2016 California Building Code (CBC).
3. International Code Council (ICC):
   a. International Building Code (IBC).
   b. ICC Evaluation Service (ICC-ES) Reports.

4. The Masonry Society (TMS):
   a. TMS 402/ACI 530/ASCE 5; Building Code Requirements for Masonry Structures and Companion Commentaries (MSJC Code and Commentary).
   b. TMS 602/ACI530.1/ASCE6; Specification for Masonry Structures.

1.02 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings.
   2. Data Sheets:
      a. Horizontal joint reinforcement.
      b. Preformed control joint materials.
      c. Water repellent masonry sealer.
      d. Grout mix design.
      e. Mortar mix design or prebagged mortar properties and data sheets.
      f. Grout sand gradation in accordance with ASTM C404.
   3. Samples:
      a. Sample:
         1) One of each type of masonry unit to be used on Project from the proposed manufacturer.
         2) One of each, textured units for selection of color and texture for each batch of manufacturer.
      b. Mortar colors for color selection.

B. Informational Submittals:
   1. Method and Location of Placing Grout: High lift or low lift.
   2. Mix design test results.
   3. Certifications:
      a. Units comply with ASTM C55 and ASTM C90.
      b. Grout test results conform to ASTM C1019.
      c. Grout aggregates conform to requirements of ASTM C33, including nonreactivity.
      d. Mortar sand conform to requirements of ASTM C144.
   4. Test results of Project samples from masonry unit manufacturer stating that units comply with ASTM C90. Documentation of material testing shall be one less than 1 year old.
   5. Test results of proposed grout mix deign stating that units comply with ASTM C1019. Documentation of material testing shall be 1 year old or less.
   6. Test reports stating aggregates for mortar meet requirements of ASTM C144.
   7. Test reports or letter of certification stating aggregates for grout meet requirements of ASTM C404.

8. Letter from water repellent admixture manufacturer verifying masonry unit manufacturer's proper use of product.
9. Method and materials for removal of efflorescence.
10. Field Test Results to Qualify Materials: Grout tests in accordance with ASTM C1019.

1.03 QUALITY ASSURANCE

A. Mockups:
   1. Mockup panel shall include each type of masonry specified and be similarly configured as an actual wall.
   2. Dimensions: Minimum 6 feet high by 8 feet long.
   3. Use approved materials and procedures.
   4. Leave intact after approval until acceptance of permanent masonry work and then remove at the end of the Project. May be part of permanent construction.
   5. Approved panels shall serve as basis of color, texture, bond, quality of finished joints, surface applied finishes, and for acceptance of permanent construction.
   6. Demonstrate proper use of running bond.
   7. Preserve mockup for approval of water repellant coating and for approval of sealant color.
   8. Compliance Requirements: For masonry finish and appearance, dimension tolerances, tolerances of construction, joint tolerances, and wall plumb tolerances, comply with the requirements and criteria of NCMA, ASTM C90, and TMS 602.1.

B. Masonry Unit Manufacturer: Qualified by manufacturer of water repellent admixture to use product.

C. Preinstallation Conference:
   1. Required Meeting Attendees:
      a. Masonry subcontractor, including masonry foreman.
      b. Ready-mix producer.
      c. Testing and sampling personnel.
   2. Schedule and conduct prior to start of masonry construction.
   3. Notify Design-Builder of location and time.
   4. Agenda shall include:
      a. High lift and low lift procedures.
      b. Mortar, grout, unit, and reinforcing submittals.
      c. Types and locations of rebar splices.
      d. Joint tooling.
      e. Admixture types, dosage, performance, and redosing at Site.
      f. Mix designs and test of mix.

g. Placement methods, techniques, equipment, consolidation, and reconsolidation.

h. Protection procedures for environmental conditions.

i. Other specified requirements requiring coordination.

5. Submit conference minutes as specified in Section 01 31 19, Project Meetings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection: Keep units and mortar/grout cementitious ingredients, including lime, dry.

PART 2 PRODUCTS

2.01 COMPRESSIVE STRENGTH OF MASONRY ASSEMBLAGE

A. Minimum 28-Day Specified Compressive Strength (f'm) of Masonry: 2,000 psi.

2.02 CONCRETE MASONRY UNITS (CMU)

A. ASTM C90: Medium weight.

1. Net Area Compressive Strength: 2,000 psi minimum, in accordance with TMS 602, Table 2.

a. Water Repellent Admixture:

1) Structural concrete masonry units in weather exposed exterior wall shall be manufactured with integral liquid polymeric admixture to provide resistance to water penetration.

2) Manufacturers and Products:

a) W.R. Grace & Co.; Dry-Block Block Admixture.

b) BASF Construction Chemicals; Rheopel Plus.

2. Nominal Size: 16 inches long by 8 inches high by thickness shown on Drawings.

3. Color of Units: Natural.

4. Surface Texture on Exposed Surfaces: Smooth.

5. Surface Texture: Smooth on interior, concealed exterior, and surface 1 foot below finished grade.

B. General Concrete Masonry Unit (CMU) Requirements:

1. Furnish or cut special shapes for corners, jambs, lintels, and other areas shown or required.

2. Special units shall match color and texture of standard units.

3. Where units are placed so end of unit is exposed, such as at a corner or intersection, exposed end of that block shall have surface to match color and texture of sides of other units.

4. Furnish sound, dry, clean units free of cracks, prior to placing in structure.

5. Vertical Cells to be Grouted: Capable of alignment sufficient to maintain clear, unobstructed continuous vertical cell dimensions in accordance with TMS 602, Table 7.

C. Textured Concrete Masonry Units (TCMU):
1. Same type and weight as structural units.
2. TCMU-1:
a. Split Face:
1) Color of Units: Basalite 490 (Dark Gray).
3. TCMU-2:
a. Precision Face: Center scored.
1) Color of Units: Basalite, Color 625 (Concrete).
4. TCMU-3:
a. Split Rib: 5 scores/block.
1) Color of Units: Basalite, Color 625 (Concrete).
5. TCMU-4:
a. Split Face: No Scoring.
1) Color of Units: Basalite, Color 769 (Dark Bronze).

2.03 MORTAR MATERIALS

A. Portland Cement-Lime Mortar:
1. ASTM C270.
2. Cement: ASTM C150, Type I and Type II portland cement.
3. Lime: ASTM C207, Type S hydrated.
4. Aggregates:
a. Nonreactive in accordance with ASTM C33, Appendix X1.
b. Mortar: ASTM C144, sand.

B. Mortar Cement Mortar: ASTM C1329.

C. Water: Fresh, clean, and potable.

D. Water Repellent Admixture:
1. ASTM C1403.
2. Mortar for structural and textured concrete masonry units in weather exposed exterior walls shall include an integral liquid polymeric admixture to provide resistance to water penetration.
3. Manufacturers and Products:
a. GCP Technologies; DRY-BLOCK.
b. Harris Specialty Chemicals.
c. Axim Italcementi Group; Intrapel.
d. BASF Chemical Co.; MasterPel 240MA Admixture.

E. Mortar Color Admixture:
   1. Meet the requirements of ASTM C979.
   2. Manufacturer and Product: Davis Colors, Los Angeles, CA; True Tone Mortar Color.
   3. Color to match adjacent CMU or TCMU unless indicated on Drawings.

2.04 GROUT MATERIALS

A. Cement: ASTM C150, Type I and Type II portland cement.

B. Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618.

C. Slag Cement: In accordance with ASTM C989, Grade 100 or Grade 120.

D. Lime: ASTM C207, Type S hydrated.

E. Aggregates:
   1. ASTM C404, fine and coarse.
   2. Nonreactive in accordance with ASTM C33, Appendix X1.

F. Water: Fresh, clean, and potable.

2.05 REINFORCEMENT

A. Reinforcement: Clean and free from loose rust, scale, and coatings that reduce bond.

B. Deformed Bars: As specified in Section 03 21 00, Steel Reinforcement.

2.06 PREFORMED CONTROL JOINTS

A. Solid rubber cross-shape extrusions as manufactured by:
   1. Dayton Superior/Dur-O-Wal, Dayton, OH; DA 2001 Control Joint Regular Rubber.
   2. Hohmann and Barnard, Inc, Hauppauge, NY; #RS-Standard.

2.07 MORTAR MIXES

A. In accordance with ASTM C270, Type S and MSJC Specifications.

B. Mix Method:
   1. Property Method: Minimum average mortar 28-day compressive strength 1,800 psi.

C. Mixing:
   1. Machine mix in approved mixers in accordance with ASTM C270. Time addition of approved admixtures in accordance with manufacturer's instructions. Procedure used for adding it to mix shall provide good dispersion.
   2. Follow manufacturer's instructions for mortar color admixture.
   3. Follow manufacturer's instructions for water repellent admixture.
   4. Review compatibility with other mortar admixture.

D. Where colored masonry units are used, color mortar to match. Inert coloring pigments may be added, but shall not exceed 6 percent by weight of cement.

2.08 GROUT MIXES

A. Compressive Strength Property: Minimum 2,000 psi at 28 days. Grout strength shall not exceed two times the minimum specified strength.

B. Mix Design:
   1. Proportions:
      a. Design mix to meet property/strength requirements.
      b. Where fly ash or slag is included in mix, fly ash or slag content shall be a minimum of 25 percent and a maximum of 30 percent of weight of total cementitious materials.
   2. Slump: 8-inch minimum, 11-inch maximum.

C. Mixing:
   1. Do not use water reducers, air entrainment, plasticizing, high-range water reducers, or other nonspecified admixtures in grout mixes.
   2. Transit-Mixed Grout: Meet requirements of ASTM C476.
   3. Fluid consistency suitable for placing without segregation with a slump of 8 inches to 11 inches.

2.09 WATER REPELLENT MASONRY SEALER

A. Characteristics:
   1. Water-based blend of silanes and siloxanes.
   2. VOC compliant.

B. Performance Requirements:
   1. Water Absorption: 95 percent reduction in weight gain when tested in accordance with ASTM C140.
   2. Water Repellency: 99 percent reduction in weight gain when tested in accordance with ASTM E514.

C. Manufacturers and Products:
   1. GCP Technologies; Infiniseal DB Sealer.
   2. BASF Construction Chemicals; MasterProtect H 185.

PART 3 EXECUTION

3.01 GENERAL

A. Meet requirements of 2016 CBC, Chapter 21 and 2013 The Masonry Society (TMS) 602/American Concrete Institute (ACI) 530.1/ASCE 6, Specification for Masonry Structures and Companion Commentaries (MSJC), Part 3, Execution, except as modified in this section.

B. Moisture Protection:
   1. Keep units dry while stored on Site.
   2. Do not wet units prior to laying.

C. Provide measures to prevent moisture from entering incomplete walls and open cells.

D. Cold Weather: Meet requirements of MSJC Specification Section “Cold Weather Construction”.

E. Hot Weather: Meet requirements of MSJC Specification Section “Hot Weather Construction”.

F. After construction during cold weather, maintain newly constructed masonry temperature above 32 degrees F for a minimum of 24 hours using MSJC or other approved cold weather methods.

G. After construction and during hot weather, fog spray newly constructed masonry in accordance with MSJC hot weather construction requirements.

3.02 PREPARATION

A. Concrete Foundations: Meet tolerance requirements of ACI 117 prior to starting any masonry work.

B. Prepare surface contact area of foundation concrete for initial mortar placement by removing laitance, loose aggregate, and other materials, and anything that would prevent mortar from bonding to foundation.

C. Patch or grind out-of-tolerance foundation surfaces to receive mortar prior to starting masonry work.

D. Clean reinforcement dowels and projecting embeds by removing laitance, spillage, or items that will adversely affect grout bond.

E. Prevent surface damage to foundation concrete that will be exposed to view outside of contact area.

3.03 LAYING MASONRY UNITS

A. General:
   1. Finish Tolerances (Measured on Interior Surfaces): Meet requirements of "Site Tolerance" requirements of Part 3, Execution, of the MSJC Specifications.
   2. Place units with chipped edges or corners such that chipped area is not exposed to view.

B. Wall Units:
   1. General:
      a. If necessary to move a unit after once set in-place, remove from wall, clean, and set in fresh mortar.
      b. Toothing of masonry units is not permitted.
   2. Running Bond:
      a. Unless otherwise shown, lay-up walls in straight, level, and uniform courses using a running bond pattern.
      b. Corners: Lay standard masonry bond for overlapping units and grout solid.
      c. Intersecting Walls: Half unit appearance shall not extend and be visible on exterior side of intersecting wall. Provide hooked corner bars in bond beam units as shown on Drawings.
   3. Special Shapes:
      a. Provide and place such special units as corner block, doorjamb block, lintel block fillers, and similar blocks as may be required.
      b. Use required shapes and sizes to work to corners and openings, maintaining proper bond throughout wall.

3.04 BUILT-IN ITEMS

A. Position door frames, windows, vents, louvers, and other items to be built in wall, and construct wall around them.

B. Install masonry anchors to secure items to wall.

C. Fill spaces around items with grout except use mortar at mortar joints.

D. Do not place electrical, instrumentation, or water conduits in a cell containing parallel reinforcement, unless approved in writing by Design-Builder. Additionally, pipes, sleeves, and conduits shall meet requirements of TMS 402/ACI 530/ ASCE 5, Building Code Requirements for Masonry Structures (MSJC Code) and MSJC specification construction requirements.

3.05 MORTAR JOINTS

A. General:
   1. Meet masonry erection requirements of MSJC, Part 3, Execution, 3.3B.
   2. As units are laid, remove excess mortar from grout space of cells to be filled. Final grout space, including any remaining mortar projections, shall be as required by MSJC Table “Grout Space Requirements”.
   3. Place mortar before initial setting of cement takes place. Retemper only as required for it to remain plastic. Retempering of colored mortar is not allowed.
   4. Remove mortar containing water repellent admixture from face of masonry before it sets.

B. Exposed Joints:
   1. Tool joints exposed to view after final construction, unless otherwise noted or shown.
   2. Cut joints flush and as mortar takes its initial set; tool to provide a concave joint.
   3. Perform tooling with tool that compacts mortar, pressing excess mortar out.
   4. Perform tooling when mortar is partially set, but still sufficiently plastic to bond rather than dragging it out.
   5. Rake out joints that are not tight at time of tooling, point, and then tool.
   6. Rake and tool joints at split-face surfaces, interior and exterior.

C. Concealed Joints: Strike flush with no further treatment required.

3.06 CONTROL JOINTS

A. Preformed Control Joints:
   1. Omit mortar from vertical joints.
   2. Place in units fabricated to receive rubber control joint material as wall is built.
   3. After wall is grouted, cured, and cleaned, install backing rod and sealant as specified in Section 07 92 00, Joint Sealants.
   4. Place and tool sealant to match depth of typical joint.

3.07 REINFORCING

A. Foundation Dowels:
   1. Locate first foundation dowel at end of wall in center of first cell; typically 4 inches from end of wall.
   2. Locate at each side of control joints and openings and below beam and joist seats, and then locate at maximum required spacing between these bars.

3. Size, number, and location of foundation dowels shall match all typical and additional vertical wall reinforcing, unless otherwise noted.
4. When foundation dowel does not line up with vertical core, do not slope more than 1 horizontal to 6 vertical to bring it into alignment.

B. Vertical Reinforcing:
1. Use deformed bars.
2. Hold in position near ends of bars by wire ties to dowels or by reinforcing positioners.
3. For high lift grouting, hold in position at maximum intervals of 160 bar diameters by reinforcing positioners.
4. Lap reinforcing bars as shown or approved.
5. Wire tie splices together.
6. Minimum Bar Clearance: 1/2-inch from masonry for coarse grout 1/4-inch from masonry for fine grout, from formed surfaces, and from parallel bars in same grout space.

C. Horizontal Reinforcing:
1. Use deformed bars.
2. Lay on webs of bond beam units and place as wall is built. Increase web depth to ensure 1/2-inch cover over top of rebar.
3. Lap reinforcing bars where spliced and wire tie together.
4. Minimum Bar Clearance: 1/2 inch from masonry for coarse grout 1/4 inch from masonry for fine grout, from formed surfaces, and from parallel bars in same grout space.
5. Terminate reinforcing bars 2 inches clear from control joints except horizontal bars at roof and floor courses shall be continuous through joints.

3.08 MORTAR PRODUCTION

A. Mix bulk materials in accordance with MSJC Specification.

B. Mix prebagged materials with water to produce a workable consistency.

C. Remix or retemper to maintain workability. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.

3.09 GROUT PLACEMENT

A. Do not mix, convey, or place with equipment constructed of aluminum.

B. Secure vertical and horizontal reinforcement, ties, bolts, anchors, and other required embedments in place; inspect and verify before placing grout.

C. Grout beams over openings in one continuous operation.

D. Maintain vertical alignment in accordance with ACI 530.1, Table 7:
   1. Place grout within 1-1/2 hours of addition of water to mix.
   2. Use reinforcing positioners to secure vertical reinforcement.

E. Grouting Requirements:
   1. Solid grout all walls.
   2. Fully embed horizontal steel with grout in an uninterrupted pour.
   3. Do not construct wall more than one course above top of grout pour prior to placing grout.

F. Vibration:
   1. Use internal “pencil” type, low energy vibrator to thoroughly consolidate grout and reduce amount of air voids. Do not use concrete vibrators.
   2. After initial water loss and settlement has occurred, but before it has taken any set, reconsolidate grout.
   3. Waiting period for reconsolidation will vary depending upon weather conditions and block absorption rates, but under “normal” weather conditions with average masonry units the waiting period should be between 30 minutes and 60 minutes.

G. Cleanouts:
   1. Construct in accordance with MSJC specification.
   2. Provide for grout pours heights over 5 feet 4 inches in accordance with the 2016 CBC.
   3. Provide sufficient size to permit cleaning of cell, positioning of reinforcing, and inspection at bottom of every vertical cell containing reinforcing and maximum of 32 inches on center.
   4. Location: Concealed from view after final construction, unless otherwise approved by Design-Builder.
   5. After wall has been inspected and approved and prior to grouting, cap cleanouts in a manner that will seal them from grout leakage and provide a flush finish.

3.10 WATER REPELLENT MASONRY SEALER

A. Remove efflorescence prior to applying water repellents. Dispose of waste generated.

B. Apply to exposed exterior concrete masonry walls.

C. Repoint loose, cracked, or disintegrating mortar at least 7 days prior to application. Ensure joint sealants and caulking are fully cured and wall surfaces are clean, dry, and free of chemical cleaners, efflorescence, dirt, oils, mortar smears, and other surface contaminants.

D. Follow manufacturer's recommendations for weather conditions during application.

E. Test a 5-foot by 5-foot wall area to ensure proper coverage and desired surface appearance when sealer is fully dried.

F. Apply with spray, brush, or roller following manufacturer's recommendations, at a coverage rate of 50 square feet to 150 square feet per gallon, as determined by testing. Use two-coat application where recommended by manufacturer.

3.11 FIELD QUALITY CONTROL

A. Special Inspection shall be provided in accordance with CBC Chapter 17 and the Statement of Special Inspections Plan on Drawings and Section 01 45 33, Special Inspection, Observation, and Testing.

B. Subcontractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Subcontractor Quality Control.

C. Masonry shall be tested by independent testing agency, retained by subcontractor and approved by Design-Builder.

D. Provide adequate facilities for safe storage and proper curing of masonry prisms, mortar samples, and grout samples, as applicable, onsite for first 24 hours, and for additional time as may be required before transporting to test lab.

E. Masonry Testing:
   1. Masonry strength shall be determined using unit strength method as shown.
   2. Masonry test prisms, when required or desired, shall be constructed onsite with same materials and workmanship to be used for Project and in accordance with ASTM C1314. Method and frequency of prism testing shall be as shown on the Special Inspection and Testing Plan.

F. Corrective Action:
   1. If compressive strength tests made prior to construction of permanent structure fail to meet Specifications, adjustments shall be made to mix designs for mortar, or grout, or both, as needed to produce specified strength.
   2. If strength tests performed on materials representative of in-place construction fail to meet Specifications, prisms or cores shall be cut from constructed walls in sufficient locations to adequately determine strength in accordance with MSJC.
   3. Water Repellent Performance Test: Masonry using concrete masonry units and mortar with integral water repellent additives, and water repellent masonry sealer, shall achieve a Class E rating when evaluated in accordance with ASTM E514, with the test extended to 72 hours.

3.12 CLEANING

A. Immediately after completion of grouting, clean masonry surfaces of excess mortar, grout spillage, scum, stains, dirt, and other foreign substances using clean water and fiber brushes.

B. Clean walls not requiring painting or sealing so there are no visible stains.

3.13 PROTECTION OF INSTALLED WORK

A. Do not allow grout and mortar stains to dry on face of exposed masonry.

B. Protect tops of walls at all times. Cover tops of walls with waterproof paper when rain or snow is imminent and when the Work is discontinued.

C. Adequately brace walls until walls and roof are completed.

D. Provide sufficient bracing to protect walls against damage from elements, including wind and snow.

E. Protect masonry against freezing for minimum 72 hours after being laid.

F. Protect masonry from damage until final acceptance of the Work. Damaged units will not be accepted.

END OF SECTION

SECTION 05 05 19
ANCHOR BOLTS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 318, Building Code Requirements for Structural Concrete.
   b. 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete.
   c. 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete.
2. American Iron and Steel Institute (AISI): Stainless Steel Type 316.
3. American National Standards Institute (ANSI).
4. ASTM International (ASTM):
   a. A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   b. A143, Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
   c. A153/A153M, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   d. A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   e. A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both.
   f. A380, Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   g. A385, Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
   h. A563, Specification for Carbon and Alloy Steel Nuts.
   i. A780, Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   j. A967, Specification for Chemical Passivation Treatments for Stainless Steel Parts.
   k. E488, Standard Test Methods for Strength of Anchors in Concrete Elements.
   l. F436, Specification for Hardened Steel Washers.
   m. F468, Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
   n. F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   o. F594, Specification for Stainless Steel Nuts.
   p. F1554, Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

5. International Association of Plumbing and Mechanical Officials Uniform ES (IAPMO-UES): Evaluation Reports for Concrete and Masonry Anchors.
6. International Code Council Evaluation Service (ICC-ES):
   a. Evaluation Reports for Concrete and Masonry Anchors.
   b. AC01, Acceptance Criteria for Expansion Anchors in Masonry Elements.
   c. AC70, Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements.
   d. AC106, Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
   e. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
   f. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements. Evaluation Reports for Concrete and Masonry Anchors.
7. Specialty Steel Industry of North America (SSINA):
   a. Specifications for Stainless Steel.
   b. Design Guidelines for the Selection and Use of Stainless Steel.
   c. Stainless Steel Fabrication.
   d. Stainless Steel Fasteners.

1.02 DEFINITIONS

A. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals.

B. Exterior Area: Location not protected from weather by a building or other enclosed structure to include buried roof structures.

C. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or wash down, and where wall or roof slab is not common to a water-holding or earth-retaining structure.

D. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or wash down, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.

E. Submerged: Location at or below top of wall of open water-holding structure, such as a basin or channel, or wall, ceiling, or floor surface inside a covered water-holding structure, or exterior below grade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Specific instructions for concrete anchor installation, including drilled hole size and depth, preparation, placement, procedures, and instructions for safe handling of anchoring systems.

B. Informational Submittals:
   1. Concrete and Masonry Anchors:
      a. Manufacturer's product description and installation instructions.
      b. Current ICC-ES or IAPMO-UES Report for each type of post-installed anchor to be used.
      c. Adhesive Anchor Installer Certification.
   2. Passivation method for stainless steel members.
   3. Hot-Dip Galvanizing: Certificate of compliance signed by galvanizer, with description of material processed and ASTM standard used for coating.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Installers of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be certified by an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Installer Certification Program or equivalent.
   2. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual of the American Galvanizers Association.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package stainless steel items in a manner to provide protection from carbon impregnation.

B. Protect hot-dip galvanized finishes from damage as a result of metal banding and rough handling.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Stainless Steel:	
Threaded Rods	F593, AISI Type 316, Condition CW
Nuts*	F594, AISI Type 316, Condition CW
Carbon Steel:	
Threaded Rods	F1554, Grade 36 unless noted otherwise
Flat and Beveled Washers (Hardened)	F436

Item	ASTM Reference
Nuts*	A194/A194M, Grade 2H
Galvanized Steel:	
All	A153/A153M
*Nuts of other grades and styles having specified proof load stresses greater than specified grade and style are also suitable. Nuts must have specified proof load stresses equal to or greater than minimum tensile strength of specified threaded rod.	

B. Bolts, Washers, and Nuts: Use stainless steel unless noted otherwise on Drawings.

2.02 POST-INSTALLED CONCRETE ANCHORS

A. General:
1. AISI Type 316 stainless or hot-dip galvanized, as shown in Fastener Schedule at end of this section.
2. Post-installed anchor systems used in concrete shall be approved by ICC Evaluation Services Report or equivalent for use in cracked concrete and for short-term and long-term loads including wind and earthquake.
3. Mechanical Anchors: Comply with the requirements of ICC-ES AC193 or ACI 355.2.
4. Adhesive Anchors: Comply with the requirements of ICC-ES AC308 or ACI 355.4.

B. Torque-Controlled Expansion Anchors (Wedge Anchors):
1. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; Kwik-Bolt –TZ (KB-TZ) Anchors (ESR-1917).
   b. Powers Fasteners, Brewster, NY; Power-Stud +SD1, +SD2, +SD4, or +SD6 Anchors (ESR-2502 and ESR-2818).
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Strong-Bolt 2 Anchors (ESR-1771 and ESR-3037).

C. Undercut Anchors:
1. Manufacturers and Products:
   a. USP Structural Connectors, Burnsville, MN; DUC Undercut Anchor (ESR-1970).
   b. Hilti, Inc., Tulsa, OK; HDA Undercut Anchor (ESR-1546).
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; TORQ-CUT Self-Undercutting Anchor (ESR-2705).
   d. Powers Fasteners, Brewster, NY; Atomic+ Undercut Anchor (ESR-3067).

D. Self-Tapping Concrete Screw Anchors:
1. Manufacturers and Products:
   a. Powers Fasteners, Brewster, NY; Wedge-Bolt+ (ESR-2526).

b. Powers Fasteners, Brewster, NY; Vertigo+ Rod Hanger Screw Anchor (ESR-2526).

c. Powers Fasteners, Brewster, NY; Snake+ Flush Mount Screw Anchor (ESR-2272).

d. Hilti, Inc., Tulsa, OK; HUS-EZ Screw Anchor (ESR-3027).

e. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Titen HD Screw Anchor (ESR-2713).

E. Adhesive Anchors:

1. Threaded Rod:

a. Diameter as shown on Drawings.

b. Length as required to provide minimum depth of embedment indicated and thread projection required.

c. Clean and free of grease, oil, or other deleterious material.

2. Adhesive:

a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.

b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.

3. Packaging and Storage:

a. Disposable, self-contained system capable of dispensing both components in proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.

b. Store adhesive on pallets or shelving in a covered storage area.

c. Package Markings: Include manufacturer's name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

d. Dispose of when:

1) Shelf life has expired.

2) Stored other than in accordance with manufacturer's instructions.

4. Manufacturers and Products:

a. Hilti, Inc., Tulsa, OK; HIT Doweling Anchor System, HIT RE 500 V3 (ESR-3814), or HIT-HY 200 (ESR-3187).

b. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-XP Epoxy Adhesive Anchors (ESR-2508), or AT-XP Adhesive Anchors (IAPMO UES-263).

c. Powers Fasteners, Brewster NY; Pure 110+ Epoxy adhesive anchor system (ESR-3298).

F. Adhesive Threaded Inserts:

1. Type 316 stainless steel, internally threaded inserts.

2. Manufacturer and Product: Hilti, Inc., Tulsa, OK; HIS-RN Insert with HIT-RE 500-V3 or HIT-HY 200 adhesive.

2.03 CAST-IN-PLACE ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

A. Cast-In-Place Anchor Bolts:
   1. Headed type, unless otherwise shown on Drawings.
   2. Material type and protective coating as shown in Fastener Schedule at end of this section.

B. Anchor Bolt Sleeves:
   1. Single unit construction with corrugated sleeve.
   2. Top of sleeve shall be self-threading to provide adjustment of threaded anchor bolt projection.
   3. Material: High-density polyethylene.
   4. Manufacturer: Sinco Products, Inc., Middletown, CT.

2.04 POST-INSTALLED MASONRY ANCHORS

A. General: AISI Type 316 stainless, hot-dip galvanized, or zinc-plated steel, as shown in Fastener Schedule at end of section.

B. Current ICC Evaluation Report indicating acceptance for anchors at structural applications in masonry.

C. Manufacturer's and Products:
   1. Hilti, Inc., Tulsa, OK; Kwik-Bolt-3 (KB-3) (ESR-1385), for grout-filled masonry, HIT-HY 70 (ESR-2682) for grout filled CMU, hollow CMU, or unreinforced masonry.
   2. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Strong-Bolt 2 (IAPMO ER 240) for grout filled CMU, Titen-HD (ESR-1056) for grout filled or hollow CMU, AT-XP (IAPMO ER-281) for grout filled CMU.
   3. DeWalt/Powers Fasteners, Brewster NY; Power-Stud+ SD1 (ESR-2966) for grout-filled masonry, Wedgebolt+ (ESR-1678) for grout-filled masonry.

PART 3 EXECUTION

3.01 CONCRETE AND MASONRY ANCHORS

A. Begin installation only after concrete or masonry to receive anchors has attained design strength.

B. Locate existing reinforcing with Ground Penetrating Radar or other method approved by Design-Builder prior to drilling. Coordinate with Design-Builder to adjust anchor locations where installation would result in hitting reinforcing.

C. Install in accordance with written manufacturer's instructions.

D. Provide minimum embedment, edge distance, and spacing as indicated on Drawings.

E. Use only drill type and bit type and diameter recommended by anchor manufacturer.

F. Clean hole of debris and dust per manufacturer's requirements.

G. When unidentified embedded steel, rebar, or other obstruction is encountered in drill path, slant drill to clear obstruction. If drill must be slanted more than indicated in manufacturer's installation instructions to clear obstruction, notify Design-Builder for direction on how to proceed.

H. Adhesive Anchors:

1. Unless otherwise approved by Design-Builder and adhesive manufacturer:
   a. Do not install adhesive anchors when temperature of concrete or masonry is below 40 degrees F or above 100 degrees F.
   b. Do not install prior to concrete attaining an age of 21 days.
   c. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry.
   d. Do not disturb anchor during recommended curing time.
   e. Do not exceed maximum torque as specified in manufacturer's instructions.
2. For hollow-unit masonry, install screen tube in accordance with manufacturer's instructions.

I. Prestressed Concrete: Do not use drilled-in anchors in prestressed or post-tensioned concrete members without Design-Builder's prior approval unless specifically shown on Drawings.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Quality Control, in accordance with the 2016 California Building Code (CBC), Chapter 17 requirements.

B. Quality Assurance: Inspection and testing as required in the Special Inspection Plan on Drawings.

3.03 MANUFACTURER'S SERVICES

A. Adhesive and Mechanical Anchors: Conduct Site training of installation personnel for proper installation, handling, and storage of adhesive anchor system. Notify Design-Builder of time and place for sessions.

3.04 FASTENER SCHEDULE

A. Unless indicated otherwise on Area Classification Table on Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Anchor Bolts Cast into Concrete for Structural Steel, Metal Fabrications and Castings		
Interior Dry Areas	Hot-dip galvanized steel headed anchor bolts, unless indicated otherwise	
Exterior and Interior Wet Areas	Stainless steel headed anchor bolts	
Submerged and Corrosive Areas	Stainless steel headed anchor bolts with fusion bonded coating	See Section 09 90 00, Painting and Coating (as included in Balance of Plant Project)
2. Anchor Bolts Cast into Concrete for Equipment Bases		
Interior Dry Areas	Hot-dip galvanized steel headed anchor bolts, unless indicated otherwise	
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel headed anchor bolts with fusion bonded coating, unless otherwise specified with equipment	See Section 09 90 00, Painting and Coating (as included in Balance of Plant Project)
3. Anchors Cast in Grout-Filled Concrete Masonry Units		
Dry Areas	Hot-dip galvanized steel headed anchor bolts	
Exterior and Interior Wet Areas	Hot-dip galvanized steel headed anchor bolts, or stainless steel sleeve anchors	

Service Use and Location	Product	Remarks
4. Post Installed Anchors for Metal Components to Cast-in-Place Concrete (such as, Ladders, Handrail Posts, Electrical Panels, Platforms, and Equipment)		
Interior Dry Areas	Anchor material type to match material being anchored (for example, stainless steel anchors to anchor stainless steel equipment, hot-dip galvanized anchors to anchor painted equipment, hot-dip galvanized anchors to anchor galvanized equipment)	Verify product acceptability and manufacturer's requirements if anchor installation will occur in an overhead application
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel adhesive anchors	Verify product acceptability and manufacturer's requirements if anchor installation will occur in an overhead application
5. Post-Installed Anchors in Grout-Filled Concrete Masonry Units		
Interior Dry Areas	Anchor material type to match material being anchored (for example, stainless steel anchors to anchor stainless steel equipment, hot-dip galvanized anchors to anchor painted equipment, hot-dip galvanized anchors to anchor galvanized equipment)	
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel adhesive anchors	

Service Use and Location	Product	Remarks
6. Post-Installed Anchors in Hollow Concrete Masonry Units		
Interior Dry Areas	Anchor material type to match material being anchored (for example, stainless steel anchors to anchor stainless steel equipment, hot-dip galvanized anchors to anchor painted equipment, hot-dip galvanized anchors to anchor galvanized equipment)	Adhesive anchors shall be installed with screen tubes
Exterior, Interior Wet, and Corrosive Areas	Stainless steel adhesive anchors	Adhesive anchors shall be installed with screen tubes
7. All Others		
All service uses and locations	Stainless steel fasteners	

B. Antiseizing Lubricant: Use on all stainless steel threads.

C. Provide insulating dielectric kit at anchor bolts where anchors and fastened item are dissimilar materials.

D. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 120 degrees F.

END OF SECTION

SECTION 05 05 23
WELDING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:
   1. American Society of Mechanical Engineers (ASME):
      a. BPVC SEC V, Nondestructive Examination.
      b. BPVC SEC IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
   2. American Society of Nondestructive Testing (ASNT): SNT-TC-1A, Personnel Qualification and Certification in Nondestructive Testing.
   3. American Welding Society (AWS):
      a. A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
      b. A3.0, Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermalspraying.
      c. D1.1/D1.1M, Structural Welding Code - Steel.
      d. D1.2/D1.2M, Structural Welding Code - Aluminum.
      e. D1.3, Structural Welding Code - Sheet Steel.
      f. D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.
      g. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
      h. QC1, Standard for AWS Certification of Welding Inspectors.
   4. ASTM International (ASTM): A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

1.02 DEFINITIONS

A. CJP: Complete Joint Penetration.

B. CWI: Certified Welding Inspector.

C. MT: Magnetic Particle Testing.

D. NDE: Nondestructive Examination.

E. NDT: Nondestructive Testing.

F. PJP: Partial Joint Penetration.

G. PQR: Procedure Qualification Record.

H. PT: Liquid Penetrant Testing.

I. RT: Radiographic Testing.

J. UT: Ultrasonic Testing.

K. VT: Visual Testing.

L. WPQ: Welder/Welding Operator Performance Qualification.

M. WPS: Welding Procedure Specification.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Shop and field WPSs and PQRs.
   2. NDT procedure specifications prepared in accordance with ASME BPVC SEC V.
   3. Welding Data (Shop and Field):
      a. Show on Shop Drawings or a weld map complete information regarding base metal specification designation, location, type, size, and extent of welds with reference called out for WPS and NDE numbers in tails of combined welding and NDE symbols as indicated in AWS A2.4.
      b. Distinguish between shop and field welds.
      c. Indicate, by welding symbols or sketches, details of welded joints and preparation of base metal. Provide complete joint welding details showing bevels, groove angles, and root openings for welds.
      d. Welding and NDE symbols shall be in accordance with AWS A2.4.
      e. Welding terms and definitions shall be in accordance with AWS A3.0.
      f. Submit welding data together with Shop Drawings as a complete package.

B. Informational Submittals:
   1. WPQs.
   2. CWI credentials.
   3. Testing agency personnel credentials.
   4. CWI reports.
   5. Welding Documentation: Submit on appropriate forms in referenced welding codes.

1.04 QUALIFICATIONS

A. WPSs: In accordance with AWS D1.1/D1.1M (Annex M Forms) for shop or field welding; or ASME BPVC SEC IX (Forms QW-482 and QW-483) for shop welding only.

B. WPQs: In accordance with AWS D1.1/D1.1M (Annex E Forms) or ASME BPVC SEC IX (Form QW-484).

C. CWI: Certified in accordance with AWS QC1, and having prior experience with the welding codes specified. Alternate welding inspector qualifications require approval by the Design-Builder.

D. Testing Agency: Personnel performing tests shall be NDT Level II certified in accordance with ASNT SNT-TC-1A.

1.05 SEQUENCING AND SCHEDULING

A. Unless otherwise specified, all Submittals required in this section shall be submitted and approved prior to commencement of welding operations.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. CWI shall be present whenever shop welding is performed. CWI shall perform inspection, as necessary, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:

1. Verifying conformance of specified job material and proper storage.
2. Monitoring conformance with approved WPS.
3. Monitoring conformance of WPQ.
4. Inspecting weld joint fit-up and performing in-process inspection.
5. Providing 100 percent visual inspection of welds.
6. Supervising nondestructive testing personnel and evaluating test results.
7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work and referenced welding codes.

PART 3 EXECUTION

3.01 GENERAL

A. Welding and Fabrication by Welding: Conform to governing welding codes referenced in attached Welding and Nondestructive Testing Table.

B. Welding procedure specifications for all pressure piping shall be qualified for notch toughness by limiting heat input; charpy testing of weld metal and heat-affected zone shall be done as a part of the welding procedure qualification. Full-size specimens shall be charpy tested in accordance with ASTM A370 at a test temperature of 30 degrees F. The minimum average energy of the test coupons shall not be less than 25 foot-pounds.

3.02 NONDESTRUCTIVE WELD TESTING REQUIREMENTS

A. Quality Control Inspection:
   1. All Welds: 100 percent VT by Subcontractor's CWI.
   2. Acceptance Criteria:
      a. Structural Pipe and Tubing: AWS D1.1/D1.1M, Paragraph 9.25.
      b. All Other Structural Steel: AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
      c. Stud Connections: AWS D1.1/D1.1M, Paragraph 7.8.1.

B. Nondestructive Testing Requirements:
   1. NDT frequency shall be as specified below, as required by referenced welding codes, or as specified in the attached table. In case there is a conflict, the higher frequency level of NDT shall apply.
      a. Nontubular Connections:
         1) CJP Butt Joint Groove Welds: 10 percent random RT. Use UT for CJP butt joint groove welds that cannot be readily radiographed.
         2) All Other CJP Groove Welds: 10 percent random UT.
         3) Fillet Welds and PJP Groove Welds: 10 percent random PT or MT.
      b. Tubular Connections:
         1) CJP butt joint groove welds made from one side without backing: 100 percent RT or UT in accordance with AWS D1.1/D1.1M, Paragraph 9.26.2 requirements.
         2) CJP Butt Joint Groove Welds made without backing or back-gouging: 10 percent random RT. Use UT for CJP butt joint groove welds that cannot be readily radiographed.
         3) All Other CJP Groove Welds: 10 percent random UT.
         4) Fillet Welds and PJP Groove Welds: 10 percent random PT or MT.

2. NDT Procedures and Acceptance Criteria:
   a. Nontubular Connections:
      1) RT: Perform in accordance with AWS D1.1/D1.1M, Clause 6, Part E. Acceptance criteria per AWS D1.1/D1.1M, Paragraph 6.12.1.
      2) UT: Perform in accordance with AWS D1.1/D1.1M, Clause 6, Part F. Acceptance criteria per AWS D1.1/D1.1M, Paragraph 6.13.1.
      3) PT and MT:
         a) Perform on fillet and PJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 6.14.4 and Paragraph 6.14.5.
         b) Acceptance criteria per AWS D1.1/D1.1M, Paragraph 6.9, Visual Inspection, Statically Loaded Nontubular Connections.
   b. Tubular Connections:
      1) RT: Comply with requirements for Nontubular Connections and additional requirements of AWS D1.1/D1.1M, Clause 9, Paragraph 9.28 and Paragraph 9.29.
      2) UT: Comply with requirements for Nontubular Connections and additional requirements of AWS D1.1/D1.1M, Clause 9, Paragraph 9.27.
      3) PT and MT:
         a) Perform on fillet and PJP groove welds in accordance with AWS D1.1/D1.1M, Paragraph 6.14.4 and Paragraph 6.14.5.
         b) Acceptance criteria per AWS D1.1/D1.1M, Paragraph 9.25.

3.03 FIELD QUALITY CONTROL

A. The CWI shall be present whenever field welding is performed. The CWI shall perform inspection, as necessary, prior to assembly, during assembly, during welding, and after welding. CWI shall perform inspections as required in AWS D1.1/D1.1M or referenced welding code and as follows:
   1. Verifying conformance of specified job material and proper storage.
   2. Monitoring conformance with approved WPS.
   3. Monitoring conformance of WPQ.
   4. Inspecting weld joint fit-up and performing in-process inspection.
   5. Providing 100 percent visual inspection of all welds.

6. Supervising nondestructive testing personnel and evaluating test results.
7. Maintaining records and preparing report confirming results of inspection and testing comply with the Work.

3.04 WELD DEFECT REPAIR

A. Repair and retest rejectable weld defects until sound weld metal has been deposited in accordance with appropriate welding codes.

3.05 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this Specification.
   1. Welding and Nondestructive Testing table.

END OF SECTION

Welding and Nondestructive Testing						
Specification Type	Governing Welding Codes or Standards	Submit WPS	Submit WPQ	Onsite CWI Req'd	Submit Written NDT Procedure Specifications	NDT Requirements
Steel Reinforcement	AWS D1.4/D1.4M, Structural Welding Code - Reinforcing Steel	Yes	Yes	Yes	Yes	100% MT of all rebar splices; see Section 03 21 00
Steel Decking	AWS D1.1/D1.1M, Structural Welding Code - Steel or AWS D1.3, Structural Welding Code - Sheet Steel	Yes	Yes	Yes	Yes	100% VT; see Section 05 31 00
Metal Fabrications	AWS D1.1/D1.1M, Structural Welding Code– Steel or AWS D1.2/D1.2M, Structural Welding Code - Aluminum or AWS D1.6/D1.6M, Structural Welding Code - Stainless Steel	Yes	Yes	Yes	Yes	100% VT; see Section 05 50 00
Aluminum Railings	AWS D1.2/D1.2M, Structural Welding Code - Aluminum	No	No	No	No	100% VT; see Section 05 52 16
Metal Gratings	AWS D1.1/D1.1M, Structural Welding Code - Steel or AWS D1.2/D1.2M, Structural Welding Code - Aluminum	No	No	No	No	100% VT; see Section 05 53 00
Welded Steel Pipe and Fittings	ASME BPV Code, Section IX; and AWS D1.1/D1.1M, Structural Welding Code – Steel	Yes	Yes	Yes	Yes	100% VT; see also Section 33 05 01.01

SECTION 05 31 00
STEEL DECKING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Iron and Steel Institute (AISI): Specifications for the Design of Cold Formed Steel Structural Members.
2. American Welding Society (AWS): D1.3, Structural Welding Code - Sheet Steel.
3. ASTM International (ASTM):
   a. A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Allow, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   b. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   c. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   d. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
4. Factory Mutual (FM):
   a. Factory Mutual Approval Guide.
   b. FM Research Corporation (FMRC): Approval Requirements for Steel Roof Deck Construction.
5. International Code Council Evaluation Service, Inc. (ICC-ES): Evaluation Reports for Deck Fasteners.
6. Steel Deck Institute (SDI):
   a. Design Manual for Composite Decks, Form Decks and Roof Decks.
   b. Diaphragm Design Manual.
7. UL: Fire Resistance Directory.

1.02 SUBMITTALS

A. Action Submittals:

1. Plan view layout of decking showing type and section properties of deck panels, reinforcing channels, pans, special jointing, and accessories.

2. Location of openings, deck laps, and deck attachment details.

B. Informational Submittals:
1. Decking manufacturer's installation requirements.
2. Welding Procedures, Qualifications, and Inspection Report: As specified in Section 05 05 23, Welding.
3. Operation manuals for mechanical fastener installation tools.
4. Manufacturer's product data for decking and attachments.

1.03 QUALITY ASSURANCE

A. General: For metal decking section properties, meet requirements of AISI Specifications for Design of Cold-Formed Steel Structural Members.

B. FM Requirements:
1. Steel Roof Deck: Listed in Factory Mutual "Approval Guide" for Class 1 fire rating and Class 1-90 wind uplift rating.
2. Mechanical Fasteners: Packing containers shall show name of manufacturer and product and FMRC approval mark.

C. Qualifications for Field Welding: As specified in Section 05 05 23, Welding.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store deck bundles on platforms or pallets, with one end elevated to provide drainage.

C. Protect bundles against condensation with a ventilated waterproof covering.

D. Stack bundles so there is no danger of tipping, sliding, rolling, shifting or material damage.

E. Architecturally exposed deck shall be appropriately packaged and protected to prevent damage during shipment.

PART 2 PRODUCTS

2.01 METAL DECKING

A. Provide metal deck as shown in the following schedule:

STEEL DECK SCHEDULE								
Type	Depth (in)	Panel Width (in)	Design Thickness (in)	Min. Yield Strength Fy (ksi)	Min. (+) S (in^3/ft)	Min. I (in^4/ft)	Minimum Diaphragm Shear Capacity (lbs/ft)	Finish
Roof Deck	1-1/2	36	As shown on Drawings	33	Per SDI Standard	Per SDI Standard	As shown on Drawings	Galv, G-90 or Prime painted

B. Materials and Finishes:

1. Galvanized Deck:
   a. Sheet steel for galvanized deck and accessories shall conform to ASTM A653 Structural Quality Grade 33 or higher, as shown in Steel Deck Schedule.
   b. Galvanizing shall conform to ASTM A924 with coating class G90 as defined in ASTM A653 and as shown in Steel Deck Schedule.

C. Manufacturers:

1. Vulcraft Division of Nucor Co., Brigham City, UT.
2. BHP Steel Building Products, USA, Inc., West Sacramento, CA.
3. Verco Manufacturing, Inc., Phoenix, AZ.
4. United Steel Deck, Inc., Summit, NJ.

2.02 SHOP PRIMER

A. Clean and coat with shop paint primer where shown in Finish Schedule.

2.03 ACCESSORIES

A. Provide pour stops, column closures, end closures, cover plates, girder fillers, ridge and valley plates, finish strips, reinforcing channels, and other accessories as required for complete installation.

B. Accessories shall be minimum 22-gauge, except edge forms shall be sized as required by the deck manufacturer, unless shown otherwise on Drawings.

2.04 MECHANICAL FASTENERS

A. Powder Driven Fasteners:

1. Knurled shank, minimum 1/2-inch diameter steel washer, corrosion-resistant coating.
2. Pin diameter and length to suit deck type and flange thickness of steel support member.
3. Manufacturers and Products:
   a. Pneutek, Hudson, NH; K-series or SDK-series pins with yellow dichromate galvanizing and Installation Tool.
   b. Hilti, Inc., Tulsa, OK; ENP-series or EDN series fasteners with electroplated zinc coating and DX-750 Installation Tool.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.02 INSTALLATION

A. Locate deck bundles to prevent overloading of support framing members.

B. Install at right angles to supporting members in a three span minimum lay-up, unless shown otherwise, and in accordance with Specification and manufacturer's installation recommendation.

C. Bearing: 1-1/2 inches, minimum.

D. Endlaps: Minimum of 2 inches and located over supports.

E. Do not stretch sidelaps.

F. Holes and Openings:

1. Cut and fit around roof openings and other work projecting through or adjacent to decking.
2. Locate holes and openings as shown to clear structural framing and bracing members.

3. Reinforcement around openings:
   a. Roof Deck: For hole sizes of at least 6 inches across, but not more than 12 inches across in roof deck, reinforce with 0.0474-inch design thickness steel plate, painted or galvanized to match deck coating. Extend plate at least 12 inches beyond opening in all directions and attach to top of roof deck with No. 10 self-drilling screws at 6-inch spacing and at all corners. For openings larger than 12 inches across, reinforce roof deck with framing as shown on Drawings.

G. Protect deck areas from heavy concentrated loads or wheel traffic with planking or other approved means.

H. Completed Deck: Free from buckles and irregularities, and in accordance with FM and UL requirements.

3.03 DECK ATTACHMENT

A. Fasten panels as shown on Drawings.

B. Welded Connections: Weld concrete filled deck sidelaps, attachment to framing, and accessories in accordance with AWS D1.3 and as specified in Section 05 05 23, Welding.

C. Sidelap Connections: Provide deck manufacturer's proprietary sidelap fastening system. Do not use button punches, screws, or top seam welds.

D. Mechanical Fasteners:
   1. Powder Driven Fasteners:
      a. Install fasteners in accordance with manufacturer's written instructions and with special installation tool.
      b. Minimum Sidelap Edge Distance: 3/8 inch.
      c. Minimum End/End Lap Distance: 1 inch.
      d. Head Projection: As specified by manufacturer for correct penetration into flange of steel support member.

3.04 TOUCHUP PAINTING

A. Immediately following erection, remove unused deck edge trimmings, screws, fasteners, welding washers, butt ends of welding rods, and debris from completed installation.

B. Clean field welds, bolted connections, rust spots, and abraded areas.

C. Repair damaged painted surfaces as specified in Section 09 90 00, Painting and Coating.

D. Repair damaged galvanized surfaces with zinc-rich spray paint in accordance with ASTM A780; color to match galvanized deck.

E. Use magnetic gauge to determine that thickness of repair is equal to or greater than base painted or galvanized coating.

3.05 FIELD QUALITY CONTROL

A. An independent testing agency shall perform following inspections.

1. Welded Connections: Visually inspect in accordance with AWS D1.3, Section 7, and as specified in Section 05 05 23, Welding.
2. Mechanical Fasteners: Visually inspect, in accordance with manufacturer's instructions, for each type of fastener.

B. Repair or replace defective welds and fasteners.

C. Provide Special Inspection in accordance with the Statement of Special Inspections Plan on Drawings, and Section 01 45 33, Special Inspection, Observation, and Testing.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
   2. American Galvanizers Association (AGA):
      a. Inspection of Hot-Dip Galvanized Steel Products.
      b. Quality Assurance Manual.
   3. American Iron and Steel Institute (AISI): Stainless Steel Types.
   4. American Ladder Institute (ALI): A14.3, Ladders - Fixed - Safety Requirements.
   5. American National Standards Institute (ANSI).
   6. American Society of Safety Engineers (ASSE): A10.11, Safety Requirements for Personnel and Debris Nets.
   7. American Welding Society (AWS):
      a. D1.1/D1.1M, Structural Welding Code - Steel.
      b. D1.2/D1.2M, Structural Welding Code - Aluminum.
      c. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
   8. ASTM International (ASTM):
      a. A36/A36M, Standard Specification for Carbon Structural Steel.
      b. A48/A48M, Specification for Gray Iron Castings.
      c. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
      d. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
      e. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      f. A143/A143M, Standard for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
      g. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      h. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
      i. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

j. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

k. A276, Standard Specification for Stainless Steel Bars and Shapes.

l. A283/A283M, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

m. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

n. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.

o. A384/A384M, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.

p. A385/A385M, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).

q. A489, Standard Specification for Carbon Steel Lifting Eyes.

r. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

s. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

t. A563, Standard Specification for Carbon and Alloy Steel Nuts.

u. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

v. A780/A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

w. A786/A786M, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.

x. A793, Standard Specification for Rolled Floor Plate, Stainless Steel.

y. A967, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.

z. A992/A992M, Standard Specification for Structural Steel Shapes.

aa. A1085, Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).

bb. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

cc. B308/B308M, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.

dd. B429/B429M, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

ee. B632/B632M, Standard Specification for Aluminum-Alloy Rolled Tread Plate.

ff. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

gg. D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

hh. F436, Standard Specification for Hardened Steel Washers.

ii. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.

jj. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

kk. F594, Standard Specification for Stainless Steel Nuts.

ll. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.

mm. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

nn. F3125, Standard Specification for High Strength Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength.

9. NSF International (NSF): 61, Drinking Water System Components—Health Effects.

10. Occupational Safety and Health Administration (OSHA):

a. 29 CFR 1910.23, Fixed Ladders.

b. 29 CFR 1926.105, Safety Nets.

c. 29 CFR 1926.502, Fall Protection Systems Criteria and Practices.

11. Specialty Steel Industry of North America (SSINA):

a. Specifications for Stainless Steel.

b. Design Guidelines for the Selection and Use of Stainless Steel.

c. Stainless Steel Fabrication.

d. Stainless Steel Fasteners.

1.02 DEFINITIONS

A. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals. Corrosive area includes areas exposed to corrosive atmosphere such as hydrogen sulfide from wastewater.

B. Exterior Area: Location not protected from weather by building or other enclosed structure.

C. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or washdown, nor where wall or roof slab is common to a water-holding or earth-retaining structure.

D. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or washdown, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.

E. Submerged: Location at or below top of wall of open water-holding structure, such as basin or channel, or wall, ceiling or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Metal fabrications, including welding and fastener information.
   2. Samples: Color samples of abrasive stair nosings.

B. Informational Submittals:
   1. Pre-engineered Ladders: Letter of certification that ladder meets OSHA 29 CFR 1910.23 requirements.
   2. Passivation method for stainless steel members.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual of the American Galvanizers Association.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Insofar as practical, factory assemble specified items. Package assemblies, which have to be shipped unassembled to protect materials from damage and tag to facilitate identification and field assembly.

B. Package stainless steel items to provide protection from carbon impregnation.

C. Protect painted coatings and hot-dip galvanized finishes from damage as a result of metal banding and rough handling. Use padded slings and straps.

D. Store fabricated items in dry area, not in direct contact with ground.

1.06 SPECIAL GUARANTEE

A. Manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at option of Owner, removal and replacement of sidewalk doors found defective during a period of 5 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in Contract Documents.

1.07 GENERAL

A. For hot-dip galvanized steel that is exposed to view and does not receive paint, limit the combined phosphorus and silicon content to 0.04 percent. For steels that require a minimum of 0.15 percent silicon (such as plates over 1.5 inches thick for ASTM A36/A36M steel), limit maximum silicon content to 0.21 percent and phosphorous content to 0.03 percent.

B. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Steel Wide Flange Shapes	A992/992M
Other Steel Shapes and Plates	A36/A36M or A572/A572M, Grade 50 or A992/A992M for other steel shapes
Steel Pipe	A53, Grade B
Hollow Structural Sections (HSS)	A500/A500M, Grade B or Grade C
Aluminum:	
Aluminum Plates	B209, Alloy 6061-T6
Aluminum Structural Shapes	B308/B308M, Alloy 6061-T6
Stainless Steel:	
Bars and Angles	A276, AISI Type 316 (316L for welded connections)
Shapes	A276, AISI Type 304 (304L for welded connections)
Steel Plate, Sheet, and Strip	A240/A240M, AISI Type 316 (316L for welded connections)
Bolts, Threaded Rods, and Anchor Studs	F593, AISI Type 316, Group 2, Condition SH
Nuts	F594, AISI Type 316, Condition CW
Steel Bolts and Nuts:	
Carbon Steel	A307 bolts, with A563 nuts
High-Strength	F3125, Grade A325, Type 1 bolts, with A563 nuts
Eyebolts	A489
Threaded Rods	A36/A36M
Flat Washers (Unhardened)	F844

Item	ASTM Reference
Flat and Beveled Washers (Hardened)	F436
Thrust Ties for Steel Pipe:	
Threaded Rods	A193/A193M, Grade B7
Nuts	A194/A194M, Grade 2H
Plate	A283/A283M, Grade D
Welded Anchor Studs	A108, Grades C-1010 through C-1020
Aluminum Bolts and Nuts	F468, Alloy 2024-T4
Cast Iron	A48/A48M, Class 35

C. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, zinc-plated steel, and aluminum material types as indicated in Fastener Schedule at end of this section.

1.08 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

A. See Section 05 05 19, Anchor Bolts.

1.09 POST-INSTALLED CONCRETE AND MASONRY ANCHORS

A. See Section 05 05 19, Anchor Bolts.

1.10 STUD SHEAR CONNECTORS

A. Headed anchor studs (HAS), or threaded anchor studs (TAS), or stud shear connectors, as indicated on Drawings.
   1. Carbon Steel: ASTM A108, Standard Quality Grades 1010 through 1020, inclusive either semikilled or killed aluminum or silicon dioxidation, unless indicated otherwise.
   2. Stainless Steel: ASTM F593, AISI Type 316, Condition CW, where indicated.

B. Manufacturers:
   1. Nelson Stud Welding, FabriSteel Co., Elyria, OH.
   2. Stud Welding Associates, Inc., Elyria, OH.

1.11 PIPE SLEEVES

A. ASTM A53/A53M, Schedule 40 steel pipe sleeves with continuously welded 3/16-inch-thick seep ring with outside diameter 3 inches greater than sleeve outside diameter. Hot-dip galvanize in accordance with ASTM A123/A123M.

1.12 STEEL LINTELS AND SHELF ANGLES

A. ASTM A36/A36M, hot-dip galvanize after fabrication in accordance with ASTM A123/A123M.

1.13 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

A. Steel angle support frames to be embedded in concrete shall be stainless steel, ASTM A276, AISI Type 316, unless indicated otherwise.

B. Welded anchors for stainless steel support frames shall also be stainless steel.

1.14 ABRASIVE NOSING FOR STAIRS

A. Unless otherwise shown on Drawings, furnish flush type abrasive nosings on stairs.

B. Nosing Components:
   1. Homogeneous epoxy abrasive, with minimum 50 percent aluminum oxide content, formed and cured upon an extruded aluminum base.
   2. Epoxy abrasive shall extend over and form curved front edge of nosing.
   3. Base of Nosing: Extruded aluminum alloy, 6063-T5, heat-treated.

C. Anchoring System: Double-set anchors consisting of two rows of integrally extruded anchors.

D. Size: 3 inches wide by 1/4 inch to 3/8 inch thick by length as shown.

E. Color: Selected by Jacobs' Engineer from manufacturer's standard color range.

F. Manufacturers and Products:
   1. Wooster Products, Inc., Wooster, OH; [A: Spectra Type WP3J] [B: and] [C: Spectra Type WP3C] [D:].
   2. American Safety Tread Co., Inc., Helena, AL; [E: Type BF-311D] [F: and] [G: Type FA-311D] [H:].

1.15 FLOOR PLATE

A. Material:
   1. Galvanized Steel: Carbon steel, ASTM A786/A786M, commercial grade, hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   2. Stainless Steel: ASTM A793, AISI Type 304.
   3. Aluminum: ASTM B632/B632M, Alloy 6061-T6.

B. Minimum Thickness:
   1. Steel: 1/4 inch, unless shown otherwise on Drawings.
   2. Aluminum: 3/8 inch, unless shown otherwise on Drawings.

C. Surface: Raised-lug pattern or diamond tread, unless slip-resistant surface is indicated.

D. Slip-Resistant Surface:
   1. Provide where indicated on Drawings.
   2. Manufacturers and Products:
      a. IKG/Borden, Clark, NJ; MEBAC 2.
      b. W.S. Molnar Co., Detroit, MI; SLIPNOT Grade 2–Medium.

1.16 SIDEWALK DOORS

A. Load Capacity: 300 psf with maximum deflection of 1/150th of span. Provide H-20 wheel loading capacity where indicated on Drawings.

B. Component Fabrication:
   1. Access Door Leaf(s): 1/4-inch aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for end of double-leaf door assembly when open.
   2. Channel Frame: 1/4-inch-thick extruded aluminum trough frame with continuous anchor flange around perimeter. Weld 1-1/2-inch diameter drain coupling, and drain pipe, to frame trough at front right corner, unless indicated otherwise on Drawings.
   3. Safety Grate: Aluminum grating with 300 psf live load capacity, 5-inch by 5-inch grate openings, permanent hinging system that locks grate in 90-degree position, and opening arm with vinyl grip handle and locking device.

C. Door Hardware:
   1. Hinges: Heavy-duty brass or stainless steel with stainless steel pins through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.
   2. Lifting Mechanism: Stainless steel compression lift springs enclosed in telescoping vertical housing or stainless steel torsion lift springs.
   3. Hold-Open Arm:
      a. Locks automatically in open position.
      b. Disengages with slight pull on vinyl grip with one hand.
      c. Door can be easily closed with one hand by pulling forward and down on vinyl grip.

4. Snap Lock:
   a. Stainless steel snap lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle.
   b. Threaded plug for flush outside surface with key wrench removed.

D. Aluminum: Mill finished with protective coating applied to surfaces to be in contact with concrete, as specified in Section 09 90 00, Painting and Coating.

E. Manufacturers and Products:
   1. Bilco Co., New Haven, CT; J Series.
   2. Nystrom Products Co., Minneapolis, MN; FG Series.
   3. U.S.F. Fabrication, Hialeah, FL; T Series.
   4. ITT Flygt Corporation, Trumbull, CT; FDRN Series.
   5. Thompson Fabricating Co., Birmingham, AL; TE Series.
   6. Halliday Products, Orlando, FL; WS Series.

1.17 FLOOR HATCHES

A. Load Capacity: 300 psf with maximum deflection of 1/150th of span.

B. Component Fabrication:
   1. Access Door Leaf(s): 1/4-inch-thick aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for end of double-leaf door assembly when open.
   2. Angle Frame: 1/4-inch thick extruded aluminum angle frame with concrete anchors and integral neoprene gasket strip.

C. Door Hardware:
   1. Hinges: Heavy-duty brass or stainless steel with stainless steel pins, through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.
   2. Lifting Mechanism: Stainless steel compression lift springs enclosed in telescoping vertical housing or stainless steel torsion lift springs.
   3. Hold-Open Arm:
      a. Locks automatically in open position.
      b. Disengages with slight pull on vinyl grip with one hand.
      c. Door can be easily closed with one hand by pulling forward and down on vinyl grip.
   4. Snap Lock:
      a. Stainless steel snap lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle.
      b. Threaded plug for flush outside surface with key wrench removed.

D. Aluminum: Mill finished with protective coating applied to surfaces to be in contact with concrete, as specified in Section 09 90 00, Painting and Coating.

E. Manufacturers and Products:
   1. Bilco Co., New Haven, CT; K Series.
   2. Nystrom Products Co., Minneapolis, MN; FH Series.
   3. U.S.F. Fabrication, Hialeah, FL; A Series.
   4. ITT Flygt Corporation, Trumbull, CT; FLE Series.
   5. Thompson Fabricating Co., Birmingham, AL; TI Series.
   6. Halliday Products, Orlando, FL; SS Series.

1.18 LADDERS

A. Fabricate ladders with rails, rungs, landings, and cages to meet applicable requirements of OSHA, CFR Part 1910.23, 1910.28, 1910.29, 1910.140, and ALI A14.3.
   1. Design ladder for concentrated load of 250 pounds plus 30 percent impact imposed by user concentrated at points that will cause maximum stress in structural member being considered.
   2. Concentrated load of 250 pounds plus 30 percent impact between consecutive attachments.
   3. Maximum rung deflection of l/360.
   4. Include weight of ladder and attached appurtenances together with live load in design of rails and fastenings.
   5. Self-closing gates at landings.

B. Flat Bar Ladder:
   1. Punch rails, pass rungs through rails, and weld on outside.
   2. Weld brackets to ladder for fastening ladder to wall.
   3. Hot-dip galvanize steel after fabrication in accordance with ASTM A123/A123M and ASTM A385/A385M.

C. Aluminum Pre-engineered Pipe Ladder:
   1. Rungs:
      a. Aluminum extrusions of Alloy 6063-T6.
      b. Nonslip grip surface, 1-inch wide flat top, and semicircular bottom with mill finish.
   2. Side Rails: ASTM B429/B429M, Alloy 6063-T6, 1-1/2 inches, Schedule 40 pipe with anodized finish, AA M32-C22-A41.
   3. Ladder Attachments and Cage Assembly Fasteners: Stainless steel.
   4. Welded, pop riveted, or glued construction is not acceptable.
   5. Fabricate to longest length as practical but not to exceed 24 feet.
   6. Furnish support attachments to side rails at 6 feet maximum spacing.
   7. Manufacturer: Thompson Fabricating Co. Inc., Tarrant, AL.

D. Ladder Safety Post:
   1. Telescoping tubular, spring balanced and automatically locking in raised position, with release lever for unlocking.
   2. Post: Stainless steel, AISI Type 304.
   3. Hardware: Stainless steel, AISI Type 316.
   4. Furnish dissimilar metal protective coatings at connections.
   5. Manufacturer and Product: Bilco Co., New Haven, CT; “Ladder Up” to fit ladder rungs.

1.19 SAFETY CLIMB DEVICE

A. General:
   1. Conforms to ALI A14.3 and OSHA CFR Part 1910.23, 1910.28, 1910.29, and 1910.140.
   2. Belt and harness shall withstand minimum drop test of 250 pounds in 6-foot free fall.
   3. Fall Prevention System Material: Stainless steel, AISI Type 316.

B. Components and Accessories:
   1. Main Components: Sleeve or trolley, safety harness, and carrier or climbing rail.
   2. Ladder Rung Clamps: Stainless steel, AISI Type 316, mounting brackets and hardware.
   3. Removable extension kit with tiedown rod or trolley gate, mandrel, and carrier rail for ladders under manholes and hatches.

C. Manufacturers and Products:
   1. Miller by Honeywell, Franklin, PA; Miller Saf-T-Climb.
   2. TS Products, Cambridge, Ontario, Canada; TS Safety Rail System.

D. Weir and Baffle Plates: Fabricate plates and associated framing of stainless steel, AISI Type 316, unless indicated otherwise on Drawings.

1.20 ACCESSORIES

A. Antiseizing Lubricant for Stainless Steel Threaded Connections:
   1. Suitable for potable water supply.
   2. Resists washout.
   3. Manufacturers and Products:
      a. Bostik, Middleton, MA; Neverseez.
      b. Saf-T-Eze Div., STL Corp., Lombard, IL; Anti-Seize.

B. Neoprene Gasket:
   1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on Drawings.
   2. Thickness: Minimum 1/4 inch.
   3. Furnish without skin coat.
   4. Manufacturer and Product: Monmouth Rubber and Plastics Corporation, Long Branch, NJ; Durafoam DK1111LD.

1.21 FABRICATION

A. General:
   1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
   2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
   3. Conceal fastenings where practical; where exposed, flush countersink.
   4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
   5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
   6. Fit and assemble in largest practical sections for delivery to Site.

B. Materials:
   1. Use steel shapes, unless otherwise noted.
   2. Steel to be Hot-dip Galvanized: Limit silicon content to less than 0.04 percent or to between 0.15 percent and 0.25 percent.
   3. Fabricate aluminum in accordance with AA Specifications for Aluminum Structures–Allowable Stress Design.

C. Welding:
   1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
   2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
   3. Steel: Meet fabrication requirements of AWS D1.1/D1.1M, Section 5.
   4. Aluminum: Meet requirements of AWS D1.2/D1.2M.
   5. Stainless Steel: Meet requirements of AWS D1.6/D1.6M.
   6. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D1.1/D1.1M, Section 7, and manufacturer's instructions.
   7. Complete welding before applying finish.

D. Painting:
   1. Shop prime with rust-inhibitive primer as specified in Section 09 90 00, Painting and Coating, unless otherwise indicated.
   2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
   3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

E. Galvanizing:
   1. Fabricate steel to be galvanized in accordance with ASTM A143/A143M, ASTM A384/A384M, and ASTM A385/A385M. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
   2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385/A385M.
   3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.
   4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
   5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
   6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
   7. Galvanized steel sheets in accordance with ASTM A653/A653M.
   8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

F. Electrolytic Protection: Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.

G. Watertight Seal: Where required or shown, furnish neoprene gasket of a type that is satisfactory for use in contact with sewage. Cover full bearing surfaces.

H. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

I. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

1.22 SOURCE QUALITY CONTROL

A. Visually inspect all fabrication welds and correct deficiencies.
   1. Steel: AWS D1.1/D1.1M, Section 6 and Table 6.1, Visual Inspection Acceptance Criteria.
   2. Aluminum: AWS D1.2/D1.2M.
   3. Stainless Steel: AWS D1.6/D1.6M.

B. Hot-Dip Galvanizing:
   1. Visually inspect and test for thickness and adhesion of zinc coating for minimum of three test samples from each lot in accordance with ASTM A123/A123M and ASTM A153/A153M.
   2. Reject and retest nonconforming articles in accordance with ASTM A123/A123M and ASTM A153/A153M.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 INSTALLATION OF METAL FABRICATIONS

A. General:
   1. Install metal fabrications plumb and level, accurately fitted, free from distortion or defects.
   2. Install rigid, substantial, and neat in appearance.
   3. Install manufactured products in accordance with manufacturer's recommendations.
   4. Obtain Jacobs' Engineer approval prior to field cutting steel members or making adjustments not scheduled.

B. Aluminum:
   1. Do not remove mill markings from concealed surfaces.
   2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
   3. Fabrication, mechanical connections, and welded construction shall be in accordance with the AA Aluminum Design Manual.

C. Pipe Sleeves:
   1. Provide where pipes pass through concrete or masonry.
   2. Holes drilled with a rotary drill may be provided in lieu of sleeves in existing walls.
   3. Provide center flange for water stoppage on sleeves in exterior or water-bearing walls.
   4. Provide rubber caulking sealant or a modular mechanical unit to form watertight seal in annular space between pipes and sleeves.

D. Steel Lintels and Shelf Angles: Provide as required for support of masonry and other construction not attached to structural steel framing, unless otherwise shown on Drawings.

3.02 ABRASIVE NOSINGS

A. Provide abrasive nosings on concrete steps not being supplied or coated with another type of nosing or nonskid material.

3.03 ACCESS COVERS

A. Install access covers, including sidewalk doors, and floor hatches in accordance with manufacturer's instructions.

B. Accurately position prior to placing concrete, such that covers are flush with floor surface.

C. Protect from damage resulting from concrete placement. Thoroughly clean exposed surfaces of concrete spillage to obtain a clean, uniform appearance.

D. Route drain pipe to exterior face of concrete or as shown on Drawings.

E. Position cover so that hinge is on side opposite ladder.

3.04 SAFETY CLIMB DEVICE SYSTEM

A. Provide for each ladder where unbroken height between levels exceeds 20 feet, or at lesser height where indicated on Drawings.

B. Install in accordance with manufacturer's instructions.

C. Furnish additional accessories required to complete system for each ladder.

D. Furnish one harness for each ladder equipped with safety climb device.

E. Furnish pivot section at platforms, landings, and roofs.

F. When installed to required height, fall prevention system shall be rigid and an integral part of the structure.

3.05 ELECTROLYTIC PROTECTION

A. Aluminum and Galvanized Steel:
   1. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 00, Painting and Coating, unless indicated otherwise.
   2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

3. Allow coating to dry before installation of the material.
4. Protect coated surfaces during installation.
5. Should coating become marred, prepare and touch up in accordance with paint manufacturer's written instructions.

B. Titanium: Where titanium equipment is in contact with concrete or dissimilar metal, provide full-face neoprene insulation gasket, 3/32-inch minimum thickness and 70-durometer hardness.

C. Stainless Steel:
1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
3. Remove contamination using cleaning and passivation methods in accordance with requirements of ASTM A380 and ASTM A967.
4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
5. After treatment, visually inspect surfaces for compliance.

3.06 PAINTING AND REPAIR OF GALVANIZED STEEL

A. Painted Galvanized Surfaces: Prepare as specified in Section 09 90 00, Painting and Coating.

B. Repair of Damaged Hot-Dip Galvanized Coating:
1. Conform to ASTM A780/A780M.
2. For minor repairs at abraded areas, use sprayed zinc conforming to ASTM A780/A780M.
3. For flame cut or welded areas, use zinc-based solder, or zinc sticks, conforming to ASTM A780/A780M.
4. Use magnetic gauge to determine thickness is equal to or greater than base galvanized coating.

3.07 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Special Inspection: In accordance with IBC Chapter 17 requirements, is provided in the Statement of Special Inspections Plan on Drawings.

B. Stud Shear Connectors:
1. At start of each production period, subcontractor shall perform the following test to determine proper generator, control unit, and stud welding gun settings, in accordance with AWS D1.1/D1.1M, Chapter 7:
   a. Weld two test studs and visually inspect for full 360-degree flash.

b. Bend test studs 30 degrees from vertical for headed anchor studs (HAS). Torque test threaded anchor studs (TAS) studs per AWS D1.1/D1.1M, Section 7.6.6.2.

c. Test studs will be acceptable if there is no failure of welds.

d. If weld fails, repeat test until two consecutive test studs test to be satisfactory.

2. During production, if visual inspection reveals weld does not exhibit full 360-degree flash or that stud has been repaired by welding, conduct the following test in accordance with AWS D1.1/D1.1M, Chapter 7:

a. Bend HAS studs or stud shear connectors approximately 15 degrees from vertical, away from missing portion of flash. For TAS studs, torque test per AWS D1.1/D1.1M, Section 7.6.6.2.

b. Studs meeting this test without exhibiting cracks in weld will be considered acceptable and left in bent position.

c. Replace studs failing test.

3.08 FASTENER SCHEDULE

A. Unless indicated otherwise on Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Connections for Structural Steel Framing		
Exterior and Interior Wet and Dry Areas	High-strength steel bolted connections	Use hot-dipped galvanized high-strength bolted connections for galvanized steel framing members.
2. Connections for Steel Fabrications and Wood Components		
Exterior and Interior Wet and Dry Areas	Stainless steel bolted connections	
3. Connections of Aluminum Components		
Submerged, Exterior and Interior Wet and Dry Areas	Stainless steel bolted connections, unless otherwise specified with equipment	
4. All Others		
Exterior and Interior Wet and Dry Areas	Stainless steel fasteners	

B. Antiseizing Lubricant: Use on stainless steel threads.

END OF SECTION

SECTION 05 52 16
ALUMINUM RAILINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. Aluminum Association, Incorporated (AA): DAF45, Designation System for Aluminum Finishes.
   2. American Concrete Institute (ACI) 318, Building Code Requirements for Structural Concrete.
   3. American Iron and Steel Institute (AISI).
   4. ASTM International (ASTM):
      a. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
      b. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
      c. E894, Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
      d. E935, Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
      e. E985, Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
   5. 2016 California Building Code (CBC).
   6. International Code Council (ICC): International Building Code (IBC).
   7. Occupational Safety and Health Act (OSHA): 29 CFR 1910, Code of Federal Regulations.

1.02 DEFINITIONS

A. ICC Evaluation Services Report: ICC report on evaluation of manufactured concrete anchor systems.

B. Railings: This term includes guardrail systems, handrail systems, platform railing systems, ramp-rail systems, and stair-rail systems. Railings may be comprised of a framework of vertical, horizontal, or inclined members, grillwork or panels, accessories, or combination thereof.

C. Special Inspection: As defined by the CBC.

D. Toeboards: Vertical barrier at floor level usually erected on railings along exposed edges of floor or wall openings, platforms, or ramps to prevent miscellaneous items from falling through.

1.03 DESIGN REQUIREMENTS

A. Structural Performance of Railing Systems: Design, test, fabricate, and install railings to withstand the following structural loads without exceeding allowable design working stress or allowable deflection. Apply each load to produce maximum stress and deflection in railing system components.

1. Railing System:
   a. Capable of withstanding the following load cases applied:
      1) Concentrated load of 200 pounds applied at any point and in any direction in accordance with CBC, and OSHA.
      2) Uniform load of 50 pounds per linear foot applied in any direction in accordance with CBC.
      3) Concentrated load need not be assumed to act concurrently with uniform loads in accordance with CBC.
2. Calculated lateral deflection at top of posts shall not exceed 1 inch.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Project-specific scaled plans and elevations of railings and detail drawings. Include railing profiles, sizes, connections, anchorage, size and type of fasteners, and accessories.
   b. Manufacturer's literature and catalog data of railing and components.
   c. Design Data. Calculations or test data using specified design performance loads and including the following:
      1) Bending stress in, and deflection of, posts in accordance with ASTM E985 as modified herein.
      2) Design of post base connection.
      3) Documentation that concrete anchors have been designed in accordance with one of the following:
         a) ACI 318, Appendix D.
         b) ICC Evaluation Services Report for selected anchor.
2. Samples:
   a. Rail sections, 6 inches long showing each type of proposed connection, proposed finish, and workmanship.
   b. Each fitting including wall brackets, castings, toeboard, and rail expansion joints.

B. Informational Submittals:

1. Manufacturer's assembly and installation instructions.
2. Special Inspection: Manufacturer's instructions for Special Inspection of post-installed anchors.

3. Test Reports: Test data may supplement load calculations providing data covers complete railing system, including anchorage:
   a. Test data for railing and components showing load and deflection as a result of load, in enough detail to prove railing is strong enough and satisfies national, state, local standards, regulations, code requirements, and OSHA 29 CFR 1910, using design loads specified. Include test data for the following:
      1) Railing and post connections.
      2) Railing wall connections.
      3) Railing expansion joint connections.
      4) Railing system gate assembly, including latch, gate stop, and hinges. Both gate latch and stop to support required loads applied independent of each other.
   b. Testing of anchorages shall be in accordance with ASTM E894 and ASTM E935 using applied loads in accordance with CBC.
   c. Deflection Criteria:
      1) In accordance with ASTM E985 and design loads specified, except as follows:
         a) Maximum calculated lateral deflection at top of posts shall not exceed 1 inch.
   d. Aluminum Rail Piping: Test data showing yield strength of pipe as delivered equals or exceeds specified values.
4. Manufacturer's written recommendations describing procedures for maintaining railings including cleaning materials, application methods, and precautions to be taken in use of cleaning materials.

1.05 QUALITY ASSURANCE

A. Qualifications: Calculations required for design data shall be stamped by a registered civil or structural engineer licensed in state where Project will be constructed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package and wrap railings to prevent scratching and denting during shipment, storage, and installation. Maintain protective wrapping to the extent possible until railing is completely installed.

B. Delivery:
   1. Shop assemble into practical modules of lengths not exceeding 24 feet for shipment.
   2. Deliver toeboards loose for field assembly.
   3. Deliver clear anodized railing pipe and posts with protective plastic wrap.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Thermal Movements: Allow for thermal movement resulting from the following maximum range in ambient temperature in design, fabrication, and installation of railings to prevent buckling, opening up of joints, over stressing of components, connections and other detrimental effects. Base design calculation on actual surface temperature of material as a result of both solar heat gain and night time sky heat loss. Temperature change is difference between high or low temperature and installation temperature.

1. Temperature Change Range: 70 degrees F, ambient; 100 degrees F, material surfaces.

PART 2 PRODUCTS

2.01 ALUMINUM RAILINGS

A. General:

1. Furnish pre-engineered and prefabricated railing systems as shown on Drawings.
2. Railing systems using pop rivets or glued railing construction are not permitted.
3. Sand cast accessories and components are not permitted.
4. Fasteners shall be AISI Type 304 or Type 316 stainless steel, unless otherwise noted.

B. Rails, Posts, and Formed Elbows:

1. Extruded Alloy 6105-T5, 6061-T6, or equivalent.
2. Tensile Strength: 38,000 psi, minimum.
3. Yield Strength: 35,000 psi, minimum.
4. Wall Thickness: 0.145 inch, minimum.
5. Posts and railings shall be nominal 1-1/2-inch diameter (1.90-inch outside diameter).

C. Accessories:

1. Fittings and Accessories:
   a. Extruded, machined bar stock, permanent mold castings, or die castings of sufficient strength to meet load requirements.
   b. Gauge metal components are not acceptable for load-resisting components.
   c. Fittings shall match color of pipe in railings.
2. Miscellaneous Extruded Aluminum Parts: Alloys 6063-T6, 6061-T6, or 6105 T5 aluminum, or equivalent, and of adequate strength for all loads.
3. Castings for Railings:
   a. Cast Al-mag with sufficient strength to meet load and test requirements.

b. Anodizable grade finish with excellent resistance to corrosion when subjected to exposure of sodium chloride solution intermittent spray and immersion.

4. Post Anchorages:
   a. Refer to standard details for types of post anchorages and minimum requirements.
   b. Bolts at anchorages shall be minimum 1/2-inch diameter.
5. Wall Brackets: Adjustable wall fitting, with provision for minimum three 3/8-inch diameter AISI Type 304 or Type 316 stainless steel bolts or concrete anchors.
6. Rail Terminals (including Wall Returns): Aluminum wall fitting with provision for three 3/8-inch Type 304 fasteners.
7. Railing System Gate:
   a. Extruded aluminum rail components.
   b. Hardware Manufacturers and Products:
      1) Julius Blum & Co., Inc., Carlstadt, NJ; No. 782/3 gate hinges with springs, and No. 784 gate latch and stop.
      2) CraneVeyor Corp., South El Monte, CA; No. C4370b gate hinges with spring, No. C4369 gate latch, and No. C4368 gate stop.
      3) Moultrie Manufacturing Co., Moultrie, GA; Part No. W60006.
8. Railing Picket Panels and Clamps:
   a. 1/2-inch Schedule 40 aluminum pipe (picket).
   b. Extruded aluminum 1-1/2-inch by 7/8-inch by 1/8-inch channel.
   c. Furnish neoprene plug for each end of picket.
   d. Fasteners: Stainless steel.
9. Toeboards:
   a. Molded or extruded Alloy 6063-T6 or 6061-T6 aluminum.
   b. Provide slotted holes for expansion and contraction where required.
10. Fasteners: Stainless steel.

D. Finishes:
   1. Pipe and Post: In accordance with AA DAF45, designation AA-M32-C22-A41.
   2. Cast Fittings and Toeboards: In accordance with AA DAF45, designation AA-M10-C22-A41.

2.02 ANCHOR BOLTS, FASTENERS, AND CONCRETE ANCHORS

A. Locknuts, Washers, and Screws:
   1. Elastic Locknuts, Steel Flat Washers, Round Head Machine Screws (RHMS): AISI Type 304 or Type 316 stainless steel.
   2. Flat Washers: Molded nylon.

B. Bolts and Nuts for Bolting Railing to Metal Beams: ASTM A193/A193M and ASTM A194/A194M, Type 304 or Type 316 stainless steel.

C. Concrete Anchors:
   1. Stainless steel, AISI Type 304 or Type 316.
   2. Post-installed anchors in accordance with Section 05 05 19, Anchor Bolts, unless otherwise specified herein.
   3. Bolt Diameter: 1/2-inch, minimum.

2.03 FABRICATION

A. Shop Assembly:
   1. Post Spacing: Maximum 6-foot horizontal spacing.
   2. Railing Posts Bolted to Metal or Concrete:
      a. In lieu of field cutting, provide approved fitting with sufficient post overlap, containing provisions for vertical adjustment.
      b. Field fit-up is required.
   3. Free of burrs, nicks, and sharp edges when fabrication is complete.
   4. Welding is not permitted.

B. Shop/Factory Finishing:
   1. Use same alloy for uniform appearance throughout fabrication for railings.
   2. Railing and Post Fittings: Match fittings with color of pipe in railing.

C. Shop Assembly:
   1. Shop assemble rails, posts, and formed elbows with a close tolerance for tight fit.
   2. Fit dowels tightly inside posts.

D. Repair of Defective Work: Remove stains and replace defective Work.

PART 3 EXECUTION

3.01 GENERAL

A. Field fabrication of aluminum railing systems is not permitted.

B. Where required, provide railing posts longer than needed and field cut to exact dimensions required in order to satisfy vertical variations on actual structure.

C. Install railing with base that provides plus or minus 1/4-inch vertical adjustment inside base fitting. If adjustment is required in field and exceeds plus or minus 1/4-inch, reduce post length not to exceed beyond bottom of lowest set-screw or bolt in base fitting.

D. Modification to supporting structure is not permitted where railing is to be attached.

E. Protection from Entrapped Water:
   1. Make provisions in exterior and interior installations subject to high humidity to drain water from railing system.
   2. For posts mounted in concrete, bends, and elbows occurring at low points, drill weep holes of 1/4-inch diameter at lowest possible elevations, one hole per post or rail. Drill hole in plane of rail.

3.02 RAILING INSTALLATION

A. Assembly and Installation: Perform in accordance with manufacturer's written recommendations for installation.

B. Expansion Joints:
   1. Maximum intervals of 54 feet on center and at structural joints.
   2. Slip joint with internal sleeve extending 2 inches beyond each side of joint. Provide 1/2-inch slip joint gap to allow for expansion.
   3. Fasten to one side using 3/8-inch diameter set-screw. Place set-screw at bottom of pipe.
   4. Locate joints within 12 inches of posts. Locate expansion joints in rails that span expansion joints in structural walls and floors supporting the posts.

C. Posts and Rails:
   1. Surface Mounted Posts:
      a. Bolt post baseplate connectors firmly in place.
      b. Shims, wedges, grout, and similar devices for railing post alignment not permitted.
   2. Set posts plumb and aligned to within 1/8 inch in 12 feet.
   3. Set rails horizontal or parallel to slope of steps to within 1/8 inch in 12 feet.
   4. Install posts and rails in same plane.
   5. Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail.
   6. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.
   7. Support 1-1/2-inch rails directly above stairway stringers with offset fittings.

D. Wall Brackets: Support wall rails on brackets spaced maximum 5 feet on centers as measured on the horizontal projection.

E. Toeboard:
   1. Provide at railings, except where 4-inch or higher concrete curbs are installed, at gates, or at stairways unless shown otherwise.
   2. Accurately measure in field for correct length; after railing post installation cut and secure to posts.
   3. Dimension between bottom of toeboard and walking surface not to exceed 1/4 inch.
   4. Install plumb and aligned to within 1/8 inch in 12 feet.

F. Railing System Gate: Install in accordance with manufacturer's installation instructions.

3.03 FIELD FINISHING

A. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces as specified in Section 09 90 00, Painting and Coating.

3.04 FIELD QUALITY CONTROL

A. Post-installed anchors supporting railing systems require special inspection.

B. Provide Special Inspection in accordance with the Statement of Special Inspections Plan on Drawings and Section 01 45 33, Special Inspection, Observation, and Testing.

C. Subcontractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Subcontractor Quality Control.

3.05 CLEANING

A. Wash railing system thoroughly using clean water and soap. Rinse with clean water.

B. Do not use acid solution, steel wool, or other harsh abrasive.

C. If stain remains after washing, restore in accordance with railing manufacturer's recommendations or replace stained railings.

END OF SECTION

SECTION 05 53 00
METAL GRATINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): Standard Specifications for Highway Bridges, 14th Edition.
2. ASTM International (ASTM):
   a. A36, Standard Specification for Structural Steel.
   b. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   c. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   d. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   e. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
   f. A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
   g. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
   h. A525, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
   i. A569/A569M, Standard Specification for Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip Commercial Quality.
   j. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
   k. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
3. National Association of Architectural Metal Manufacturers (NAAMM):
   a. MBG 531, Metal Bar Grating Manual.
   b. MBG 532, Heavy-Duty Metal Bar Grating Manual.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

a. Grating: Show dimensions, weight, and size, and location of connections to adjacent grating, supports, and other Work.

b. Grating Anchorage: Show structural calculations and details of anchorage to supports to prevent displacement from traffic impact.

c. Grating Supports: Show dimensions, weight, size, location, and anchorage to supporting structure.

d. Catalog information and catalog cuts.

e. Manufacturer's specifications, to include coatings.

B. Informational Submittals:

1. Special handling and storage requirements.
2. Installation instructions.
3. Factory test reports.
4. Manufacturer's Certification of Compliance for specified products.
5. Written Test Report that swaged crossbars, if used on grating, meet the requirements of the specified test and additional requirements of these Specifications.

1.03 PREPARATION FOR SHIPMENT

A. Insofar as is practical, factory assemble items provided.

B. Package and clearly tag parts and assemblies that are of necessity shipped unassembled and protect the materials from damage, and facilitate identification and final assembly in the field.

PART 2 PRODUCTS

2.01 FOOT TRAFFIC GRATING

A. Design:

1. Uniform Service Load: 100 psf minimum, unless otherwise shown.
2. Maximum Deflection: 1/4 inch, unless otherwise shown.
3. Space bearing bars at 1-3/16 inch center-to-center.
4. Banding: 3/16 inch minimum.

B. Material:

1. Aluminum Bar Type Grating:

   a. Press-locked rectangular design, as manufactured by Harsco Industrial IKG, Channelview, TX; Harsco Industrial IKG Type B or Type F or equivalent.

   b. Swage locked aluminum grating, rectangular bar type, as manufactured by:

      1) IKG/Borden, Channelview, TX; Harsco Industrial IKG Type BS or Type FS.

      2) Seidelhuber Metal Products Inc., San Carlos CA; Type A-2.

      3) Ohio Gratings, Inc., Canton, OH; Aluminum Flush Top, Type 19SGF2.

   c. Swage locked aluminum I-bar grating, as manufactured by:

      1) Harsco Industrial IKG, Channelview, TX; Type IF.

      2) Seidelhuber Metal Products, Inc., San Carlos, CA; Type 19SI2.

      3) Ohio Gratings, Inc., Canton, OH; Type 19 SGI 2.

      4) Klemp Corp., Chicago, IL; Type KIP.

2. Galvanized Steel Bar Type Grating: Press-locked, deep rectangular crossbar design, as manufactured by Harsco Industrial IKG, Channelview, TX; Type B or Type F or equivalent.

3. Stair Treads:

   a. Material and Type: Same as grating material and grating type as furnished for connecting walkway or work surface.

   b. Nosings: Integral ribbing and serrated edge on one long axis of tread or nonslip, abrasive on each tread along one long edge.

   c. Carrier Plate or Angle: Furnish at each end for connection to stair stringers.

   d. Manufacturers: Same as for grating.

2.02 LIGHT VEHICULAR TRAFFIC GRATING

A. Design:

1. Maximum Load: 2,000 pounds per wheel, minimum wheel base and axle width of 4 feet 0 inch.

2. Space main bars at 1-3/16 inch center-to-center.

3. Banding: 1/4 inch.

B. Material:

1. Aluminum Bar Type Grating: Press-locked deep rectangular crossbar design as manufactured by Harsco Industrial IKG, Channelview, TX, Harsco Industrial IKG; Type B or Type F, "or-equal."
2. Galvanized Steel Bar Type Grating:
   a. After Fabrication: ASTM A123, zinc coating.
   b. Manufacturer and Products: Harsco Industrial IKG, Channelview, TX; Harsco Industrial IKG heavy-weld Type HWF or Type HWB or press-locked, rectangular crossbar, Type FJ or Type BJ.

2.03 HEAVY VEHICULAR TRAFFIC GRATING

A. Design:

1. Loading: AASHTO HS 20-44.
2. Banding: 1/4 inch.

B. Material:

1. Galvanized Steel Bar Type:
   a. Heavy-duty, main bars spaced at 1-7/8 inch maximum center-to-center.
   b. After Fabrication: ASTM A123, zinc coating.
   c. Manufacturer and Products: Harsco Industrial IKG, Channelview, TX; KG/Borden heavy-weld Type HWF or HWB or press-locked, rectangular crossbar, Type BJ or Type FJ.

2.04 ACCESSORIES

A. Anchor Bolts and Nuts:

1. Carbon Steel: ASTM A307 or ASTM A36.
2. Stainless Steel: ASTM A193 and ASTM A194, Type 316.
3. Galvanized Steel Bolts and Nuts: ASTM A153, zinc coating for ASTM A307 or ASTM A36.

B. Flat Washers (Unhardened): ASTM F844; use ASTM A153 for zinc coating.

C. Removable Fastener Clips and Bolts:

1. Removable from above grating walkway surface.
2. Hat Bracket: Type 304 stainless steel.
3. Bolt: Type 316 stainless steel.
4. Cast iron, galvanized body.
5. Manufacturer and Product: Struct-Fast, Wellesley Hills, MA; Gratefast.

D. Partially Removable Anchor:
   1. Bolt: Threaded stud, Type 316 stainless steel.
      a. Manufacturer: Nelson Stud Welding Co., Lorain, OH.
   2. Hat Bracket: Type 304 stainless steel.
      a. Manufacturer: STRUCT-FAST, Wellesley Hills, MA.

2.05 FABRICATION

A. General:
   1. Exposed Surfaces: Smooth finish and sharp, well-defined lines.
   2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in a neat, substantial manner.
   3. Conceal fastenings where practical.
   4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
   5. Weld Connections: Not permitted on grating except at banding bars.

B. Design:
   1. Field measure areas to receive grating, verify dimensions of new fabricated supports, and fabricate to dimension required for specified clearances.
   2. Section Length: Sufficient to prevent its falling down through clear opening when oriented in the span direction when one end is touching either the concrete or the vertical leg of grating support.
   3. Minimum Bearing: NAAMM MBG 531.
   4. Metal Crossbar Spacing: 2 inches maximum, unless otherwise shown or specified.
   5. Crossbars: Flush with top of main bar and extend downward a minimum of 50 percent of the main bar depth.
      a. Swaged Crossbars:
         1) Within 1/4 inch of top of grating with 1/2 inch minimum vertical dimension after swaging, and minimum before swaging dimension of 5/16 inch square.
         2) Crossbar Dimension After Swaging: Minimum 1/8 inch wider than the opening at minimum of two corners at each side of each square opening in main bar.
         3) Crossbars may be a special extruded shape so that after swaging the top will be flat, 3/16 inch wide and will be flush with the top surface of the bearing bars for a minimum of 5/8 inch at center between bearing bars.

4) Flush crossbar meeting all of the above except that after swaging shall overlap one corner by a minimum of 1/8 inch. A Sample of one bearing bar and one crossbar shall be tested by holding the bearing bar and pulling on the crossbar. The crossbar to bearing bar shall sustain a minimum of 300 pounds without pullout of the bearing bar.

5) Tightly fit main bars and crossbars allowing no differential movement.

6. Do not use weld type crossbars.

7. Banding: Same material as grating; NAAMM MBG 531 and NAAMM MBG 532.

8. Furnish stainless steel Type 316 threaded anchor studs, as fasteners for grating attachment to metal supports either not embedded or partially embedded in concrete, as manufactured by Nelson Studs Welding Co., Lorain, OH.

C. Supports:

1. Seat Angles and Beams:

a. Same material as rectangular bar grating.

b. Extruded aluminum frame with slot for recessed grating clips, as manufactured by Thompson Fabricating Co., for aluminum I-Bar type grating or equivalent.

2. Coordinate dimensions and fabrication with grating to be supported.

3. Coordinate dimensions with increased depth due to serrations.

4. Welded Frames with Anchors: Continuously welded.

D. Slip-Resistant Surface:

1. Rectangular Steel or Aluminum Bar Grating:

a. As manufactured by:

1) Harsco Industrial IKG, Channelview, TX; EZ Weldslip-Resistant Coating.

2) Seidelhuber Metal Products, Inc., Hayward, CA; Safety Grit Non-Slip System.

3) Ohio Gratings, Inc., Canton, OH with “Slip-Not” Safety Surface manufactured by W.S. Molnar Co., Detroit, MI.

2. I-Bar grating aluminum shall incorporate a striated antiskid walking surface produced during the extrusion process, as manufactured by:

a. Harsco Industrial IKG, Channelview, TX.

b. Seidelhuber Metal Products, Inc., Hayward, CA.

E. Aluminum:
   1. ASTM B221 extruded shapes.
   2. Fabricate as shown and in accordance with manufacturer's recommendations.
   3. Grind smooth sheared edges exposed in the finished work.
   4. Swage crossbars, if used, with equipment strong enough to deform crossbars.
   5. Eliminate any loose crossbar intersections on swaged grating.

F. Foot Traffic Grating: Any single grating section, individual plank, or plank assembly shall be not less than 1 foot 6 inches or greater than 3 feet 0 inch in width or weigh more than 150 pounds.

G. Light Vehicular Traffic Grating: Any single grating section, individual plank, or plank assembly shall not be less than 1 foot 6 inches or greater than 3 feet 0 inch in width (except 3/8-inch thick bearing bar grating), or weigh more than 150 pounds.

H. Heavy Vehicular Traffic Grating: Minimum width of grating sections shall be 2 feet 0 inch regardless of length and weight.

PART 3 EXECUTION

3.01 PREPARATION

A. Electrolytic Protection:
   1. Aluminum in contact with dissimilar metals, other than stainless steel, and embedded or in contact with masonry, grout, and concrete, protect surfaces as specified in Section 09 90 00, Painting and Coating.
   2. Allow paint to dry before installation of the material.

3.02 INSTALLATION

A. Install supports such that grating sections have a solid bearing on both ends, and that rock and wobble grating movement does not occur under designed traffic loading.

B. Install plumb or level as applicable.

C. Install welded frames with anchors to straight plane without offsets.

D. Anchor grating securely to supports using minimum of four fastener clips and bolts per grating section.

E. Use stainless steel anchors and accessories with aluminum gratings.

F. Completed installation shall be rigid and neat in appearance.

G. Commercially Manufactured Products:
   1. Install in accordance with manufacturer's recommendations.
   2. Secure grating to support members with fasteners.
   3. Welding is not permitted.
   4. Fasteners: Field locate and install.
   5. Permit each grating section or plank style grating assembly to be easily removed and replaced.

H. Protect painted surfaces during installation.

I. Should coating become marred, prepare and touch up surface in accordance with paint manufacturer's instructions.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Forest and Paper Association (AF&PA): 2, National Design Specification for Wood Construction.
2. American Lumber Standards Committee's Board of Review (ALSC).
3. American Wood Preservers' Association (AWPA):
   a. M4, Standard for the Care of Preservative-Treated Wood Products.
   b. U1, User Specification for Treated Wood.
4. APA - The Engineered Wood Association (APA):
   a. PRP-108, Performance Standards and Qualification Policy for Structural-Use Panels (Form E445).
   b. Form B445, APA Quality Assurance Policies for Structural-Use Panels Qualified to PRP-108.
5. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   c. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   d. C954, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
   e. C1177/C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
   f. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   g. E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.
   h. F1667, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

6. International Code Council (ICC):
   a. ESR-1539, Power-Driven Staples and Nails.
   b. International Building Code (IBC).
7. National Fire Protection Association (NFPA): 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
8. Southern Pine Inspection Bureau (SPIB): 1003, Grading Rules.
9. UL: 723, Standard for Safety Test for Surface Burning Characteristics of Building Materials.
10. U.S. Department of Commerce—Voluntary Product Standard (DOC):
    a. PS 1, Structural Plywood.
    b. PS 20, American Softwood Lumber Standard.
11. Western Wood Products Association (WWPA): G5, Western Lumber Grading Rules.

1.02 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Indicate component materials and dimensions, and include construction and application details for the following:
         1) Construction panel thickness where not shown.

B. Informational Submittals:
   1. ICC Evaluation Service Reports, including the following as a minimum:
      a. Connections and Fasteners.
      b. Wood Treatment.
      c. Nails.
   2. Wood treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.
   3. Material Certificates: Showing species and grade selected for dimension lumber for each use.
      a. Material certificates for dimensional lumber in compliance with allowable unit stresses. Show species and grade selected for each use as well as design values approved by the ALSC's Board of Review.
      b. For each type of preservative-treated wood product, include certification by treatment plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

c. For waterborne-treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to Site.

4. Material test reports from testing laboratory showing and interpreting test results in accordance with test methods UL 723, NFPA 255, and ASTM E84, relative to fire-retardant treated wood products.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Upon delivery to Site, immediately place materials in area protected from weather. Do not store seasoned materials in wet or damp areas.

B. Protect sheet materials from breaking corners and damaging surfaces while unloading.

C. Store materials a minimum of 6 inches above ground on framework or blocking and cover with waterproof covering, providing for adequate air circulation and ventilation. Store sheet materials flat, not on edge.

D. Protect fire-retardant materials against high humidity and moisture during storage and erection.

E. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

F. Store materials for which maximum moisture content is specified in areas where humidity can be controlled.

PART 2 PRODUCTS

2.01 GENERAL

A. Lumber Standards:

1. In accordance with DOC PS 20 and applicable grading rules and wood species certified by ALSC.
2. Design values for wood members equal to those published in supplement to AF&PA 2.
3. Stamp or brand each unexposed piece of lumber with grade, species, and moisture content at time of mill surfacing.
4. Furnish exposed lumber pieces with grade stamps applied to ends or back of each piece. If completely exposed, and permitted by local building jurisdiction, omit grade stamps entirely.

B. Lumber sizes shown on Drawings are nominal, unless shown otherwise. Provide actual sizes as required by DOC PS 20 for use.

C. Dressed lumber S4S, unless shown otherwise on Drawings.

D. Moisture content of lumber not to exceed 19 percent, unless otherwise specified and marked "DRY."

E. Each plywood panel identified with designated grade trademark of APA.

2.02 LUMBER

A. Framing lumber shall be Douglas Fir-Larch, No. 1 or better unless indicated otherwise below:

Usage	Minimum Grade
Blocking and nailers	Douglas Fir-Larch No. 2, Hemlock, Southern Pine Stud grade, nondense

2.03 CONSTRUCTION PANELS

A. Plywood:

1. General:

a. Where construction panels are shown on Drawings for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements designated under each application for grade designation, span rating, exposure durability classification, edge detail, and thickness.

b. Construction Panel Standards: Comply with DOC PS 1 for plywood construction panels and for products not manufactured under DOC PS 1 provisions, in accordance with APA PRP-108 and APA Form B445.

c. Trademark: Each construction panel factory-marked with APA trademark evidencing compliance with grade requirements.

B. Plywood Backing Panel: Mounting electrical, telephone, and like equipment; provide fire-retardant treated plywood panel with grade designation, APA C-D Plugged Exposure 1, in thickness shown on Drawings, or, if not shown on Drawings, not less than 15/32 inch.

2.04 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

A. Where lumber or plywood is indicated as preservative-treated wood, in accordance with AWPA U1 and AWPA M4, mark and grade each treated item in accordance with SPIB 1003 or WWPA G5.
   1. Kiln-dry after treatment to maximum moisture content of 19 percent.
   2. Treat wood in contact with roofing or flashing.
   3. Treat wood in contact with concrete.

B. Aboveground Materials:
   1. Pressure treat items with waterborne preservatives to a minimum retention of 0.25 per cubic foot.
   2. Interior Use: After treatment, kiln-dry lumber and plywood to maximum moisture content of 19 percent and 15 percent respectively.
   3. Treat the following items:
      a. Wood nailers, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
      b. Wood blocking, furring, stripping, and similar concealed members in contact with concrete.

C. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.05 FIRE-RETARDANT TREATED WOOD

A. Pressure treat lumber and plywood with fire-retardant chemicals in accordance with applicable AWPA U1 and AWPA M4 standard for species, product, preservative and end use to ensure flame-spread rating not higher than 25 with no evidence of significant progressive combustion when tested for 30 minutes duration under UL 723 and ASTM E84.

B. Treated lumber and plywood labeled and tested by UL shall show performance rating.

2.06 HARDWARE

A. Fasteners and connectors in contact with preservative-treated or fire-retardant-treated wood shall be hot-dipped zinc-coated galvanized steel or stainless steel in accordance with ASTM A153/A153M.

B. Conform to ASTM F1667.

C. Nails:
   1. Conform to ASTM F1667.
   2. Steel common nails or alternatives listed in rough carpentry section of General Structural Notes found on Drawings.
   3. Use hot-dipped zinc-coated nails wherever exposed.

D. Power Driven Fasteners: Conform to ICC ESR-1539.

E. Bolts and Screws: Conform to ASTM A307, galvanized where exposed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify surfaces to receive rough carpentry materials are prepared to exact grades and dimensions.

3.02 GENERAL

A. Lay out, cut, fit, and install rough carpentry items. Anchor sufficiently to ensure rigidity and permanence.

B. Install items accurate to dimension, true to line, level, and square unless shown otherwise on Drawings. Provide for installation and support of other Work.

C. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.

D. Countersink nail heads on exposed carpentry work and fill holes.

E. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

F. Field cuts and holes in pressure-treated lumber shall be field treated with preservative in accordance with AWPA M4.

G. Holes shall be 1/16 inch larger than nominal bolt diameter, except holes for cast-in-place anchor bolts shall be 3/16 inch larger than nominal bolt diameter. Tight holes requiring forcible driving of bolts shall be enlarged by reaming.

H. Provide washers under bolt heads and nuts bearing on wood.

3.03 INSTALLATION

A. Miscellaneous Framing: Install where shown on Drawings and as needed to facilitate installation of finishing materials, fixtures, specialty items, hardware and trim.

3.04 PRESERVATIVE-TREATED WOOD PRODUCTS

A. Provide preservative-treated wood for framing, blocking, furring, nailing strips built into exterior masonry walls, wood in contact with concrete or masonry and in conjunction with roof edge flashing and roofing.

B. Apply two brush coats of same preservative used in original treatment to sawed or cut surfaces of treated lumber.

3.05 FIRE-RETARDANT TREATED WOOD

A. Provide fire-retardant treated lumber and plywood for backing panels at electrical, telephones, and like equipment and where indicated on Drawings.

B. Use FR-S rated wood on interior only.

C. Use exterior rated wood outside and where relative humidity is above 80 percent.

END OF SECTION

SECTION 07 14 00
FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Copies of manufacturer's literature for products proposed.
   2. Samples:
      a. Cured membrane and coating system applied to 12-inch square by 1/4-inch-thick plywood or similar rigid base.
      b. Sample of each color and coating to be used on Project.

B. Informational Submittals:
   1. Certification: Compliance with product requirements specified.
   2. Sample copy of guarantee to be provided. Upon completion and acceptance of the Work required by this section, submit an executed copy of the guarantee.
   3. Applicator approval letter from membrane manufacturer.

1.02 QUALITY ASSURANCE

A. Applicator: Approved and licensed by fluid applied waterproofing manufacturer.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in sealed, undamaged containers. Identify each container with material name, date of manufacture, and lot number.

B. Store material in dry area out of direct sunlight. Storage area temperature shall not exceed 90 degrees F.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Perform Work only when existing and forecasted weather conditions are within limits established by manufacturer of materials and products used.

B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive waterproofing.

1.05 SPECIAL GUARANTEE

A. Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as Special Guarantee. Special Guarantee shall provide for correction or, at the option of Owner, removal and replacement of Work specified in this specification section found defective during a period of 3 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the Contract Documents.

PART 2 PRODUCTS

2.01 MEMBRANE

A. Polyurethane elastomer-based fluid applied waterproofing membrane.

B. Manufacturers and Product:
   1. 3M Co., St. Paul, MN; Scotch-Clad Brand Deck Coating.
   2. The Neogard Corp., Dallas, TX; Perma-Gard III.
   3. Gaco Western, Seattle, WA; LM-60.
   4. Carlisle Coatings and Waterproofing, Sapulpa, OK; CCW-525.
   5. Sonneborn a Division of BASF, Shakopee, MN; HLM 5000.
   6. W.R. Grace & Co., Cambridge, MA; Procor 20.
   7. Pecora Corp., Harleyville, PA; Duramem V500.

2.02 RELATED MATERIALS

A. As follows, compatible with components produced by membrane manufacturer:
   1. Primers: As recommended by membrane manufacturer for type of substrate involved.
   2. Sealants: Low modulus, unmodified polyurethane or as recommended by membrane manufacturer.
   3. Backer Rod: Expanded polyethylene rod as manufactured by Dow Chemical.
   4. Flashing Reinforcement: Woven, uncoated fiberglass mesh on 0.050-inch thick precured neoprene.
   5. Protection Board: Approved by membrane manufacturer.

PART 3 EXECUTION

3.01 CONDITIONS OF SURFACES

A. Verify curing methods used for concrete are compatible with membrane system.

3.02 PREPARATION

A. Cleaning:
   1. Thoroughly clean surfaces to receive membrane following membrane manufacturer's recommendations.
   2. Treat as necessary to remove laitance, loose material on surface, grease, oil, and other contaminants that will affect bond of the membrane.
   3. Vacuum clean or clear water wash surfaces and allow to dry completely.

B. Fill voids and control joints with sealant and overcoat with nonflow membrane material. Fill or coat visible shrinkage cracks to minimum 2 inches either side of crack.

C. Use drop cloths or masking as required for protection of adjacent surfaces.

3.03 FLASHINGS-FLUID APPLIED

A. Unless Drawings establish more restrictive requirements, the following minimum requirements apply:
   1. Fill construction joint voids at intersections of vertical and horizontal walls with backer rod and sealant in accordance with requirements of membrane manufacturer.
   2. Nonreinforced Flashing:
      a. Install nonreinforced flashing at construction joints not subject to movement, at all intersecting surfaces that are structurally and rigidly connected, and at all piping or other penetrations through membraned surface that do not require reinforced flashing.
      b. Apply 50-mil minimum dry film thickness of membrane for 4 inches minimum onto adjacent surfaces.
      c. At intersections of membrane with vertical walls, piping penetrations, and at projections through horizontal membrane, extend flashing coat to a height not greater than finished horizontal surface, with due allowance for installation of sealant work. Trowel a 1-inch-high, 45-degree cant at meeting angle using nonflowing membrane material.
      d. At projections through a vertical membrane, extend flashing coat 4 inches minimum onto penetrating element.
   3. Reinforced Flashing:
      a. Apply flashing reinforcement over cracks, expansion and control joints, and at changes of plane where adjacent surfaces are not structurally and rigidly connected and also at penetrations through a membrane surface.
      b. Apply 50-mil dry film thickness embedment coat of membrane to surfaces to be flashed. Extend 6 inches minimum out onto adjacent deck surface.

c. Embed reinforcement in wet coating. Embedment coating should extend 2 inches beyond reinforcement.

d. At intersections of membrane with vertical walls, extend embedment coat and reinforcement to a height not greater than finished horizontal surface with due allowance for installation of sealant work. Trowel a 1-inch high, 45-degree cant at meeting angle using nonflowing coating material.

3.04 MEMBRANE

A. Install, following safety and weather conditions required by manufacturer or as modified by applicable rules and regulations of federal, state, and local authorities having jurisdiction.

B. Following manufacturer's instructions, apply membrane material with a calibrated notched squeegee, trowel, or approved spray equipment to produce a 50-mil minimum dry thickness.

C. Extend membrane over previously flashed areas.

D. Use self-leveling membrane material up to a 5 percent slope.

E. Use nonflow membrane material for vertical surfaces and surfaces over a 5 percent slope.

F. Allow membrane to cure overnight. At temperatures less than 75 degrees F and relative humidities less than 50 percent, extend curing time.

3.05 PROTECTION

A. Protect cured vertical membranes exposed to backfilling operations with protection board.

B. Butt all boards; do not overlap.

C. Adhere or bond protection boards to membrane as recommended by membrane manufacturer.

D. Apply a second 20-mil (0.020-inch) thick topcoat of self-leveling (up to 5 percent pitch) or nonflow (over 5 percent pitch) coating to surfaces previously base coated.

3.06 CLEANING

A. Clean stains from adjacent surfaces with toluene, 1-1-1, trichloroethane, xylene, commercial tar remover, or as recommended by the membrane manufacturer.

B. Remove foreign matter from finished membrane surface.

3.07 APPLICATION SCHEDULE

A. Membrane:

1. Apply waterproofing membrane and protection board to exterior surfaces of cast-in-place concrete structures below finish ground level that enclose spaces that may be occupied, such as stairways, galleries, pump rooms, mechanical and electrical equipment rooms, and other areas shown. Do not include water-holding basins. Areas to be protected include:
   a. Grit Pump Room.
   b. Electrical Building Cabling Room.
2. Apply membrane from top of footings to 6 inches below finished grade.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Rigid and Batt insulation used in the roof and walls.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. C272, Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.
      b. C303, Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
      c. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
      d. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
      e. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
      f. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.

1.03 SUBMITTALS

A. Action Submittals: Product data for items specified herein.

1.04 DELIVERY, STORAGE, AND HANDLING

A. On packaging clearly identify manufacturer, contents, brand name, applicable standard, and R-value.

B. Store materials off ground and keep them dry. Protect against weather, condensation, and damage.

PART 2 PRODUCTS

2.01 BATT INSULATION AND FASTENERS

A. Fiberglass or Mineral Wool Batts:
   1. ASTM C665, Type III, Class B, with 0.5 perm rating, reflective aluminum foil vapor retarder membrane laminated to one side with R-values as indicated on Drawings.
   2. Manufacturers:
      a. CertainTeed Corp.
      b. Owens-Corning Insulating Systems.
      c. Johns Manville.
      d. “Or-equal.”

B. Fasteners: As recommended by insulation manufacturer.

C. Tape: As recommended by insulation manufacturer.

D. Provide R-value or thickness shown on Drawings.

2.02 RIGID INSULATION

A. Extruded Polystyrene Foam:
   1. ASTM C578, Type IV.
   2. Flame Spread: Less than 25 when tested in accordance with ASTM E84.
   3. Thickness: As shown on Drawings.
   4. Manufacturers and Products:
      a. Dow Chemical Co.; Styrofoam Square Edge.
      b. UC Industries; Foamular.
      c. “Or-equal.”

B. Adhesives and Fasteners: As recommended by insulation manufacturer.

PART 3 EXECUTION

3.01 BATT INSULATION

A. Install in accordance with manufacturer’s instructions and as specified below:
   1. Install in widths required by framing spacing with vapor retarder facing warm side.

2. Fit tightly to ensure continuous seal. Tape overlapping flanges of vapor retarder when necessary, using tape as recommended by insulation manufacturer.
3. Where electrical outlets, ducts, pipes, vents, or other utility items occur, place insulation on cold weather side of obstruction.
4. Protect installed insulation from tears and other damage until covered with finish material.
5. Remove and replace damaged material.

3.02 RIGID INSULATION

A. Install in accordance with the following:
   1. Install boards in location and in thickness as shown.
   2. Cut insulation with saw, knife, or other sharp tool to fit tightly around obstructions.
   3. Butt insulation boards together tightly at joints.
   4. Where thickness required exceeds 1-1/2 inches, install two layers of boards.
   5. Apply to masonry or concrete with adhesive recommended by insulation manufacturer:
      a. Adhere first layer to substratum, then adhere second layer to first, staggering joints.
      b. Follow manufacturer's recommendations for preparing surfaces and applying adhesive.

END OF SECTION

SECTION 07 26 16
BELOWGRADE VAPOR RETARDERS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Concrete Institute (ACI): 302, Guide for Concrete Floor and Slab Construction.
   2. ASTM International (ASTM):
      a. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
      b. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
      c. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
      d. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
      e. F1249, Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.02 SUBMITTALS

A. Action Submittals: Manufacturer's material specifications.

B. Informational Submittals:
   1. MSDS for proposed materials.
   2. Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.
   3. Manufacturer's written instructions for preparation, installation/application, repair, protection and maintenance.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in labeled packages. Store and handle in strict compliance with manufacturer's instructions. Protect from damage from weather, excessive temperature and construction operations. Remove and dispose of damaged material in accordance with applicable regulations.

PART 2 PRODUCTS

2.01 UNDERSLAB VAPOR RETARDER

A. Meet or exceed ASTM E1745, Class A, with the following properties:
   1. Water Vapor Permeance: 0.03 perm maximum when tested in accordance with ASTM E96/E96M or ASTM F1249.
   2. Tensile Strength: 45-foot-pounds per inch minimum, when tested in accordance with ASTM D882.
   3. Puncture Resistance: 2,200 grams minimum, when tested in accordance with ASTM D1709.
   4. Thickness: 10 mils minimum, in accordance with ACI 302.

B. Manufacturers and Products:
   1. Fortifiber Building Systems Group; Moistop Ultra 10.
   2. Reef Industries, Inc.; Griffolyn 10 mil Green.
   3. Stego Industries, LLC; Stego Wrap Class A Vapor Retarder.

2.02 ANCILLARY MATERIALS

A. Fasteners, Tape, Adhesive, or Sealant: As recommended by vapor retarder manufacturer.

B. Pipe Boots: Manufacturer's recommended prefabricated or field fabricated item.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine conditions of substrates and other conditions under which work is to be performed. Do not proceed with work until satisfactory conditions are obtained.

3.02 INSTALLATION

A. Underslab Vapor Retarder:
   1. Apply in accordance with manufacturer's instructions.
   2. After base for slab has been leveled and tamped, apply vapor retarder with roll width parallel to direction of concrete pour.
   3. Lap vapor retarder over footings and seal to foundation walls.
   4. Overlap joints 6 inches and seal with tape.
   5. Seal penetrations with pipe boots.
   6. Repair damaged areas with patches of vapor retarder, overlapping damaged area by 6 inches and sealing sides of patch with tape.

3.03 CLEANING

A. Upon completion of vapor retarder installation, remove waste materials and debris resulting from this operation and dispose offsite.

END OF SECTION

SECTION 07 54 23
THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section addresses fully adhered, thermoplastic membrane (TPO) roofing system including cover board over metal deck surface and vapor retarder, rigid roof insulation, membrane roofing, base flashings, roofing membrane expansion joints and counterflashings.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Wood Protection Association (AWPA): U1, Use Category System: User Specification for Treated Wood.
2. ASTM International (ASTM):
   a. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   b. C728, Standard Specification for Perlite Thermal Insulation Board.
   c. C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   d. D41, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
   e. D312, Standard Specification for Asphalt Used in Roofing.
   f. D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
   g. D471, Standard Test Method for Rubber Property—Effect of Liquids.
   h. D573, Standard Test Method for Rubber—Deterioration in an Air Oven.
   i. D751, Standard Test Methods for Coated Fabrics.
   j. D1149, Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment.
   k. D1204, Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
   l. D4601, Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
   m. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   n. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
   o. E108, Standard Test Methods for Fire Tests of Roof Coverings.
   p. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.

q. E408, Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

r. E1980, Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

3. FM Global (FM):
   a. DS 1-28, Design Wind Loads.
   b. DS 1-29, Roof Deck Securement and Above-Deck Roofing Components.
   c. 4450, Approval Standard for Class I Insulated Steel Deck Roofs.
4. International Code Council (ICC): International Building Code (IBC).
5. Intertek Testing Services (Warnock Hersey Listed) (WH), Certification Listings.
6. National Roofing Contractors Association: NRCA Roofing and Waterproofing Manual.
7. Single Ply Roofing Institute (SPRI): ES-1, Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
8. UL:
   a. 790, Standard Test Methods for Fire Tests of Roof Coverings.
   b. 1256, Fire Test of Roof Deck Constructions.
   c. 1897, Uplift Tests for Roof Covering Systems.
9. U.S. Department of Defense Military Standard (MIL): 3010, Test Procedures for Packaging Materials.
10. U.S. Environmental Protection Agency (EPA): ENERGY STAR - ENERGY STAR Voluntary Labeling Program.

1.03 DESIGN REQUIREMENTS

A. Low Slope Membrane Roof Edge Securement: Conform to SPRI ES-1 for wind speeds determined from applicable edition of California Building Code.

1.04 PERFORMANCE REQUIREMENTS

A. Roof Assembly Classification: FM Class 1 Construction, windstorm classification of I-90, in accordance with FM DS 1-28.

B. Vapor Retarder Permeance: Maximum 0.5 perms when tested in accordance with ASTM E96/E96M, water method.

1.05 SUBMITTALS

A. Action Submittals:
   1. Layout of tapered insulation.
   2. Project-specific details of roof penetrations and perimeter conditions.
   3. Layout and details of fully adhered system.

4. List of materials proposed for use; include roofing materials, accessories, insulation, and fasteners.
5. Manufacturer's specifications selected for use; include description of complete system from deck up.
6. Documentation that anchoring system meets uplift requirements.

B. Informational Submittals:
1. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
2. Manufacturer's installation instructions.
3. Letter or other documentation from roofing materials manufacturer stating that installer has been trained and approved to apply roof system.
4. Sample copy of guarantee to be provided.
5. Record of Preroofing Conference.
6. Inspection reports for inspections conducted by membrane manufacturer's representative; include written instructions or recommendations as conditions to special guarantee.
7. Operation and Maintenance Data:
   a. As specified in Section 01 78 23, Operation and Maintenance Data.
   b. Include sketches where applicable, recommendations for periodic inspection, care, and maintenance.
   c. Identify common causes of damage with instructions for temporary patching until permanent repair can be made.
8. Manufacturer's Certificate of Proper Installation per Section 01 43 33, Manufacturers' Field Services, (or alternately, test results or calculations) that assure item's and its anchorage's design criteria meets requirements of Section 01 88 15, Anchorage and Bracing, for loads provided in Section 01 61 00, Common Product Requirements.
9. Proposed Maintenance Agreement.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.

B. Roof Assembly Fire Classification: Minimum Class C when tested in accordance with ASTM E108 or UL 790.
1. Roof Assembly with Foam Insulation: Passes FM 4450 or UL 1256.

C. Surface Burning Characteristics:
1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.07 QUALITY CONTROL

A. Installer Qualifications:
   1. Trained and approved by roof membrane manufacturer.
   2. Experience: 3 years, minimum, in the installation of the specific roofing and flashing system specified.

B. Materials, including insulation used in roofing system shall be furnished by or approved by manufacturer whose roofing system is selected for use.

1.08 PREROOFING CONFERENCE

A. Conference Requirements:
   1. Attendees: Jacobs' Engineer, roofing installer, roofing manufacturer, installers of related Work, and other entities concerned with roofing performance included, where applicable, Owner's insurer, test agencies, governing authorities, and Owner.
   2. Agenda: Follow outline in NRCA's Waterproofing Manual. Include acceptability of deck, roofing system, materials, manufacturer's specifications selected, flashing details, roof guarantee, and protection of furnished roofing system.
   3. Documentation: Record discussion and agreements. Furnish copy to each attendee invited.

B. Membrane manufacturer's inspections as required to meet conditions of guarantee.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in their original, unopened containers, clearly labeled with manufacturer's name, brand name, and such identifying numbers as are appropriate.

B. Storage:
   1. Store materials at temperatures between 60 degrees F and 80 degrees F. Should they be exposed to lower temperatures, restore to 60 degrees F prior to use.
   2. Store rigid roof insulation materials on clean, raised platform.
   3. Do not store uncured flashing membrane on roof or at temperatures exceeding 75 degrees F.

C. Protect materials against wetting, moisture absorption, and construction traffic.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Weather: Do not install roofing during precipitation or when it is probable.

B. Temperature:
   1. Install roofing when ambient temperature is 50 degrees F or above.
   2. When temperature is below 50 degrees F, install only with approval or and under supervision of membrane manufacturer.

1.11 COORDINATION

A. Coordinate Work with installation of associated roof penetrations and metal flashings, as Work of this section proceeds.

1.12 SPECIAL GUARANTEE

A. Product: Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of roofing membrane, flashing, insulation, and accessories found defective during a period of 20 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the Contract Documents.

B. Coverage and Conditions:
   1. Costs for repairs required to maintain roofing system, flashing, expansion joint covers, and roof vents in watertight condition.
   2. Natural deterioration of roofing system as a result of ordinary wear and tear by elements.
   3. Defects as a result of faulty materials or workmanship during application.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fully Adhered TPO Roofing:
   1. Johns Manville; ST6RA-S/I, 60-mil membrane.
   2. GenFlex Roofing Systems; TPO.

2.02 ROOFING SYSTEM

A. Roofing system shall meet these Specifications, and approval and warranty of membrane manufacturer to provide a fully adhered complete TPO system including the following:
   1. Membrane.
   2. Roof insulation.
   3. Cover board.

4. Flashing.
5. Adhesives.
6. Fasteners.
7. Accessory materials.

2.03 MEMBRANE MATERIALS

A. Reinforced thermoplastic polyolefin sheet, 0.060 inch thick with the following properties:

Properties	Test Method	Specification
Thickness Tolerance	ASTM D751	Plus or minus 10%
Breaking Strength (min)	ASTM D751, Grab Method	270 pounds
Elongation at Break	ASTM D412	28%
Tear Strength (min)	ASTM D751	70 pounds
Ozone Resistance	ASTM D1149, 70 hours at 100 degrees F	No cracks or other affect
Heat Aging	ASTM D573, 28 days at 212 degrees F retention of tensile	Maintain 100% of original breaking strength
Water Absorption (change in mass)	ASTM D471, 158 degrees F for 7 days	1%
Hydrostatic Resistance (min)	ASTM D751, Method A	430 psi
Puncture Resistance	MIL Std 3010	380 pounds
Dimensional Stability (% change max.)	ASTM D1204	+ 0.4%

B. Membrane Sheet Size: Minimum width 60 inches by length of largest sheet possible, determined by Project conditions.

C. Color: White.

D. Energy and Environment:
   1. Roof Surface: Minimum solar reflectance index (SRI) for 75 percent of roof area, in accordance with ASTM E1980. Emissivity in accordance with ASTM E408.
      a. California Title 24: Reflectivity 0.78, emissivity 0.87.

2.04 ACCESSORY MATERIALS

A. Adhesives and Fasteners:
   1. Surface Conditioner: Compatible with membrane.
   2. Membrane cover board, and insulation adhesives and fasteners as recommended by membrane manufacturer.
   3. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

B. Flashing:
   1. 0.060-inch roofing membrane.
   2. Provide unreinforced 0.070-inch-thick roofing membrane for field fabricated vent stacks, pipes, and corners.

C. Primer: ASTM D41 Asphalt.

D. Asphalt: ASTM D312, Type III steep asphalt.

E. Roofing Felt: ASTM D4601, Type IV or VI asphalt-coated glass fiber mat.

F. Nailers: Preservative treated wood as specified in Section 06 10 00, Rough Carpentry.
   1. Waterborne salt preservatives; AWPA U1.
   2. Apply two brush coats of same preservative used in original treatment to sawed or cut surfaces of treated lumber.
   3. Minimum Grade: Standard of Better, or Stud Grade.

2.05 RIGID ROOF INSULATION BOARD

A. Average Aged R-value for Total Thickness of Rigid Insulation: Minimum R-30.

B. The following insulation materials may be used on this Project provided roofing materials manufacturer will guarantee roofing system.
   1. Polyisocyanurate Foam Board:
      a. ASTM C1289, Type II with FM Class I approval.
      b. Minimum Size: 2 feet by 4 feet.
      c. Manufacturers and Products:
         1) Atlas Roofing Corp.; AC Foam II.
         2) Celotex; H-T AP.
         3) GAF; GAFTEMP Isotherm.
         4) Johns Manville; E'NRG'Y 2.
   2. Tapered Board System:
      a. Factory precut or field tapered insulation board, minimum 1 inch thick with top surface cut to a uniform, continuous slope or as shown on Drawings.

b. Fabricate miters and edges to match abutting blocks.

c. Manufacturers and Products:

1) Johns Manville; Tapered E'NRG'Y Plus.

2) Owens Corning; Foamular 250.

3) Apache Products Co.; Tapered Millox.

2.06 COVER BOARD

A. ASTM C1289, Type II, Class 4. Consisting of closed cell polyisocyanurate.

B. Manufacturer and Product (Basis of Design): Johns Manville; Invinsa Roof Board.

2.07 ROOF WALKWAY

A. Manufacturers and Products:

1. Johns Manville; TPO Walkpad.
2. Stevens; EP Walkway Pad.

PART 3 EXECUTION

3.01 PREPARATION

A. Surfaces to be adhered shall be dry before and throughout entire application.

B. Notify Jacobs' Engineer and inspecting agency at least 48 hours before installation of vapor retarder, insulation, membrane, and roofing system.

C. Inspection:

1. Verify work of other trades that penetrates roof deck or requires roof access has been completed.
2. Ensure deck is firm, dry, free of foreign material, and reasonably smooth.
   a. Differential height between adjacent roof deck members of more than 1/8 inch is not acceptable.
   b. Repair joints greater than 1/4 inch wide.
3. Report immediately to Jacobs' Engineer cracks, breaks, holes, or other unusual irregularities in surface.
4. Cover rough surface that would cause damage to membrane with protection board.

D. Nailers:

1. Install wooden nailers where shown on details.
2. Anchor nailer with a suitable fastener with minimum withdrawal resistance of 100 pounds.
3. Stagger fasteners 6 inches on center within 8 feet of outside corner and 12 inches on center along other perimeter areas.
4. Nailer Thickness: Choose to match top surface of adjacent construction.

3.02 INSTALLATION

A. In accordance with membrane manufacturer's standard details for flashing and termination conditions not shown.

B. In accordance with Article Performance Requirements for uplift conditions.

C. In accordance with applicable recommendations of FM DS 1-29.

D. Insulation:
   1. Keep insulation dry before and during application.
   2. Install rigid insulation where and to thickness necessary for R-30 in two or more layers, staggering joints.
   3. Lay insulation with longest dimension perpendicular to direction of membrane seams with joints staggered over roof area to be covered.
   4. Butt boards as closely as possible with no gaps over 1/4 inch.
   5. Mechanically fasten insulation to deck following roofing membrane manufacturer's instructions.
   6. Do not install more insulation each day than can be covered with membrane before end of day or start of inclement weather.

E. Cover Board: Fasten cover board with mechanical fasteners to metal deck in accordance with roofing membrane manufacturer's instructions.

F. Membrane:
   1. Install membrane and flashing in accordance with manufacturer's recommendations and instructions.
   2. Heat weld joints following manufacturer's instructions.
   3. Fully adhere membrane to substrate.

G. Flashing:
   1. Install perimeter, curb, vents, expansion joints, drains, and other detail flashing as shown on manufacturer's standard detail drawings and as follows:
      a. Heat weld flashing to membrane and attach to other surfaces following manufacturer's instructions.
      b. Install pipe flashing, expansion joints, and roof drains in accordance with manufacturer's standard details and instructions.

H. Temporary and Night Seals:
   1. Provide water cutoffs under the following circumstances:
      a. Where and when a danger exists that water caused by precipitation may get under new roofing membrane.
      b. At end of each day.

2. Make by securely setting end of membrane in 6-inch-wide continuous application of cement and weight adhered edge to prevent displacement of cutoff.
3. Remove temporary water cutoffs prior to proceeding with next work period by cutting off and disposing of portion of membrane that has been in contact with cement.

I. Walkways: Adhere to membrane with membrane manufacturer's bonding adhesive.

3.03 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection and Certification of Proper Installation, equipment testing, startup assistance, and training of Design-Builder's personnel for specified component, subsystem, equipment, or system.

3.04 CLEANING

A. Remove spots and smears of asphalt or other material from flashings, gravel stops, and other surfaces not intended to be coated with such material. During removal, do not damage surfaces. Use solvents, if necessary, to clean surfaces.

3.05 PROTECTION

A. Limit traffic of personnel and equipment on completed roof to that deemed essential for completion of Project.

END OF SECTION

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   c. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, and Flat Bar.
   d. A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   e. B32, Standard Specification for Solder Metal.
   f. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   g. B370, Standard Specification for Copper Sheet and Strip for Building Construction.
   h. C920, Standard Specification for Elastomeric Joint Sealants.
   i. C1311, Standard Specification for Solvent Release Sealants.
   j. D1187, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
   k. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.
2. Federal Specifications (FS): QQ-L-201F(2), Lead Sheet.
3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual, 5th Edition.

1.02 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49.

C. Wind Loads:
   1. Ultimate Wind Speed: 115 mph.
   2. Nominal Wind Speed: 90 mph.
   3. Wind Loads for Component and Cladding Wall Elements:
      a. Ultimate: 43 pounds per square foot.
      b. Service: 26 pounds per square foot.
   4. Wind Loads for Component and Cladding Roof Elements:
      a. Typical Uplift Force (ultimate): 35 pounds per square foot.
      b. Perimeter Uplift Force (ultimate): 60 pounds per square foot.
      c. Corner Uplift Force (ultimate): 90 pounds per square foot.
   5. Wind Loads for Overhang Elements:
      a. Ultimate: 50 pounds per square foot.
      b. Service: 30 pounds per square foot.

D. Thermal Movements:
   1. Provide sheet metal flashing and trim that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
   2. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements.
   3. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   4. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

E. Water Infiltration: Provide sheet metal flashing and trim that does not allow water infiltration to building interior.

1.03 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown, unless more stringent requirements are indicated.

1.04 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Show joints, types and location of fasteners, and special shapes.

b. Catalog data for stock manufactured items.

2. Samples: Color Samples for items to be factory finished.

1.05 DELIVERY, HANDLING, AND STORAGE

A. Inspect for damage, dampness, and wet storage stains upon delivery to Work Site.

B. Remove and replace damaged or permanently stained materials that cannot be restored to like-new condition.

C. Carefully handle to avoid damage to surfaces, edges, and ends.

D. Do not open packages until ready for use.

E. Store materials in dry, weathertight, ventilated areas until immediately before installation.

1.06 SPECIAL GUARANTEE

A. Product: Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as Special Guarantee. Special Guarantee shall provide for correction or, at the option of the Owner, removal and replacement of factory-applied fluoropolymer coating, finish, and accessories found defective during a period of 20 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the Contract Documents.

B. Conditions:

1. Finish: No cracking, blistering, flaking, chipping, checking, chalking, peeling, or fading.
2. All Components: Watertight and weathertight with normal usage.

PART 2 PRODUCTS

2.01 METAL

A. Prefinished Galvanized Steel Sheet: ASTM A924/A924M, Grade A or ASTM A653/A653M, G90 zinc coating; 24-gauge (0.02-inch) core steel, shop prefinished with fluoropolymer coating (Kynar polyvinylidene fluoride resin) coating; color as selected from manufacturer's standard color range.

2.02 PREFABRICATED METAL SYSTEMS

A. Coping System:
   1. Snap-on system, stucco embossed pattern aluminum, 0.050-inch minimum thickness.
   2. Include ancillary items, such as mitered and welded corners, and end caps, where shown and as required for complete system.
   3. Manufacturers and Products:
      a. Johns Manville; PrestoLock FA.
      b. MM Systems Corp.; Snap-Lok Coping.
      c. "Or-equal."

B. Finish: Factory finished with full strength fluoropolymer coating (Kynar polyvinylidene fluoride resin) in color as indicated in Exterior Finish Schedule on Drawings.

2.03 ANCILLARY MATERIALS

A. Solder: ASTM B32, alloy composition Sn 50.

B. Soldering Flux: ASTM B32, Type RA.

C. Sealing Tape: Polyisobutylene sealing tape.

D. Isolation Paint: As specified in Section 09 90 00, Painting and Coating.

E. Isolation Tape: Butyl or polyisobutylene, internally reinforced, or 20-mil thick minimum polyester.

F. Plastic Roof Cement: ASTM D4586, Type II.

G. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

I. Fasteners:
   1. For Galvanized Steelwork: Steel, galvanized per ASTM A153/A153M or stainless steel fasteners.
   2. For Stainless Steelwork: Stainless steel.

2.04 FABRICATION OF FLASHING

A. Field measure prior to fabrication.

B. Fabricate in accordance with SMACNA Architectural Sheet Metal Manual that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Counter Flashing Systems: Figure 4-3.
   2. Roof Penetration Flashings: Figures 4-13, 4-14, 4-15, 4-16, and 4-17.

C. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

D. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

E. Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

F. Reinforcements and Supports: Provide same material as flashing, unless other material is shown. Steel, where shown or required, shall be galvanized or stainless.

G. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

H. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with butyl sealant concealed within joints.

I. Fabricate sheet metal in 10-foot maximum lengths, unless otherwise indicated.

J. At exposed ends of counterflashing furnish watertight closures.

K. Fabricate corners in one-piece with legs extending 30 inches each way to field joint. Lap, rivet, or solder corner seams watertight. Apply sealant if necessary.

L. Neutralize soldering flux.

M. Solvent clean sheet metal. Surfaces to be in contact with roofing or otherwise concealed shall be coated with isolation paint.

N. Pipe Penetrations through Roof: As shown on Drawings.

O. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

P. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and cant strips and reglets in place.

B. Verify nailing strips and blocking are properly located.

C. Verify membrane termination and base flashings are in place, sealed, and secure.

3.02 INSTALLATION

A. Flashing:

1. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
2. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   a. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch centers.
3. Isolate metal from wood and concrete and from dissimilar metal with isolation tape or two coats of isolation paint.
4. Use only stainless steel fasteners to connect isolated dissimilar metals.
5. Joints: 10-foot maximum spacing and 2-1/2 feet from corners, butted with 3/16-inch space centered over matching 8-inch-long backing plate with sealing tape in laps.

6. Set flanges of flashings and roof accessories on continuous sealer tape or in plastic roof cement on top of envelope ply of roofing. Nail flanges through sealing tape and at 3-inch maximum spacing. Touch up isolation paint on flanges.
7. Joints, Fastenings, Reinforcements, and Supports: Sized and located as required to preclude distortion or displacement due to thermal expansion and contraction.
8. Conceal fastenings wherever possible.
9. Set flashing and sheet metal to straight, true lines with exposed faces aligned in proper plane without bulges or waves.

B. Prefabricated Metal Systems:
1. Follow system manufacturer's printed instructions.
2. Place color variations in pieces so no extremes are next to each other.

C. Downspouts and Gutters: Anchor downspouts to wall with straps of same material as downspouts. Install gutters, as indicated on Drawings.

3.03 FINISH

A. Exposed Surfaces of Flashing and Sheet Metalwork: Free of dents, scratches, abrasions, or other visible defects, and clean and ready for painting where applicable.

3.04 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 70 01
ROOF SPECIALTIES AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM): D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.02 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings of each item specified showing materials, details, flashing, anchorage, and relation to adjacent structure.
   2. Catalog cuts of each item specified item.

1.03 SEQUENCING AND SCHEDULING

A. Coordination: Schedule and coordinate work of this section with work of Section 07 54 23, Thermoplastic Membrane Roofing, and Section 07 62 00, Sheet Metal Flashing and Trim.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Prefabricated Galvanized Steel: Minimum 8-inch-high curb above roofing membrane, with treated wood nailer liner panel, and factory installed insulation as required for conditions shown on Drawings.

B. Metal Gauge and Reinforcement: To suit imposed loads of equipment to be supported.

C. Fabricate curbs to fit roof slope.

D. Manufacturers and Products:
   1. Pate Co.; PC-2b.
   2. ThyBar; Model TC-3b.
   3. RPS Corporation; RC-2A.
   4. “Or-equal.”

2.02 EQUIPMENT SUPPORT CURBS

A. Prefabricated Galvanized Steel: Minimum 12-inch-high curb with counterflashing, factory installed insulation, and treated wood nailer as required for conditions shown on Drawings.

B. Metal Gauge and Reinforcement: To suit imposed loads of equipment to be supported.

C. Fabricate curbs to fit roof slope.

D. Manufacturers and Products:

1. Pate Co.; ES-2.
2. ThyCurb; Model TEMS-3.
3. RPS Corporation; ER-2A.

2.03 PIPE SEALS

A. Prefabricated one-piece aluminum flanged base with stepped, graduated EPDM cap and adjustable stainless steel clamps.

B. Manufacturers and Products:

1. Pate Co.; Pipe Seal.
2. Portals Plus, Inc.; Alumi-Flash.
3. “Or-equal.”

2.04 FLEXIBLE BASE PIPE SEALS

A. Prefabricated one-piece aluminum flanged base with stepped, graduated EPDM cap and adjustable stainless steel clamps. Aluminum base shall be capable of bending to match profile of sheet metal roofing panels.

B. Manufacturers and Products:

1. Pate Co.; Dektite.
2. Portals Plus, Inc.; Deck-Mate.
3. “Or-equal.”

2.05 ROOF HATCHES

A. Material: Galvanized steel, 14-gauge with factory-insulated curb and cover.

B. Factory assembled units consisting of:
   1. Curb: Double-wall with 1-inch insulation, fully welded corner joints, integral flashing and mounting flanges.
   2. Cover: Double-wall with 1-inch insulation, fully welded corners joints, and internally reinforced for 40 psf live load.
   3. Furnish EPDM rubber gasketing and corrosion resistant hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior handles.

C. Curb Height: 8-inches minimum clearance above roofing membrane.

D. Manufacturers and Products:
   1. Roof Hatch (for ladder) Size: 3 feet by 2.5 feet:
      a. Bilco; S-20.
      b. Babcock-Davis; B-RHG Series.
      c. JL Industries; RHG-1.
      d. “Or-equal.”

2.06 ANCILLARY MATERIALS

A. Sealer Tape: Polyisobutylene sealer tape.

B. Isolation Paint: As specified in Section 09 90 00, Painting and Coating.

C. Coat aluminum surfaces in contact with concrete or dissimilar metals as specified in Section 09 90 00, Painting and Coating.

D. Isolation Tape: Butyl or polyisobutylene, internally reinforced, or 20-mil-thick minimum polyester.

E. Plastic Roof Cement: ASTM D4586, Type II.

F. Fasteners: Stainless steel of type required.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine surfaces and structures to receive the Work of this section.

B. Take measurements at Site and fabricate work to suit. No changes shall be made in supporting structure to accommodate this Work.

3.02 INSTALLATION

A. General:

1. Install roof specialties and accessories as detailed in approved Shop Drawings and in conformance with manufacturer's instructions, recommendations, and standards.
2. Use appropriate pipe seal, flexible base pipe seal, or vent pipe flashing where pipe, conduit, or cable, etc., penetrate roofing membrane.
3. Factory Finished Units: Place color variations in pieces so no extremes are next to each other.
4. Make Work weathertight and free of expansion and contraction noise.

B. Roof Hatches: Install to operate freely and not rattle when closed or open.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:
   1. ASTM International (ASTM):
      a. C665, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
      b. E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.
      c. E814, Test Method for Fire Tests of Through-Penetration Firestops.
   2. UL:
      a. 1479, Fire Tests of Through-Penetration Firestops.
      b. 2079, Tests for Fire Resistance of Building Joint Systems.

1.02 SYSTEM DESCRIPTION

A. Provide systems of material or combination of materials used to fill openings around penetrating items to prevent the spread of fire and retain integrity of fire rated construction by maintaining an effective barrier against spread of flame, smoke, water, and hot gases through penetrations in fire rated wall, ceiling and floor assemblies as shown on Architectural Drawings.

B. Performance Requirements: Provide firestop systems with materials that have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

C. Regulatory Requirements:
   1. Firestop Systems: Meet requirements of ASTM E814, UL 1479, or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
   2. Proposed Firestop Materials and Methods: Conform to applicable governing codes having local jurisdiction.
   3. Meet F and T ratings of ASTM E814 for a period equal to construction penetrated.
   4. UL classified as fill, void, or cavity materials under UL 1479.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Show layout, profiles, and product components; include UL Systems Number on Shop Drawings and diagram of UL approved assembly.
   2. Product Data: Include manufacturer's SPEC-DATA® product sheet for products selected for use.

B. Informational Submittals:
   1. Manufacturer's installation instructions.
   2. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
   3. Certificates:
      a. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
      b. Certificate indicating installer qualifications.
      c. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.
   4. Special Guarantee documents specified below.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Experienced in performing Work of this section and specialized in the installation of work similar to that required for this Project.

B. Preinstallation Meetings: Conduct preinstallation meeting to identify where seals are required and verify Project requirements, substrate conditions, manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at Project Site.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification and UL listing mark intact.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Follow recommended procedures, precautions, or remedies described in Material Safety Data Sheets as applicable.

1.06 SEQUENCING AND SCHEDULING

A. Firestopping requirements may be created by mechanical and electrical portions of Work:
   1. Identify locations requiring firestopping.
   2. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

PART 2 PRODUCTS

2.01 GENERAL

A. Furnish firestop system products from a single manufacturer.
   1. Basis of Design is Hilti, FS – ONE MAX.

2.02 MANUFACTURERS

A. 3M Corp.; Firestopping Products.

B. Hilti Construction Chemicals; FS – ONE MAX, High Performance Firestop Systems.

C. Isolatek International (Cafco); TPS.

D. United States Gypsum Co. (USG); Firestop Systems and Thermafiber Safing Insulation.

2.03 MIXES

A. For those products requiring mixing prior to application, follow firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

2.04 FIRESTOPPING PRODUCTS

A. Fire Safing: Noncombustible, noncorrosive, moisture-resistant, and nondeteriorating fiber batt specifically intended for use in fire containment systems.
   1. 4.0 pcf or 6.0 pcf.
   2. ASTM C665 Noncorrosive, Type 1 or Type 2.
   3. ASTM E136 Rated Noncombustible.

B. Fire Putty: Fire barrier sealant, flexible with excellent adhesion to most substrates, weather resistant, and specifically intended for use in fire containment systems.

1. Will not react to temperature less than 200 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

A. With manufacturer's representative, examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning:

1. Clean openings and joints immediately prior to installing firestopping in accordance with firestop manufacturer recommendations and the following requirements:

a. Remove foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

b. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.

c. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping seal with substrates.

3.03 INSTALLATION

A. Manufacturer's Instructions: Follow manufacturer's instructions for installation of through-penetration systems selected for use.

1. Seal holes or voids made by penetrations for pipes, conduits and ducts through fire-rated floors, walls, and ceilings, and to ensure air and water resistant seals.
2. Receive Jacobs' Engineer's approval prior to installation of UL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.

B. Fire Safing: Install, following manufacturer's instructions, to completely fill gaps between tops of fire-rated walls and ceiling above, between edge of floors and walls, and other locations indicated on Drawings.

C. Fire Putty: Install following manufacturer's instructions with no voids or gaps. Leave finished surfaces and edges flush, straight, and aligned with adjoining materials. Remove smears and all overage from adjacent surfaces.

D. Meet UL and Factory Mutual requirements.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of Work accessible until inspection by applicable code authorities.

C. Perform patching and repairing of firestopping caused by cutting or penetrating existing firestop systems.

3.05 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection and certification of proper installation, and training of installer's personnel in proper installation procedures.

3.06 PROTECTION

A. Protect installed product from contact with contaminating substances and from damage during construction.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM):
      a. C661, Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by Means of a Durometer.
      b. C834, Standard Specification for Latex Sealants.
      c. C920, Standard Specification for Elastomeric Joint Sealants.
      d. C1193, Standard Guide for Use of Joint Sealants.

1.02 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Surface preparation instructions. Indicate where each product is proposed to be used.
   2. Samples: Material proposed for use showing color range available.

B. Informational Submittals:
   1. Installation instructions.
   2. Documentation showing applicator qualifications.
   3. Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.
   4. Special guarantee.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum of 5 years' experience installing sealants in projects of similar scope.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Ambient Temperature: Between 40 degrees F and 80 degrees F (4 degrees C and 27 degrees C) when sealant is applied. Consult manufacturer when sealant cannot be applied within these temperature ranges.

1.05 SPECIAL GUARANTEE

A. Product: Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction or, at the option of the Owner, removal and replacement of Work specified in this section found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the Contract Documents.

B. Conditions: No adhesive or cohesive failure of sealant.

C. Sealed Joints: Watertight and weathertight with normal usage.

PART 2 PRODUCTS

2.01 SEALANT MATERIALS

A. Characteristics:
   1. Uniform, homogeneous.
   2. Free from lumps, skins, and coarse particles when mixed.
   3. Nonstaining, nonbleeding.
   4. Hardness of 15 minimum and 50 maximum, measured by ASTM C661 method.
   5. Immersible may be substituted for nonimmersible.
   6. All sealants used inside the building envelope shall meet the approved VOC limits in Cal Green Section 5.504.4.

B. Color: Unless specifically noted, match color of the principal material adjoining area of application.

C. Type 1—Silicone, Nonsag, Nonimmersible:
   1. Silicone base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
   2. Capable of withstanding movement up to 50 percent of joint width.
   3. Manufacturers and Products:
      a. Dow Corning Corp.; No. 790.
      b. General Electric; Silpruf.
      c. BASF; Sonneborn, Omniseal-50.
      d. "Or-equal."

D. Type 2—Multipart Polyurethane, Self-leveling, Immersible:
   1. Polyurethane base, multicomponent, chemical curing; ASTM C920, Type M, Grade P, Class 25.
   2. Capable of being continuously immersed in water.
   3. Manufacturers and Products:
      a. BASF; Sonneborn, SL-2.
      b. Pecora Corp.; Urexspan NR-200.
      c. Tremco; THC-900/901.
      d. Sika Chemical Corp.; Sikaflex 2c SL.
      e. "Or-equal."

E. Type 5—One-part Polyurethane, Immersible:
   1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
   2. Capable of being continuously immersed in water.
   3. Manufacturers and Products for Nonsag:
      a. Sika Chemical Corp.; Sikaflex-1a.
      b. Tremco; Vulkem 116.
      c. "Or-equal."
   4. Manufacturers and Products for Self-leveling:
      a. BASF; Sonneborn, SL-1.
      b. Tremco; Vulkem 45.
      c. Sika Chemical Corp.; Sikaflex 1c SL.
      d. "Or-equal."

F. Type 10—Sanitary Sealant:
   1. Silicone sealant similar to Type 1, above, formulated to resist mold growth and repeated exposure to high humidity while retaining adhesion, flexibility, and color.
   2. Manufacturers and Products:
      a. Dow Corning; 786.
      b. General Electric; Sanitary Sealant SCS1700.
      c. "Or-equal."

G. Type 13—Tape Sealant:
   1. Compressible polyurethane foam impregnated with polybutylene or polymer-modified asphalt.
   2. Color: Black.

3. Size: 3/4 inch wide by length required by expanded thickness recommended by manufacturer for particular application.
4. Manufacturers and Products:
   a. Mescal Joint Systems, Ltd.; AST—High Acrylic.
   b. Dayton Superior; Polities Standard.
   c. PARR Technologies; PARR Sealant EP-7212-T.
   d. "Or-equal."

2.02 BACKUP MATERIAL

A. No gassing, extruded, closed-cell round polyurethane foam or polyethylene foam rod, compatible with sealant used, and as recommended by sealant manufacturer.

B. Size: As shown or as recommended by sealant material manufacturer. Provide for joints greater than 3/16 inch wide.

C. Manufacturers and Products:
   1. Sonneborn; Sonolastic Closed-cell Backing Rod.
   2. Tremco; Closed-cell Backing Rod.
   3. Pecora Corporation; Green Rod.
   4. "Or-equal."

2.03 ANCILLARY MATERIALS

A. Bond Breaker: Pressure sensitive tape as recommended by sealant manufacturer to suit application.

B. Joint Cleaner: No corrosive and no staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Primer: Nonstaining type recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 GENERAL

A. Use of more than one material for the same joint is not allowed unless approved by sealant manufacturer.

B. Install joint sealants in accordance with ASTM C1193.

C. Horizontal and Sloping Joints up to 1 Percent Maximum Slope: Use self-leveling (Grade P) joint sealant.

D. Steeper Sloped Joints, Vertical Joints, and Overhead Joints: Use nonsag (Grade NS) joint sealant.

E. Use joint sealant as required for the applicable application and as follows:

Joint Size	Sealant Type
Less than 1"	1, 2, 5, or 10
Less than 2"	1 or 2
Over 2"	Follow manufacturer's recommendation

3.02 PREPARATION

A. Verify that joint dimensions, and physical and environmental conditions, are acceptable to receive sealant.

B. Surfaces to be sealed shall be clean, dry, sound, and free of dust, loose mortar, oil, and other foreign materials.
   1. Mask adjacent surfaces where necessary to maintain neat edge.
   2. Starting of work will be construed as acceptance of subsurface.
   3. Apply primer to dry surfaces as recommended by sealant manufacturer.

C. Verify joint shaping materials and release tapes are compatible with sealant.

D. Examine joint dimensions and size materials to achieve required width/depth ratios.

E. Follow manufacturer's instructions for mixing multi-component products.

3.03 INSTALLATION

A. Use joint filler to achieve required joint depths, to allow sealants to perform intended function.
   1. Install backup material as recommended by sealant manufacturer.
   2. Where possible, provide full length sections without splices; minimize number of splices.
   3. Tape sealant may be used as joint filler if approved by sealant manufacturer.

B. Use bond breaker where recommended by sealant manufacturer.

C. Seal joints around window, door and louver frames, expansion joints, control joints, and elsewhere as indicated.

D. Joint Sealant Materials: Follow manufacturer's recommendation and instructions, filling joint completely from back to top, without voids.

E. Joints: Tool slightly concave after sealant is installed.
   1. When tooling white or light color sealant, use a water wet tool.
   2. Finish joints free of air pockets, foreign embedded matter, ridges, and sags.

F. Tape Sealant: Compress to 50 percent of expanded thickness and install in accordance with manufacturer's instructions.

3.04 CLEANING

A. Clean surfaces next to the sealed joints of smears or other soiling resultant of sealing application.

B. Replace damaged surfaces that are cracked, torn, or deformed that result from joint sealing or cleaning activities.

3.05 JOINT SEALANT SCHEDULE

A. This schedule lists the sealant types acceptable for each joint location. Use as few different sealant types as possible to meet the requirements of Project.

Joint Locations	Sealant Type(s)
Expansion/Contraction and Control Joints At:	
Concrete Walls (except water-holding and below grade portions of structures)	1, 5
Concrete Floor Slabs (except for water-holding Structures)	2, 5
Slabs Subject to Vehicle and Pedestrian Traffic	2, 5
Masonry Walls	1, 5, 13

Joint Locations	Sealant Type(s)
Material Joints At:	
Metal Door, Window, and Louver Frames (Exterior)	1, 5
Metal Door, Window, and Louver Frames (Interior)	1, 5
Wall Penetrations (Exterior)	1, 5
Wall Penetrations (Interior)	1, 5
Floor Penetrations	5
Ceiling Penetrations	1, 5
Roof Penetrations	5
Sheet Metal Flashings	5
Sheet Metal Roofing and Siding	5
Other Joints:	
Threshold Sealant Bed	5
Between Counter Tops and Backsplashes	10
Around Plumbing Fixtures	10
Openings Around Pipes, Conduits, and Ducts Through Fire-Rated Construction	As specified in Section 07 84 00, Firestopping

END OF SECTION

SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASTM International (ASTM): E1399, Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.
   2. UL.

1.02 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Product data including Engineer's identification mark, size, and description of components.
      b. UV performance of exterior covers.
      c. Movement performance of each cover.
      d. Details of blockout and anchorage required.
   2. Samples:
      a. Manufacturer's flexible material in standard colors as applicable for color selection.
      b. Base material with surface finish.

1.03 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain expansion joint cover assemblies from a single manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Ship metal pieces with protective film covering.

B. Deliver and store products in original containers at not less than 70 degrees F ambient temperature for not less than 24 hours immediately before installation.

PART 2 PRODUCTS

2.01 GENERAL

A. Design joint covers for dynamic structural movement without material degradation or fatigue in nonfire-rated construction as tested in accordance with ASTM E1399.

2.02 FLOOR JOINT COVERS (FEJ-1)

A. Material: Heavy-duty, extruded aluminum construction, mill finish, with replaceable elastomeric gasket, and complete with anchors.

B. Manufacturer and Product:
   1. Exposed Concrete Floors:
      a. Watson Bowman Acme; Model SFP 1200.
      b. "Or-equal."

PART 3 EXECUTION

3.01 PREPARATION

A. Examine surfaces and structures to receive work of this section.

B. Field measure and fabricate work to suit.

C. Coordinate and furnish anchorages, setting drawings, templates, and instructions for installation of expansion joint cover assemblies to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

3.02 INSTALLATION

A. Install floor expansion joint covers as detailed and in accordance with manufacturer's instructions and recommendations.

B. Maintain continuity of expansion joint cover assemblies with a minimum number of end joints and align metal members mechanically using splice joints.

C. Cut and fit ends to produce joints that accommodate thermal expansion and contraction of metal to avoid buckling of frames.

D. Securely anchor covers in their proper locations, plumb and level and without distortion. Adhere and seal, watertight, cross joints in covers.

3.03 CLEANING

A. When protective material is removed, clean exposed metal surfaces to comply with manufacturer's instructions.

3.04 PROTECTION

A. Do not remove protective material until finish work in adjacent areas is complete.

END OF SECTION

SECTION 08 11 00
METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American National Standards Institute (ANSI):
      a. A250.6, Hardware on Standard Steel Doors (Reinforcement - Application).
      b. A250.8, Recommended Specification for Standard Steel Doors and Frames.
      c. A250.11, Recommended Erection Instructions for Steel Frames.
   2. ASTM International (ASTM):
      a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
      c. E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
   3. Builders Hardware Manufacturers Association (BHMA): A156.115, Hardware Preparations in Standard Steel Doors and Frames.
   4. National Fire Protection Association (NFPA): 80, Standard for Fire Doors and Other Opening Protectives.
   5. UL: Building Materials Directory.

1.02 SUBMITTALS

A. Action Submittals:
   1. Applicable information for each type of door and frame, including:
      a. Frame conditions and complete anchorage details, supplemented by suitable schedules covering doors and frames.
      b. Glass opening sizes and locations in doors.
      c. Connections of door frames to structural steel framing concealed in frames.
      d. Location and field splice joints for frames too large to ship in one piece; indicate complete instructions for making field splices.
      e. Joints required to accommodate expansion joint movement.
      f. Relate to door numbers used on Drawings.

B. Informational Submittals: Certificate of Compliance per Section 01 43 33, Manufacturers' Field Services (or alternately, test results or calculations) that assure items and its anchorages design criteria meets requirements of Section 01 88 15, Anchorage and Bracing, for loads provided in Section 01 61 00, Common Product Requirements.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Properly identify each item with number used on Drawings.

B. Store doors upright, in protected dry area, at least 1 inch off ground or floor and at least 1/4 inch between individual pieces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:
   1. Curries Manufacturing.
   2. Monarch Steelcraft, Ltd.
   3. Republic Steel Corp.
   4. Steelcraft Manufacturing Co.

2.02 MATERIALS

A. Basic Metal Material: ASTM A1008/A1008M; sheet steel, cold-rolled, stretcher level.

B. Hollow Metal Frames:
   1. Products of hollow metal door manufacturer.
   2. ANSI 250.8, except as modified herein.
   3. Frames for Doors and Relights: 16 gauge for interior and 14 gauge with thermal break, for exterior, welded type, of cross-section shown.
   4. Prepare floor and wall anchors, reinforcement, and cutouts for hardware to meet requirements of BHMA A156.115 and ANSI A250.6.
   5. Finished size, shape, and profile of frame members as shown.
   6. Concealed fasteners or welding are preferred to through-the-face fasteners.
   7. Identification: Stamp opening number, as shown on Drawings, on center hinge reinforcement of each frame.

C. Hollow Metal Doors (HM): ANSI A250.8, except as modified herein. BHMA A156.115 and ANSI A250.6 to receive hardware specified in Door and Hardware Schedule on Drawings.
   1. Interior:
      a. Flush Panel Doors: 18 gauge, Level 2, Model 2.
      b. Stile and Rail Doors: 16 gauge, Level 3, Model 3.
      c. Flush end closure at top of doors.
   2. Exterior:
      a. Flush Panel Doors: 16 gauge, Level 3, Model 2.
      b. Stile and Rail Doors: 16 gauge, Level 3, Model 3.
      c. Double Doors: Overlapping astragals for active leaf, except as noted or detailed otherwise.
      d. Flush end closure at top of doors.
      e. R-Value: 8.

D. Labeled Fire Doors and Frames (HM):
   1. Conform to listing requirements of UL.
   2. Label each door and frame for class of rating required.
   3. Overlapping astragal on active leaf of double doors.
   4. Label requirements, dimensions, and type of door are indicated in Door and Hardware Schedule on Drawings.
      a. Modify drawing details if required to secure label.
      b. Clearly identify modifications on Shop Drawings.

2.03 MISCELLANEOUS ITEMS

A. Filler or Transom Panels: Furnish of same construction and finish as door to include fire-resistive rating.

B. Furnish manufacturer's standard core filler, anchors, fasteners, and other ancillary items.

2.04 FACTORY FINISHING REQUIREMENTS

A. Galvanized with A60 zinc coating in accordance with ASTM A653/A653M (Wipe Coat galvanized coating is not acceptable).

B. Phosphate treat metal for paint adhesion.

C. One shop coat of baked-on rust-inhibiting prime coating compatible with finish coating as specified in Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Frames:
   1. Follow ANSI A250.11 and manufacturer's instructions.
      a. Maintain scheduled dimensions, hold head level, and maintain jambs plumb and square.
      b. Secure anchorages and connections to adjacent construction.
      c. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb and anchors are securely attached.

B. Doors:
   1. Hollow Metal Doors: ANSI A250.8.
   2. Hardware: In accordance with manufacturer's templates and instructions.
      a. Adjust operable parts for correct function.
      b. Remove hardware, with exception of prime coated items, tag, box, and reinstall after finish paint work is completed.
   3. Labeled Doors: NFPA Pamphlet No. 80.

3.02 FIELD PAINTING

A. Where prime coat has been damaged, sand smooth and touch up with same primer as applied at shop.
   1. Remove rust before painting.
   2. Touch Up: Not obvious.
   3. Perform immediately after door and frame installation.

3.03 PROTECTION

A. Protect installed doors and frames against damage from other construction work.

3.04 SCHEDULES

A. For tabulation of door and frame characteristics, such as size, type, detail, and finish hardware requirements, see Door and Hardware Schedule and Window and Relight Schedule on Drawings.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. Builders Hardware Manufacturer's Association (BHMA):
      a. A156.1, Butts and Hinges.
      b. A156.3, Exit Devices.
      c. A156.4, Door Controls - Closers.
      d. A156.13, Mortise Locks & Latches.
      e. A156.16, Auxiliary Hardware.
      f. A156.18, Materials and Finishes.
   2. International Code Council (ICC): A117.1, Accessible and Usable Buildings and Facilities.
   3. UL: Fire Protection Equipment List.

1.02 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Product Data: Manufacturer's literature for each item of finish hardware required herein, clearly marked.
      b. Finish Hardware Schedule: Furnish complete and detailed schedule, show product items, numbers, and finishes for hardware for each separate opening.
      c. Special Tools: Provide listing and description of usage.

B. Informational Submittals:
   1. Operation and Maintenance Data as specified in Section 01 78 23, Operation and Maintenance Data.
   2. Manufacturer's Field Service Report.
   3. Certification of Hardware Consultant.
   4. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.

1.03 QUALITY ASSURANCE

A. Qualifications of Supplier: Recognized supplier of architectural finish hardware, with warehousing facilities, who has been furnishing hardware in vicinity of Project for not less than 5 years, and who is, or who employs, architectural hardware consultant.

B. Qualifications of Architectural Hardware Consultant (AHC): Certified by Door and Hardware Institute.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Before delivery, clearly identify and tag each item of hardware with respect to specified description and location of installation.

B. Provide secure storage for finish hardware until installation is made.

1.05 EXTRA MATERIALS

A. Special Tools: Two sets for installation and maintenance of hardware.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide end products of one manufacturer for each product in order to achieve standardization for appearance, maintenance, and replacement.

B. Finishes: BHMA A156.18.

2.02 FASTENERS

A. Stainless steel.

2.03 BUTT HINGES

A. BHMA A156.1.

B. Quantity per Door Leaf (Minimum):

Door Height	Hinges
Up to 5'-0"	1 pair
5'-1" to 7'-7"	1-1/2 pair
7'-8" to 10'-0"	2 pairs
10'-1" to 12'-6"	2-1/2 pairs

C. Hinge Height (Minimum):

Door Width	Hinge Height
Up to 3'-0"	4-1/2"
3'-1" to 4'-0"	5"
Over 4'-0"	6"

D. Width: Minimum for clearance of trim and 180-degree swing.

E. Exterior Hinges: Nonremovable pin.

F. Joint Tolerance: 0.012 inch maximum, gauged in CLOSED position.

G. Finish: Satin stainless steel No. 630.

H. Types and Manufacturers:

No.	Type Description	Stanley	Mc-Kinney	Lawrence	BHMA
H1	Regular weight, two ball-races, full mortise, stainless steel	FBB191-32D	TB2314	BB4101-32D	A5112
H2	5-knuckle concealed bearing electrified hinge	CECB191 - 56	TA2314		

2.04 LOCKS AND LATCH SETS

A. Mortise Locks: BHMA A156.13, Series 1000, Grade 1.
   1. Materials: Brass or stainless steel.
   2. Trim: Wrought or forged lever handles and roses.
   3. Core Cylinders: Interchangeable, removable; minimum of six pins.
   4. Bolt Throw: 5/8 inch minimum.
   5. Lever Backset: 2-3/4 inches.
   6. Manufacturers and Products:
      a. Sargent; LNJ.
      b. Schlage; 03.
      c. Best; 3H Fairbanks.

B. Tactile Warning: Knurl lever handles for touch identification; ICC A117.1, Section 4.29.3.

C. Finish: Satin stainless steel No. 630.

D. Types and Manufacturers:

No.	Type Description	Best	Sargent	Schlage	BHMA
L5	Mortise utility room lock with lever handle	45H7D3H	8204-LNJ	L9080-03	F07

No.	Type Description	Best	Sargent	Schlage	BHMA
L7	Deadlock W/ Occupied Notification	83T7K	15-475	B560	E2151
L8	Mortise privacy lock with lever handle	45H7L3H	8265-LNJ	L9040-03	F19, F22
L16	Lock by exit device manufacturer; furnish cylinders for keying to other locks as required				

E. Keying:
   1. Lock Cylinders: Operate by master key system that allows for future expansion.
   2. Keylocks: As directed by Owner.
   3. Keys: Two per lock; tag with schedule information.
   4. Master Keys: Four; send by registered mail to Owner.

2.05 CONSTRUCTION KEY SYSTEM

A. Assemble permanent cylinders with construction inserts and ship with all lock sets.

B. Change Keys: Pack in separately identified envelopes and ship.

C. Construction Keys: Pack in cartons marked “packing list” and ship.

D. Construction Insert Extractor Keys, Master Keys, and Grand Master Keys: Ship by registered mail to Owner.

E. On completion of job, deliver construction keys to Owner.

2.06 EXIT DEVICES

A. BHMA A156.3.

B. Furnish fire exit devices and mullions at fire-rated doors.

C. Trim:
   1. Levers: Sargent ETJ; Von Duprin 03.

D. Finish:
   1. Exit Device: Satin chromium-plated No. 626.
   2. Removable Mullion: Mill aluminum.

E. Types and Manufacturers:

No.	Type Description	Sargent	VonDuprin	BHMA
X1	Rim type, active leaf; with removable mullion for pairs	8813ETJ	99L	Type 1 08
X3	Rim type, electric latch bolt retraction	80 Series ELR	99QEL	
X5	Vertical rod type, exit only, for singles or pairs	8710	9927EO	Type 2 01

2.07 CLOSERS

A. BHMA A156.4.

B. Size closers in accordance with manufacturer's standards. Mount regular arm closers on pull side of doors. Mount parallel arm closers on push side of doors. On pair of doors provide closer on active leaf only, unless noted otherwise.

C. Finish: Satin chromium-plated No. 626.

D. Types and Manufacturers:

No.	Type/Description	LCN	Sargent	BHMA
C1	Regular arm	4010 Series	351 Series	C02011
C6	Parallel arm with integral stop and hold-open	4110H Cush-N-Stop Series	351-PSH Series	C02061

2.08 STOPS AND HOLDERS

A. BHMA A156.16.

B. Machine Screws: In threaded anchors at concrete or masonry.

C. Self-Tapping Screws: At stud partitions, wood, or metal mountings.

D. Finish: Satin chromium-plated No. 626.

E. Types and Manufacturers for Each Leaf:

No.	Type Description	BBW or GJ	Baldwin	BHMA
S1	Floor stop	F121X	4086	L02131
S2	Wall bumper	WC9X	4031	L02241

2.09 KICKPLATES

A. Solid metal, not plated. Bevel four edges.

B. Width of door leaf less than 1-1/2 inches at single leaf and less than 1 inch at pairs.

C. Finish: Satin stainless steel No. 630.

D. Types and Manufacturers:
   1. Builders Brass Works, Baldwin, Rockwood, or Cipco as follows:
      a. K1: 10 inches high by 0.125 inch thick.

2.10 THRESHOLDS

A. Thresholds: One-piece full width of opening; extend beyond jamb where indicated.

B. Provide with stainless steel machine screws in threaded expansion anchors at concrete.

C. Finish: Mill finish aluminum, unless indicated otherwise.

D. Types and Manufacturers:

No.	Type Description	Pemko	Reese
T1	Saddle (smooth, 4" x 1/2")	175A	S104A
T2	Saddle (serrated, 4" x 1/4")	270A	S404A
T3	Panic Threshold	2001DT	S257DU

2.11 WEATHERSTRIP

A. Finish: Clear dark bronze anodized aluminum, unless indicated otherwise.

B. Seal Types and Manufacturers:

No.	Type Description	Pemko	Reese
W1	Rubber or vinyl bulb at jambs and head, and at meeting stiles of pairs	S88D	797B
	Door shoe	222AV	DB596AF
	Rain drip	346C	R201C
W2	Rubber or vinyl bulb at jambs and head, and at meeting stiles of pairs	S88D	797B
	Door shoe	222AV	DB596AF

2.12 MISCELLANEOUS ITEMS

A. Provide as indicated in Door and Hardware Schedule on Drawings:

M1	Nameplate as specified in Section 10 14 00, Signage, in text noted in Door and Hardware Schedule on Drawings
M2	Nameplate and barrier-free pictorial symbol as specified in Section 10 14 00, Signage, in text noted in Door and Hardware Schedule on Drawings
M3	Barrier-free pictorial symbol, 6 inch by 6 inch, as specified in Section 10 14 00, Signage, in text noted in Door and Hardware Schedule on Drawings

2.13 SILENCERS

A. Ives, Glynn-Johnson.

B. At metal frame of each hinged door that does not have seals scheduled.

C. Three at single leaves and two at pairs.

2.14 TEMPLATES

A. Fabricate to template hardware applied to metal doors and frames.

B. Ensure that required templates are furnished to various manufacturers for fabrication purposes.

C. Templates: Make available not more than 10 days after receipt of approved Hardware Schedule.

2.15 EXIT AND FIRE DOORS

A. Exit Doors: Always openable from inside by simple turn of lever handle or push on panic bar without use of key or any special knowledge or effort, to include each leaf of door pairs.

B. Hardware for Fire Doors: UL, Fire Protection Equipment List.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with manufacturer's written instructions.

B. Make Work neat and secure, develop full strength of components, and provide proper function.

C. Prevent marring, scratching, or otherwise damaging adjacent finishes during hardware installation.

D. Latchbolts:
   1. Install to engage in strikes automatically, whether activated by closers or manually.
   2. In no case shall additional manual pressure be required to engage latchbolt in strike.

E. Stops and Holders: Set to allow doors to open as far as possible.

F. Wall Mounted Hardware: Install over solid structural backing or solid blocking in hollow walls.

G. Thresholds:
   1. Cope ends neatly to profile of jamb.
   2. Set in sealant and seal ends to jambs.

H. Hardware: Adjust for easy, noise-free operation.

I. Replace damaged hardware items.

3.02 MOUNTING DIMENSIONS

A. Standard Door Hardware Locations: As recommended and published by Door and Hardware Institute, except as noted or detailed otherwise.

B. Door Silencers: Install 3 inches from top and bottom of jamb and 1 inch above strike at single doors, and 3 inches from edges of doors in head for pairs of doors.

C. Nameplates: Attach to doors or walls adjacent to doors 5 feet 6 inches above floor using self-sticking adhesive.

3.03 PROTECTION

A. Cover and protect exposed surfaces of hardware during installation and until Substantial Completion.

B. Fit, dismantle, and reinstall finish hardware as required for finish painting work.

C. Protect and prevent staining of hardware during construction in accordance with manufacturer's recommendations.

D. Remove protective measures and permanent lock cylinders installed prior to final cleaning.

3.04 DOOR AND HARDWARE SCHEDULE

A. Door and Hardware Schedule on Drawings is guide to functional requirements of each opening.

B. Provide finish hardware as scheduled. Sizes omitted shall be as recommended by manufacturer.

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Architectural Manufacturers Association (AAMA): 800, Voluntary Specifications and Test Methods for Sealants.
2. American National Standards Institute (ANSI): Z97.1, Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test.
3. ASTM International (ASTM):
   a. C542, Standard Specification for Lock-Strip Gaskets.
   b. C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   c. C920, Standard Specification for Elastomeric Joint Sealants.
   d. C1036, Standard Specification for Flat Glass.
   e. C1048, Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
   f. C1172, Standard Specification for Laminated Architectural Flat Glass.
   g. E774, Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units.
4. Code of Federal Regulations (CFR): 16 CFR 1201, Safety Standard for Architectural Glazing Materials.
5. Glass Association of North America (GANA):
   a. Glazing Manual.
   b. Sealant Manual.
6. Insulating Glass Certification Council (IGCC).
7. Insulating Glass Manufacturer's Alliance (IGMA).
8. UL:
   a. 752, Standard for Bullet-Resisting Equipment.
   b. Automotive Burglary Protection and Mechanical Equipment Directory (ABPMED).

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

a. Complete schedule of glass and glazing material to be used for each purpose.

b. Catalog cuts of glazing materials with inclusion of glass edge cutting procedures.

B. Informational Submittals:

1. Manufacturer's Certificate of Compliance for each type of glazing, in accordance with Section 01 43 33, Manufacturers' Field Services.

2. Details and methods of glazing for each type of glazing condition; include manufacturer's recommendations for setting, sealing materials, and installing each type of glazing.

3. Documentation declaring compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants and other glazing materials.

4. Documentation of glazer's previous experience and manufacturer's approval.

1.03 QUALITY ASSURANCE

A. Glazier:

1. Have previous experience with installation of equal size and requirements that can be inspected by Owner.

2. Have approval of glass and framing manufacturer(s).

B. Factory Label Glass: Nonlabeled glass will be rejected.

C. Single Source Fabrication Responsibility: Fabrication processes, including Low-E and reflective coatings, insulating, laminating, silkscreen, and tempering, shall be fabricated by a single fabricator.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage:

1. Support cases on both sides when stored vertically.

2. After unpacking, place interleaving protection between lites.

3. Keep glass and interleaving dry by storing inside where temperatures are above dewpoint, or if outside storage is necessary, cover the glass interleaving with opaque tarpaulins or plastic and inspect periodically. Wet interleaving can stain glass.
4. Avoid exposing stored glass to direct sunlight.

B. Handling:
1. Stack individual lites on edge and lean them against sturdy uprights at a slope of 5 degrees to 7 degrees from vertical.
2. Cushion bottom edges with soft, firm pads free of dirt, grit, glass chips, or other foreign material.
3. Do not rotate or cartwheel insulating glass units over their corners. Use turning device such as a rolling block if units must be rotated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products of the following manufacturers, that meet these Specifications, may be used on this Project:
1. Flat Glass:
   a. AFG Industries, Inc.
   b. Pilkington Libbey-Owens-Ford Glass Co.
   c. PPG Industries, Inc.
   d. Guardian Industries, Corp.
   e. Monsanto Co.
   f. Viracon, Inc.
   g. “Or-equal.”
2. Laminated Safety Glass, Insulated Glass, Tempered and Heat-strengthened Glass:
   a. AFG Industries, Inc.
   b. Arch Aluminum & Glass Co.
   c. Cardinal LG.
   d. Interpane Glass Company.
   e. TPG Technical Glass Products.
   f. “Or-equal.”
5. Sealant, Gasket, Tape, and Compound:
   a. Dow Corning.
   b. General Electric Silicones.

c. Pecora Corporation.

d. Tremco.

g. F. H. Maloney Co.

h. Standard Products Co.

i. "Or-equal."

2.02 GLAZING MATERIALS

A. Float Glass (F.G.): ASTM C1036, Type I, Class 1 (clear), Glazing Quality q3, 1/4 inch (6 mm) minimum thickness.

B. Tempered Glass (S.G.):

1. ASTM C1048, Type 1 transparent flat, Quality q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering.
2. Furnish tempered glass where heat strengthened glass cannot meet specified performance requirements.

C. Laminated Safety Glass (L.G.): ASTM C1172, 7 mm minimum total thickness, consisting of two lights of float glass, bonded to minimum 0.030-inch clear polyvinyl butyral (PVB) interlayer, meeting 16 CFR 1201, Class 2 (tinted), as applicable, and ANSI Z97.1 and testing of 16 CFR 1201 for Category II materials.

D. Tinted Float Glass (T.): ASTM C1036, Type I, Class 3, Glazing Quality q3, 52 percent visible daylight transmittance, gray color.

E. Tinted Insulating Glass (I.G.): Insulating glass units with 1/2-inch air space, specified tinted glass outboard and clear glass inboard, each sheet 5 mm minimum thickness meeting ASTM E774, Class C, warranted by manufacturer against failure of edge sealing for minimum 5 years from date of manufacture.

1. Total Unit Thickness: 1-inch.
2. Product: Solarban 60 Optigray, manufactured by PPG.
   a. "Or-equal."
   b. U-Factor Winter: 0.29 maximum.
   c. U-Factor Summer: 0.27 maximum.
   d. Solar Heat Gain Coefficient: 0.30 maximum.
   e. UV Transmittance: 10 maximum.
   f. Visible Light Transmittance: 50 percent minimum.
   g. Solar Transmittance: 23 maximum.

2.03 ANCILLARY MATERIALS

A. Setting Blocks: ASTM C864 Option neoprene 70 Shore A durometer hardness, chemically compatible with sealant used.

B. Glazing Tape: Preformed, semisolid, polymeric-based material of proper size and compressibility. Use only where glazing rabbet is designed for tape and tape is recommended by glass or sealant manufacturer.

C. Glazing Sealant: One-component nonsag silicone elastomeric sealant ASTM C920, Type S, Grade NS, Class 25, Use G, or AAMA 800.

D. Compression Gaskets: Preformed dense elastomeric compression glazing gaskets, ozone resistant, meeting ASTM C864, Option 1, Shore A durometer between 65 and 75, of profile required to maintain weathertight seal.

PART 3 EXECUTION

3.01 PREPARATION

A. Do not perform glazing work in damp, foggy, or rainy weather, or when temperatures are not within range recommended by GANA “Glazing Manual”.

B. Surfaces: Smooth, even, sound, dry, and clean.

C. Priming: Complete and cured.

D. Measure size of frames to receive glass and compute actual glass size allowing for edge clearances.

E. Verify functioning weep system is present.

F. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.02 GLAZING INSTALLATION

A. General:

1. Follow recommendations of glass manufacturer GANA “Sealant Manual,” GANA “Glazing Manual,” and the following:

   a. Cutting:

      1) Make concealed edges clean, straight cut, and free from chips and fissures.

      2) Shop cut all glass. Nipping glass on job not allowed.

      3) Allow for maximum grip on all edges.

b. Positioning Glass:
   1) Set glass with equal bearing on entire width of pane.
   2) Position sheets of glass with setting blocks of hardness, chemically compatible with sealants used, and sizes recommended by glass and sealant manufacturers.
   3) Set tong marks of tempered glass at bottom of installed sheet.
   4) Orient pattern and draw of glass pieces in same direction.
   5) Place glass waves parallel or horizontal to floor.
   6) Set glass with one translucent surface, with smooth surface, on weather side.

c. Glass shall not move or rattle.

3.03 HOSE TEST

A. Use 3/4-inch minimum hose without nozzle. With full stream, flood glazing from bottom to top.

B. Correct any leaks disclosed by hose test by reglazing and retesting until eliminated.

3.04 CLEANING

A. Leave glass and glazing in undamaged condition and ready for final cleaning.

B. Remove excess glazing compound from installed glass.

C. Remove labels from glass surface at time of final cleaning.

D. Wash and polish both faces of glass.

3.05 PROTECTION OF COMPLETED WORK

A. Protection:
   1. Keep glass free from contamination by materials capable of staining glass.
   2. Install tape across lights secured to frames or structure.
   3. No tape or marking allowed on glass.

B. Replacements and Repairs: Prior to Substantial Completion, replace broken, defective, or scratched glass and repair damaged compounds.

END OF SECTION

SECTION 08 90 00
LOUVERS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. Air Movement and Control Association (AMCA): 500-L, Laboratory Methods of Testing Louvers for Rating.
   2. American Architectural Manufacturers Association (AAMA): 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performance Organic Coatings on Aluminum Extrusions and Panels.
   3. ASTM International (ASTM): D1187, Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.

1.02 DESIGN REQUIREMENTS

A. Installed Louvers: Capable of resisting wind load of 30 pounds per square foot.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Large scale details of louvers, anchorage to structure including proposed fasteners and spacing, and relationship to adjoining construction.
      a. Manufacturer's Literature: Descriptive and performance data of louvers, including standard drawings and louver-free area.
   2. Samples: At least 3-inch-long Samples of color and finish for selection of custom color.

B. Informational Submittals:
   1. Factory test data.
   2. Certificates of AMCA ratings.
   3. Installation instructions.
   4. Parts list, if applicable.
   5. Maintenance procedures.
   6. Special Guarantee.

PART 2 PRODUCTS

2.01 GENERAL

A. Nonacoustical louver sizes are based on 50 percent free area and 800 fpm maximum velocity through free area. If louvers furnished do not meet these parameters, Contractor is responsible for resizing louvers and wall openings, and for making other adjustments to allow for larger openings.

B. Water Penetration Rate: No greater than 0.02 ounce per square foot.

C. Louvers: Rated and tested in accordance with AMCA 500-L.

2.02 FIXED DRAINABLE LOUVER (TYPE DB)

A. Frame: Extruded aluminum channel, 0.081-inch-thick, 4 inches deep, concealed mullions.

B. Blades: Extruded aluminum, minimum 0.081-inch-thick, 35-degree to 45-degree pitch angles, with integral front drain gutter, spaced 3 inches to 4 inches on center.

C. Pressure Loss: AMCA certified rating of no greater than 0.10-inch WC.

D. Sizes: As scheduled on Drawings.

E. Screen: Inside mounted, painted aluminum, 1/2-inch mesh.

F. Finish:

1. Two coats minimum, factory spray applied, 70 percent Kynar 500 PVDF Fluoropolymer resin-based paint coating; AAMA 2605.
2. Custom color as scheduled.

G. Manufacturers and Products:

1. Construction Specialties; Model A4097.
2. Greenheck; Model ESD-435.
3. Ruskin; Model ELF375DX.

2.03 ACCESSORIES

A. Anchors and Fasteners: Stainless steel.

B. Flashings: Match louver frame.

C. Isolation Tape: Tremco 440, 3M EC1202, or Presstite 579.6.

D. Isolation Paint: ASTM D1187, bituminous coating.

2.04 SOURCE QUALITY CONTROL

A. Factory Performance Tests:
   1. Airflow versus pressure loss.
   2. Rain penetration data.

PART 3 EXECUTION

3.01 EXAMINATION

A. Check openings to ensure dimensions conform to Drawings.

B. Ensure openings are free of irregularities that would interfere with installation.

C. Do not install louvers until defects have been corrected.

3.02 INSTALLATION

A. Install louvers as shown on reviewed Shop Drawings. Coordinate with heating or ventilation ductwork to be connected.

B. Follow procedures in manufacturer's recommended installation instructions.

C. Separate aluminum from other metals with isolation tape or paint.

3.03 CLEANING

A. After erection, protect exposed portions from damage by machines, paint, lime, acid, cement, or other harmful compounds.

B. Remove protective materials and clean with plain water, water with soap, or household detergents.

3.04 SCHEDULE

A. For tabulation of louver characteristics for each opening numbered on Drawings, refer to Louver Schedule on Drawings.

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI): A118.9, Test Methods and Specifications for Cementitious Backer Units.
2. ASTM International (ASTM):
   a. A641/A641M, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
   b. C208, Standard Specification for Cellulosic Fiber Insulating Board.
   c. C475/C475M, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
   d. C514, Standard Specification for Nails for the Application of Gypsum Board.
   e. C645, Standard Specification for Nonstructural Steel Framing Members.
   f. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   g. C754, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
   h. C840, Standard Specification for Application and Finishing of Gypsum Board.
   i. C1002, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   j. C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
   k. C1177/C1177M, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
   l. C1178/C1178M, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.
   m. C1396/C1396M, Standard Specification for Gypsum Board.
   n. D4977, Standard Test Method for Granule Adhesion to Mineral Surfaced Roofing by Abrasion.
   o. D5420, Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
   p. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   q. E90, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

r. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.

s. E413, Classification for Rating Sound Insulation.

t. E695, Standard Test Method of Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading.

3. Gypsum Association (GA):

a. 214, Recommended Levels of Gypsum Board Finish.

b. 216, Application and Finishing of Gypsum Panel Products.

4. UL: UL Fire Resistance Directory.

1.02 SUBMITTALS

A. Submittals:

1. Control joint pattern proposed for gypsum board.
2. Manufacturer's list of items and materials proposed for use, with descriptive literature for each system used.
3. Sample: Manufacturer's FRP panel sample matching color selected on Drawings.

1.03 QUALITY ASSURANCE

A. General: Regardless of the minimum specifications herein, utilize materials and applications recommended by manufacturer.

B. Applicator's Qualifications: Use only workers regularly employed in this type of work who can show experience in application of similar materials and specific systems specified.

C. Single Source Responsibility: Use gypsum board and related joint treatment materials from a single manufacturer for each type used.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver fire-rated materials bearing testing agency label and required fire classification numbers.

B. Storage:

1. Store materials inside, under cover, stacked flat, off floor.
2. Stack gypsum board so that long lengths are not over short lengths.
3. Avoid overloading floor system of storage area.
4. Store adhesives and finishing compounds in dry areas; protect against freezing at all times.

1.05 ENVIRONMENTAL CONDITIONS

A. Temperature: In areas receiving gypsum board installation, maintain minimum temperature of 40 degrees F for 48 hours before, during, and after gypsum board application. Maintain minimum temperature of 50 degrees F for 48 hours before, during, and after application of adhesive methods of attachment and finishing compounds until drying is complete.

B. Ventilation:
   1. Provide ventilation during and following adhesives and joint treatment applications.
   2. Use temporary air circulators in enclosed areas lacking natural ventilation.
   3. Under slow drying conditions, allow additional drying time between coats of joint treatment.
   4. Protect installed materials from drafts of ambient air during hot, dry weather.
   5. Protect materials from drying too rapidly during hot and dry weather.

PART 2 PRODUCTS

2.01 GYPSUM BOARD

A. Regular Board (GWB): ASTM C1396/C1396M, 5/8-inch thick with tapered edges.

B. Water-Resistant Board (WRB): ASTM C1396/C1396M, 5/8-inch thick with tapered edges.

2.02 FRP LAMINATED FINISH

A. Impact Resistant FRP:
   1. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D5319.
      a. Coating: Multi-layer print, primer and finish coats or applied over-layer.
      b. Dimensions:
         1) Thickness: 0.090 inch (2.29 mm) nominal.
         2) Width: 4 feet, 0 inch (1.22 m) nominal.
         3) Length: 8 feet, 0 inch (2.4 m) nominal.
      c. Tolerance:
         1) Length and Width: Plus or minus 1/8 inch (3.175 mm).
         2) Square: Not to exceed 1/8 inch for 8-foot (2.4 m) panels or 5/32 inch (3.96 mm) for 10-foot (2.4 m) panels.
      d. Manufacturers and Products:
         1) Marlite; Dover OH. (Induro – Taylored Linen 4992, by Wilsonart).
         2) Kal-Lite: (Kal-Lite - Linen Pattern: Slate blue).
         3) Crane: (Varietex® – Coastal Canvas).

e. Color and Pattern:
   1) Color: As scheduled on Interior Finish Schedule and Color List on Drawings.
   2) Pattern: 4 by 4 tile pattern.
   3) Trim: PVC trim to match color and pattern selected.
   4) Corner Guard (all outside corners): Stainless steel corner guard, 4-foot length.

2.03 FASTENERS

A. Gypsum Board:
   1. Screws: ASTM C1002, self-drilling, self-tapping, bugle head, for use with power-driven tool.
      a. Type S, 1 inch long for gypsum board to sheet metal.
      b. Type W, 1-1/4 inches long for gypsum board to wood.

2.04 JOINT TREATMENT MATERIALS

A. Tape:
   1. General Interior Applications: ASTM C475/C475M, perforated paper tape.
   2. Soffit Board, Glass Mesh Mortar Units, and Cementitious Backer Board: 2-inch wide 10 by 10 open weave glass mesh tape as recommended by manufacturer.

B. Compound:
   1. General Interior Applications: ASTM C475/C475M, all-purpose, ready-mixed compound.
   2. Water-Resistant GWB and Soffit Boards: Chemically curing, polyindurate type material as recommended by manufacturer.

2.05 ANCILLARY MATERIALS

A. Adhesives: As recommended by gypsum board manufacturer for intended use.

2.06 TRIM ACCESSORIES

A. ASTM C1047, Zinc-Coated Metal.

B. Manufacturers and Products:
   1. Corner Bead:
      a. 1-1/4 inches by 1-1/4 inches:
         1) United States Gypsum; Dur-A-Bead.
         2) Gold Bond; standard corner beads.
   2. Edge Trim:
      a. United States Gypsum; 200B metal trim.

b. Gold Bond; No. 200 casing bead.

3. Metal Control Joint:
   a. United States Gypsum; No. 093.
   b. Gold Bond; E-Z strip control joint.

2.07 NONSTRUCTURAL METAL FRAMING MEMBERS

A. ASTM C645, galvanized C-studs with 1-5/8-inch flanges.

B. Sizes and Gauge: As noted on Drawings.

C. Manufacturers:
   1. United States Gypsum.
   2. Dale/Incor.
   3. Gold Bond.
   4. Unimast, Inc.

2.08 LIGHT-GAUGE METAL FRAMING ACCESSORIES

A. Cold-Rolled Carrying Channel: Cold-rolled steel, 16-gauge metal with minimum 1/2-inch wide flange, free of rust and coated with factory-applied rust-inhibitive paint, 2-1/2 inches deep.

B. Cold-Rolled Bridging Channel: Cold-rolled steel, 16-gauge metal with minimum 1/2 inch wide flange free of rust and coated with factory-applied rust-inhibitive paint, 1-1/2 inches deep.

C. Cold-Rolled Furring Channel: Cold-rolled steel, 25-gauge metal with minimum 1/2-inch wide flange, galvanized 3/4 inches deep.

D. Hat-Shaped Furring Channels: Roll-formed hat shaped section of 20 gauge galvanized steel with a face width of 1-1/4 inches and a depth of 1-1/2 inch(es).

E. Hanger Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

F. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.625-inch diameter or double strand of 0.0475-inch diameter wire.

2.09 DRY WALL CEILING SUSPENSION SYSTEM

A. Use system of main runners, cross tees, and furring channels.

B. Manufacturers:
   1. Armstrong World Industries, Inc.; Furring Systems/Drywall.
   2. Chicago Metallic Corporation; 660C - Dry-wall Suspension System.
   3. USG Interiors, Inc.; Drywall Suspension System.

2.10 SPRAY TEXTURE

A. Manufacturers and Products:
   1. Aggregate Finish:
      a. National Gypsum Company; ProForm Spray Quick.
      b. United States Gypsum Company; Ceiling Spray Texture.

B. Manufacturers and Products:
   1. Nonaggregate Finish:
      a. National Gypsum Company; ProForm Perfect Spray EM/HF.
      b. United States Gypsum Co.; SHEETROCK Wall and Ceiling Spray Texture (unaggregated).

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect surfaces to receive gypsum board and related materials before beginning work and report to Engineer any defects in such work which will adversely affect the quality of work specified herein.

3.02 PREPARATION

A. General: Provide, install, and maintain necessary scaffold, staging, trestles, planking, and temporary heating, lighting, and ventilation as necessary for duration of gypsum board work.

B. Protection: Protect work of other trades.

C. Coordination:
   1. Coordinate work with that of other trades. Check specifications and drawings of other trades to determine parts of work requiring coordination.
   2. Cut and repair gypsum board systems for installation of omitted work.

D. Surface Preparation: Repair defective surfaces prior to starting work. Prepare as specified for application of specific materials.

3.03 ERECTION OF DRY WALL CEILING SUSPENSION SYSTEM

A. Follow manufacturer's printed instructions.

B. Hangers:
   1. Space not over 4 feet OC in direction of runners and within 6 inches of ends of runners.
   2. Securely attach to structure above and provide for full saddle tie to main runner at indicated height.
   3. Connections shall develop full strength of hanger wire.

C. Bracing:
   1. Securely brace ceiling areas against sway.
   2. Where required by code, install for seismic control.
   3. Prevent runner and furring channels from contacting masonry walls.

D. Where ducts interfere with normal spacing of hangers and carrying channels, install additional hangers and channels to properly suspend ceiling.

3.04 ERECTION OF LIGHT-GAUGE NONSTRUCTURAL METAL FRAMING

A. Layout: Align partitions as shown on Drawings.

B. Tracks:
   1. Attach metal runner tracks to floor slabs with suitable fasteners located 2 inches from each end and spaced not more than 24 inches OC.
   2. Where partitions terminate at suspended or framed ceilings attach top tracks to suspended ceiling with toggle or molly bolts spaced 24 inches OC.
   3. Where partitions terminate above suspended ceilings provide diagonal bracing from top of partitions to structure above. Bracing shall be 3-5/8-inch metal studs staggered at 48 inches OC.
   4. Where partitions terminate at underside of concrete or metal decking attach deflection channels to substrate with suitable fasteners located 2 inches from each end and spaced not more than 24 inches OC. Locate partition top tracks within deflection channels with a minimum top clearance of 1 inch. Do not attach track to channel.

C. Studs:
   1. ASTM C754.
   2. Following manufacturer's printed instructions, position studs vertically, engaging floor and ceiling tracks and spaced as noted on Drawings.
   3. Splice: When necessary, use 8-inch nested lap and one positive attachment per stud flange.
   4. Place in direct contact with doorframe jambs, abutting partitions, and partition corners. Provide for anchorage of doorframes to studs.
   5. Anchor studs for shelf-walls and those adjacent to window and doorframes, partition intersections, and corners to ceiling and floor runner flanges. Securely anchor studs to jamb and head anchor clips of door or borrowed-light frames by bolt or screw attachment.
   6. Over metal door and borrowed-light frames, place horizontally a cut-to-length section of runner, with a web-flanged bend at each end, and secure with one positive attachment per flange. Position a cut-to-length stud (extending to ceiling runner) at vertical panel joints over doorframe header.
   7. Locate studs at abutting construction, partition intersections, and partition corners.
   8. Spacing: At 16 inches OC, unless otherwise required by manufacturer.

9. At Doorframes and Cased Openings:
   a. Full height double studs, No. 20 gauge minimum, secured to jamb anchors by bolts, screws, or welds.
   b. Header Track: Secure to frame head anchors and double studs.
   c. Provide double channel stiffeners through studs above frame and extend at least one stud space beyond each jamb.
10. Windows: Similar framing to door openings with stiffeners both above and below.
11. Wall Mounting Accessories: Provide channels, horizontal studding, No. 16 gauge sheet 8 inches by 2 inches greater than stud spacing, or other members within walls as required to provide secure and adequate support.

D. Furring:
1. Space furring channels the same as studs or as shown.
2. Around columns and beams construct furring as shown using metal studs and furring channels securely tied together and anchored in-place.
3. Attach resilient furring channels to wood framing with screws.

3.05 APPLICATION OF GYPSUM BOARD

A. Inspection and Preparation:
1. Check framing for accurate spacing and alignment.
2. Verify spacing of installed framing does not exceed maximum allowable for thickness of gypsum board to be used.
3. Verify frames are set for thickness of gypsum board to be used.
4. Do not proceed with installation of gypsum board until deficiencies are corrected and surfaces to receive gypsum board are acceptable.
5. Repair protrusions of framing, twisted framing members, or unaligned members before installation of gypsum board is started.

B. General:
1. Meet requirements of ASTM C840 and GA 216.
2. Joints: Use gypsum board of maximum lengths to minimize end joints. Stagger end joints when they occur. Locate end joints as far as possible from center of wall or ceiling. Abut gypsum board without forcing. Neatly fit ends and edges of gypsum board. Do not place butt ends against tapered edges.
3. Support ends and edges of gypsum board panels on framing or furring members except for face layer of double layer and where ends are back blocked and floated.
4. Use metal edge trim where gypsum board abuts another material, at corners, and where shown or noted on Drawings.
5. Use water-resistant board in toilet, and janitor room walls behind FRP panels and elsewhere as indicated on Drawings.
6. Follow manufacturer’s recommendation of good practice.

C. Over Framing:
   1. Apply gypsum board first to ceiling and then to walls for single layer horizontal application.
   2. Use vertical application for fire-rated walls.
   3. Fasten gypsum board securely to framing using double nailing, screw, or adhesive method.

3.06 JOINT SYSTEM FOR GYPSUM WALLBOARD

A. Interior Gypsum Board: Conform to ASTM C840.

B. Required: On exposed gypsum board, under ceramic tile and wall covering, and behind casework.

C. Prefill: Fill V-grooves formed by abutting rounded edges of gypsum board with prefill joint compound. Fill V-joint flush and remove excess compound beyond groove. Leave clear depression to receive tape. Permit prefill joint compound to harden prior to application of tape.

D. Taping and Finishing Joints:
   1. Taping or Embedding Coat: Apply compound in thin, uniform layer to joints and angles to be reinforced. Apply reinforcing tape immediately. Center tape over joint and seat tape into compound. Leave approximately 1/64-inch to 1/32-inch compound under tape to provide bond. Apply skim coat immediately following tape embedment but not to function as fill or second coat. Fold tape and embed in angles to provide true angle. Dry embedding coat prior to application of fill coat.
   2. Filling Coat: Apply joint compound over embedding coat. Fill taper flush with surface. Apply fill coat to cover tape. Feather out fill coat beyond tape and previous joint compound line. For joints with no taper, feather out at least 4 inches on either side of tape. Do not apply fill coat on interior angles. Allow fill coat to dry prior to application of finish coat.
   3. Finishing Coat: Spread joint compound evenly over and beyond fill coat on joints. Feather to smooth uniform finish. Apply finish coat to taped angles to cover tape and taping compound. Sand final application of compound to provide surface ready for decoration.
   4. Filling and Finishing Depressions: Apply joint compound as first coat to fastener depressions. Apply at least two additional coats of compound after first coat is dry. Leave filled and finished depressions level with plane of surface.

E. Finishing Beads and Trim:
   1. First Fill Coat: Apply joint compound to bead and trim. Feather out from ground to plane of the surface. Dry compound prior to application of second fill coat.
   2. Second Fill Coat: Apply joint compound in same manner as first fill coat. Extend beyond first coat onto face of gypsum board. Dry compound prior to application of finish coat.

3. Finish Coat: Apply joint compound to bead and trim. Extend beyond second fill coat. Feather finish coat from ground to plane of surface. Sand finish coat to provide flat surface ready for decoration.

3.07 FINAL FINISHES FOR GYPSUM WALLBOARD

A. Levels of Finish: Conform to GA 214.

B. Level 1:
1. Taping or embedding coat only.
2. Use in concealed areas, and where indicated, unless a higher level is required for fire-resistive or sound-rated assemblies.

C. Level 2:
1. Taping, filling, and finishing coats.
2. Use on water-resistant gypsum backing board.

D. Level 3:
1. Taping, filling, and finishing coats.
2. Use on surfaces indicated to have spray texture or ceramic tile.

E. Level 4:
1. Taping, filling, and finishing coats plus two separate coats applied over joints, angles, fastener heads, and trim accessories.
2. Sand between coats and after last coat.
3. Use on surfaces indicated to receive wall coverings.

F. Level 5:
1. Same as Level 4, plus a thin, smooth, uniform skim coat of joint compound, or product specially formulated for this purpose, over entire surface.
2. Produce surfaces free of tool marks and ridges, ready for decoration.
3. Use on surfaces not indicated otherwise, those indicated to receive gloss, semi-gloss, and nontextured flat paints, and where indicated.

3.08 SPRAY TEXTURE

A. Application:
1. Apply on gypsum board wall and ceiling surfaces, except behind wall covering, following manufacturer's printed directions for a medium build orange peel texture.
2. Before texture application, finish gypsum board as specified for Level 3.
3. When surfaces are prepared and dry, apply sealer and allow to dry. Mix texture finish material as directed by manufacturer.
4. Use spray equipment of a size and type to assure acceptable results.

B. Apply by spray only at a coverage rate as recommended by manufacturer and in accordance with directions printed on container. Apply material to blend uniformly and cover fully without starved spots or other evidence of thin application. Provide uniform texture without application patterns.

3.09 ADJUST AND CLEAN

A. Clean: Remove droppings or texture overspray from walls, windows, and floor, leaving room clean for following trades.

B. Nail Pop: Repair nail pop by driving new nail approximately 1-1/2 inches from nail pop and reseat nail. When face paper is punctured, drive new nail or screw approximately 1-1/2 inches from defective fastening and remove defective fastening. Fill damaged surface with compound.

C. Ridging:
   1. Do not repair ridging until condition has fully developed, approximately 6 months after installation or one heating season.
      a. Sand ridges to reinforcing tape without cutting through tape.
      b. Fill concave areas on both sides of ridge with topping compound.
      c. After fill is dry, blend in topping compound over repaired area.
   2. Fill cracks with compound and finish smooth and flush.

END OF SECTION

SECTION 09 50 00
METAL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Acoustical metal ceiling panels.
   2. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.
   3. Perimeter trim.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. ASHRAE Standard 62 1 2004, Ventilation for Acceptable Indoor Air Quality.
   2. ASTM International (ASTM):
      a. A1008, Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
      b. A641, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
      c. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
      d. D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
      e. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
      f. E580, Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint.
   3. 2016 California Building Code.
   4. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010
   5. NFPA 70, National Electrical Code.

1.03 SYSTEM DESCRIPTION

A. Continuous/wall-to-wall 4-inch wide metal slat ceiling system with black reveal trim.

1.04 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Manufacturer's technical data for specified ceiling unit and suspension system.

b. Layout and details of metal slats and trim showing locations of items that are to be coordinated with or supported by the ceilings.

c. Submit anchorage and bracing drawings and/or catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on Drawings.

2. Samples:

a. Minimum 6-inch samples of specified metal panel; 8-inch long samples of exposed wall molding and suspension system, including main runner and 4-foot cross tees.

b. Mark with manufacturer's name and specific design and technical data.

B. Informational Submittals:

1. Submit anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on Drawings.

2. Manufacturer's recommendation for installation of system.

3. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide linear metal ceiling panels and support components by a single manufacturer.

B. Coordination of Work: Coordinate, Metal ceiling work with installers of related work including, but not limited to building insulation, aluminum entry doors, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver 4-inch wide metal slat ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.07 PROJECT CONDITIONS

A. Space Enclosure for Standard Ceilings: Do not install metal ceilings until work above ceilings is complete. Building areas to receive ceilings shall be free of construction dust and debris.

1.08 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Metal Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of amount installed.
   2. Exposed Suspension System Components: Furnish quantity of each exposed suspension component equal to 2.0 percent of amount installed.

PART 2 PRODUCTS

2.01 METAL CEILING SYSTEM

A. Suspended, wall-to-wall, metal slat ceiling system. 4-inch slats with trim and supports by same manufacturer:
   1. Armstrong, Metalworks ™ Linear Planks: Unperforated metal ceiling system.
      a. 5494 - Contrasts Filler Strip.
      b. 5490 – 4-inch Panel (Slats) Splice.
   2. "Or-equal."

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, resilient flooring and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of Metal slats, border trim with light and sprinkler penetrations. Comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

3.03 INSTALLATION

A. Follow manufacturer installation instructions.

B. Install suspension system and slats in accordance with the manufacturer's instructions and in compliance with ASTM C636.

C. Furnish manufacturer's hold down clips and accessories required for a complete system addressing Seismic Design Category indicated in General Structural Notes on Drawings.

D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

3.04 ADJUSTING AND CLEANING

A. Replace damaged slats and trim.

B. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:
   1. ASTM International (ASTM):
      a. A641/A641M, Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
      b. C635/C635M, Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
      c. C636/C636M, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
      d. E1264, Standard Classification for Acoustical Ceiling Products.
   2. UL: Fire Resistance.

1.02 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Detailed layout of grid indicating hanger spacing, fastening and splicing details, change in level details, and access location.
      b. Submit anchorage and bracing drawings and/or catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on Drawings.
   2. Samples:
      a. One 12-inch square of each acoustical unit material to illustrate range of appearance.
      b. One full-size Sample of each suspension system member and molding.
      c. Mark with manufacturer's name and specific design and technical data.

B. Informational Submittals:
   1. Submit anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing, for loads shown on General Structural Notes on Drawings.
   2. Manufacturer's recommendation for installation of system.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials with manufacturer's labels indicating brand name, pattern, size and thickness.

B. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Where acoustical materials are to be installed, maintain humidity of 65 percent to 75 percent in area for 25 hours before, during, and 25 hours after installation.

B. Maintain uniform temperature of 55 degrees F to 70 degrees F prior to and during installation of materials.

1.05 EXTRA MATERIAL

A. Provide acoustical units from same production run as installed equal to 1 percent of area.

PART 2 PRODUCTS

2.01 SUSPENSION SYSTEMS

A. Components, Materials, and Accessories: Product of a single manufacturer.

B. ASTM C635/C635M, Heavy Duty:
   1. Exposed Tee Grid: Spaced to fit lay-in panels.
      a. Manufacturer and Product:
         1) Armstrong; Prelude ML.
         2) "Or equal."
   2. Main and Cross Members:
      a. Double web design, cold-rolled steel, minimum thickness of 0.020 inch, electrozinc-coated and factory-painted low-sheen satin white finish.
      b. Exposed Flange Width: 15/16 inch.
   3. Edge Molding:
      a. Minimum 0.020-inch steel, channel- or angle-shaped.
      b. Flange Width: 15/16 inch minimum.
      c. Finish to match main members.
   4. Hanger Wire: ASTM A641/A641M, minimum 12-gauge, galvanized, soft-annealed, mild steel wire.
   5. Wire Ties: ASTM A641/A641M, 18-gauge, galvanized, annealed steel wire.

6. Furnish manufacturer's hold down clips and accessories required for a complete system addressing Seismic Design Category indicated in General Structural Notes on Drawings.

2.02 ACOUSTICAL UNITS

A. Recessed Edge Lay-In Panels:
   1. Material: Fire-resistive mineral fiber, Class A.
   2. In accordance with ASTM E1264, Type III, Form 2.
   3. Pattern: Textured, fissured.
   4. Noise Reduction Coefficient (NRC): 0.60 to 0.70.
   5. Ceiling Attenuation Class (CAC): 30 to 39.
   6. Light Reflectance: LR 0.75.
   7. Nominal Size: 24 inches by 24 inches by 3/4 inch thick.
   8. Edges: Reveal or rabbeted.
   9. Finish and Color: Painted white, unless scheduled otherwise.
   10. Manufacturers and Products:
      a. Armstrong; Item 540 Travertone Sanserra.
      b. Celotex; Item PST-454, Everest.
      c. U.S.G.; Item 3845, Auratone, Aspen.

PART 3 EXECUTION

3.01 SEQUENCING

A. Lay out grid.

B. Coordinate with mechanical and electrical equipment in framing and cutting material around ceiling penetrations.

C. Install suspension systems after mechanical work above is complete.

D. Install acoustical units.

3.02 INSTALLATION OF SUSPENDED GRID SYSTEM

A. Hang level and in straight alignment directly from structure in accordance with ASTM C636/C636M and manufacturer's printed instructions.

B. Hanger Wires:
   1. Space maximum 4 feet on center each direction and securely attach to structure above.
   2. Install additional hangers at ends of each suspension member and at light fixtures, 6 inches from vertical surfaces.
   3. Do not splay wires more than 5 inches in a 4-foot vertical drop.

4. Provide four-way wire splays at 45 degrees from main runner to support structure for every 144 square feet of ceiling area.
5. Wrap wire minimum three times horizontally, turning ends upward.
6. Where hanger wires cannot be hung vertically from structure above because of ducts, pipes, cable trays, or other interferences, provide steel channel trapezes (minimum 2-inch deep, 16-gauge cold-rolled carrying channels) hung on steel rods or 8-gauge wire from structural members above. Hang ceiling wires from these trapezes or similar members supporting ducts or pipes. Do not hang directly from ducts or pipes.
7. Follow suspension system manufacturer's instructions for modified installation required for Seismic Design Category indicated in General Structural Notes on Drawings.

C. Edge Molding:
1. Install at intersection of suspended ceiling and vertical surfaces.
2. Miter corners where moldings intersect or install corner caps.
3. Attach to vertical surface with mechanical fasteners.

D. Provide additional channels, hangers, and trapezes as required to support edges of ceiling around and under mechanical and electrical work.

3.03 INSTALLATION OF ACOUSTICAL UNITS

A. Upon completion of suspended grid system and other concealed work, install with pattern running in one direction.

B. Place material to bear all around on suspension members.

3.04 CLEANING

A. Clean soiled or discolored unit surfaces after installation.

B. Touch up scratches, abrasions, voids, and other defects in painted surfaces.

3.05 SCHEDULE OF CEILING TYPES

A. Areas to Receive Acoustical Ceilings: Indicated on Interior Finish Schedule located on Drawings by type described below.

B. Acoustical Ceiling Type 1 (ACT):
1. Suspension System: Exposed painted steel tee grid system, 24 inches by 24 inches.
2. Exposed grid with main runners at 48 inches on center and cross tees at 24 inches on center.

3. Lay out grid to provide symmetrical borders as shown and which are not less than half the size of the lay-in panels.
4. Acoustical Units: Recessed edge lay-in panels.

END OF SECTION

SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Field and shop applied paints and coatings for normal exposures.
   2. Quality control and inspection of coatings.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. American Water Works Association (AWWA): C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   2. Bay Area Resources Requirements.
   3. California Air Resource Board Requirements.
   4. Environmental Protection Agency (EPA).
   5. California Green Building Standards Code (Cal Green).
   6. NACE International (NACE): SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
   7. NSF International (NSF): 61, Drinking Water System Components - Health Effects.
   8. Occupational Safety and Health Act (OSHA).
   9. The Society for Protective Coatings (SSPC):
      a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
      b. PA 3, Guide to Safety in Paint Applications.
      c. SP 1, Solvent Cleaning.
      d. SP 2, Hand Tool Cleaning.
      e. SP 3, Power Tool Cleaning.
      f. SP 5, White Metal Blast Cleaning.
      g. SP 6, Commercial Blast Cleaning.
      h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
      i. SP 10, Near-White Blast Cleaning.
      j. SP 11, Power Tool Cleaning to Bare Metal.
      k. SP 12, Surface Preparation and Cleaning of Metals Waterjetting Prior to Recoating.
      l. SP 13, Surface Preparation of Concrete.

m. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

1.03 DEFINITIONS

A. Terms used in this section:

1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
2. FRP: Fiberglass Reinforced Plastic.
3. HCl: Hydrochloric Acid.
4. MDFT: Minimum Dry Film Thickness, mils.
5. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
6. Mil: Thousandth of an inch.
7. PPDS: Paint Product Data Sheet.
8. PSDS: Paint System Data Sheet.
9. PVC: Polyvinyl Chloride.
10. SFPG: Square Feet per Gallon.
11. SFPGPC: Square Feet per Gallon per Coat.
12. SP: Surface Preparation.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

a. Data Sheets:

1) For each product, furnish a Paint Product Data Sheet (PPDS), the manufacturer's technical data sheets, and paint colors available (where applicable). The PPDS form is appended to the end of this section.

2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.

3) For each paint system, furnish the manufacturer's MSDS (manufacturer's Safety Data Sheet).

4) Technical and performance information that demonstrates compliance with Specification.

5) Furnish copies of paint system submittals to the coating applicator.

6) Indiscriminate submittal of only manufacturer's literature is not acceptable.

b. Detailed chemical and gradation analysis for each proposed abrasive material.

2. Samples:

a. Proposed Abrasive Materials: Minimum 5-pound sample for each type.

b. Reference Panel:

1) Surface Preparation:

a) Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel for each grade of sandblast specified herein, prepared to specified requirements.

b) Provide panel representative of the steel used; prevent deterioration of surface quality.

c) Panel to be reference source for inspection upon approval by Jacobs' Engineer.

2) Paint:

a) Unless otherwise specified, before painting work is started, prepare minimum 8-inch by 10-inch sample with type of paint and application specified on similar substrate to which paint is to be applied.

b) Furnish additional samples as required until colors, finishes, and textures are approved.

c) Approved samples to be the quality standard for final finishes.

B. Informational Submittals:

1. Applicator's Qualification: List of references substantiating experience.

2. Coating manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.

3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.

4. Manufacturer's written verification that submitted material is suitable for the intended use.

5. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer's written confirmation that materials are compatible.

6. Manufacturer's written instructions and special details for applying each type of paint.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years' experience in application of specified products.

B. Regulatory Requirements:
   1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
   2. Perform surface preparation and painting in accordance with recommendations of the following:
      a. Paint manufacturer's instructions.
      b. SSPC PA 3, Guide to Safety in Paint Applications.
      c. Federal, state, and local agencies having jurisdiction.

C. Mockup:
   1. Before proceeding with Work under this section, finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details.
   2. After Jacobs' Engineer approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Shipping:
   1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.
   2. Protect shop painted surfaces during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.

B. Storage:
   1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.
   2. Primed surfaces shall not be exposed to weather for more than 2 months before being topcoated, or less time if recommended by coating manufacturer.

1.07 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.

2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.

B. Minimum of 5 years' verifiable experience in manufacture of specified product.

C. Each of the following manufacturers is capable of supplying most of the products specified herein:
   1. Akzo-Nobel (including Devoe and International).
   2. Carboline.
   3. PPG (Including Ameron).
   4. Sherwin-Williams.
   5. Tnemec.

2.02 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.03 PAINT MATERIALS

A. General:
   1. Manufacturer's highest quality products suitable for intended service.
   2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.
   3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.
   4. All paints and coatings used inside the building envelope shall meet the approved VOC limits in Cal Green Section 5.504.4.

B. Products:

Product	Definition
Acrylic Latex	Single-component, finish as required
Acrylic Latex (Flat)	Flat latex
Acrylic Latex	Single-component, finish as required
Acrylic Sealer	Clear acrylic
Alkyd (Semigloss)	Semigloss alkyd
Alkyd Enamel	Optimum quality, gloss or semigloss finish as required, medium long oil
Bituminous Paint	Single-component, coal-tar pitch based
Block Filler	Primer-sealer designed for rough masonry surfaces, 100% acrylic emulsion
Coal-Tar Epoxy	Amine, polyamide, or phenolic epoxy type 70% volume solids minimum, suitable for immersion service
Epoxy Primer—Ferrous Metal	Anticorrosive, converted epoxy primer containing rust-inhibitive pigments
Epoxy Primer—Other	Epoxy primer, high-build, as recommended by coating manufacturer for specific galvanized metal, copper, or nonferrous metal alloy to be coated
Fusion Bonded Coating/Lining	100% solids, thermosetting, fusion bonded, dry powder epoxy, suitable for the intended service
Fusion Bonded, TFE Lube or Grease Lube	Tetrafluoroethylene, liquid coating, or open gear grease as supplied by McMaster-Carr Supply Corporation., Elmhurst, IL; RL 736 manufactured by Amrep, Inc., Marietta, GA
High Build Epoxy	Polyamidoamine epoxy, minimum 69% volume solids, capability of 4 to 8 MDFT per coat
Epoxy, High Solids	Polyamidoamine epoxy, 80% volume solids, minimum, suitable for immersion service
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish
Rust-Inhibitive Primer	Single-package steel primers with anticorrosive pigment loading

2.04 MIXING

A. Multiple-Component Coatings:
   1. Prepare using each component as packaged by paint manufacturer.
   2. No partial batches will be permitted.
   3. Do not use multiple-component coatings that have been mixed beyond their pot life.
   4. Furnish small quantity kits for touchup painting and for painting other small areas.
   5. Mix only components specified and furnished by paint manufacturer.
   6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

2.05 SHOP FINISHES

A. Shop Blast Cleaning: Reference Paragraph Shop Coating Requirements.

B. Surface Preparation: Provide Jacobs' Engineer minimum 7 days' advance notice to start of shop surface preparation work and coating application work.

C. Shop Coating Requirements:
   1. When required by equipment Specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.
   2. Where manufacturer's standard coating is not suitable for intended service condition, Jacobs' Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Pipe:
   1. Ductile Iron Pipe:
      a. Use SSPC standards as a guide for desired prepared surface. Follow recommendations of pipe and coating manufacturers for means and methods to achieve SSPC-equivalent surface.
      b. The surface preparation and application of the primer shall be performed by pipe manufacturer.

c. For high performance (epoxy) coatings, follow additional recommendations of pipe and coating manufacturers.

d. Prior to blast cleaning, grind smooth surface imperfections, including, but not limited to delaminating metal or oxide layers.

PART 3 EXECUTION

3.01 GENERAL

A. Provide Jacobs' Engineer minimum 7 days' advance notice to start of field surface preparation work and coating application work.

B. Perform the Work only in presence of Jacobs' Engineer, unless Jacobs' Engineer grants prior approval to perform the Work in Jacobs' Engineer's absence.

C. Schedule inspection of cleaned surfaces and all coats prior to succeeding coat in advance with Jacobs' Engineer.

3.02 EXAMINATION

A. Factory Finished Items:

1. Schedule inspection with Jacobs' Engineer before repairing damaged factory-finished items delivered to Site.
2. Repair abraded or otherwise damaged areas on factory-finished items as recommended by coating manufacturer. Carefully blend repaired areas into original finish. If required to match colors, provide full finish coat in field.

B. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3.03 PROTECTION OF ITEMS NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering.

E. Protect surfaces adjacent to or downwind of Work area from overspray.

3.04 SURFACE PREPARATION

A. Field Abrasive Blasting:
   1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.
   2. Refer to coating systems for degree of abrasive blasting required.
   3. Where the specified degree of surface preparation differs from manufacturer's recommendations, the more stringent shall apply.

B. Surface Contamination Testing:
   1. A surface contamination analysis test shall be performed every 500 square feet by means of a Chlor Test CSN Salts.
   2. Surface with chloride levels exceeding 3 µg/square centimeter for submerged surfaces and 5 µg/square centimeter for exposed surfaces shall be treated with a liquid soluble salt remover equivalent to CHLOR*RID (CHLOR*RID International, Chandler, AZ).
   3. Follow manufacturer's recommendations and procedures for the use of this product to remove the surface contamination.

C. Metal Surface Preparation:
   1. Where indicated, meet requirements of SSPC Specifications summarized below:
      a. SP 1, Solvent Cleaning: Removal of visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.
      b. SP 2, Hand Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using nonpower hand tools.
      c. SP 3, Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using power-assisted hand tools.
      d. SP 5, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.
      e. SP 6, Commercial Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light

shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.

f. SP 7, Brush-Off Blast Cleaning: Removal of visible rust, oil, grease, soil, dust, loose mill scale, loose rust, and loose coatings. Tightly adherent mill scale, rust, and coating may remain on surface.

g. SP 10, Near-White Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.

h. SP 11, Power Tool Cleaning to Bare Metal: Removal of visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter using power-assisted hand tools capable of producing suitable surface profile. Slight residues of rust and paint may be left in lower portion of pits if original surface is pitted.

i. SP 12, Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating: Surface preparation using high-pressure and ultrahigh-pressure water jetting to achieve specified surface cleanliness condition. Surface cleanliness conditions are defined in SSPC SP 12 and are designated WJ-1 through WJ-4 for visual surface preparation definitions and SC-1 through SC-3 for nonvisual surface preparation definitions.

2. The words “solvent cleaning”, “hand tool cleaning”, “wire brushing”, and “blast cleaning”, or similar words of equal intent in these Specifications or in paint manufacturer’s specification refer to the applicable SSPC Specification.

3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers’ recommendations for wet blast additives and first coat application shall apply.

4. Ductile Iron Pipe Supplied with Asphaltic Varnish Finish: Remove asphaltic varnish finish prior to performing specified surface preparation.

5. Hand tool clean areas that cannot be cleaned by power tool cleaning.

6. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.

7. Welds and Adjacent Areas:

   a. Prepare such that there is:

      1) No undercutting or reverse ridges on weld bead.

      2) No weld spatter on or adjacent to weld or any area to be painted.

3) No sharp peaks or ridges along weld bead.

b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

8. Preblast Cleaning Requirements:

a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.

b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.

c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.

9. Blast Cleaning Requirements:

a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer's recommendations.

b. Select type and size of abrasive to produce surface profile that meets coating manufacturer's recommendations for particular primer to be used.

c. Use only dry blast cleaning methods.

d. Do not reuse abrasive, except for designed recyclable systems.

e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.

10. Post-Blast Cleaning and Other Cleaning Requirements:

a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.

b. Paint surfaces the same day they are blasted. Reblast surfaces that have started to rust before they are painted.

D. Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation:

1. Remove soil, cement spatter, and other surface dirt with appropriate hand or power tools.

2. Remove oil and grease by wiping or scrubbing surface with suitable solvent, rag, and brush. Use clean solvent and clean rag for final wiping to avoid contaminating surface.

3. Obtain and follow coating manufacturer's recommendations for additional preparation that may be required.

E. Concrete Surface Preparation:

1. Do not begin until 30 days after concrete has been placed.
2. Meet requirements of SSPC SP 13.
3. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
4. Brush-off blast clean to remove loose concrete and laitance, and provide a tooth for binding. Upon approval by Jacobs' Engineer, surface may be cleaned by acid etching method. Approval is subject to producing desired profile equivalent to No. 80 grit flint sandpaper. Acid etching of vertical or overhead surfaces shall not be allowed.
5. Secure coating manufacturer's recommendations for additional preparation, if required, for excessive bug holes exposed after blasting.
6. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting.

F. Plastic and FRP Surface Preparation:

1. Hand sand plastic surfaces to be coated with medium grit sandpaper to provide tooth for coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

G. Masonry Surface Preparation:

1. Complete and cure masonry construction for 14 days or more before starting surface preparation work.
2. Remove oil, grease, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent washing, or other suitable cleaning methods.
3. Clean masonry surfaces of mortar and grout spillage and other surface deposits using one of the following:
   a. Nonmetallic fiber brushes and commercial muriatic acid followed by rinsing with clean water.
   b. Brush-off blasting.
   c. Water blasting.
4. Do not damage masonry mortar joints or adjacent surfaces.
5. Leave surfaces clean and, unless otherwise required for proper adhesion, dry prior to painting.
6. Masonry Surfaces to be Painted: Uniform texture and free of surface imperfections that would impair intended finished appearance.

7. Masonry Surfaces to be Clear Coated: Free of discolorations and uniform in texture after cleaning.

H. Gypsum Board Surface Preparation: Typically, new gypsum board surfaces need no special preparation before painting.

1. Surface Finish: Dry, free of dust, dirt, powdery residue, grease, oil, or any other contaminants.

I. Existing Painted Surfaces to be Repainted Surface Preparation:

1. Detergent wash and freshwater rinse.
2. Clean loose, abraded, or damaged coatings to substrate by hand or power tool, SP 2 or SP 3.
3. Feather surrounding intact coating.
4. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.
5. Apply one full finish coat of specified primer to entire surface.
6. If an aged, plural-component material is to be topcoated, contact coating manufacturer for additional surface preparation requirements.
7. For ductile iron pipe with asphaltic varnish finish not specified to be abrasive blasted, apply coat of tar stop prior to application of cosmetic finish coat.
8. Application of Cosmetic Coat:
   a. It is assumed that existing coatings have oxidized sufficiently to prevent lifting or peeling when overcoated with paints specified.
   b. Check compatibility by application to a small area prior to starting painting.
   c. If lifting or other problems occur, request disposition from Jacobs' Engineer.
9. Perform blasting as required to restore damaged surfaces. Materials, equipment, procedures shall meet requirements of SSPC.

3.05 SURFACE CLEANING

A. Brush-off Blast Cleaning:

1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC SP 7.
2. Abrasive: Either wet or dry blasting sand, grit, or nutshell.
3. Select various surface preparation parameters, such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.

4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.
5. Jacobs' Engineer will review acceptable trial blast cleaned area and use area as a representative sample of surface preparation.
6. Repair or replace surface damaged by blast cleaning.

B. Acid Etching:
1. After precleaning, spread the following solution by brush or plastic sprinkling can: One part commercial muriatic acid reduced by two parts water by volume. Adding acid to water in these proportions gives an approximate 10 percent solution of HCl.
2. Application:
   a. Rate: Approximately 2 gallons per 100 square feet.
   b. Work acid solution into surface by hard-bristled brushes or brooms until complete wetting and coverage is obtained.
   c. Acid will react vigorously for a few minutes, during which time brushing shall be continued.
   d. After bubbling subsides (10 minutes), hose down remaining slurry with high pressure clean water.
   e. Rinse immediately to avoid formation on the surface of salts that are difficult to remove.
   f. Thoroughly rinse to remove any residual acid surface condition that may impair adhesion.
3. Ensure surface is completely dry before application of coating.
4. Apply acid etching to obtain a "grit sandpaper" surface profile. If not, repeat treatment.

C. Solvent Cleaning:
1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.
2. Meet requirements of SSPC SP 1.

3.06 APPLICATION

A. General:
1. The intention of these Specifications is for new, interior and exterior metal surfaces to be painted, whether specifically mentioned or not, except as specified otherwise. Do not paint exterior concrete surfaces, unless specifically indicated.

2. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.
3. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating until completion of curing cycle.
4. Apply coatings in accordance with these Specifications and paint manufacturers' printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
5. Sand wood lightly between coats to achieve required finish.
6. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
7. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
8. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
9. Water-Resistant Gypsum Board: Use only solvent type paints and coatings.
10. On pipelines, terminate coatings along pipe runs to 1 inch inside pipe penetrations.
11. Keep paint materials sealed when not in use.
12. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

B. Galvanized Metal, Copper, and Nonferrous Metal Alloys:
1. Concealed galvanized, copper, and nonferrous metal alloy surfaces (behind building panels or walls) do not require painting, unless specifically indicated herein.
2. Prepare surface and apply primer in accordance with System No. 10 specification.
3. Apply intermediate and finish coats of the coating system appropriate for the exposure.

C. Porous Surfaces, Such As Concrete and Masonry:
1. Filler/Surfacer: Use coating manufacturer's recommended product to fill air holes, bug holes, and other surface voids or defects.
2. Prime Coat: May be thinned to provide maximum penetration and adhesion.
   a. Type and Amount of Thinning: Determined by paint manufacturer and dependent on surface density and type of coating.

3. Surface Specified to Receive Water Base Coating: Damp, but free of running water, just prior to application of coating.

D. Film Thickness and Coverage:

1. Number of Coats:
   a. Minimum required without regard to coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Application Thickness:
   a. Do not exceed coating manufacturer's recommendations.
   b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
   a. Perform with properly calibrated instruments.
   b. Recoat and repair as necessary for compliance with Specification.
   c. Coats are subject to inspection by Jacobs' Engineer and coating manufacturer's representative.
4. Visually inspect concrete, masonry, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.

3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Jacobs' Engineer before starting work in question.

B. Apply paint systems as scheduled in Interior Finish Schedule on Drawings, as required in the Piping Schedule, as called out on Drawings, or as noted below if not scheduled otherwise.

C. System No. 4 Exposed Metal—Highly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Epoxy Primer—Ferrous Metal	1 coat, 2.5 MDFT
	High Build Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Exposed metal surfaces, new, located inside or outside of structures exposed to weather, and the following specific surfaces:
   a. Grit washer/compactor.

D. System No. 5 Exposed Metal—Mildly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Epoxy Primer—Ferrous Metal	1 coat, 2.5 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Use on the following items or areas:
   a. Exposed metal surfaces, located inside or outside of structures and exposed to weather or in a highly humid atmosphere, such as pipe galleries and similar areas, unless otherwise noted.
   b. As indicated on Architectural Finish Schedules, Door and Hardware Schedule and Window and Relight schedules.

E. System No. 7 Concrete Encased Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning	High Build Epoxy	2 coats, 16 MDFT

1. Use on the following items or areas:
   a. Use on concrete encased ferrous metals including wall pipes, pipe sleeves, access manholes, gate guides, and thimbles.

F. System No. 8 Buried Metal—General:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Wax Tape Coat System	AWWA C217

1. Use on the following items or areas:
   a. Buried metallic fittings and appurtenances associated with nonmetallic pipe.
   b. Miscellaneous buried metal items not covered elsewhere.

G. System No. 19A Concrete Exposed Metal Repair Coatings—Wastewater:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush blast concrete in accordance with Paragraph Concrete Surface Preparation; blast exposed reinforcing steel to Near White Metal, SSPC SP10. See Note 1	Amine-cured epoxy, suitable for exposure to primary wastewater, finish color gray	2 coats, 8 MDFTPC, see Note 2
Note 1. Surface Preparation Alternative: Mechanical abrade concrete surfaces to meet International Concrete Restoration Association standard 37/32, Concrete Surface Profile No. 3. Mechanically abrade exposed ends of reinforcing steel in accordance with SSPC SP-11. Note 2. Brush out surface voids and irregularities to provide a monolithic film.		

1. On saw-cut concrete surfaces that will not receive new concrete to cover exposed ends of rebar and metal embeds. Or alternately, where approved, over ends of and minimum two inches around ends of exposed metal and rebar in lieu of entire surface.

H. System No. 25 Exposed FRP, PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Plastic and FRP Surface Preparation	Acrylic Latex Semigloss	2 coats, 320 SFPGPC

1. Use on the following items or areas:
   a. All exposed-to-view PVC and CPVC surfaces, and FRP surfaces without integral UV-resistant gel coat.

I. System No. 27 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1)	Prime in accordance with manufacturer's recommendations	
	Bituminous Paint	1 coat, 10 MDFT

1. Use on aluminum surfaces embedded or in contact with concrete.

J. System No. 29 Fusion Bonded Coating/Lining:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Fusion Bonded Coating/Lining 100% Solids Epoxy	1 or 2 coats, 7 MDFT

1. For steel pipe and fittings, meet all requirements of AWWA C213.

K. System No. 29A Fusion Bonded, Steel Dowel Coating:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Fusion Bonded Coating 100% Solids Epoxy	1 or 2 coats, 7 MDFT
TFE Lube, Shop Applied;		

3.08 ARCHITECTURAL PAINT SYSTEMS AND APPLICATION SCHEDULE

A. Apply paint surfaces as described. Apply paint systems where shown in Interior Finish Schedule and Drawings. Additional requirements are included in the Piping Schedule. Apply paint systems where shown below if not otherwise scheduled on Drawings.

B. System No. 106 Galvanized Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation	Manufacturer's Recommended Primer	1 coat, as recommended by manufacturer
	DTM Acrylic (Semigloss)	2 coats, 4 MDFT

1. Use on the following items or areas:
   a. Galvanized metal stairs.
   b. Galvanized metal railings.

C. System No. 107 Metal Trim and Structural Steel:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning	Rust-Inhibitive Primer	1 coat, 2 MDFT
	DTM Acrylic (Semigloss)	2 coats, 4 MDFT

1. Use on the following items or areas:
   a. Metal flashing and trim with no factory finish or with damaged factory finish.

D. System No. 109 Masonry, Semigloss:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Masonry Surface Preparation	Block Filler	1 coat, 75 SFPG
	Acrylic Latex (Semigloss)	2 coats, 240 SFPGPC

1. Use on the following items or areas:
   a. As indicated on Interior Finish Schedule.

E. System No. 110 Masonry Sealer:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Masonry Surface Preparation	Siloxane Sealer	See Section 04 22 00, Concrete Unit Masonry

1. Use on the following items or areas:
   a. Exposed exterior CMU walls.

F. System No. 113 Concrete, Semigloss (Egg Shell):

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Concrete Surface Preparation	Acrylic Latex (Semigloss, Egg Shell)	2 coats, 240 SFPGPC

1. Use on the following items or areas:
   a. Interior surfaces of concrete walls.

G. System No. 115 Gypsum Board and Plaster, Semigloss:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Gypsum Board Surface Preparation	Latex Primer/Sealer	1 coat, 350 SFPG
	Acrylic Latex (Semigloss) or Alkyd (Semigloss)	2 coats, 400 SFPGPC

1. Use on the following items or areas:
   a. As indicated on Interior Finish Schedule.

H. System No. 116 Gypsum Board and Plaster, Gloss Epoxy:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Gypsum Board Surface Preparation	Manufacturer's Recommended Primer	1 coat, 350 SFPG
	Water Base Epoxy (Gloss)	1 coat, 250 SFPG

1. Use on the following items or areas:
   a. As indicated on Interior Finish Schedules.

I. System No. 117 Concrete Masonry, Gloss Epoxy:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Masonry Surface Preparation	Block Filler	1 coat, 75 SFPG
	Water Base Epoxy (Gloss)	2 coats, 300 SFPGPC

1. Use on the following items or areas:
   a. As indicated on Interior Finish Schedules.

3.09 COLORS

A. Provide as shown in Interior Finish Schedules Piping Schedule. Colors will be selected by Owner from manufacturer's standard colors.

B. Proprietary identification of colors is for identification only. Selected manufacturer may supply matches.

C. Equipment Colors:
   1. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.
   2. Paint nonsubmerged portions of equipment the same color as the piping it serves, except as itemized below:
      a. Dangerous Parts of Equipment and Machinery: OSHA Orange.
      b. Fire Protection Equipment and Apparatus: OSHA Red.
      c. Radiation Hazards: OSHA Purple.
      d. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.

D. Pipe Identification Painting:
   1. Color code nonsubmerged metal piping, except electrical conduit. Paint fittings and valves the same color as pipe, except equipment isolation valves.
   2. Pipe Color Coding: In accordance with Piping Schedule.
   3. On exposed stainless steel piping, apply color 24 inches in length along pipe axis at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 9 feet on center.
   4. Pipe Supports: Painted light gray, as approved by Owner.
   5. Fiberglass reinforced plastic (FRP) pipe, polyvinylidene fluoride (PVDF), and polyvinyl chloride (PVC) pipe located inside of buildings and enclosed structures will not require painting, except as noted or scheduled.

3.10 FIELD QUALITY CONTROL

A. Testing Equipment:
   1. Provide magnetic type dry film thickness gauge to test coating thickness specified in mils, as manufactured by Nordson Corp., Anaheim, CA, Mikrotest.

2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities, as manufactured by Tinker and Rasor, San Gabriel, CA, Model M-1.
3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit as recommended by coating manufacturer.

B. Testing:
1. Thickness and Continuity Testing:
a. Measure coating thickness specified in mils with a magnetic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating.
b. Holiday detect coatings subject to immersion service on 100 percent of the surfaces:
1) Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE SP0188.
2) Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE SP0188.
c. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Jacobs' Engineer.

C. Inspection: Leave staging and lighting in place until Jacobs' Engineer has inspected surface or coating. Replace staging removed prior to approval by Jacobs' Engineer. Provide additional staging and lighting as requested by Jacobs' Engineer.

D. Unsatisfactory Application:
1. If item has an improper finish color or insufficient film thickness, clean surface and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

E. Damaged Coatings, Pinholes, and Holidays:
   1. Feather edges and repair in accordance with recommendations of paint manufacturer.
   2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
   3. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.11 MANUFACTURER'S SERVICES

A. In accordance with Section 01 43 33, Manufacturers' Field Services, coating manufacturer's representative shall be present at Site as follows:
   1. On first day of application of any coating system.
   2. A minimum of two additional Site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.
   3. As required to resolve field problems attributable to or associated with manufacturer's product.
   4. To verify full cure of coating prior to coated surfaces being placed into immersion service.

3.12 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.13 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:
   1. Paint System Data Sheet (PSDS).
   2. Paint Product Data Sheet (PPDS).

END OF SECTION

PAINT SYSTEM DATA SHEET (PSDS)

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

Paint System Number (from Spec.):
Paint System Title (from Spec.):
Coating Supplier:
Representative:
Surface Preparation:

Paint Material (Generic)	Product Name/Number (Proprietary)	Min. Coats, Coverage

PAINT PRODUCT DATA SHEET (PPDS)

Complete and attach manufacturer's Technical Data Sheet to this PPDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning: _____

Ambient Temperature Limitations: min.:_____ max.:_____

Surface Temperature Limitations: min.:_____ max.:_____

Surface Profile Requirements: min.:_____ max.:_____

SECTION 09 96 35
CHEMICAL-RESISTANT COATINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following list is of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D522, Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
   b. D578, Standard Specification for Glass Fiber Strands.
   c. D579, Standard Specification for Greige Woven Glass Fabrics.
   d. D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
   e. D4138, Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.
   f. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
   g. F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   h. F2170, Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes.
2. International Concrete Restoration Institute (ICRI): Guideline 03732, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymers.
3. The Society for Protective Coatings (SSPC):
   a. SSPC-SP-5, White Metal Abrasive Blast Cleaning
   b. SSPC-SP-10, Near White Abrasive Blast Cleaning.
   c. SSPC-SP13/NACE 6, Surface Preparation of Concrete.

1.02 ABBREVIATIONS

A. CRC: Chemical Resistant Coating.

B. MDFT: Minimum Dry Film Thickness.

C. Mil: One thousandth of an inch.

D. SDS: Safety Data Sheet.

E. SSPC SP: Surface Preparation Standard for Protective Coatings.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. List materials in proposed system.
      b. Manufacturer's product specification and technical data sheets.
      c. Chemical resistance test results for exposure to service conditions.
      d. Application instructions.
      e. Configuration details of materials at terminations, construction joints, floor drains, and trenches.
   2. Samples: 4-inch square complete system proposed for use showing thickness and finish.
   3. Manufacturer's confirmation of applicator's training and qualifications.
   4. Perform complete project planning and submit a Work Plan or series of process control procedures to the Design Builder.
   5. Applicator's Qualifications:
      a. List of references from the State of California substantiating experience. Include projects with successful service history, including project name and location, name of City and Engineer, and description of products used, substrates, and application procedures.
   6. Coating Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.

B. Informational Submittals:
   1. Field inspection and test reports.
   2. Safety Data Sheets.
   3. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.
   4. Special guarantee.
   5. Completed Applicator's Quality Control Program forms as specified herein, but not limited to:
      a. Holiday testing.
      b. Surface contamination testing.
      c. Thickness testing.
      d. Surface preparation.
      e. Environmental conditions.

1.04 QUALITY ASSURANCE

A. Manufacturer's Experience: Minimum 5 years manufacturing proposed products.

B. Applicator's Experience: Minimum 3 years applying proposed products.

C. Applicator shall be trained and qualified by the manufacturer.

D. Applicator Quality Control Plan: Applicator shall maintain and in-house quality assurance program that monitors surface preparation, coating application, environmental testing, and quality control testing for coating and lining operations. Level of experience, quality assurance program, and quality control testing by the applicator shall meet the minimum requirements specified herein, the coating manufacturer's instructions, and related government regulations.

E. Mockups: Required for coating systems over 1,000 square feet in area or exposed to view in service.

1. Before proceeding with Work under this section, finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details.
2. Procedure:
   a. Prepare, prime and coat one section of concrete, 10 feet by 10 feet, at a location mutually agreed upon by the Subcontractor and City. Use a "Step" down mockup as follows:
      1) Leave one-quarter of the surface exposed to allow observation of the surface preparation.
      2) Apply resurfacing mortar three-quarters of remaining surface.
      3) Apply filler/surfacer and primer to one-half of the surface, over the resurfacing mortar, leaving one-quarter of the surface exposed with resurfacing mortar.
      4) Apply finish coat to filler/surfacer with primer, leaving one-quarter of the surface exposed with surfacer/filler/primer.
   b. Mockup shall include concrete cuts for coating terminations.
   c. Leave mockup in place to serve as a reference and standard for the remaining work.
   d. At completion of Project, clean and prepare all surfaces that are not complete and finish coat the mockup area for incorporation into the Work.
   e. After Jacobs' Engineer review and approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers.

B. Storage: Maintain materials in clean and dry condition. Follow manufacturer's instructions.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Temperature: Apply resurfacing materials, surfacer/fillers and protective coating only when substrate, ambient air, and coating material are within the manufacturer's recommended range.

B. Substrate: Moisture content shall be within manufacturer's recommended range for product application.

C. Ventilation: Provide during and after application to meet all applicable safety and health regulations.

1.07 EXTRA MATERIALS

A. Furnish minimum 2 gallons of unopened topcoating material for future use by Owner.

1.08 SPECIAL GUARANTEE

A. Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of Work specified in this Specification section found defective during a period of 2 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the Contract Documents.

1. 24-Month Warranty Period Inspection: City will conduct inspection of interior and exterior coated surfaces prior to the end of warranty period. City will notify Contractor in advance of inspection and Contractor may attend at its option. City will prepare list of coating defects and failures identified during inspection and transmit to Contractor. List shall serve as notice of repairs required under warranty.
2. Repairs:
   a. If repairs are required, requirements of Contract shall apply including, but not limited to, requirements to remove standing water and perform repair work.
   b. Repair defective coatings using coating materials, equipment, and methods similar to those used in original work. Materials shall be of fresh manufacture and within manufacturer's stated shelf life at time of application.
   c. Provide extended warranty of 1 year for repairs.
   d. Complete repairs within 30 calendar days of Warranty Period Inspection.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. CRC-2: Sauereisen, Raven, Warren, "or-equal".

2.02 SERVICE CONDITIONS

A. Existing Structures: Milpitas Structure and Santa Clara 1 Structure:
   1. Location and Exposure: Existing concrete exposed to raw sewage immersion and head space, subject to hydrogen sulfide, dilute sulfuric acid with a pH of 1 to 3.
   2. Surface: Concrete walls and ceiling.

B. New Structures: Where shown on Drawings for new concrete in Grit Basins, Raw Sewage Pump Station, and Influent Screenings.
   1. Location and Exposure: New concrete exposed to raw sewage immersion and head space, subject to hydrogen sulfide, dilute sulfuric acid with a pH of 1 to 3.

2.03 MATERIALS

A. Chemical Resistant Coatings:
   1. A mixture of liquid resin-based material, setting agent, and filler designed to be troweled or sprayed into place to cure to a hard state.
   2. Provide Manufacturer's highest quality products suitable for intended service conditions.

B. Product Service Experience: Minimum 3 years of verifiable successful product performance in the listed exposure and process condition.

C. Only compatible materials from a single manufacturer shall be used within any system.

D. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.

E. Materials shall not contain lead or lead compounds.

F. Joints:
   1. Provide joint filler material of type, size and composition as recommended by the CRC manufacturer for the particular joint condition.
   2. Joint materials shall maintain a liquid tight joint for the life of the coating system.
   3. Chemical resistance of the joint material shall be the same or better than the coating system.
   4. Provide joint backing material per CRC manufacturer's recommendation.

G. Lining Reinforcement: Fiberglass chopped-strand or woven-mat.

2.04 COATING SYSTEMS

A. CRC-2—Epoxy Polymer, Trowel or Spray Applied:

1. Description: Chemical-resistant barrier lining suitable for application to existing and new concrete structures.
2. CRC Components:
   a. Concrete:
      1) Primer: One coat of Manufacturer's recommended moisture-resistant epoxy primer, 2 mils MDFT. As required by CRC manufacturer.
      2) Resurfacing Mortar (existing concrete only): Low shrinkage, high strength trowel or spray applied cement mortar.
      3) Surfacer/Filler (new concrete only): One coat of 100 percent solids, epoxy, surfacer, application rate as required to fill and level 100 percent of the concrete surface in preparation for coating. 1/16-inch nominal thickness.
      4) Corrosion Barrier Lining: One coat of trowel grade, 100 percent solids, chemical resistant amine-cured epoxy lining material, 80 mils MDFT.
      5) At Contractor's option, a plural component, spray applied epoxy liner system may be submitted for Design Builder approval.
   b. Steel:
      1) Corrosion Barrier Lining: One coat of spray applied, 100 percent solids, chemical resistant amine-cured epoxy, 80 mils MDFT.
      2) Glaze Coat: One coat of spray applied, 100 percent solids, chemical resistant amine-cured epoxy for sealing the Corrosion Barrier Lining, 20 mils MDFT.

2.05 MIXING

A. Thoroughly mix until homogeneous following manufacturer's instructions.

B. Mix only components furnished by coating manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Surface Preparation:

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed directions and recommendations of the system manufacturer whose product is to be applied.
2. Provide Jacobs' Engineer minimum 3 days' advance notice of start of surface preparation and system application Work.

3. Perform Work only in presence of Jacobs' Engineer, unless Jacobs' Engineer grants prior approval to perform Work in Jacobs' Engineer's absence.

B. Schedule inspection with Jacobs' Engineer in advance for cleaned surfaces and system application Work.

3.02 PREPARATION

A. As specified herein and in accordance with the manufacturer's printed directions and recommendations.

B. Concrete Surfaces, Existing:
1. Clean surfaces by water blasting (5,000 psi minimum) or abrasive blasting to remove all unsound concrete, contaminants, dirt, debris, oil, grease, and deteriorated reinforcing steel.
2. pH of cleaned concrete shall be greater than 8.
3. Inspect cleaned surfaces to identify corroded reinforcing steel, cracks, leaks, and joints.
4. Repair cracks, leaks and joints in accordance with the coating manufacturer's recommendations.

C. Concrete Surfaces, New:
1. Do not begin until 30 days after concrete has been placed.
2. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
3. Prepare surfaces and provide a concrete profile by abrasive blasting SSPC SP-13, or by high pressure water blasting, 4,000 psi minimum. Minimum surface profile shall meet ICRI CSP 3 to 5, or higher if required by coating manufacturer.
   a. Prepared surfaces must be clean, dry, and firm.
4. Secure coating manufacturer's recommendations for additional preparation if required by the coating manufacturer.
5. Ensure that concrete surfaces are sufficiently dry prior to coating.
   a. Test for moisture using plastic sheets in accordance with ASTM D4263.
   b. If the test indicates moisture is present, conduct tests to determine moisture content in accordance with ASTM F1869. If the moisture content exceeds 3 pounds per 1,000 square feet in a 24-hour period, provide the manufacturer's recommendations for mitigation of moisture effect on lining application and long term lining performance. All tests using electronic moisture meters shall conform to ASTM F2170.

D. Reinforcing Steel:
   1. If reinforcing steel is corroded to the extent that it must be replaced, request disposition from Jacobs' Engineer.
   2. For reinforcing steel that some corrosion but does not require replacement, abrasive blast (SSPC SP-10) remove all rust and contaminants and apply one coat of the manufacturer's recommended epoxy.

E. For existing, deteriorated concrete surfaces. Inspect all surfaces for soundness. Remove all material that is not intact. Apply resurfacing mortar. Secure coating manufacturer's recommendations for special situations that become apparent after deteriorated concrete is removed.

F. Provide saturated surface dry (SSD), as required by the manufacturer. Use only clean water to obtain saturated surface dry condition.

G. Concrete Defects, new concrete: Fill holes and cracks with manufacturer's recommended materials. Secure the Manufacturer's recommendations for additional preparation if required for excessive bug holes exposed after blasting.

H. Metal: Abrasive blast to SSPC SP-5, White Metal Blast Cleaning and achieve Manufacturer's recommend anchor profile.

3.03 APPLICATION

A. General:
   1. This section is intended for special chemical resistant coatings. See Section 09 90 00, Painting and Coating, for ferrous metal and other general painting requirements.
   2. Surfacer/Filler: Apply surfacer/filler to concrete with methods recommended by the coating manufacturer as required to provide a surface that is continuous, smooth, void-free surface. Force material into voids and irregularities and remove excess filler before the material sets.
   3. Spray or trowel apply coating system components in accordance with manufacturer's written instructions.
   4. Cove corners at vertical and horizontal intersections, and reinforce as specified in Paragraph Joints, this section.
   5. Apply saturant/intermediate coat to wet out and embed fiberglass reinforcement.
   6. Provide minimum number of coats required for each coating system, regardless of application method. Do not apply succeeding coats until previous coat has cured in accordance with coating manufacturer's recommendations.
   7. Observe manufacturer's published recoat windows. If recoat window is exceeded, mechanically abrade before recoating in accordance with manufacturer's directions and as approved by Engineer.

B. Priming and Holiday Prevention on Concrete and Substrates: Follow manufacturer's written instructions related to application during decreasing substrate temperature conditions, adequate surface preparation and other application techniques that may be necessary to reduce the potential for outgassing and formation of pinholes during coating application and cure. If required by the coating manufacturer, apply manufacturer's recommended epoxy penetrating primer to minimize the effects of vapor transmission from the concrete.

C. Product Mixing:
   1. Thoroughly mix until homogeneous following manufacturer's instructions.
   2. Mix only components furnished by coating manufacturer.

D. Film Thickness: Provide specified thickness of material. Use screeds or wet film gauges to monitor thickness during application.

E. Joints:
   1. Provide continuous sealant, backing material, and joint-lining treatment recommended by the coating manufacturer at all expansion, isolation, and construction joints.
   2. Provide continuous sealant bead at joints between different coating systems.
   3. Provide fiberglass or synthetic fabric reinforcement at construction joints and large substrate cracks to maintain liquid-tight requirements under the specified service conditions.

F. Penetrations: Coat over or around equipment anchors, base plates, pipes, and similar items installed in areas receiving CRC to maintain continuous liquid tight seal.

G. Terminations:
   1. Conform to manufacturer's details.
   2. For coating exposed to wastewater or vapor space above wastewater liquid levels, terminate leading edges in beveled saw cuts 1/4-inch-wide by 1/4-inch-deep, or as required by manufacturer. Prime and extend coating into the saw cut. Do not fill saw cut with epoxy surfacer. Saw cut shall be provided by CRC subcontractors.

3.04 UNSATISFACTORY APPLICATION

A. If an item has an improper appearance or insufficient film thickness, the surface shall be cleaned, prepared, and top-coated as required to achieve proper appearance and/or thickness. Provide specific procedures in writing from manufacturer prior to cleaning and preparation.

3.05 DAMAGED COATINGS

A. Damaged coatings, pinholes, and holidays shall have the edges feathered and repaired in accordance with the recommendations of the manufacturer.

B. All finish coats, including touchup and damage-repair coats, shall be applied in a manner that will present a uniform texture and color-matched appearance.

C. All visible areas of chipped, peeled, or abraded coatings shall be hand or power sanded. Prime and finish coat these in accordance with these Specifications and the manufacturer's recommendations.

3.06 FIELD QUALITY CONTROL

A. Inspection: Inspect finished system for complete, uniform coverage of specified area. Evidence of defects include improper thickness, hardness, and appearance.

B. Holiday Testing:
   1. All surfaces provided with a barrier lining shall be electrically checked with high-voltage holiday test equipment to determine location of discontinuities.
      a. Provide suitable electrical contact to reinforcing steel. Verify conductivity of electrical contact by touching the second, ungrounded, electrode to another metallic ground connected to the concrete structure.
         1) Do not perform electrical inspection until the barrier lining is sufficiently cured, as determined by the manufacturer.
      b. All electrical inspection testing shall be performed in accordance with NACE SP0188.
      c. Perform all electrical tests at 100 volts/mil for the minimum approved thickness of the lining material.
   2. Repair all lining defects in accordance with the manufacturer's written instructions.
   3. After repaired and recoated areas have dried sufficiently, retest each.

C. Film Thickness:
   1. Perform destructive dry film thickness measurements in accordance with ASTM D4138.
   2. Perform one film thickness measurement per 500 square feet of lined surface.
   3. Perform additional testing if any one measurement does not meet specified thickness requirement.
      a. Perform an additional four measurements in the area where inadequate thickness is found. No single measurement shall be less than specified dry film thickness.

4. Provide additional coats of barrier lining as required to meet specified film thickness. Abrade surface by brush blasting if manufacturer's recommended recoat window is exceeded.

D. Repair all damaged coatings associated with film thickness testing in accordance with manufacturer's written instructions.

3.07 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection, and Manufacturer's Certificate of Proper Installation.

B. Manufacturer's representative shall visit the Project Site at the following intervals:
   1. At preconstruction conference.
   2. On first day of application of any system.
   3. As necessary during surface preparation and application to ensure installations are made in accordance with the manufacturer's recommendations.
   4. As required to resolve field problems attributed to or associated with manufacturer's product.
   5. Minimum Number of Site Visits: Two site visits, each for a minimum of 6 hours.

C. Travel time is not included as part of duration listed above.

3.08 APPLICATION SCHEDULE

A. Unless otherwise shown or specified, apply coatings in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Jacobs' Engineer before starting Work in question.

B. Coating System CRC-2:
   1. Use in the following areas:
      a. Where shown on Drawings for new grit basins, influent screenings, and raw sewage pump station.
      b. Where shown on Drawings for the Milpitas Structure and Santa Clara 1 Structure.
      c. Interior of the steel, foul air stack.

END OF SECTION

SECTION 09 97 13.02
PIPELINE JOINT COATING

PART 1 GENERAL

1.01 REQUIREMENT

A. Coat field welded joints of steel pipes in accordance with ANSI/AWWA C216 for heat-shrinkable sleeves.

B. Cathodic Protection: Coordinate as specified in Section 26 42 01, Pipe Bonding and Test Stations, and Section 26 42 00, Cathodic Protection System.

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this section:
   1. ANSI/AWWA: C216, Heat-Shrinkable, Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines.
   2. NACE International (NACE): SP0274, High Voltage Electrical Inspection of Pipeline Coatings Prior to Installation.
   3. Society for Protective Coatings (SSPC) Surface Preparation Standards:
      a. SP-1, Solvent Cleaning Surface Preparation.
      b. SP-2, Hand Tool Cleaning Surface Preparation.
      c. SP-3, Power Tool Cleaning Surface Preparation.
      d. SP-5, White Metal Abrasive Blast Surface Preparation.
      e. SP-6, Commercial Abrasive Blast Surface Preparation.
      f. SP-10, Near White Metal Abrasive Blast Surface Preparation.
      g. SP-11, Power-Tool Cleaning to Bare Metal.

1.03 DEFINITIONS

A. Manufacturer's Representative: Employee of manufacturer who is factory trained and knowledgeable in technical aspects of their products and systems.

1.04 SUBMITTALS

A. Action Submittals:
   1. Materials List: Joint coating materials indicating manufacturer, product numbers, and thickness.
   2. Materials Information: Technical data sheets with technical and performance information indicating compliance with requirements of this section and reference standards.

B. Informational Submittals:
   1. Samples of coating materials. Identify each sample with catalog number, size, color, and other information.
   2. Recommended procedures for installation quality assurance.
   3. Letter from manufacturer of shop-applied holding primer applied to joints stating that shop primer at pipe holdbacks is compatible with the joint coating.

1.05 QUALITY ASSURANCE

A. Provide a qualified technical representative, employed by the coating manufacturer, in the field for 1 day, minimum, at the start of coating application. Conduct manufacturer's representative observations and tests as required to confirm that coating application is in conformance with manufacturer's recommended methods and conditions.

B. Provide additional visits by manufacturer's representative at sufficient intervals during surface preparation and coating application as required for product application quality assurance, and to confirm compliance with manufacturer's instructions, and as necessary to resolve problems attributable to, or associated with, manufacturer's products furnished for this Project.

C. Furnish calibrated inspection devices in good working condition for measurement of environmental conditions, surface profile, film thickness, adhesion, and holiday detection.
   1. Use trained technicians to test the coating system and prepare reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store all coating products including primer, filler, tape, heat shrinkable sleeves, and wax tape in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.01 COATING SYSTEMS

A. Heat Shrinkable Sleeves: In accordance with ANSI/AWWA C216, Type II and this section.
   1. Canusa-CPS; ShawCor:
      a. Primer: As recommended by sleeve manufacturer.
      b. Mastic: Aqua-Shield RG Filler.
      c. Heat Shrink Sleeve: Aqua-Shield AQW.
      d. Minimum Total Thickness: 80 mils; 100 mils after recovery.
   2. Seal For Life; Berry Plastics (Covalence):
      a. Primer: As recommended by sleeve manufacturer.
      b. Mastic: Covalence 939-125 filler.

c. Heat Shrink Sleeve: WaterWrap PCI.

d. Minimum Total Thickness: 80 mils; 100 mils after recovery.

3. Size heat shrink sleeves to provide minimum overlap as shown on Drawings, or as required by heat shrink sleeve manufacturer, whichever is greater.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare joint area for coating after completion of pipe jointing.

B. Trim off any damaged or curled coating resulting from welding or preheating.

C. Remove weld spatter. Grind sharp edges and corners to remove potential stress points in joint coating.

D. Prepare steel surfaces with intact primer as recommended by joint coating manufacturer. Verify compatibility of shop primer applied to holdback area with joint coating manufacturer.

E. Abrasive blast rusted steel surfaces to a minimum of SSPC SP-6. As an alternative, and as approved by Jacobs' Engineer, surfaces may be prepared using power tool cleaning in accordance with SSPC SP-11.

3.02 JOINT COATINGS

A. Heat Shrinkable Coating Application:

1. In accordance with ANSI/AWWA C216 and as described below:

a. Preheat steel to maintain temperature in the required range during installation of joint coating. Apply primer to prepared steel surfaces and allow to dry as recommended by coating manufacturer.

b. Apply filler tape to lap joints, step-downs, and other discontinuities to fully support tape and prevent voids, gaps, or bridging. For welded lap joints, apply filler on the weld and adjacent spigot.

c. Loosely fit heat-shrink sleeve over joint, using spot attachments and closure strips as specified by manufacturer.

d. Heat sleeve center portion on the spigot side of the weld to conform sleeve to the spigot and weld. Use gloved hand or light roller pressure to press sleeve into the base of weld as sleeve shrinks. Allow sleeve center portion to fully conform to the weld around the pipe circumference before shrinking sleeve outer edges.

e. Work outward from center toward edges to shrink sleeve onto pipe. Press sleeve outer edges onto shop coating.

f. Visually inspect installed sleeve to confirm that it is free of holes, and conforms to surfaces along pipe joint contour. Confirm that adhesive is visible along sleeve edges.

2. After joint has cooled to ambient temperature, examine sleeve and conduct holiday testing in accordance with NACE SP0274. Confirm that sleeves tightly conform to pipe and without holidays, voids or gaps.

END OF SECTION

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:
   1. American National Standards Institute (ANSI): A117.1, American Standard for Building and Facilities Providing Accessibility and Usability for Physically Handicapped People.
   2. American Society of Mechanical Engineers (ASME): A13.1, Scheme for the Identification of Piping Systems.
   3. ASTM International (ASTM):
      a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
      b. D709, Standard Specification for Laminated Thermosetting Materials.
   4. California Fire Code (CFC): Chapter 50, Hazardous Materials-General Provisions.
   5. California Occupational Safety and Health Act (CALOSHA).
   6. National Fire Protection Association (NFPA):
      a. 704, Standard System for the Identification of the Hazards of Materials for Emergency Response.
      b. HAZ-01, Fire Protection Guide to Hazardous Materials.
   7. U.S. Department of Transportation, Federal Highway Administration: Manual on Uniform Traffic Control Devices for Streets and Highways.

1.02 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Drawings showing layouts, actual letter sizes and styles, and Project-specific mounting details.
      b. Manufacturer's literature showing letter sizes and styles, sign materials, and standard mounting details.
   2. Samples: One full size for each type of nameplate, sign, and label specified.

B. Informational Submittals: Manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 DOOR NAMEPLATES

A. Material: Plastic with square corners.

B. Thickness: 1/8 inch.

C. Height: 2 inches.

D. Finish: Nondirectional matte.

E. Background: Brown.

F. Letters: Raised.
   1. Size: 1 inch high.
   2. Color: White.
   3. Style: Helvetica medium upper case.
   4. Message Text: As shown on Door and Hardware Schedule on Drawings.

G. Provide contracted (Grade 2) Braille in compliance with 2016 California Building Code, Chapter 11B, Sections 703.3 and 703.4.

H. Manufacturer and Product:
   1. Best Sign Systems, Montrose, CO; Graphic Blast.
   2. "Or-equal."

2.02 PICTORIAL SYMBOLS

A. Material: Plastic with square corners, match door nameplates.

B. Conform to 2016 California Building Code, Chapter 11B, Division 7.

C. Manufacturer and Product:
   1. Best Sign Systems, Montrose, CO; Graphic Blast.
   2. "Or-equal."

2.03 SIGNS TYPES

A. Plastic Signs (Type A):
   1. Exterior: Laminated plastic subsurface image type, 3/16-inch-thick with high-gloss finish.
   2. Interior: Plastic, 1/8-inch-thick with nondirectional matte finish and engraved letters.

3. Rounded corners.

B. Metal Signs (Type B):
   1. Material: Baked enamel finished 20-gauge (minimum) steel or 18-gauge (minimum) aluminum signs.
   2. Manufacturers:
      a. Seton Identification Products.
      b. Nutheme Illustrated Safety Co.
      a. "Or-equal."

C. Fiberglass Signs (Type C):
   1. Material: Three-ply laminated fiberglass, minimum 1/8-inch-thick, with contrasting color core message layer between two clear weather-resistant surface layers.
   2. Manufacturers:
      a. Best Manufacturing Co.
      b. Brady Signmark.
      c. "Or-equal."

D. Traffic Signs (Type D):
   1. Painted aluminum reflectorized signs, standard design meeting requirements of U.S. Department of Transportation, Federal Highway Administration, Manual on Uniform Traffic Control Devices for Streets and Highways.
   2. Materials and Fabrication: Per Caltrans' standard specifications.

E. Hazardous Material Signals (Type H):
   1. Conform to NFPA 704 and NFPA HAZ-01.
   2. Material: Fiberglass 1/8 inch thick.
   3. Background, Letters, and Numbers: Die-cut vinyl with pressure sensitive adhesive.
   4. Manufacturers:
      a. Brady Signmark.
      b. Emed Co., Inc.
      c. "Or-equal."

2.04 IDENTIFICATION LABELS

A. Pipe Labels:
   1. Labels:
      a. Snap-on, reversible type with lettering and directional arrows, sized for outside diameter of pipe and insulation.
      b. Provided with ties or straps for pipes of 6 inches and over diameter.
      c. Designed to firmly grip pipe so labels remain fixed in vertical pipe runs.
   2. Material: Heavy-duty vinyl or polyester, suitable for exterior use, long lasting, and resistance to moisture, grease, and oils.
   3. Letters and Arrows: Black on OSHA safety yellow background.
   4. Color Field and Letter Height: Meet ASME A13.1.
   5. Message: Piping system name as indicated on Piping Schedule on Drawings.
   6. Manufacturers and Products:
      a. Brady Signmark; B-915 Brady Snap-On and Strap-On Pipe Markers.
      b. Seton Identification Products; Ultra-mark Pipe Markers.
      c. “Or-equal.”

B. Pipe Labels:
   1. Labels: Self-adhesive tape, with separate directional flow arrows.
   2. Material: Pressure sensitive vinyl.
   3. Letters and Arrows: Black on OSHA safety yellow background.
   4. Color Field and Letter Height: ASME A13.1.
   5. Message: Piping system name as indicated on Piping Schedule on Drawings.
   6. Manufacturers and Products:
      a. Brady Signmark; B-946 Self-Sticking Vinyl Pipe Markers and Vinyl Arrows.
      b. Seton Identification Products; Opti-Code Markers and Directional Arrows.
      c. “Or-equal.”

C. Equipment Labels:
   1. Applies to equipment with assigned tag numbers, where specified.
   2. Letters: Black bold face, 3/4 inch minimum high.
   3. Background: OSHA safety yellow.

4. Materials: Aluminum or stainless steel with a baked-on finish suitable for use on wet, oily, exposed, abrasive, and corrosive areas.
5. Furnish 1-inch margin with holes at each end of label, for mounting. On fiberglass labels, furnish grommets at each hole.
6. Size:
   a. 2 inches minimum and 3 inches maximum high, by 14 inches minimum and 18 inches maximum long.
   b. Furnish same size base dimensions for all labels.
7. Message: Equipment names and tag numbers as used in sections where equipment is specified.
8. Manufacturers:
   a. Brady Signmark.
   b. Seton Identification Products.
   c. "Or-equal."

2.05 ANCILLARY MATERIALS

A. Fasteners: Stainless steel screws or bolts of appropriate sizes.

B. Wood Posts: Preservative treated 4 by 4 wood as specified in Section 06 10 00, Rough Carpentry.

C. Pipe Posts: 2-1/2-inch galvanized steel pipe meeting ASTM A53, Type S, Grade B.

D. Chain: Type 304 stainless steel, No. 16 single jack chain or No. 2 double loop coil chain.

PART 3 EXECUTION

3.01 INSTALLATION—GENERAL

A. In accordance with manufacturer's recommendations.

B. Mount securely, plumb, and level.

3.02 DOOR NAMEPLATES AND PICTORIAL SYMBOLS

A. Attach to doors or walls adjacent to doors with self-sticking adhesive. See Door and Hardware Schedule on Drawings for locations and messages.

B. Mount with bottom of nameplate at 5 feet 6 inches above floor.

3.03 SIGNS

A. Fasten to walls or posts or hang as scheduled. Anchor in place for easy removal and reinstallation with ordinary hand tools.

B. Information, Exit, and Safety Signs:
   1. Install facing traffic. Locate for high visibility with minimum restriction of working area around walkways and equipment.
   2. Removable with ordinary hand tools without leaving scars on structure or equipment.

C. Traffic Signs: Mount each sign on scheduled support using two 1/4-inch stainless steel bolts through sign and post. Install facing traffic at locations and in manner shown in Caltrans standard specification.

D. Hazardous Material Signals:
   1. Install where required by NFPA No. 704 and CFC, Chapter 50.
   2. Install at entrances to spaces where hazardous materials are stored, dispensed, used, or handled and on sides of stationary tanks.

3.04 IDENTIFICATION LABELS

A. Pipe Labels:
   1. Locate at connections to equipment, valves, or branching fittings at wall boundaries.
   2. At intervals along piping not greater than 18 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.
   3. At exposed piping not normally in view, such as above suspended ceilings and in closets and cabinets.
   4. Supplementary Labels: Provide to Owner those listed on Piping Schedule that do not receive arrows.
   5. Application: To pipe only after painting in vicinity is complete or as approved by Jacobs' Engineer.
   6. Installation: In accordance with manufacturer's instructions.

B. Equipment Labels:
   1. Locate and install on equipment or concrete equipment base.
   2. Anchor to equipment or base for easy removal and replacement with ordinary hand tools.

3.05 SUPPLEMENT

A. The supplement listed below, following "End of Section," is a part of this Specification.

1. Sign Schedule: A tabulation of characteristics and mounting information for each sign on the Project. Provide items as scheduled. Meet requirements of Occupational Safety and Health Act (OSHA).

END OF SECTION

Sign Schedule														
Sign														
			Size			Mounting			Lettering					
No. of Signs	Type[1]	Format[2]	Width	Height	Color	Location	Method	Height to Top	Height	Style	Color	Message	Faces	Other Requirements
20	C	1014-002	20"	14"	Yellow	Hanging	Chain	5'-6"	1" min.	Helvetica	Black	CAUTION Equipment Starts Automatically	1	Provide at all equipment that may start automatically.
4	C	1014-002	20"	14"	Yellow	Wall	Bolts	5'-6"	1" min.	Helvetica	Black	CAUTION Ear Protection Required	1	Provide at locations directed by Jacobs' Engineer.
4	C	1014-001	20"	14"	White	Door	Screws or Bolts	5'-6"	1" min.	Helvetica	Black	DANGER High Voltage	1	Provide at locations directed by Jacobs' Engineer.
2	C	1014-001	20"	14"	White	Door	Screws	5'-6"	1" min.	Helvetica	Black	DANGER Hazardous Area NO SMOKING Possible Toxic Fumes and Lack of Oxygen	1	Provide at locations directed by Jacobs' Engineer.

Sign Schedule														
Sign														
			Size			Mounting			Lettering					
No. of Signs	Type[1]	Format[2]	Width	Height	Color	Location	Method	Height to Top	Height	Style	Color	Message	Faces	Other Requirements
4	C	1014-001	20"	14"	White	Wall	Bolts	5'-6"	1" min.	Helvetica	Black	DANGER No Smoking	1	Provide at locations directed by Jacobs' Engineer.
2	B	1014-001	20"	14"	White	Pipe Post	Bolts	3'-6"	1" min.	Helvetica	Black	DANGER No Smoking	1	Provide at locations directed by Jacobs' Engineer.
6	C	1014-001	20"	14"	White	Wall	Bolts	3'-6"	1" min.	Helvetica	Black	DANGER Nonpotable Water Not for Drinking	1	Provide at interior W2 hose valves.
8	B	1014-001	20"	14"	White	Pipe Post	Bolts	3'-6"	1" min.	Helvetica	Black	DANGER Nonpotable Water Not for Drinking	1	Provide at exterior W2 hose valves.
2[3]	C	1014-001	10"	7"	White	Door	Screws	5'-6"	1" min.	Helvetica	Black	DANGER CONFINED SPACE AUTHORIZED EMPLOYEES ONLY	1	Provide at locations directed by Jacobs' Engineer.

Sign Schedule														
Sign														
			Size			Mounting			Lettering					
No. of Signs	Type[1]	Format[2]	Width	Height	Color	Location	Method	Height to Top	Height	Style	Color	Message	Faces	Other Requirements
1	H	1014-006	10" min.	10" min.	*	Door	Adhesives	5'-6"	4"	Block	Black	*	1	*See format detail and Spec Article, Signs.
2	A	1014-008	20"	14"	White	Wall	Screws	5'-6"	1" min.	Helvetica	Black	NOTICE Authorized Personnel Only	1	Provide at locations directed by Jacobs' Engineer.
2	D	STD	30"	30"	Red	Wood	Bolts	7'-6" min.	7" min.	Block	White	STOP	1	
1	D	STD	24"	30"	White	Wood Post	Bolts	3'-6"	7" min.	Helvetica	Black	SPEED LIMIT 25	1	
2[3]	D	1014-004	12"	18"	Blue	Pipe Post	Bolts	5'-6"	1" min.	Block	White	*HANDICAPPED PARKING STATE PERMIT REQUIRED	1	*With symbol above.

Sign Schedule														
Sign														
			Size			Mounting			Lettering					
No. of Signs	Type[1]	Format[2]	Width	Height	Color	Location	Method	Height to Top	Height	Style	Color	Message	Faces	Other Requirements
2	C	1014-003	20"	14"	Orange	Wall	Bolts	5'-6"	1" min.	Helvetica	Black	WARNING Corrosive Materials Wear Required Protection	1	Provide at locations directed by Jacobs' Engineer.
2	C	1014-003	20"	14"	Orange	Wall	Bolts	5'-6"	1" min.	Helvetica	Black	WARNING Eye Protection Required in this Area	1	Provide at locations directed by Jacobs' Engineer.

[1]Letters refer to sign types specified in this section.
[2]Numbers refer to Design Details that show sign layout.
[3]Verify requirements for this sign with Laws and Regulations in state where Project is located.
[4]To be determined in the field.

SECTION 10 28 00
TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. National Fire Protection Association (NFPA): 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

1.02 DESIGN REQUIREMENTS

A. Design grab bars and attachments to resist minimum 250-pound (0.22-kN) concentrated load applied at any point in any direction.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Manufacturer's literature clearly indicating:
         1) Jacobs' Engineer's identification mark, size, and description of components.
         2) Base material with surface finish inside and out.
         3) Hardware and locks and attachment devices.
         4) Description of rough-in framing.
         5) Details of blocking and anchorage required.

B. Informational Submittals:
   1. Distributor's List: List of local distributors for supplies required for accessories installed.
   2. Cleaning instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials and products specified in this section shall be products of:
   1. Bobrick Washroom Equipment, Inc.
   2. Bradley Corp.

2.02 TOILET AND BATH ACCESSORIES

A. Furnish accessory items listed where indicated by mark or note on Drawings.

Item	Mark	Bobrick	Bradley
Surf. Mounted Shelf, Dual Roll Paper Dispenser	TPD-S	No. B-2840	No. 5263
Wall Mounted Liquid Soap Dispenser	SD-2	No. B-4112	No. 6542
Mirror and Shelf, Size on Dwgs	MIR-S	No. B-292	No. 7805
Surf. Mounted Paper Towel Dispenser	PTD-2	No. B-262	No. 250-15
Recessed Waste Receptacle	RWR-1	No. B-3644	No. 346-10
Surf. Mounted Napkin Disposal	ND	No. B-270	No. 4781-15
Recessed Seat Cover Dispenser	SCD-1	No. B-301	No. 584
Mop and Broom Holder (24")	M&BH	No. B-223 x 24	No. 9953
Robe Hook	RH	No. B-6727	No. 9124
Grab Bars (straight) (36")	GB-1	No. B-6806-36	No. 812-001-36
Grab Bars (straight) (42")	GB-2	No. B-6806-42	No. 812-001-42
Grab Bars (straight), 18" for Vertical Mounting	GB-3	No. B-6806-18	No. 812-001-18

B. Finish:
   1. Satin stainless steel.
   2. Manufacturer's or brand name on face of units is not acceptable.

C. Anchors: Furnish anchors, fasteners, or other devices necessary for a complete, secure installation.
   1. Fasteners: Tamper-proof screws or bolts.

D. Supplies: Furnish fill supplies, such as paper goods, soap, and napkins, as recommended by accessory manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate support framing and backing as necessary for proper installation of accessories.

B. Coordinate the Work with placement of internal wall reinforcement to receive anchor attachments.

3.02 INSTALLATION

A. Mounting Heights and Locations: Locate where mark is shown on Drawings at height required by accessibility regulations.

B. Follow manufacturer's instruction and recommendations.

C. Install and securely anchor accessories in their proper locations, plumb and level, and without distortion.

D. Remove protective masking and clean surfaces, leaving them free of soil and imperfections.

E. Fill units with necessary supplies within 10 days before Substantial Completion.

F. Deliver to Owner keys and devices required to fill and service units.

3.03 CLEANING

A. Clean and repair existing toilet accessories which remain or are to be reinstalled.

END OF SECTION

SECTION 10 44 00
PORTABLE FIRE AND SAFETY EQUIPMENT

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:
   1. National Fire Protection Association (NFPA): No. 10, Standard for Portable Fire Extinguishers.
   2. UL: Fire Protection Equipment List.

1.02 SUBMITTALS

A. Action Submittals: Manufacturer's product data for each item including sizes, ratings, UL listings, or other certifications, and mounting information.

PART 2 PRODUCTS

2.01 PORTABLE FIRE EXTINGUISHERS

A. General:
   1. Conform to NFPA 10 for fire extinguishers.
   2. Furnish fire extinguishers and cabinets from one manufacturer.
   3. All Extinguishers: UL listed, charged and ready for service.

B. Multipurpose Hand Extinguisher (F. Ext-1):
   1. Tri-class dry chemical extinguishing agent.
   2. Pressurized, red enameled steel shell cylinder.
   3. Activated by top squeeze handle.
   4. Agent propelled through hose or opening at top of unit.
   5. For use on A, B, and C class fires.
   6. Minimum UL Rating: 4A-60B:C, 10-pound capacity.

C. Carbon Dioxide Hand Extinguisher (F. Ext-2):
   1. Carbon dioxide.
   2. Pressurized, red enameled aluminum shell cylinder.
   3. Activated by top squeeze handle.
   4. Agent propelled through hose and spreader nozzle.
   5. For use on B and C class fires.
   6. Minimum UL Rating: 10B:C, 15-pound capacity.

2.02 FIRST-AID CABINETS AND SUPPLIES

A. Manufacturers:
   1. Afassco, Inc.
   2. Johnson & Johnson.
   3. Zee Medical Products Co., Inc.
   4. "Or-equal."

B. Cases:
   1. Enameled metal or break-resistant plastic.
   2. Carrying handles.
   3. Made to hang on wall.

C. Supplies: Quantities to serve 10 people.

2.03 ACCESSORIES

A. Fasteners: Furnish necessary screws, bolts, brackets, and other fastenings of suitable type and size to secure items of fire and safety equipment in position.
   1. Metal expansion shields for machine screws at concrete and masonry.
   2. Interior: Rust-resistant.
   3. Exterior: Stainless steel.

B. Brackets: For all hand extinguishers not located in cabinets, furnish heavy-duty brackets with clip-together strap for wall mounting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install where indicated or directed and following manufacturer's recommendations.

B. Plumb and level equipment.

C. Provide adequate backing for mounting surfaces.

3.02 PORTABLE FIRE EXTINGUISHERS AND CABINETS

A. Provide at locations shown or as directed by Jacobs' Engineer.

B. Mount hangers securely in position, following manufacturer's recommendations.

C. Top of Extinguisher: No more than 54 inches above floor.

END OF SECTION

SECTION 10 73 16
MANUFACTURED ALUMINUM CANOPIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Building supported, pre-engineered metal canopies including fascia channels, decking, hanger rods, downspouts, and attachment hardware.

1.02 SYSTEM DESCRIPTION

A. System: Pre-engineered, hanger rod-supported extruded aluminum canopy. All components, connections (including attachments to the building), and accessories shall be designed and detailed by the canopy manufacturer.

B. Design Requirements: Design canopy system to withstand wind uplift pressure and roof live load in accordance with 2016 California Building Code. Structural design loads shall be as specified in general structural notes on Drawings.

C. Size: As shown on Drawings.

1.03 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Manufacturer's literature and technical data.
      b. Shop Drawings: Signed and sealed by a professional engineer registered in the State of California. Indicate system components, dimensions, attachments, and accessories.
   2. Samples:
      a. 3-inch by 3-inch coating samples showing available colors for preliminary selection.
      b. 6-inch long fascia extrusion sample showing profile and finish.
      c. 6-inch decking samples showing profile and finish.

B. Informational Submittals:
   1. Experience records of manufacturer and installer.
   2. Manufacturer's Certificate of Proper Installation.
   3. Structural calculations signed and sealed by a professional engineer registered in the State of California. Include calculations for structural components and for anchorage to the masonry wall.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Minimum 5 years' experience in work of the type required for this Project.
   2. Installer: Minimum 5 years' certified experience in installation of similar system to those required for this Project.
   3. Designer: A civil or structural engineer registered in the State of California.

1.05 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation of awnings in exterior locations to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Where canopy installation is indicated to fit to other work, verify dimensions of other work by field measurements before fabrication and indicate measurements on Shop Drawings. Notify architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect canopy components and accessories from corrosion, deformation, and other damage during delivery, storage, and handling.

1.07 SPECIAL GUARANTEE

A. Provide manufacturer's extended guarantee or warranty with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for repair or replacement of canopy components that fail in materials or workmanship within 9 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Manufacturers are subject to compliance with the specified requirements. Products that may be incorporated into the Work include, but are not limited to:
   1. MASA Architectural Canopies, Avenel, NJ; Extrudeck aluminum canopy.
   2. Mapes Canopies, LLC, Lincoln, NE; Super Lumideck.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B221 and ASTM B4329, 6061-T6 alloy and temper.

B. Hardware: All anchors and fasteners shall be stainless steel only.

2.03 COMPONENTS

A. Framing:
   1. Type: Extruded aluminum “J” channel fascia.
   2. Size: As required to meet overall canopy design shown on Drawings.

B. Canopy Supports: 3 inches by 3 inches by 0.25 inch extruded aluminum canopy support “I” beam (minimum).

C. Decking: 3 inches by 6 inches by 0.078 inch interlocking, extruded aluminum flat soffit decking (minimum).

D. Fascia Profile: 10-inch extruded (minimum).

E. Rear gutter as shown on Drawings.

F. Downspouts as shown on Drawings. Color to match canopy.

G. Other Components: As indicated or as required for system attachments and performance.

2.04 FABRICATION

A. Fabricate canopy system in accordance with approved Shop Drawings.

B. All canopies to be mechanically assembled with a minimum shear stress strength of 350 pounds. Pre-welding is not acceptable.

2.05 FINISHES

A. Aluminum:
   1. Pre-treatment: Pre-treat to ASTM D1730 Type B, Method 5 using a multistage chromate process or an approved chrome-free pretreatment process approved by powder coating manufacturer for optimized weather resistance.
   2. Finish Coat: AAMA 2603 thermosetting polyester resin-based powder.
   3. Source: Tiger Drylac powder coating or equivalent.
   4. Color: To be selected by architect.

PART 3 EXECUTION

3.01 FIELD DIMENSIONS

A. Field verify dimensions of supporting structure at site of installation prior to fabrication.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations and approved Shop Drawings.

B. Install components plumb and level, in proper plane, free from warp and twist.

C. Anchor system to building components; provide adequate clearance for movement caused by thermal expansion and contraction and wind loads.

3.03 ADJUSTING

A. Touch up minor scratches and abrasions on finished surfaces to match original finish.

END OF SECTION

SECTION 13 34 19
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Architectural Manufacturers' Association (AAMA):
   a. 101, Standard Specifications for Windows, Doors, and Unit Skylights.
   b. 605, Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
   c. 606.1, Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
2. American Institute of Steel Construction (AISC):
   a. 360, Specification for Structural Steel Buildings.
   b. RCSC Specification for Structural Joints Using High Strength Bolts.
   c. Design Guide 3: Serviceability Design Considerations for Steel Buildings.
3. American Iron and Steel Institute (AISI): Specification for the Design of Cold-Formed Steel Structural Members.
4. American Welding Society (AWS): D1.1/D1.1M, Structural Welding Code - Steel.
5. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
   c. A325, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.
   d. A529/A529M, Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
   e. A572/A572M, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   f. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   g. A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   h. A992/A992M, Standard Specification for Steel for Structural Shapes.

i. C991, Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.

j. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

k. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.

l. E1514, Standard Specification for Structural Standing Seam Steel Roof Panel Systems.

m. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.

n. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

6. 2016 California Building Code (CBC).
7. International Accreditation Service, Inc. (IAS): Quality Certification Program.
8. International Code Council (ICC): International Building Code (IBC).
9. Metal Building Manufacturer's Association (MBMA): Metal Building Systems Manual.
10. Steel Door Institute (SDI): A250.8, Standard Steel Doors and Frames.
11. UL: 580, Tests for Uplift Resistance of Roof Assemblies.

1.02 SYSTEM DESCRIPTION

A. Complete building package using manufacturer's standard components and components specified in other sections.

B. Primary Framing System: Clear span rigid frame.

C. Lateral Support System in Longitudinal Direction: Cross bracing, located as shown on Drawings.

D. Include insulated metal wall panels and metal roof panels, insulation, and roof accessories as specified herein.

1.03 DESIGN REQUIREMENTS

A. Applicable Building Code: The 2016 California Building Code (CBC).

B. Snow Load: None.

C. Minimum Roof Live Load: 20 pounds per square foot.

D. Building system dead load.

E. Photovoltaic Dead Load: See Structural General Notes on Drawings.

F. Mechanical and Electrical Equipment Loads:
   1. Purlins and Secondary Framing: As indicated on Drawings, minimum 10 pounds per square foot collateral load.
   2. Primary Frames: As indicated on Drawings, minimum 10 pounds per square foot collateral load.

G. Special Equipment Loads, as shown on Drawings: Louvers, fans, and other equipment loads as shown on Drawings.

H. Wind Load: As shown on the General Structural Notes on Drawings.

I. Earthquake Load: As shown on the General Structural Notes on Drawings.

J. Deflection and Drift Criteria:
   1. In accordance with the applicable provisions of the AISC Design Guide 3. Conformance is required to deflection criteria as stated in the Appendix.
   2. Applies to primary and secondary framing members, bracing members, roof panels, and wall cladding.
   3. Metal building systems shall limit amplified story drifts in the north/south direction to avoid damaging contact between adjacent buildings for the building separations shown on Drawings in accordance with ASCE 7-10 Section 12.12.3.

K. Design Standards:
   1. AISC 360.
   2. AISC RCSC Specification for Structural Joints Using High Strength Bolts.
   3. AISI Specification for the Design of Cold-Formed Steel Structural Members.
   4. AWS D1.1/D1.1M.

L. Consider prying action of bolts for bolted moment-resistant connections in primary framing.

M. Design column bases as pinned, unless specifically indicated otherwise.

1.04 SUBCONTRACTOR/METAL BUILDING MANUFACTURER COORDINATION

A. Subcontractor shall verify interface of building components with foundation and coordinate required foundation revisions with Design-Builder.

1.05 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:

   a. Manufacturer's literature and technical data.

   b. Drawings Stamped by Engineer registered in the State of California:

      1) Drawings shall be specifically prepared for this Project.

      2) Mark out details that do not apply to Project.

      3) Show design load criteria, material specifications for framing members and connections, roof framing plan with dimensions and member sizes, baseplate details showing anchor bolt size and bolt layout, elevations of wall framing and bracing, instructions for temporary bracing, framing around roof and wall openings, details for joining and sealing of roof panels and wall cladding, and sections and details for all components and accessories.

   c. Painting System: Specifications; include paint manufacturer's name, product trade name, and preparation for shop and field coats.

2. Samples: Minimum 2-inch by 3-inch metal for components requiring color selection.

B. Informational Submittals:

1. Structural Calculations Stamped by Engineer registered in the State of California:

   a. Complete analysis and design of structural components and connections in accordance with design requirements indicated.

   b. Summary of building column reactions to foundation level for load cases.

   c. Mark out calculations that do not apply to Project.

2. Manufacturer's written instructions for shipping, handling, storage, protection, and erection or installation of building and components.

3. Manufacturer:

   a. IAS Quality Certification: IAS certificate showing name and address of manufacturer, effective date, and category of certification.

4. Erector:

   a. IAS Quality Certification: IAS certificate showing name and address of erector, effective date, and category of certification, or, in lieu of IAS certification, documentation of past 5 years' experience record to include project name, location, date of completion, building manufacturer, and name and phone number of Owner's contact person.

b. Certification of approval by manufacturer.

5. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. Designer: Registered professional engineer valid in same state as Project.
2. Manufacturer and Product: IAS Quality Certification; Metal Building Systems (MB).
3. Erector:
   a. IAS Quality Certification as Certified Steel Erector (CSE), or 5 years of experience in erection of metal building systems in lieu of IAS certification.
   b. Approval by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect building components and accessories from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Deliver to Site with parts individually tagged.

C. Store on wood blocking or pallets, flat and off ground, to keep clean and to prevent damage or permanent distortion. Support bundles so there is no danger of tipping, sliding, rolling, shifting, or material damage. Cover with tarpaulins or other suitable weathertight ventilated covering.

D. Protect finish of metal panels by application of removable plastic film or other suitable material placed between panels. Do not allow panels to come in contact with other material that would result in scratching, denting, staining, or other damage to panel finish.

1.08 SPECIAL GUARANTEE

A. Guarantee shall provide for correction, or at the option of Owner, removal and replacement of Work specified in this Specification section found defective during a minimum period of 20 years and as stated below after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the Contract Documents.

B. Conditions:

1. Finish on metal roof, flashing, and trim will not chalk, crack, check, blister, peel, flake, chip, or lose adhesion for 20 years.

2. Roofing will remain weathertight for 20 years.

PART 2 PRODUCTS

2.01 BUILDING SYSTEM MANUFACTURERS

A. Products manufactured or supplied by the following, and meeting these Specifications, may be used on this Project:
   1. Butler Manufacturing Co., Kansas City, MO.
   2. Garco Building Systems, Airway Heights, WA.
   3. Varco-Pruden Buildings, Memphis, TN.

B. Building layout as shown on Drawings is based on products of Butler Manufacturing Co.

2.02 COMPONENTS

A. Structural Framing and Bracing:
   1. Primary Framing: ASTM A36/A36M, ASTM A529/A529M, ASTM A572/A572M, or ASTM A992 with 3/16-inch minimum thickness and factory primer compatible with finish coating.
   2. Secondary Framing:
      a. Steel for cold-formed galvanized channel and z-sections shall be ASTM A653/A653M, Structural Steel (SS) Grade 33 or High-Strength Low-Alloy Steel (HSLAS) Grade 50 Type A or B, with G60 galvanized coating and minimum design thickness equal to 0.0346 inch.
      b. Light Gauge Steel Parapet Framing:
         1) ASTM A653/A653M, Structural Steel (SS) Grade 33, or High-Strength Low-Alloy Steel (HSLAS), Type A or B, Grade 50.
         2) Section: Type, size, as indicated on Drawings and as required by PEMB suppliers calculations.
         3) Flanges: 1 5/8 inch minimum flange stiffened with return lip.
         4) 14-gauge, G90, galvanized steel studs with punched webs.
   3. Bracing:
      a. ASTM A36/A36M or ASTM F1554, Grade 36, for threaded rod, or ASTM A36/A36M for rolled shapes.
      b. Do not use wire rope or cable for permanent bracing.
   4. Bolted Connections:
      a. Primary Framing: ASTM F3125 Grade A325 or ASTMA490/A490M high-strength bolted connections.
      b. Secondary Framing: ASTM F3125 Grade A325.

B. Roof Panels:
   1. Material:
      a. Minimum 24-gauge galvanized steel with roll-formed corrugations for structural stiffness and appearance.
      b. Finish: Factory-applied Kynar 500.
   2. Roof Panel System:
      a. ASTM E1514 structural standing seam steel roof panel system.
      b. Panels shall be one piece from eave to ridge, with concealed clips and fasteners to purlins to allow for thermal movement over 120-degree ambient temperature range.
      c. Design is based on Butler MR 24 Roofing panels, “or-equal”.
      d. Side-lap joints shall be made with a factory caulked, mechanically seamed cleat.
      e. Tested and certified to meet UL 580, Class 90 wind uplift rating.
      f. Finish: Factory-applied Kynar 500 Paint system.
         1) Color: Butler BN5A222B Cool Gray Stone.

2.03 ACCESSORIES

A. Trim: Factory-formed and factory-painted ridge cap, rake trim, simple eave trim, panel side trim, corner trim, door trim, and other trim as necessary.

B. Gutter Fascia and Downspouts:
   1. Material: ASTM A653/A653M, 26-gauge galvanized steel.
   2. Gutter Fascia:
      a. Prefinish.
      b. Furnish hangers with factory-applied paint.
   3. Preformed Corner Closures: Furnish to match configuration of gable fascia.
   4. Downspouts:
      a. Configuration: Nominal 4-inch corrugated rectangular box with minimum 11 square inches of cross section area.
      b. Factory finish to match wall panels.

C. Miscellaneous: Furnish fasteners, metal-backed neoprene washers, weatherstripping, sealants, roof jacks, gaskets, and other items as required for a complete installation.

2.04 FABRICATION

A. Factory Fabricate: To manufacturer’s written standards, MBMA Metal Building Systems Manual, and AISC Specification for Structural Steel Buildings.

B. Building Parts: Accurate and true to dimension to facilitate building erection without cutting, fitting, or other alterations.

C. Welded Connections: In accordance with AWS D1.1/D1.1M.

D. Shop Primer for Primary Framing:
   1. Clean and apply one coat of manufacturer's standard primer in accordance with MBMA Metal Building Systems Manual.
   2. Surface Preparation and Primer: As specified in Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting concrete foundation and anchor bolt placement for compliance with requirements for installation tolerances and other conditions affecting performance of metal building.

3.02 BUILDING ERECTION

A. Erect building system in accordance with manufacturer's standards and instructions.

B. Provide temporary bracing in accordance with MBMA standards and as required for safe installation.

C. Structural Framing:
   1. Do not field cut or alter primary or secondary framing members.
   2. Installation and tolerances shall be in accordance with MBMA Metal Building Systems Manual.

D. Roof Panels:
   1. Field cutting of panels by torch is not permitted.
   2. Attach panels to structural supports to maintain a weathertight seal while allowing for thermal and structural movement.
      a. Install exposed fasteners in true vertical and horizontal alignment.
      b. Field seam side laps of standing seam roof panels using electrically operated seaming machine.
      c. Use proper tools to install screw fasteners to compress neoprene washer without damaging washer or stripping metal.
   3. Install manufacturer's standard joint sealants, gaskets, and closure strips as required for weathertight installation.

4. Install all seals for pipe and conduit penetrations. Center penetrations in roof panel to ensure that seals do not have to travers standing seams.
5. Field Cutting and Patching: Perform in manner not to impair appearance, weathertightness, or structural capacity of panel system.

3.03 REPAIR, CLEANING, AND PAINTING

A. Immediately following erection, remove unused material, screws, fasteners, and other debris from completed installation. Use caution in removing metal cuttings from surface of prefinished metal panels.

B. Replace damaged, dented, buckled, or discolored metal panels.

C. Repair damaged painted and galvanized surfaces as specified in Section 09 90 00, Painting and Coating.

D. Finish Painting: As specified in Section 09 90 00, Painting and Coating.

3.04 FIELD QUALITY CONTROL

A. Provide Special Inspection in accordance with the Statement of Special Inspection Plan on Drawings and Section 01 45 33, Special Inspection, Observation, and Testing.

3.05 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection, and certification of proper installation.

END OF SECTION