SPECIFICATION



POMONA UNIFIED SCHOOL DISTRICT 800 S GAREY AVENUE, POMONA, CA 91766

EDUCATION CENTER AUDITORIUM MODERNIZATION

AT

POMONA OFFICE OF EDUCATION CENTER 800 S GAREY AVENUE, POMONA, CA 91766

PREPARED BY





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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Access to site.
 - 4. Work restrictions.
 - 5. Specification and drawing conventions.
 - 6. Miscellaneous provisions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. Interior renovation of the existing Education Center. The project includes a new movable roll-down digital wall, AV and theatrical lighting modification in the auditorium, a new green room, modifications to the interior of the existing green room, new lighting, flooring and millwork in the control room.
- B. Type of Contract.
 - 1. Project will be constructed under a single prime contract.

1.4 ACCESS TO SITE

A. Coordinate with the construction manager for access to site.

1.5 WORK RESTRICTIONS

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

Education Center Auditorium Modernization Pomona Office of Education Center 800 S Garey Avenue, Pomona, CA 91766 Summary

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- 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- 2. The existing building and the parking lot will be occupied during construction. Contractor shall not disturb the building daily operations. Coordinate with the construction manager for access:

1.6 SPECIFICATION AND DRAWING CONVENTIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

Education Center Auditorium Modernization Pomona Office of Education Center 800 S Garey Avenue, Pomona, CA 91766 Substitution Procedures

- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- 1. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on District's standard forms.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Refer to the project General Conditions for instruction.
- B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values. Refer to project General Conditions for requirements.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect through Construction Manager at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.

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- 2. Arrange schedule of values consistent with the District's standards.
- 3. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
- 5. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- 7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
- 8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Requests for Information (RFIs).
 - 2. Project meetings.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use the District's standard form (if any) and include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

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- 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
- 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

1.5 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Contractor.
 - 5. Name of Architect and Construction Manager.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor shall always provide suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 12. Contractor's signature.
 - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
- C. RFI Forms: District's standard form.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven (or as indicated in the General Condition, whichever is longer) working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.

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- 1. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or inaccurately prepared RFIs.
- 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
- 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B.
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect and Construction Manager.
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's and Construction Manager's response was received.
- F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven days if Contractor disagrees with response.
 - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 - 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.6 **PROJECT MEETINGS**

- A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

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- 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.
- B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Procedures for processing field decisions and Change Orders.
 - e. Procedures for RFIs.
 - f. Procedures for testing and inspecting.
 - g. Procedures for processing Applications for Payment.
 - h. Distribution of the Contract Documents.
 - i. Submittal procedures.
 - j. Preparation of record documents.
 - k. Use of the premises and existing building.
 - l. Work restrictions.
 - m. Working hours.
 - n. Owner's occupancy requirements.
 - o. Responsibility for temporary facilities and controls.
 - p. Procedures for moisture and mold control.
 - q. Procedures for disruptions and shutdowns.
 - r. Construction waste management and recycling.
 - s. Parking availability.
 - t. Office, work, and storage areas.
 - u. Equipment deliveries and priorities.
 - v. First aid.
 - w. Security.
 - x. Progress cleaning.
 - 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Daily construction reports.
 - 3. Site condition reports.

1.2 DEFINITIONS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
 - 3. Two paper copies.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

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- 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- C. Daily Construction Reports: Submit at weekly intervals.
- D. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

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- C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion
- D. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 - 1. Unresolved issues.
 - 2. Unanswered Requests for Information.
 - 3. Rejected or unreturned submittals.
 - 4. Notations on returned submittals.
 - 5. Pending modifications affecting the Work and Contract Time.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Testing and commissioning.
 - i. Punch list and final completion.

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- j. Activities occurring following final completion.
- 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
- 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
- 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the schedule of values).
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.

2.3 REPORTS

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

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- 1. List of subcontractors at Project site.
- 2. Approximate count of personnel at Project site.
- 3. Equipment at Project site.
- 4. Material deliveries.
- 5. High and low temperatures and general weather conditions, including presence of rain or snow.
- 6. Accidents.
- 7. Meetings and significant decisions.
- 8. Unusual events.
- 9. Stoppages, delays, shortages, and losses.
- 10. Meter readings and similar recordings.
- 11. Emergency procedures.
- 12. Orders and requests of authorities having jurisdiction.
- 13. Change Orders received and implemented.
- 14. Construction Change Directives received and implemented.
- 15. Services connected and disconnected.
- 16. Equipment or system tests and startups.
- 17. Partial completions and occupancies.
- 18. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
 - 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

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- a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
- b. Contractor shall execute a data licensing agreement as required by the architect prior to the release of the digital files.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 30 days (or as stated in the General Condition, whichever is longer) for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 - 3. Simply copying the contractor document details and include them as part of the contractor submittal is not acceptable.
 - 4. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Name of subcontractor.
 - f. Name of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.

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- 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
- i. Number and title of appropriate Specification Section.
- j. Drawing number and detail references, as appropriate.
- k. Location(s) where product is to be installed, as appropriate.
- 1. Other necessary identification.
- 5. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
 - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 - 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 - 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software electronic form acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 1. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.

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- n. Related physical samples submitted directly.
- o. Indication of full or partial submittal.
- p. Transmittal number, numbered consecutively.
- q. Submittal and transmittal distribution record.
- r. Other necessary identification.
- s. Remarks.
- 5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
 - e. Insert required information.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations: Identify deviations from the Contract Documents on submittals.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements:
 - 1. Post electronic submittals as PDF electronic files directly to Architect's FTP site or other online construction administration tool specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

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- 2. If acceptable to the construction manager and the architect, submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
- 3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
- 4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
- 5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 - 5. Submit Product Data before or concurrent with Samples.
 - 6. Submit Product Data in the following format:
 - a. PDF electronic file.

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- b. Three paper copies of Product Data unless otherwise indicated. Architect, through Construction Manager, will return two copies.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 - 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
 - b. Two opaque (bond) copies of each submittal. Architect will return one copy(ies).
 - c. Three opaque copies of each submittal. Architect will retain two copies; remainder will be returned.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 - 4. Disposition: Maintain sets of approved Samples at Project site, available for qualitycontrol comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

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- b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 - 1. Submit product schedule in the following format:
 - a. PDF electronic file.
 - b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.
- F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures.
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- U. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
- V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

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

3.2 ARCHITECT'S ACTION

- A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.
- F. Review stamp: Architect's review stamp does not relieve the contractor's responsibility to fully comply with the contract document.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other qualityassurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

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- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

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

- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

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- d. When testing is complete, remove test specimens, assemblies, [and]mockups[, and laboratory mockups]; do not reuse products on Project.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Demolish and remove mockups when directed unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.7 QUALITY CONTROL

- A. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- C. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 3. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 4. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

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

1.2 INDUSTRY STANDARDS

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

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

1.3 ABBREVIATIONS AND ACRONYMS

- A. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
 - 1. DIN Deutsches Institut fur Normung e.V.; www.din.de.
 - 2. IAPMO International Association of Plumbing and Mechanical Officials; www.iapmo.org.
 - 3. ICC International Code Council; www.iccsafe.org.
 - 4. ICC-ES ICC Evaluation Service, LLC; www.icc-es.org.
- B. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
 - 1. COE Army Corps of Engineers; www.usace.army.mil.
 - 2. CPSC Consumer Product Safety Commission; www.cpsc.gov.
 - 3. DOC Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 - 4. DOD Department of Defense; http://dodssp.daps.dla.mil.
 - 5. DOE Department of Energy; <u>www.energy.gov</u>.
 - 6. EPA Environmental Protection Agency; www.epa.gov.
 - 7. FAA Federal Aviation Administration; www.faa.gov.
 - 8. FG Federal Government Publications; www.gpo.gov.
 - 9. GSA General Services Administration; www.gsa.gov.
 - 10. HUD Department of Housing and Urban Development; www.hud.gov.
 - 11. LBL Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; http://eetd.lbl.gov.
 - 12. OSHA Occupational Safety & Health Administration; www.osha.gov.
 - 13. SD Department of State; www.state.gov.
 - 14. TRB Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
 - 15. USDA Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
 - 16. USDA Department of Agriculture; Rural Utilities Service; www.usda.gov.
 - 17. USDJ Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
 - 18. USP U.S. Pharmacopeia; www.usp.org.
 - 19. USPS United States Postal Service; www.usps.com.

- C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.
 - 1. CFR Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 - 2. DOD Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
 - 3. DSCC Defense Supply Center Columbus; (See FS).
 - 4. FED-STD Federal Standard; (See FS).
 - 5. FS Federal Specification; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
 - 6. MILSPEC Military Specification and Standards; (See DOD).
 - 7. USAB United States Access Board; www.access-board.gov.
 - 8. USATBCB U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- D. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
 - 1. CBHF State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
 - 2. CCR California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
 - 3. CDHS California Department of Health Services; (See CDPH).
 - 4. CDPH California Department of Public Health; Indoor Air Quality Program; www.caliaq.org.
 - 5. CPUC California Public Utilities Commission; <u>www.cpuc.ca.gov</u>.
 - 6. DSA Division of the State Architects
 - 7. SCAQMD South Coast Air Quality Management District; www.aqmd.gov.
 - 8. TFS Texas Forest Service; Forest Resource Development and Sustainable Forestry; http://txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014523 - TESTING AND INSPECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Testing and inspection services to meet requirements of the California Building Code (CBC), Title 24, Parts 1 and 2, as indicated on the Drawings.
- B. One or more DSA certified inspectors employed by the OWNER in accordance with the requirements of California Building Standards Administrative Code will be assigned to the Work with their duties as specifically defined in Section 4-333(b).
- C. Tests of materials are required by a DSA certified testing agency as set forth in Section 4-335 of the California Building Standards Administrative Code.

1.02 RELATED SECTIONS

Section 011000:	Summary
Section 012500:	Substitution Procedures
Section 013300:	Submittal Procedures
Section 015000:	Temporary Facilities and Controls
Section 017700:	Closeout Procedures
Section 019113:	General Commissioning Requirements
	Section 011000: Section 012500: Section 013300: Section 015000: Section 017700: Section 019113:

- PART 2 PRODUCTS (Not applicable)
- PART 3 EXECUTION

3.01 TESTS

- A. OWNER will select an independent testing agency to conduct tests, sampling, and testing of materials. Selection of material to be tested shall be by the agency and not by CONTRACTOR.
- B. Any material shipped from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from IOR such testing and inspection is not required shall not be incorporated into the Work.
- C. OWNER will select and directly reimburse testing agency the costs for all DSA and/or DSA required tests and inspections but may be reimbursed by

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CONTRACTOR for such costs as noted in related sections of the Contract Documents.

D. The independent testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work. The agency shall not perform any duties of CONTRACTOR.

3.02 TEST REPORTS

A. Test reports shall include all tests performed, regardless of whether such tests indicate the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. Reports shall indicate the material or materials were sampled and tested in accordance with requirements of CBC, Title 24, Parts 1 and 2, as indicated on the Drawings. Test reports shall indicate specified design strength. They shall also definitely state whether or not material or materials tested comply with the specified requirements.

3.03 VERIFICATION OF TEST REPORTS

A. Each testing agency shall submit to the Division of the State Architect a verified report in duplicate covering tests which are required to be performed by that agency during progress of the Work. Such report shall be furnished each time construction on the Work is suspended, covering tests up to that time, and prior to Final Completion of the Work, covering all tests.

3.04 INSPECTION BY OWNER

- A. OWNER and its representatives shall at all times have access, for purpose of inspection, to all parts of the Work and to shops wherein the Work is in preparation, and CONTRACTOR shall at all times maintain proper facilities and provide safe access for such inspection.
- B. OWNER shall have the right to reject materials and/or workmanship deemed defective Work, and to require correction. Defective workmanship shall be corrected in a satisfactory manner and defective materials shall be removed from the premises and legally disposed of, all without charge to OWNER. If CONTRACTOR does not correct such defective Work within a reasonable time, fixed by written notice and in accordance with the terms and conditions of the Contract Documents, OWNER may correct such defective Work and proceed in accordance with related Articles of the Contract Documents.

C. CONTRACTOR is responsible for compliance to all applicable local, state, and federal regulations regarding codes, regulations, ordinances, restrictions, and requirements.

3.05 INSPECTOR OF RECORD

- A. Inspector of Record is employed by OWNER in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein.
- B. Inspection of Work shall not relieve CONTRACTOR from any obligation to fulfill all of the terms and conditions of the Contract Documents.
- C. CONTRACTOR shall be responsible for scheduling times of inspection, tests, sample taking, and similar activities of the Work.

3.06 TESTS AND INSPECTIONS

- A. The following tests and inspections do not limit inspection of the Work but are required by DSA, other agencies, or are required in related Sections of the Contract Documents.
- B. Excavations, Foundations and Retaining Walls CBC, Chapter 18A
- C. Concrete CBC, Chapter 19A:
 - 1. Materials:

a.	Test of Materials	1903A.1
b.	Portland Cement Tests	1903A.2
c.	Concrete Aggregate	1903A.3
d.	Shotcrete Aggregate	1903A.3; 1924A.3
e.	Reinforcing Bars	1903A.5.1; 1903A.5.2; 1903A.5.3; 1903A.5.4;
f.	Prestressing Steel & Anchorage	1903A.5.5;
g.	Structural Steel, Steel Pipe or tubing	1903A.5.6

	h.	Admixtures	1903A.6	
2.	Quality:			
	a.	Proportions of Concrete	1905A.1; 1905A.2; 1905A.3; 1905A.4; 1905A.5; 1905A.6,	
	b.	Mixing and Placing	1905A.1.1; 1905A.1.2; 1905A.1.3	
	c.	Concrete Testing	1905A.6;	
	d.	Test Of Shotcrete	1905A.6; 1924A.10	
	e.	Composite Construction Cores	1929A.8	
	f.	Gypsum Concrete Strength Tests	1925A.1; 1929A.13	
	g.	Insulating Concrete Tests	DSA IR 27-1	
3.	Inspection:			
	a.	Project Site Inspection	1905A.7.1	
	b.	Batch Plant or Weigh-master Inspection	1929A.4, 1929A.5;	
	c.	Pre-stressed Concrete Inspection	1929A.0 1929A.9	
	d.	Shotcrete Inspection	1929A.10	
	e.	Reinforcing Bar Welding Inspection	1929A.12, 1903A.10	
Lightv	weight Metal - CBC, Chapter 20A:			
1.	Materials:			
	a.	Alloys	2001A.2	
	b.	Identification	2001A.4	
2.	Inspec	ction:		

D.

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		a.	Welding	2004A.8
E.	Masonry - CBC, Chapter 21A:			
	1. Materials:		rials:	
		a.	Masonry Units	2102A.2,4,5,6
		b.	Portland Cement	2102A.2.2
		c.	Mortar & Grout Aggregates	2102A.2.1; 2103A.4.3
		d.	Reinforcing Bars	2102A.2.10; 1903A5,
	2. Quality:		ity:	2102A.2.10
		a.	Portland Cement Tests	1903A.2
		b.	Mortar & Grout Tests	2105A.3.4.2
		c.	Masonry Prism Tests	2105A.3.2, 2105A3.5
		d.	Masonry Core Tests	2105A 3.1
		e.	Reinforcing Bars	2102A.2.10
	3. Inspection:		ection:	
		a.	Reinforced Masonry	2105A
		b.	Reinforcing Bar Welding Inspection	1903A.10
F. Steel - CBC, Chapters 17A & 22A:		, Chapters 17A & 22A:		
	1. Materials:		rials:	
		a.	Structural Steel	2202A.1
		b.	Material Identification	2203.A4
	2. Inspection and Tests:		ection and Tests:	
		a.	Test of Structural Steel	2231.A
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		b.	Tests of High Strength Bolts, Nuts, and Washers	2231.A.2
		c.	Tests of End Welded Studs	2231.A.3
		d.	Shop Fabrication Inspection	2231.A.4
		e.	Welding Inspection	2231.A.5
		f.	High Strength Bolt Inspection	2231A.6
		g.	Steel Joist Load Tests	2231A.7
		h.	Spray applied fire resistance materials	1701
G. Wood - CBC, Chapter 23A:				
	1.	Mate	erials:	
		a.	Lumber and Plywood Grading	2303A.1, 2304A
		b.	Glue - Laminated Members	2303A.2, 2304A
	2.	Inspe	ection:	
		a.	Glue - Laminated Fabrication	2337A.1
		b.	Timber Connectors	2337A.2
		c.	Manufactured Trusses	2337A.3
Н.	Exter	rior Wa	ll Coverings - CBC, Chapter 14A, 25A:	
	1.	Mate	erials:	
		a.	Portland Cement Plaster	2508A, 2509A,
	2.	Inspe	ection:	2310A
		a.	Veneer Inspection	1405A

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END OF SECTION 014523

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SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

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

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- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 8 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails. Also provide green screen.
- B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 8 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts. Also provide green screen.
- C. Wood Enclosure Fence: Plywood, 8 feet high, framed with four 2-by-4-inch rails, with preservative-treated wood posts spaced not more than 8 feet apart.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Provide prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Provide at least (1) office of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
- D. Temporary toilet facilities: Contractor shall provide and maintain temporary toilet facilities throughout the entire duration of the project. Contractor and its subcontractors shall not use the District's toilet facilities.

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2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

PART 3 - EXECUTION

- 3.1 INSTALLATION, GENERAL
 - A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
 - B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

- D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead unless otherwise indicated.
 - 2. Connect temporary service to Owner's existing power source, as directed by Owner.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide a dedicated telephone line for each facsimile machine in each field office.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.

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- 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- K. Electronic Communication Service: Provide (1) desktop computer and (1) printer including software in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications. Computer and printer specification to be determined by the construction manager. Total amount shall not exceed \$5,000

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as indicated on Drawings.
 - 1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
 - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.

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- 3. Maintain and touchup signs so they are legible at all times.
- G. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.
- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardanttreated plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
 - 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 4. Insulate partitions to control noise transmission to occupied areas.
 - 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 6. Protect air-handling equipment.
 - 7. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Discard or replace water-damaged and wet material.
 - 4. Discard, replace, or clean stored or installed material that begins to grow mold.
 - 5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

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

3.7 NOISE

A. Contractor shall cease all noisy construction activities should the Construction Manager receives complaints from the District. It is the contractor's responsibility to make sure that construction activities will not disturb any daily District activities.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

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

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- 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

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

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

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- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 - 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 - 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

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

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Progress cleaning.
 - 6. Starting and adjusting.
 - 7. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 INFORMATIONAL SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Certified Surveys: Submit two copies signed by land surveyor professional engineer.
- C. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.3 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Engage a land surveyor professional engineer to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

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3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

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- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

3.7 PROTECTION OF INSTALLED CONSTRUCTION

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

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END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

- 1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements, and for disposition of hazardous waste.
- 2. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 90 percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

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

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- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to everyone concerned within 3 days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Donation: Permitted on Project site.
- C. Salvaged Items for Owner's Use:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by the construction manager.
 - 5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

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

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- B. Recycling Receivers and Processors.
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Grind asphalt to maximum 1-1/2-inch size.
- B. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum 1-1/2-inch size.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Pulverize masonry to maximum 3/4-inch size.
 - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- F. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

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- G. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- H. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- I. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- J. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- K. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- L. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- M. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- N. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

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

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Remove waste materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

1.3 CLOSEOUT SUBMITTALS

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

- 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
- 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
- 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
- 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Construction Manager. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.
- 5. Submit test/adjust/balance records.
- 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Owner of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 - 6. Advise Owner of changeover in heat and other utilities.
 - 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 - 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 9. Complete final cleaning requirements, including touchup painting.
 - 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
 - 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 - 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 4. Submit pest-control final inspection report and warranty.
 - 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.
 - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

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- 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
- 3. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect, through Construction Manager, will return annotated copy.
 - b. PDF electronic file. Architect, through Construction Manager, will return annotated copy.
 - c. Three Insert number paper copies unless otherwise indicated. Architect, through Construction Manager, will return two copies.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - 1. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.

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- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Professional cleaning: Contractor shall also employ a professional cleaning company to perform a final clean for all interior and exterior areas.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

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- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of Owner.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

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- a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
- 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
- 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
- 4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.

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- 4. Required sequences for electric or electronic systems.
- 5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

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

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

2.4 PRODUCT MAINTENANCE MANUALS

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

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

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- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 - 1. Do not use original project record documents as part of operation and maintenance manuals.
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Record data as soon as possible after obtaining it.
 - c. Record and check the markup before enclosing concealed installations.
 - 2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 - 3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 - 4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file paper copy scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file paper copy scanned PDF electronic file(s) of marked-up paper copy of Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file paper copy scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Demolition and removal of selected portions of existing wall, ceiling and wall.
 - 3. Salvage of existing items to be reused or recycled.
 - 4. Patch existing surface affected by demolition as needed to match adjacent surface.
- B. See Division 01 Section "Construction Waste Management and Disposal" for disposal of demolished materials.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, interruption of utility services, use of elevator and stairs, and locations of temporary partitions and means of egress.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1. Comply with submittal requirements in Division 01 Section "Construction Waste Management and Disposal."

1.4 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Pre-demolition Conference: Conduct conference at Project Site, indicated in Drawings.

1.5 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect/Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect/Engineer and Owner. Owner will remove hazardous materials under a separate contract.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations. Maintain fire-protection facilities in service during selective demolition operations.

1.6 PATCHING

A. Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass

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area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 5. Dispose of demolished items and materials promptly. Comply with requirements in Division 01 Section "Construction Waste Management and Disposal."

- B. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect/Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally disposed of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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SECTION 05 12 00 STRUCTURAL STEEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY

- A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Structural steel is that work defined in American Institute of Steel Construction (AISC) "Code of Standard Practice" and as otherwise shown on drawings.
- C. Miscellaneous Metal Fabrications are specified elsewhere in Division 5.
- D. Refer to Division 3 for anchor bolt installation in concrete; Division 4 for masonry.
- E. Source Quality Control: Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
 - 1. Promptly remove and replace materials or fabricated components which do not comply.
- F. Design of Members and Connections: Details shown are typical; similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at site whenever possible without causing delay in the work.
 - 1. Promptly notify Architect whenever members and connections for any portion of structure are not clearly indicated.

1.03 SUBMITTALS

- A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
 - 1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.
 - 2. High-strength bolts (each type), including nuts and washers.
 - 3. Structural steel primer paint.
 - 4. Shrinkage-resistant grout.
- B. Shop Drawings: Submit shop drawings prepared under supervision of a registered professional engineer, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.

- C. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS A2.1 and A2.4 symbols, and show size, length, and type of each weld.
 - 1. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of others sections.
- D. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
 - 2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.
 - 3. AISC "Specifications for Architecturally Exposed Structural Steel".
 - 4. AISC "Specifications for Structural Joints using High-Strength Bolts" approved by the Research Council on Structural Connections.
 - 5. American Welding Society (AWS) D1.1 "Structural Welding Code Steel".
 - 6. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".
 - 1. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests and governing agency requirements.
 - a. If recertification of welders is required, retesting will be Contractor's responsibility.

1.05 DELIVERY, STORAGE AND HANDLING

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

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, rust and scale seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
- B. Structural Steel Shapes, Plates and Bars:
 - 1. Wide flanges, ASTM A992.
 - 2. Plates, ASTM A572, Grade 50.
 - 3. Channels and angles, ASTM A36.
- C. Cold-Formed Steel Tubing: ASTM A500, Grade C.
- D. Steel Pipe: ASTM A53, Type E or S, Grade B; or ASTM A500.
 - 1. Finish: Black, except where indicated to be galvanized.
- E. Headed Stud-Type Shear Connectors: ASTM A29, Grade 1015 or 1020, cold finished carbon steel; with dimensions complying with AISC Specifications, and as indicated on drawings.
- F. Anchor Bolts: ASTM F1554 Grade 36 for headed bolts and threaded rods.
- G. Expansion bolt fasteners: Hilti Anchors per drawings.
- H. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low-carbon steel bolts and nuts.
 - 1. Provide hexagonal heads and nuts for all connections.
- I. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325.
 - 2. Quenched and tempered alloy steel bolts, nuts and washers, complying with ASTM A490.
 - 3. Direct tension indicator washers may be used at Contractor's option.
- J. Electrodes for Welding: E-70 electrodes complying with AWS Code.
- K. Structural Steel Primer Paint: SSPC Paint 13, or fabricator's standard rust-inhibiting primer.
- L. Non-metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage

compensating agents, plasticizing and water reducing agents, complying with CE-CRD-C621.

2.02 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
- B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
- C. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects.
- D. Connections: Provide welded or bolted connections, as indicated.
- E. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using High-Strength Bolts" (RCSC).
- F. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
- G. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Field weld shear connectors, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.
- I. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, where indicated.
- J. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.
- K. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.03 SHOP PAINTING

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
 - 1. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.
 - 2. Do not paint surfaces which are scheduled to receive sprayed-on fire proofing.
 - 3. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

- B. Surface Preparation: After inspection and before shipping, clean steel work to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:
 - 1. SP-1 "Solvent Cleaning".
 - 2. SP-2 "Hand Tool Cleaning".
 - 3. SP-3 "Power Tool Cleaning".
 - 4. SP-5 "White Metal Blast Cleaning".
- C. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting methods, which result in full coverage of joints, corners, edges and exposed surfaces.

PART 3 - EXECUTION

3.01 ERECTION

- A. Surveys: Check elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to Architect. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with Architect.
- B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.
- C. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
- D. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
- E. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
- F. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to grouting.
- G. Grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - 1. For proprietary grout materials, comply with manufacturer's instructions.
- H. Field Assembly: Set structural frames accurately to line and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces, which will be in

permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

- I. Level and plumb individual members of structure with in specified AISC tolerances.
- J. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- K. Splice members only where indicated on structural drawings.
- L. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- M. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
- N. Do not enlarge unfair holes in members by burning or by use of drift pins. Ream holes that must be enlarged to admit bolts.
- O. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in structural framing.
- P. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.
- Q. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.

3.02 QUALITY CONTROL

- A. Owner will engage an independent testing and inspection agency to inspect high-strength bolted connections and welded connections and to perform tests and prepare test reports.
- B. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.
- C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
- D. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.
- E. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.
- F. Shop and Field Bolted Connections: Inspect or test in accordance with AISC specifications.
- G. Shop and Field Welding: Inspect and test during fabrication of structural steel assemblies, as follows:

- 1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
- 2. Perform visual inspection of all welds.
- 3. Perform tests of welds as follows:
 - a. Ultrasonic Inspection: ASTM E164.

END OF SECTION

SECTION 064116 – PLASTIC LAMINATE ARCHITECTURAL CABINETS AND COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-faced architectural cabinets.
 - 2. Plastic-laminate-faced countertops.
 - 3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.2 SUBMITTALS

- A. General: Shop drawings and product submittals shall be certified by Woodwork Institute (WI) through the Certified Compliance Program (CCP)
- B. Product Data: For each type of product including high-pressure decorative laminate, adhesive for bonding plastic laminate and cabinet hardware and accessories.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- D. Samples:
 - 1. Plastic laminates, for each color, pattern, and surface finish.
 - 2. Thermoset decorative panels, for each color, pattern, and surface finish.

1.3 INFORMATIONAL SUBMITTALS

A. Woodwork Quality Standard Compliance Certificates: Furnish and Provide WI Certified Compliance Program certificates.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: WI Accredited Millwork Company
- B. Installer Qualifications: Licensee of WI's Certified Compliance Program

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide certificates from WI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
- B. Grade: Custom.
- C. Certified Wood: Plastic-laminate cabinets shall be made from wood products certified as "FSC Pure" according to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."
- D. Type of Construction: Frameless.
- E. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- F. High-Pressure Decorative Laminate (VGS): NEMA LD 3, as required by woodwork quality standard.
 - 1. Manufacturers (Basis of Design): Wilsonart or approved equal.
- G. Colors and Patterns for exposed laminate surfaces (Basis of Design): 4669-60 Natural Tigris

2.2 PLASTIC-LAMINATE-FACED COUNTERTOPS

- A. Countertop configuration: Self-Edged with Bull Splash.
 - 1. Edge Treatment: PVC-mold matching laminate with Narrow Build Up.
- B. High-Pressure Decorative Laminate (HGS): NEMA LD 3, as required by woodwork quality standard.
 - 1. Manufacturers (Basis of Design): Wilsonart or approved equal.
- C. Colors and Patterns for exposed laminate surfaces (Basis of Design): 7988-38 Hibiscus Cherry

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2.3 MATERIALS

- A. Provide materials that comply with requirements of referenced quality standard for each type of grade specified.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - a. Thickness: ³/₄"
 - b. Use at cabinets and countertops.
 - 2. Thermoset Decorative Overlay: Medium-density fiberboard with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1
 - a. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.
 - b. Color and pattern: Match adjacent.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware per ANSI/BHMA standards (latest edition) Grade1. Comply with CBC 1126B.4 for all pull hardware.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 165 degrees of opening. Automatic closing shall engage only in the last 10 degrees of swing.
 - 1. Basis of Design: Series 3000 by Grass America, Inc. or approved equal.
 - 2. Quantity: As recommended by the manufacturer base on the size of cabinets.
 - 3. Finish: Bright Nickel, BHMA 619 brass/bronze or 646 steel.
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter. BHMA A156.9, B02011.
- D. Catches: Magnetic catches, BHMA A156.9, B03141
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081
- F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- G. Drawer Slides: BHMA A156.9.
 - 1. Provide positive stop, side-mounted, full extension, zinc-plated steel drawers slides with steel ball bearings.
 - 2. Basis of Design: No. 3640A Accuride, Inc. 200 pound capacity minimum, up to 42" wide.
- H. Door and Drawer Silencers: BHMA A156.16, L03011. Rubber, approximately ¹/₄" diameter, color compatible with adjacent finish.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

Education Center Auditorium Modernization Pomona Office of Education Center 800 S Garey Avenue, Pomona, CA 91766 Plastic Laminate Architectural Cabinets and Countertops 064116 - 3 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

2.5 MISCELLANEOUS MATERIALS

- A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
- B. Adhesives: Do not use adhesives that contain urea formaldehyde.
- C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Adhesive for Bonding Plastic Laminate: As recommended by laminate manufacturer (Low VOC content.

2.6 FABRICATION

- A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Contractor shall remove existing finish and install backing as required. Patch wall to match existing adjacent.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

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- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or screws for exposed fastening, countersunk and filled flush with woodwork.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

END OF SECTION 064116

SECTION 06 61 16 - SOLID SURFACING

PART 1 - GENERAL

1.1 SUMMARY

- 1. Section Includes:
 - 1. Toilet room counter tops with integral bowls.
- 2. Related Sections: Following description of work is included for reference only and shall not be presumed complete:
 - 1. Provision of finish carpentry and architectural woodwork: Section 06 41 16
 - 2. Provision of joint sealants: Section 07 92 00
 - 3. Provision of tile work: Section 09 30 13
 - 4. Provision of plumbing and plumbing fixtures: Division 22

1.2 REFERENCES

- 3. Abbreviations and Acronyms:
 - 1. MDF: Medium Density Fibreboard.
 - 2. SCAQMD: South Coast Air Quality Management District; <u>www.aqmd.gov</u>.
 - 3. VOC: Volatile Organic Compound.
- 4. Definitions:
 - 1. Solid Surface: Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.
- 5. Reference Standards:

1.	ANSI/NPA A208.2-09	- Medium Density Fiberboard (MDF) For Interior Applications
2.	ASTM C920-14a	- Standard Specification for Elastomeric Joint Sealants
3.	ASTM D638-10	- Standard Test Method for Tensile Properties of Plastics

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4.	ASTM D785-08	- Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
5.	ASTM D790-10	- Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
6.	ASTM D5420-10	- Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
7.	ASTM E84-14	- Standard Test Method for Surface Burning Characteristics of Building Materials
8.	ASTM E228-11	- Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer
9.	ASTM G21-13	- Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
10.	ASTM G22-76(96)	- Standard Practice for Determining Resistance of Plastics to Bacteria
11.	ASTM G155-13	- Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
12.	CSA B45.5-11/ IAPMO Z124-2011	- Plastic Plumbing Fixtures
13.	CSA 0115-M82	- Hardwood and Decorative Plywood
14.	NFPA 255-06	- Standard Method of Test of Surface Burning Characteristics of Building Materials
15.	NSF/ANSI 51-07	- Food Equipment Materials
16.	SCAQMD Rule 1168	- Adhesive and Sealant Applications (amended January 2005)
17.	CAN/ULC-S102-07	- Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
18.	UL 723	- Standard for Test for Surface Burning Characteristics of Building Materials
19.	UL Environment/ GREENGUARD – UL 2818	- Standard for Chemical Emissions for Building Materials, Finishes and Furnishings, Section 7.1
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- 20. UL Environment/ GREENGUARD -UL 2818 - Gold Standard for Chemical Emissions for Building Materials, Finishes and Furnishings, Section 7.1 and 7.2
- 21. UL 2824 GREENGUARD Certification Program, Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers

1.3 ADMINISTRATIVE REQUIREMENTS

6. Preinstallation Meetings: Arrange preinstallation meeting prior to commencing work with all parties associated with trade as designated in Contract Documents. Presided over by Contractor, include Consultant who may attend, Architect, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.4 SUBMITTALS

- 1. Product Data: Indicate Product description including solid surface sheets, sinks, bowls and illustrating full range of standard colours, fabrication information and compliance with specified performance requirements. Submit Product data with resistance to list of chemicals.
- 2. Shop Drawings: Submit Shop Drawings for work of this Section. Indicate plans, sections, dimensions, component sizes, edge details, thermosetting requirements, fabrication details, attachment provisions, sizes of furring, blocking, including concealed blocking and coordination requirements with adjacent work. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacles and other items installed in solid surface.
- 3. Coordination Drawings: Submit coordination drawings indicating plumbing and miscellaneous steel work indicating locations of wall rated or non-rated, blocking requirements, locations and recessed wall items and similar items.
- 4. Samples: Submit minimum 150 mm x 150 mm (6" x 6") samples. Cut sample and seam together for representation of inconspicuous seam. Indicate full range of colour and pattern variation. Approved samples will be retained as standards for work.
- 5. Test and Evaluation Reports: Submit flammability test reports.

1.5 CLOSEOUT SUBMITTALS

1. Operation and Maintenance Data:

- I. Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in Project closeout documents.
- II. Provide a commercial care and maintenance kit and video. Review maintenance procedures and warranty details with Owner upon completion.

1.6 QUALITY ASSURANCE

- i. Qualifications:
 - 1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and assemblies specified and with approval and training of the Product manufacturers.

ii. Mock-Ups:

- 1. Prior to final approval of Shop Drawings, erect 1 full size mock-up of each component at Project site demonstrating quality of materials and execution for Consultant review.
- 2. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from Project site.
- 3. Approved mock-up will be used as standard for acceptance of subsequent work.
- 4. Approved mock-ups may remain as part of finished work.

1.7 DELIVERY, STORAGE AND HANDLING

- i. Delivery and Acceptance Requirements: Deliver no components to Project site until areas are ready for installation.
- ii. Storage and Handling Requirements:
 - 1. Store components indoors prior to installation.
 - 2. Handle materials to prevent damage to finished surfaces.

1.8 WARRANTY

1. Manufacturer Warranty: Provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Consultant and at no expense to Owner.

PART 2 - PRODUCTS

1.1 MANUFACTURERS

- 1. Basis of Design: Corian[®] by DuPont; <u>www.corian.com</u>
- 2. Color and pattern: Corian Designer White. (Upon requested by the architect, provide other colors and patterns)

1.9 MATERIALS

- 1. Description: See Technical Bulletin K-26829 DuPontTM Corian[®] Performance Properties.
- 2. Performance/Design Criteria:

Property	Requirement	Test	Procedure
	min or max		

3. Solid Surface Based Products:

•	Tensile Strength	6000 psi min	ASTM D638
•	Tensile Modulus	1.5 x 10 ⁶ psi min	ASTM D638
•	Tensile Elongation	0.4% min.	ASTM D638
•	Flexural Strength	10000 psi min	ASTM D790
•	Flexural Modulus	1.2 x 10 ⁶ psi min	ASTM D790
•	Hardness	>85-Rockwell "M" scale min.	ASTM D785
•	Thermal Expansion	3.90 x 10 ⁻⁵ in./in./°C (2.2 x 10 ⁻⁵ in./in./°F)	ASTM E228
•	Fungi and Bacteria	Does not support microbial growth	ASTM G21 & G22
•	Microbial Resistance	Highly resistant to mould growth	UL 2824
•	Ball Impact	No fracture - 1/2 lb. Ball: 1/4" slab - 36" drop 1/2"* slab - 144" drop * - approximate weight per sq ft	NEMA LD 3, Method 3.8
•	Weatherability	ΔE* ₉₄ <5 in 1,000 hrs	ASTM G155
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• Flammability

ASTM E84, NFPA 255 & UL 723

		All Colours		
		1/4"	1/2"	
•	Flame Spread	<25	<25	
•	Smoke Developed	<25	<25	
•	Class	А	А	NFPA 101®, Life Safety Code

- Industry standard is to use 12 mm (1/2") thick Products. 6 mm (1/4") thick Product is used vertically only. Contact manufacturer's rep. for 19 mm (3/4") thick Product and Product data and panel size limitations.
- 3. Solid Surface Material:
 - 4. Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria:
 - Flammability: Flame Spread Index: 0 and Smoke Development Index: 5 when tested to CAN/ULC-S102.
 - 5. Ensure material has minimum physical and performance properties specified under "Performance/Design Criteria".
 - 6. Ensure superficial damage to a depth of 0.25 mm (0.010") is repairable by sanding and polishing.
- 4. Adhesive for Bonding to Other Products: One component silicone to ASTM C920.
- 5. Sealant: A standard mildew-resistant, FDA/UL[®] recognized silicone color coordinated sealant or clear silicone sealants.

1.10 COMPONENTS

- 6. Counter Perimeter Frame: Ensure 3/4" thick, moisture resistant cores for counter tops in wet areas having sinks or lavatories are 19 mm (3/4") thick exterior grade plywood with waterproof adhesive, CSA O115-M (G/SO) Fir or Poplar plywood, veneer core only
- 7. Lavatory Tops with Integral Bowls: Moulded countertop of solid surfacing material (22"), complete with integrally molded bowls of 100% acrylic solid surface material; edge details

as indicated on Drawings. Provide with coved backsplash and endsplashes as shown on Drawings.

- 8. Fabrication:
 - 7. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid surface manufacturer requirements. Form joints between components to create inconspicuous seams, using manufacturer's standard joint adhesive. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
 - 8. When requested by the architect, thermoform corners and edges or other objects to shapes and sizes as required prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
 - 9. Ensure no blistering, whitening and cracking of components during forming.
 - 10. Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings. Backsplashes for most colours may be fabricated by traditional means discussed in K-25294 Backsplashes. Colours with metallic/mica particle or veined colours creating directional aesthetics (K-26833 Directional Aesthetics) may require the techniques in Technical Bulletin K-28235 Thermoformed Backsplash.
 - 11. Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid surface material under each joint. Reinforcing strip of solid surface material is not required when using DuPont[™] Joint Adhesive 2.0.
 - 12. Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.
 - 13. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
 - 14. Finish: Ensure surfaces have uniform finish:
 - Matte, with a 60° gloss rating of 5 20.
 - 15. Fabrication Tolerances:
 - Variation in Component Size: +/-3 mm (+/-1/8").
 - Location of Openings: +/-3 mm (+/-1/8") from indicated location.

1.11 EXAMINATION

- 1. Verification of Conditions:
 - 16. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 17. Verify actual site dimensions and location of adjacent materials prior to commencing work.
 - 18. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 3 mm in 3 m (1/8" in 10' 0").
 - 19. Notify Consultant in writing of any conditions which would be detrimental to installation.
- 2. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.
- 1.12 INSTALLATION
 - 1. General: Installation shall comply with CBC accessibility requirements and ADA.
 - 2. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.
 - 3. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.
 - 4. Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's written recommendations using adhesive in color to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.
 - 5. Install countertops with no more than 3 mm (1/8") sag, bow or other variation from a straight line.
 - 6. Seal between wall and components with joint sealant as recommended by solid surfacing and sealant manufacturer. Ensure compatibility.
 - 7. Provide backsplashes and endsplashes. Adhere to countertops using a standard colourcoordinated silicone sealant. Adhere applied sidesplashes to countertops using a standard colour-coordinated silicone sealant. Provide coved backsplashes and sidesplashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes tion Center Auditorium Modifications Solid Surfacing

to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard colour-coordinated joint adhesive.

- 8. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Performance of the Work.
- 9. Coordinate connections of plumbing fixtures and make plumbing connections to sinks accordingly.

1.13 REPAIR

- 1. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Technical Bulletins".
- 1.14 SITE QUALITY CONTROL
 - 1. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

1.15 CLEANING

- 1. Remove excess adhesive and sealant from visible surfaces.
- 2. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

1.16 **PROTECTION**

- 1. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.
- 2. Protect surfaces from damage until date of Substantial Performance of the Work.

END OF SECTION 064116

SECTION 072100 - ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-fiber acoustical batt insulation.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research/evaluation reports.

PART 2 - PRODUCTS

2.1 GLASS-FIBER ACOUSTICAL BATT INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers:
 - 1. CertainTeed Corporation.
 - 2. Johns Manville.
 - 3. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Acoustical Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Density: 3lbs / cu.ft
- D. Insulation shall be Formaldehyde-Free.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- B. Install insulation that is undamaged, dry, and unsolled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.2 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber Batt Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - 6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
 - b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

END OF SECTION 072100

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.2 REFERENCES

1. Comply with the latest SDI (Steel Door Institute), ANSI and ASTM standards.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and framing anchor details.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required.
- E. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Steelcraft

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

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- 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Extra Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.032 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Kraft-paper honeycomb.
 - f. Finish: Factory primed and field painted
 - 3. Frames:
 - a. Materials: Uncoated, cold-rolled steel sheet, minimum thickness 18GA.
 - b. Construction: Knocked down.
 - 4. Finish: Factory primed and field painted.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Extra Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule.
 - 1. Physical Performance: Level A according to SDI A250.4.
 - 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Faces: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Core: Manufacturer's standard insulation material.
 - f. Finish: Factory primed and field painted
 - 3. Frames:

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- a. Materials: Metallic-coated steel sheet, minimum thickness of 16ga with minimum A40 coating.
- b. Construction: Fully welded.
- 4. Finish: Factory primed and field painted.

2.5 FRAME ANCHORS

- A. General: Comply with SDI requirements.
- B. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inchdiameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- C. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

- 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing).
- J. Glazing: Section 088000 "Glazing."
- K. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat.

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 - 4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 5. Jamb Anchors: Provide number and spacing of anchors as follows:

- a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
- b. Compression Type: Not less than two anchors in each frame.
- c. Post installed Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
- 6. Door Silencers: Provide Silencers at both exterior and interior frames.
 - a. Except on weather-stripped frames, drill stops to receive door silencers.
 - 1) Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - 2) Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollowmetal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

A. Factory Finish: Factory primed and field painted.

2.9 ACCESSORIES

- A. Louvers: Provide sight-proof louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post installed expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.
 - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 - 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 - 6. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

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- 7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
- 8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- B. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollowmetal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.2 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

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END OF SECTION 081113

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glazed Ceramic wall tile assembly.
 - 2. Porcelain floor tile assembly.

1.2 REFERENCES

A. TCNA, Handbook for Ceramic Tile Installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. System Schedule: Submit a complete list of products for each application. Contractor shall verify with the manufacturers to make sure these products are compatible with each other.
- C. Grout color: Submit manufacturer's full range for architect's selection.
- D. Shop Drawings: Include floor plans, elevations, details, etc.
- E. Samples:
 - 1. Each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required.
 - 3. Stone thresholds.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced firm who has successfully completed tile installations similar in material, design, and extent to that indicated for Project for at least 5 years.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

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- 1. Build mockup of floor tile installation (6-foot square).
- 2. Build mockup of wall tile installation (6-foot square).
- 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.2 TILE PRODUCTS

- A. Ceramic Wall Tile Type [CT-1] and [CT-2]:
 - 1. Basis-of-Design Product: Glazed Ceramic wall tile by Allen + Roth a. Color: Chocolate
 - b. Size (Nominal): 3"x6"
 - c. Pattern: Running bond
 - d. Floor to ceiling installation (TCNA W244)
 - 2. Grout Color: To be selected by Architect from manufacturer's full range.
 - 3. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cap: Per manufacturer's standard cap.
 - b. External Corners for Thinset Mortar Installations: Surface bullnose size per manufacturer.
 - c. Internal Corners: Cove, size per manufacturer
- B. Porcelain Floor Tile Type [T1] and [T2]:
 - 1. Basis of Design Product: Natural Porcelain Tile by Capri.
 - a. Color: 77170
 - b. Size: 6"x6"
 - c. Pattern: Grid
 - d. Floor Installation (TCNA F115)
 - e. Contractor shall verify with the manufacturer to determine the Coefficient of Friction of the tile. Inform the Architect immediately if it does not meet CBC and/or ADA requirements.
 - 2. Grout Color: To be selected by Architect from manufacturer's full range.

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- 3. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cove: Cove, 6" wide to match wall and floor tile width.
 - b. External and internal cove base Corners: Internal Corners: Cove, size per manufacturer.

2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.
- B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 12 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
 - a. Color and pattern to match adjacent floor tile. Submit sample and drawing detail to architect for review and approval.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, Type A.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Wonderboard.
 - b. United States Gypsum Company; DUROCK Cement Board.
 - 2. Thickness: 5/8 inch.

2.5 WATERPROOF MEMBRANE

- A. General: Provide waterproofing membrane at all tile assemblies. Complies with ANSI A118.10
 - 1. Basis of Design: Laticrete 9235 (without reinforcing fabric) by Laticrete International or approved equal

2.6 CRACK ISOLATION MEMBRANE

A. General: Provide crack isolation membrane as needed. After demolition and prior to installation, review existing condition with the architect to determine if crack isolation membrane is required.

- B. Product: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
 - 1. Basis of Design: Hydroban by Laticrete International or approved equal.

2.7 SETTING MATERIALS

- A. Thinset Mortar: Latex fortified mortar complying with ANSI 118.4 and ANSI 118/11
 - 1. Basis of Design: 254 Platinum by Laticrete International or approved equal.

2.8 GROUT MATERIALS

- A. General: Epoxy, sanded group complying with ANSI A1183.3.
 - 1. Basis of Design: SpectraLock Pro Premium by Laticrete International

2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: After Demolition and prior to installation, contractor shall walk with the architect/project inspector to verify the existing substrate condition. If deemed necessary, contractor shall provide self-leveling / patching compound to existing substrate as needed. Submit product to the architect for review and approval.
- B. Provide matching base, caps, stops, returns, trimmers as required to complete the installation.
- C. Grout Sealer: Seal all tile joints. Provide manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Products: Per grout manufacturer's recommendations. Submit product for review and approval.
 - 2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
- 2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated. Provide self-leveling / patching compound as needed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: to be determined by the architect. Consult with the architect prior to shop drawing production.
- F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Glazed Wall Tile: 1/8 inch .
 - 2. Porcelain Tile: 1/4 inch
- G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated or as needed. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
 - 1. Provide stone thresholds at doors, submit drawing details and samples to the architect for review.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- K. Floor Sealer: Apply floor sealer to grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- L. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- M. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- N. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- O. Sound tile after setting. Replace or reset hollow sounding units.
- P. Cut and drill so that electrical outlets, plumbing fixtures, pipes, fixtures and fittings standard plates, escutcheon and collars will overlap the tile. Do not cut or split tile at penetrations.
- Q. Install tile in patterns indicated with uniform joints and perimeter units not less than ¹/₂ unit wide. Adjust to minimize cutting.
- R. No cut edge shall be exposed. All exposed edges shall be factory finished.
- S. Maximum deviation from true lines and levels shall not exceed 1/8-inch in 10-foot for floors, and 1/8-inch in 8-foot for walls.
- T. Comply with ANSI A108.6 for epoxy grout at interior locations. Finish joints of square edge tiles flush with tile surfaces; finish joints of cushion edge tiles to depth of cushion. Grout shall be free of voids and pits.
- U. Fill joints grouted with epoxy flush with tile edges. The epoxy cures to a slight depression.

END OF SECTION 093013

SECTION 09 65 13 - RESILIENT WALL BASE AND ACCESSORIES

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient Wall Base.
 - 2. Transition / Edge Strip.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of product indicated, submit manufacturer's full range or color for initial selection.
- C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.
- D. Shop drawings:
 - 1. Floor plans showing the scope of work.
 - 2. Details and transition.
- E. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

A. Mockups: Provide resilient products with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.6 PROJECT CONDITIONS

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Maintain ambient temperatures within range recommended by Johnsonite, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation.

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- 2. During installation.
- 3. 48 hours after installation.
- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. Until Substantial Completion, maintain ambient temperatures within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

PART 2 - PRODUCTS

2.1 TRANSITION / EDGE STRIP

- A. Basis of Design Manufacturer: Johnsonite, Inc.
- B. Provide vinyl transition and edge strips as needed in compliance with ADA and CBC accessibility code.
- C. Color: To be selected from manufacturer's full range. Provide custom color upon requested.

2.2 RESILIENT WALL BASE

- 1. Basis of Design Product: Traditional Rubber Base by Johnsonite, Inc.
 - a. Thickness: 1/8"
 - b. Height: 6"
 - c. Style: DC (Toe)
 - d. Color:
 - 1) B1: Dusk (54).
 - 2) B2: To be selected from manufacturer's full range. Provide custom color upon requested.
 - e. Provide preformed corners to match wall base (both inside and outside corners).
- 2. Adhesive: As recommended by manufacturer:
 - a. Johnsonite 960 Cove Base Adhesive
 - b. Johnsonite 946 Premium Contact Bond Adhesive
- 3. Physical characteristics:
 - a. Manufactured from a proprietary thermoplastic rubber formulation.
 - b. Meets performance requirements for ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP, Group 1.
 - c. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I.
 - d. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, Class A, Smoke <450.
 - e. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1 1/4" diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.
 - f. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring protocols.
 - g. Phthalate-free.
 - h. Contains at least 14% pre consumer recycled content.

- i. 100% Recyclable.
- j. SCS FloorScore® Certified and meets California Specifications Section 01350

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based formulation manufactured and warranted by a reputable manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient wall base.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

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- E. Do not stretch resilient base during installation.
- F. Preformed corners: Install preformed corners if available before installing straight pieces.
- G. Job-formed corners:
 - 1. Outside corners: Form by bending without producing discoloration (whitening) at bends.
 - 2. Inside corners: Butt one piece to corner then scribe next piece to fit.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 096513.13

SECTION 09 65 20 - VINYL ENHANCED TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:1. Resilient Tile (Vinyl Enhanced Tile) Flooring.
- B. Related Sections:

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Shop Drawings:
 - 1. Installation and transition details
 - 2. Area of work.
 - 3. Coordination with other items such as casework.
- D. Samples for Verification: For each type of product indicated, in manufacturer's standard-size samples of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

A. Mockups: Provide resilient products with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

1.6 **PROJECT CONDITIONS**

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Maintain ambient temperatures within range recommended by Johnsonite, but not less than 65 deg F (18 deg C) or more than 85 deg F (29 deg C) in spaces to receive resilient products during the following time periods:
 - 1. 48 hours before installation
 - 2. During installation
 - 3. 48 hours after installation
- C. Maintain the ambient relative humidity between 40% and 60% during installation.
- D. Until Substantial Completion, maintain ambient temperatures within range recommended by Johnsonite, but not less than 55 deg F (13 deg C) or more than 85 deg F (29 deg C).

PART 2 - PRODUCTS

2.1 RESILIENT TILE FLOORING

- A. Basis of Design Manufacturer: Johnsonite, Inc.
- B. Resilient Vinyl Enhanced Tile Flooring
 - 1. Basis of Design project: AZTERRA Resilient Vinyl Enhanced Tile.
 - a. Adhesive: Tarkett 800 Pressure Sensitive Adhesive.
 - b. Color and Pattern: AT103 Warn Sand
 - 2. Product physical characteristics:
 - a. Complies with requirements for ASTM F 1066, Class 3 (Surface Pattern) Standard Specification for Vinyl Composition Floor Tile
 - b. Wear layer/Overall thickness: 1/8" (3.2 mm)
 - c. Tile size: 12" x 12" (30.5 x 30.5 cm)
 - d. Slip Resistance: ADA, DSA and CBC Compliant
 - e. Polyurethane Reinforced wear surface with Tritonite Finish
 - f. ASTM F 970, Standard Test Method for Static Load Limit 400 PSI (modified for higher load)
 - g. ASTM E 648, Standard Test method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class I
 - h. Johnsonite offers a RESTART reclamation program for returning unused jobsite scrap
 - i. Vinyl Enhanced Tiles contain 23% pre-consumer and 6% post-consumer recycled content
 - j. Phthalate-free
 - k. 100% Recyclable
 - 1. SCS FloorScore® Certified and meets California Specifications Section 01350
 - 3. Warrant: Manufacturer's standard 10 year Warranty.

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2.2 INSTALLATION MATERIALS

- A. General: Install per manufacturer's requirements.
- B. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation subject to manufacturer representative's approval.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to Johnsonite written instructions to ensure adhesion of Resilient Tile Flooring.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate paint, coatings and other substances that are incompatible with adhesives or contain soap, wax, oil, solvents, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Mechanically remove contamination on the substrate that may cause damage to the resilient flooring material. Permanent and non-permanent markers, pens, crayons, paint, etc., must not be used to write on the back of the flooring material or used to mark the substrate as they could bleed through and stain the flooring material.
 - 4. Prepare Substrates according to ASTM F 710 including the following:
 - a. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 1) Perform anhydrous calcium chloride test, ASTM F 1869. Results must not exceed 5 lbs. Moisture Vapor Emission Rate per 1,000 sq. ft. in 24 hours.

– or –

- 2) Perform relative humidity test using in situ probes, ASTM F 2170. Results must not exceed 80%.
- b. A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
- c. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
- 5. Wood subfloors must have a minimum 18" (45.7 cm) of cross-ventilated space beneath the bottom of the joist.
 - a. The floor must be rigid, free of movement.

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- b. Single wood and tongue and groove subfloors should be covered with ¹/₄" (6.4 mm) or ¹/₂" (12.7 mm) APA approved underlayment plywood.
 - 1) Use ¹/₄" (6.4 mm) thick underlayment panels for boards with a face width of 3" (76 mm) or less.
 - 2) Use ½" (12.7 mm) thick underlayment panels for boards with a face width wider than 3" (76 mm).
- c. Do not install over OSB (Oriented Strand Board), particle board, chipboard, lauan or composite type underlayments.
- B. Fill cracks, holes, depressions and irregularities in the substrate with good quality Portland cement based underlayment leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- C. Floor covering shall not be installed over expansion joints.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT TILE FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient tile flooring.
- B. Vinyl Enhanced Tile Flooring:
 - 1. Install with manufacturer recommend adhesive for the site conditions and follow adhesive label for proper use.
 - 2. Follow Manufacturer's recommendation for installation instruction.
 - 3. Open enough cartons of floor tiles to cover each area, and mix tile to ensure shade variations do not occur within any one area.
 - 4. Roll the flooring in both directions using a 100 pound three-section roller.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. No traffic for 24 hours after installation.

- E. No heavy traffic, rolling loads, or furniture placement for 72 hours after installation.
- F. Wait 72 hours after installation before performing initial cleaning.
- G. A regular maintenance program must be started after the initial cleaning.

END OF SECTION 096520
SECTION 096816 - CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- 1. Section 024119 "Selective Demolition" for removing existing floor coverings.
- 2. Section 096513.13 "Resilient Wall Base and Accessories" for resilient wall base and accessories installed with carpet.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written specifications and lab documents for any physical testing.
 - 2. Include installation recommendations for each type of substrate as specified in carpet manufacturer's installation guidelines and/or Carpet and Rug Institute Standard 2011, where applicable.
 - 3. Include carpet maintenance recommendations as outlined by manufacturer.
 - 4. Carpet manufacturer shall also submit a plan for recycling the specified carpet at the end of the useful life of the carpet.
 - 5. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. Shop Drawings: Show the following:
 - 1. Floor plans showing the scope of the carpeting work.
 - 2. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 3. Carpet type, color, and dye lot.
 - 4. Locations where dye lot changes occur.
 - 5. Seam locations, types, and methods.
 - 6. Type of subfloor.
 - 7. Type of installation.
 - 8. Pattern type, repeat size, location, direction, and starting point.
 - 9. Pile direction.
 - 10. Type, color, and location of insets and borders.
 - 11. Type, color, and location of edge, transition, and other accessory strips.
 - 12. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet: 12-inch square Sample.

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- 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.
- 3. Carpet Seam: 6-inch Sample.
- 4. Mitered Carpet Border Seam: 12-inch square Sample. Show carpet pattern alignment.
- D. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: For carpet, for tests performed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - a. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - b. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Carpet manufacturer shall have no less than 5 years experience of producing recyclable carpet and shall have published product literature clearly indicating compliance with requirements of this section.
- B. Installer Qualifications: An Installer with a minimum of 5 years of commercial carpet installation experience, and who is certified by the International Certified Floorcovering Installers Association at the Commercial II and Master II certification level.
- C. Fire-Test-Response Ratings: Where indicated, provide carpet [and carpet cushion] identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - a. Build mockups at locations to be determined by the architect in the field.
 - b. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with carpet manufacturer's installation recommendations and the Carpet and Rug Institute Installation Standard 2011 where applicable.

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1.7 FIELD CONDITIONS

- A. Comply with carpet manufacturer's installation recommendations and the Carpet and Rug Institute Standard 2011 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. HVAC system should be operational and running prior to carpet installation and should remain running after carpet installation.
- D. Do not install carpet over concrete slabs until slabs have cured, and are sufficiently dry to allow bond between adhesive and concrete, and Concrete slabs should have moisture and pH readings that are within specified tolerance of the adhesive to be used.
- E. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - a. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - b. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, dimensional stability, excess static discharge, loss of tuft bind strength, delamination, stain removal, colorfastness to light, and colorfastness to atmospheric contaminants.
 - c. Carpet and fiber must be manufactured and warrantied by same manufacturer.
 - d. Warranty Period: Ten Year Limited Commercial Warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET FLOOR (C1)

A. Provide carpet tile or sheet carpeting to match existing. Provide all accessories as needed. Verify existing carpet construction in the field.

2.2 TUFTED BROADLOOM SHEET CARPET (C2)

B. Basis-of-Design Product: Subject to compliance with requirements, provide Patcraft Opportunity Knocks CB I0162.

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- C. Source Limitations:
 - a. Single Source Responsibility: Provide products that have components manufactured by a single source, i.e. fiber and backing, as well as final carpet product, should be manufactured and warranted by same company.
- D. Product specification:
 - a. Pile Characteristics: Pattern Loop pile.
 - b. Color: New City 62502
 - c. Fiber Content: 100 percent trilobal nylon 6.
 - d. Fiber Name: Solution Q Nylon.
 - e. Dye Method: 100 percent solution dye.
 - f. Gauge: 1/10.
 - g. Stitches: 11.5.
 - h. Pile Thickness: 0.141 inch for finished carpet per ASTM D 6859.
 - i. Surface Pile Weight: 24 oz. /sq. yd.
 - j. Density: 6128 oz. /cu. yd.
 - k. Primary Backing: Woven synthetic.
 - 1. Secondary Backing: SBR latex laminated to a woven secondary.
 - m. Backing System: ClassicBac.
 - n. Width: 12 feet.
 - o. Applied Soil-Resistance Treatment: SSP Shaw Soil Protection.
 - p. Texture Appearance Retention Rating (T.A.R.R.): Moderate.
- E. Performance Characteristics: As follows:
 - a. Critical Radiant Flux Classification, Flooring Radiant Panel ASTM E 648: Not less than 0.45 W/sq. cm.
 - b. Smoke Density: Less than 450 per ASTM E 662.
 - c. Methanamine Pill Test CPSC FF1-70: Must pass pill test.
 - d. Tuft Bind: Not less than 6.25 lbf per ASTM D 1335.
 - e. Delamination: Not less than 2.5 lbf/in. per ASTM D 3936.
 - f. Colorfastness to Atmospheric Contaminants: Not less than 4, per AATCC 164.
 - g. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC 16, Option E.
 - h. Electrostatic Propensity: Less than 3.5 kV per AATCC 134.
 - i. Emissions: Provide carpet that complies with testing and product requirements of Carpet & Rug Institute's "Green Label Plus" program.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Trowelable Adhesives: Water-resistant, mildew-resistant, non-staining, premium grade type to suit products and subfloor conditions indicated, that complies with flammability requirements

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for installed broadloom sheet carpet and is recommended by carpet manufacturer for installation.

- a. Basis of design product: Shaw 1000 or Shaw 1200 where slab moisture does not exceed 85 percent per ASTM F 2170 or 5 lbs per ASTM F 1869. Where moisture does not exceed 85 percent and anti-microbial protection is required, use the Shaw 1036 adhesive, or available equivalent. Where moisture exceeds 85 percent or 5 lbs but does not exceed 90 percent or 8 lbs, use Shaw 6300 Indoor Outdoor Adhesive or available equivalent.
- b. Use adhesives with VOC content not more than 50 g/L when calculated accord.ng to 40 CFR 59, Subpart D (EPA Method 24).
- c. Use adhesives that comply with the product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- d. Adhesives shall comply with the testing ad product requirements of the carpet and Rug Institute Green Label Plus Program.
- C. Tackless Carpet Stripping (Where a Stretch in Installation is Required): Water-resistant plywood, in strips as required to match cushion thickness and that comply with manufacturer's modular carpet installation guidelines and/or Carpet and Rug Institute Installation Standard 2100 where applicable.
- D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams. Seal seams using a premium grade seam sealer such as the Shaw 4000.
- E. Transition / Edge Strips: See section 096513.13

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects prior to installation See manufacturer's requirements for substrate conditions and ambient conditions.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - a. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet cushion manufacturer.

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- b. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- c. Provide primer as required by the manufacturer for Lightweight concrete and gypcrete subfloors to reduce surface porosity.
- d. Provide self-leveling compound as needed to provide an acceptable substrate.
- C. For wood subfloors, verify the following:
 - a. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
 - b. Unfinished wood should be primed using a liquid latex primer, such as Shaw 9050 or as recommended by the manufacturer.
- D. For Painted Subfloors: Verify the following:
- E. Perform bond test recommended in writing by adhesive manufacturer.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with Carpet and Rug Institute Installation Standard 2011, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds containing a cementitious base with a latex additive, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet cushion manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

- A. Comply with Carpet and Rug Institute Installation Standard 2011.
- B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.

- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.
- G. Install pattern parallel to walls and borders to comply with Carpet and Rug Institute Installation Standard 2011, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
 - a. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - b. Remove yarns that protrude from carpet surface.
 - c. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with the latest Carpet and Rug Institute Installation Standard, "Protecting Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.
- D. Contractor shall provide professional commercial carpet cleaning service for the entire building at Substantial Completion. Notify and coordinate with the architect and the District prior to scheduling such service.

END OF SECTION 096816

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Galvanized metal.
 - 2. Ferrous metal.
 - 3. Gypsum board.
 - 4. Stucco/Plaster.

B. Scope of work:

- 1. Contractor shall paint all factory primed products including but not limited to doors, frames, access panels, etc.
- 2. Contractor shall paint all new work that is exposed to view including but not limited to drywall, conduits, galvanized surface, etc.. Do not paint factory finished product, labels, tags, etc.
- 3. Schedule: Contractor shall submit a paint schedule indicating all of the paint systems that will be used for the project. Contractor shall submit paint systems for substrates that are not specified in the contract document but required to complete the project. Contractor shall also verify the compatibility of the products against the substrate and each other.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.
- C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

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- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 - 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

- A. District Standard Manufacturer: Dunn-Edwards.
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with SCAQMD and the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Flat Paints, Coatings, and Primers: VOC content of not more than 5 g/L or less.
 - 2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 5 g/L or less.
 - 3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 5 g/L or less.
 - 4. Floor Coatings: VOC not more than 5 g/L or less.
 - 5. Shellacs, Clear: VOC not more than 5 g/L or less.
 - 6. Shellacs, Pigmented: VOC not more than 5 g/L or less.
 - 7. Flat Topcoat Paints: VOC content of not more than 5 g/L or less.
 - 8. Nonflat Topcoat Paints: VOC content of not more than 5 g/L or less.
 - 9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 5 g/L or less.

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- 10. Floor Coatings: VOC not more than 5 g/L or less.
- 11. Shellacs, Clear: VOC not more than 5 g/L or less.
- 12. Shellacs, Pigmented: VOC not more than 5 g/L or less.
- 13. Primers, Sealers, and Undercoaters: VOC content of not more than 5 g/L or less.
- 14. Dry-Fog Coatings: VOC content of not more than 5 g/L or less.
- 15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 5 g/L or less.
- 16. Pre-Treatment Wash Primers: VOC content of not more than 5 g/L or less.
- D. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.
 - j. 1,2-dichlorobenzene.
 - k. Diethyl phthalate.
 - l. Dimethyl phthalate.
 - m. Ethylbenzene.
 - n. Formaldehyde.
 - o. Hexavalent chromium.
 - p. Isophorone.
 - q. Lead.
 - r. Mercury.
 - s. Methyl ethyl ketone.
 - t. Methyl isobutyl ketone.
 - u. Methylene chloride.
 - v. Naphthalene.
 - w. Toluene (methylbenzene).
 - x. 1,1,1-trichloroethane.
 - y. Vinyl chloride.
- E. Colors: As selected by Architect from manufacturer's full range. Provide custom color as requested by the Architect.

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- F. Low-Emitting Materials: Interior paints and coating shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- G. Colorants: The use of colorants containing hazardous chemicals, such as ethylene glycol, is prohibited.

2.2 DRYWALL, STUCCO AND PLASTER PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: Dunn-Edwards, Vinylastic Select Low Odor Zero VOC VNSL00-1, MPI #50.

2.3 METAL PRIMERS

- A. Rust-Inhibitive Primer (Water Based) for Ferrous Metal: Dunn-Edwards, Bloc-Rust Premium BRPR001-1 Series, MPI #107.
- B. Waterborne Galvanized and Non-Ferrous Metal Primer: Dunn-Edwards, Ultra-Grip Premium UGPR00-1, MPI #134.

2.4 LATEX PAINTS

- A. Interior Latex Institutional (Flat): Dunn-Edwards, Everest EVER10, MPI #143 X-Green (Gloss Level 1).
- B. Interior Latex Institutional (Eggshell): Dunn-Edwards, Everest EVER30, MPI #154 X-Green (Gloss Level 3).
- C. Interior Latex Institutional (Semigloss): Dunn-Edwards, Everest EVER50, MPI #147 X-Green (Gloss Level 5).
- D. Interior Latex 100% Acrylic (Gloss): Dunn-Edwards, Evershield EVSH60, MPI #154 (Gloss Level 6).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.	
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- 2. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Comply with the Surface Preparation Standards published by the Society for Protective Coatings (SSPC).
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:
 - 1. Mechanical Work:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Tanks that do not have factory-applied final finishes.
 - e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
 - 2. Electrical Work:
 - a. Switchgear.

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- b. Panelboards.
- c. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- F. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- G. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE

- A. Ferrous Metal Substrates:
 - 1. Latex Over Waterborne Primer System: MPI INT 5.3J.
 - a. Prime Coat: Rust-Inhibitive Primer
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (semigloss).
- B. Galvanized-Metal Substrates:
 - 1. Latex Over Waterborne Primer System: MPI INT 5.3J.
 - a. Prime Coat: Waterborne galvanized-metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (semigloss).
- C. Gypsum Board Substrates:
 - 1. Latex System: MPI INT 9.2A.
 - a. Prime Coat: Interior latex drywall primer/sealer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (flat).
- D. Plaster Substrates:
 - 1. Latex System: MPI INT 9.2A.
 - a. Prime Coat: Interior latex stucco/plaster primer/sealer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (flat).

END OF SECTION 099123

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SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Public-use washroom accessories.
 - 2. Underlavatory guards.
 - 3. Custodial accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify products using designations indicated.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. All items are subject to the District's and the architect's approval. The contractor shall obtain the latest District standards prior to ordering.

1.5 WARRANTY

- A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

- A. Basis-of-Design Manufacturer: Bobrick Washroom Equipment, Inc.
- B. Toilet Tissue (Roll) Dispenser T1:
 - 1. Basis-of-Design Product: Bobrick B-2888.
 - 2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
 - 3. Mounting: Surface mounted.
 - 4. Operation: Noncontrol delivery with theft-resistant spindle.
 - 5. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
 - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
- C. Paper Towel (Folded) Dispenser and Waste Receptacle T8:
 - 1. Basis-of-Design Product: Bobrick B-380349.
 - 2. Mounting: Surface mounted.
 - 3. Minimum Capacity: 200 C-fold paper towel.
 - 4. Material and Finish: Stainless steel, No. 4 finish (satin).
 - 5. Lockset: Tumbler type.
 - 6. Refill Indicators: Pierced slots at sides or front.
- D. Combination Seat Cover, Toilet Tissue Dispenser, and Sanitary Napkin Disposal T9:
 - 1. Basis-of-Design Product: Bobrick B-3579.
 - 2. Description: Combination unit for dispensing Toilet Tissue and Toilet Seat Cover .
 - 3. Mounting: Surface mounted .
 - 4. Minimum Seat Cover -Dispenser Capacity: 500 single or half fold paper covers.
 - 5. Minimum Toilet Tissue Dispenser Capacity: 2-standard core toilet tissue rolls up to 5 1/4".
- E. Liquid-Soap Dispenser T7:
 - 1. Basis-of-Design Product: Bobrick B2111.
 - 2. Description: Designed for dispensing soap in liquid or lotion form.
 - 3. Mounting: Vertically oriented, surface mounted.
 - 4. Capacity: 40 oz..
 - 5. Materials: Valve shall be black molded plastic push button. Container shall be 22-gauge stainless steel with satin finish.
 - 6. Lockset: Tumbler type.
 - 7. Refill Indicator: Window type.
- F. Grab Bar T3:
 - 1. Basis-of-Design Product: Bobrick B5806.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch thick.

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- a. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area.
- 4. Outside Diameter: 1-1/4 inches.
- 5. Configuration and Length: As indicated on Drawings .
- G. Sanitary-Napkin Disposal Unit T5:
 - 1. Basis-of-Design Product: Bobrick B-270.
 - 2. Mounting: Surface mounted.
 - 3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
 - 4. Receptacle: Removable.
 - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
- H. Seat-Cover Dispenser T4:
 - 1. Basis-of-Design Product: Bobrick B-221.
 - 2. Mounting: Surface mounted.
 - 3. Minimum Capacity: 250 seat covers.
 - 4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
 - 5. Lockset: Tumbler type.
- I. Mirror Unit T6:
 - 1. Basis-of-Design Product: Bobrick B-290.
 - 2. Frame: Stainless-steel angle, 0.05 inch thick.
 - a. Corners: Mitered and mechanically interlocked.
 - 3. Integral Shelf: 5 inches deep.
 - 4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
 - a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
 - b. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
 - 5. Size: As indicated on Drawings.

2.2 UNDERLAVATORY GUARDS

- A. Basis-of-Design Manufacturer: Truebro by IPS Corporation.
- B. Underlavatory Guard:
 - 1. Basis-of-Design Product: Truebro LAV GUARD2 E-Z.

Toilet Accessories

- 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
- 3. Material and Finish: Antimicrobial, molded plastic, white.

2.3 CUSTODIAL ACCESSORIES

- A. Basis-of-Design Manufacturer: Bobrick Washroom Equipment, Inc.
- B. Mop and Broom Holder:
 - 1. Basis-of-Design Product: Bobrick B-224.
 - 2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
 - 3. Length: 36 inches.
 - 4. Hooks: Three.
 - 5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
 - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
 - b. Rod: Approximately 1/4-inch- diameter stainless steel..

2.4 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.
- C. Install accessories at height in compliance with ADA, CBC and DSA requirements.

END OF SECTION 102800

Toilet Accessories

SECTION 23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following hangers and supports for HVAC system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Equipment supports.

1.02 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

PERFORMANCE REQUIREMENTS 1.03

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.04 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
 - Trapeze pipe hangers. Include Product Data for components.
 Metal framing systems. Include Product Data for components.

 - 6. Pipe stands. Include Product Data for components.
 - 7. Equipment supports.
- B. Welding certificates.

1.05 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.4. "Structural Welding Code--Reinforcing Steel."
 - ASME Boiler and Pressure Vessel Code: Section IX.

Hangers and Supports for HVAC Piping and Equipment

PART 2 - PRODUCTS

2.01 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Or equal.
- C. Galvanized, Metallic Coatings: Pre-galvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.03 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries.
 - 2. Or equal.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.04 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. ERICO/Michigan Hanger Co.
 - 2. Or equal.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- 2.05 PIPE STAND FABRICATION
 - A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosionresistant components to support roof-mounted piping.
- 2.06 EQUIPMENT SUPPORTS
 - A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.
- 2.07 MISCELLANEOUS MATERIALS
 - A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-

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center closure for hanger installation before pipe erection.

- 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
- 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
- 8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.
- 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.
- 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.
- 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
- 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
- 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
- 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
- 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
- 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
- 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
- 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
- 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system

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Sections, install the following types:

- 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
- 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
- 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
- 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
- 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
- 6. C-Clamps (MSS Type 23): For structural shapes.
- 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
- 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.
- 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
- 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
 - 4. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use mechanical-expansion anchors instead of building attachments where required in concrete

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construction. Obtain approval from Architect or Structural Engineer.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

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- N. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood inserts.
 - 6. Insert Material: Length at least as long as protective shield.
 - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

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3.05 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 93 TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.

1.02 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. TAB: Testing, adjusting, and balancing.
- C. TABB: Testing, Adjusting, and Balancing Bureau.
- D. TAB Subcontractor: An entity engaged by the Contractor to perform TAB Work.

1.03 SUBMITTALS

- A. Qualification Data: Within 15 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.04 QUALITY ASSURANCE

- A. Perform work in accordance with ASHRAE Standard 202, Guideline 0 and Title 24.
- B. TAB Contractor Qualifications: Engage a TAB entity certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC as a

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TAB technician.

- C. TAB Conference: Meet with University's Representative on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.
 - 1. Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plans.
 - c. Coordination and cooperation of trades and subcontractors.
 - d. Coordination of documentation and communication flow.
- D. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- E. TAB Report Forms: Use standard TAB contractor's forms approved by University's Representative.
- F. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.05 PROJECT CONDITIONS

- A. Full Occupancy: University will occupy the site and existing building during entire TAB period. Cooperate with University's Representative during TAB operations to minimize conflicts with University's operations.
- B. Partial Occupancy: University may occupy completed areas of building before Substantial Completion. Cooperate with University's Representative during TAB operations to minimize conflicts with University's operations.

1.06 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
 - B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermome

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ter wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

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- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in ASHRAE 111 and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
 - 1. Comply with requirements in ASHRAE 62.1-2010, Section 7.2.2, "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.

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- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Division 15 Section "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
 - 4. Measure static pressures entering and leaving other devices, such as sound traps, heatrecovery equipment, and air washers, under final balanced conditions.
 - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 - 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fanmotor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

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- 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
 - 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 - 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.06 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus, or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus, or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus, or minus 10 percent.
 - 4. Cooling-Water Flow Rate: Plus, or minus 10 percent.

3.07 REPORTING

- A. Contract Documents Examination Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.08 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Pump curves.
 - 2. Fan curves.
 - 3. Manufacturers' test data.
 - 4. Field test reports prepared by system and equipment installers.
 - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.

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- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB contractor.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB supervisor who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 - 12. Nomenclature sheets for each item of equipment.
 - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
 - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
 - 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
 - 1. Quantities of outdoor, supply, return, and exhaust airflows.
 - 2. Water and steam flow rates.
 - 3. Duct, outlet, and inlet sizes.
 - 4. Pipe and valve sizes and locations.
 - 5. Terminal units.
 - 6. Balancing stations.
 - 7. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - j. Number, make, and size of belts.

- k. Number, type, and size of filters.
- 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- 3. Test Data (Indicated and Actual Values):
 - a. Total air flow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.
 - i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - I. Return-air damper position.
 - m. Vortex damper position.
- F. Apparatus-Coil Test Reports:
 - 1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft.
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
 - 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Entering-water temperature in deg F.
 - i. Leaving-water temperature in deg F.
 - j. Refrigerant expansion valve and refrigerant types.
 - k. Refrigerant suction pressure in psig.
 - I. Refrigerant suction temperature in deg F.
- G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

- 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave, and number of adjustments in inches.
- 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and number of adjustments in inches.
 - g. Number, make, and size of belts.
- 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- H. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.d. Duct static pressure in inches wg.

 - e. Duct size in inches.
 - f. Duct area in sq. ft.
 - g. Indicated air flow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual air flow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
 - I. Seal type.
- Instrument Calibration Reports: Ι.
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.09 INSPECTIONS

- A. Initial Inspection:
 - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
 - 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - c. Verify that balancing devices are marked with final balance position.
 - d. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:
 - 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by University's Representative.
 - 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of University's Representative.
 - 3. University's Representative shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
 - 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 - 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
 - 1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, University may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.10 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

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SECTION 23 07 13 DUCT INSULATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Outdoor, concealed supply and return.
 - 6. Outdoor, exposed supply and return.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.
- 1.03 INFORMATIONAL SUBMITTALS
 - A. Field quality-control reports.

PART 2 - PRODUCTS

- 2.01 PERFORMANCE REQUIREMENTS
 - A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
 - 1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.02 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Ducts in unconditioned and indirectly conditioned spaces as described by California Title 24 code -All supply and return air ducts located outdoors; or in a space between the roof and an insulated ceiling; or in a space directly under a roof with fixed vents or openings to the out
doors or unconditioned spaces; or in an unconditioned crawl space; or in other unconditioned spaces shall be insulated as follows.

- D. Liner used for ducts in unconditioned and indirectly conditioned spaces shall be 2" thick (minimum "R" value = 8). Duct dimensions shown are net clear inside dimensions after liner has been installed. Fiberglass mat faced duct liner shall be Johns Manville Permacote Linacoustic per industry standard ASTM C-1071. Flame spread not over 25, fuel contributed and smoke developed not over 50. Installation shall be per manufacturer recommendations document AHS-197 dtd 9-04. Supply and return air plenums for rooftop package units shall also have this type duct liner.
- E. Thermal duct wrap: All supply and return ductwork in unconditioned and indirectly conditioned spaces, not specified to be lined shall be insulated with foil back fiberglass blanket 3/4 lb. density, type 75. Ductwork insulation shall be 3" thick. Wrap shall be Johns Manville Microlite XG, FSK wrap, formaldehyde free. Flame spread not over 25, fuel contributed and smoke developed not over 50. Minimum "R" value = 8. Installation shall be per manufacturer recommendations document AHS-197 dtd 9-04.
- F. All supply and return air ducts located in conditioned spaces as described by California Title 24 code shall be insulated as follows.
- G. Liner used for ducts in conditioned spaces shall be 1.5" thick (minimum "R" value = 4.2). Duct dimensions shown are net clear inside dimensions after liner has been installed. Fiberglass mat faced duct liner shall be Johns Manville Permacote Linacoustic per industry standard ASTM C-1071. Flame spread not over 25, fuel contributed and smoke developed not over 50. Installation shall be per manufacturer recommendations document AHS-197 dtd 9-04. Supply and return air ducts installed in conditioned spaces exposed to view shall have this type of liner unless otherwise noted.
- H. Thermal duct wrap: All supply and return ductwork in conditioned spaces, not specified to be lined shall be insulated with foil back fiberglass blanket 3/4 lb. density,. Ductwork insulation shall be 1.5" thick. Wrap shall be Johns Manville Microlite XG, FSK wrap, formaldehyde free. Flame spread not over - 25, fuel contributed and smoke developed not over 50. Minimum "R" value = 4.2. Installation shall be per manufacturer recommendations document AHS-197 dtd 9-04.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Cut insulation in a manner to avoid compressing insulation.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect and , by removing field-applied jacket and insulation in layers in reverse order of their installation.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.04 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Outdoor, concealed supply and return.
 - 6. Outdoor, exposed supply and return.
- B. Items Not Insulated:
 - 1. Metal ducts with duct liner.
 - 2. Factory-insulated flexible ducts.

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- 3. Flexible connectors.
- Vibration-control devices.
 Factory-insulated access panels and doors.

END OF SECTION

SECTION 23 31 13 METAL DUCTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Duct liner.
 - 5. Sealants and gaskets.
 - 6. Hangers and supports.
- B. Related Sections:
 - 1. Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.

1.02 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

1.03 SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.

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- 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
- 12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
- C. Delegated-Design Submittal:
 - 1. Sheet metal thicknesses.
 - 2. Joint and seam construction and sealing.
 - 3. Reinforcement details and spacing.
 - 4. Materials, fabrication, assembly, and spacing of hangers and supports.
 - 5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.
- D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- E. Field quality-control reports.

1.04 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007, Section 6.4.4 "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct

Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-1, "Seams Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

A. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.04 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
 - 2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
 - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."
 - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 - 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 - 3. Butt transverse joints without gaps, and coat joint with adhesive.
 - 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 - 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 - 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 - 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have

either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

- a. Fan discharges.
- b. Intervals of lined duct preceding unlined duct.
- c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
- 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
- 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.05 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 4 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Service: Indoor or outdoor.
 - 8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.

Education Center Auditorium Modernization Pomona Office of Education Center 800 S Garey Avenue, Pomona, CA 91766 Metal Ducts

- 3. Grade: NS.
- 4. Class: 25.
- 5. Use: O.
- 6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
 - 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
 - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electro-galvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.07 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2. Ductmate Industries, Inc.
 - 3. Hilti Corp.
 - 4. Kinetics Noise Control.
 - 5. Loos & Co.; Cableware Division.
 - 6. Mason Industries.
 - 7. TOLCO; a brand of NIBCO INC.

- 8. Unistrut Corporation; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service or an agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmiumplated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

- 3.01 DUCT INSTALLATION
 - A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
 - B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
 - C. Install round and flat-oval ducts in maximum practical lengths.
 - D. Install ducts with fewest possible joints.
 - E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
 - F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
 - G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
 - H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
 - I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 15 Section "Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.02 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class C.
 - 4. Outdoor, Return-Air Ducts: Seal Class C.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class C.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class B.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.04 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 4, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.05 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 15 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - b. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
 - c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct

sections[, selected by Architect from sections installed,] totaling no less than 100 percent of total installed duct area for each designated pressure class.

- d. Exhaust Ducts with a Pressure Class of 2-Inch or Higher: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
- e. Outdoor Air Ducts with a Pressure Class of 2-Inch or Higher: Test representative duct sections, selected by Engineer from sections installed, totaling no less than 100 percent of total installed duct area for each designated pressure class.
- 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- 4. Test for leaks before applying external insulation.
- 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
- 6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - Test sections of metal duct system, chosen randomly by District's representative, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.07 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 15 Section "Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive

assemblies.

- 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
- 4. Coils and related components.
- 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
- 6. Supply-air ducts, dampers, actuators, and turning vanes.
- 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 - 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - 6. Provide drainage and cleanup for wash-down procedures.
 - 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.08 START UP

- A. Air Balance: Comply with requirements in Division 15 Section "Testing, Adjusting, and Balancing."
- 3.09 DUCT SCHEDULE
 - A. Supply Ducts:
 - 1. Ducts Connected to Heat Pumps:
 - a. Pressure Class: Positive 1-inch wg or 1.25 times the equipment external static pressure, whichever is greater.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 2-inch wg or 1.25 times the equipment external static pressure, whichever is greater.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 - 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg or 1.25 times the equipment external static

pressure, whichever is greater.

- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 3.
- d. SMACNA Leakage Class for Round and Flat Oval: 3.
- 4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg or 1.25 times the equipment external static pressure, whichever is greater.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- B. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 1-inch.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 12.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 3.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- C. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Velocity 1000 fpm or Lower:
 - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
 - 2) Mitered Type RE 4 without vanes.
 - b. Velocity 1000 to 1500 fpm:
 - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
 - Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
 - c. Velocity 1500 fpm or Higher:
 - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

- 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
- 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90degree elbow.
 - Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - a. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- D. Branch Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-6, "Branch Connections."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.

END OF SECTION

SECTION 23 33 00 DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Combination fire and smoke dampers.
 - 4. Flange connectors.
 - 5. Turning vanes.
 - 6. Flexible connectors.
 - 7. Flexible ducts.
 - 8. Duct accessory hardware.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Duct security bars.
 - f. Wiring Diagrams: For power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.03 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

1.04 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.
- D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: Comply with ASTM B 22, Alloy 6063, Temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff; a division of PCI Industries, Inc.
 - 3. Ruskin Company.
- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 3000 fpm.
- D. Maximum System Pressure: 2-inch wg.
- E. Frame: 0.052-inch-thick, galvanized sheet steel, with welded corners and mounting flange.
- F. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch width, 0.025-inch-thick, roll-formed aluminum with sealed edges.
- G. Blade Action: Parallel.

- H. Blade Seals: Felt.
- I. Blade Axles:
 - 1. Material: Nonferrous metal.
 - 2. Diameter: 0.20 inch.
- J. Tie Bars and Brackets: Aluminum.
- K. Return Spring: Adjustable tension.
- L. Bearings: Steel ball or synthetic pivot bushings.
- M. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators.
 - 4. Chain pulls.
 - 5. Screen Mounting: Rear mounted.
 - 6. Screen Material: Galvanized steel.
 - 7. Screen Type: Bird.
 - 8. 90-degree stops.

2.03 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGill AirFlow LLC.
 - b. Nailor Industries Inc.
 - c. Pottorff; a division of PCI Industries, Inc.
 - d. Ruskin Company.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Bearings:
 - a. Stainless-steel sleeve.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Tie Bars and Brackets: Galvanized steel.

- B. Low-Leakage, Steel, Manual Volume Dampers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. McGill AirFlow LLC.
 - b. Nailor Industries Inc.
 - c. Pottorff; a division of PCI Industries, Inc.
 - d. Ruskin Company.
 - 2. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Hat shaped.
 - b. Galvanized-steel channels, 0.064 inch thick.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.064 inch thick.
 - 6. Blade Axles: Stainless steel.
 - 7. Bearings:
 - a. Stainless-steel sleeve.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 8. Blade Seals: Neoprene.
 - 9. Jamb Seals: Cambered stainless steel.
 - 10. Tie Bars and Brackets: Galvanized steel.
 - 11. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Nailor Industries Inc.
 - 3. Pottorff; a division of PCI Industries, Inc.
 - 4. Ruskin Company.
- B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 4000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

- F. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.
- G. Smoke Detector: Integral, factory wired for single-point connection.
- H. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.
- I. Leakage: Class I.
- J. Rated pressure and velocity to exceed design airflow conditions.
- K. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- L. Master control panel for use in dynamic smoke-management systems.
- M. Damper Motors: Modulating or two-position action.
- N. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for Plumbing and HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 16 Sections.
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 - Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 - 6. Non-spring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- O. Accessories:
 - 1. Auxiliary switches for signaling fan control or position indication.
 - 2. Test and reset switches, damper mounted.

2.05 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.06 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. METALAIRE, Inc.
 - 4. SEMCO Incorporated.
 - 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
- E. Vane Construction: Double wall.

2.07 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

- 1. Minimum Weight: 24 oz./sq. yd.
- 2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
- 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.08 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Casco, C.A. Schroeder, Inc.
 - 2. Flexmaster U.S.A., Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, spun-bonded nonwoven nylon fabric mechanically locked (no adhesive) to helically wound spring steel wire; fibrous-glass insulation; UL rated Class 1 metalized polyester vapor barrier sleeve.
 - 1. Pressure Rating: 2-inch wg positive and 1/2-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 200 deg F.
 - 4. Insulation R-value: Comply with 2010 CEC.
 - 5. Maximum length: 6 ft.
- C. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a wormgear action in sizes 3 through 18 inches, to suit duct size.

2.09 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construc

tion Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install flexible connectors to connect ducts to equipment.
- H. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- I. Connect diffusers or light troffer boots to ducts[directly or] with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- J. Connect flexible ducts to metal ducts with draw bands adhesive plus sheet metal screws.
- K. Install duct test holes where required for testing and balancing purposes.
- L. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.02 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.
 - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 33 10 HVAC AIR-DISTRIBUTION SYSTEM CLEANING & SEALING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes cleaning HVAC air-distribution equipment, ducts, plenums, and system components.

1.02 DEFINITIONS

- A. ASCS: Air systems cleaning specialist.
- B. NADCA: National Air Duct Cleaners Association.
- C. SMACNA Standards as used in this specification means the HVAC Duct Construction Standards, Metal and Flexible
- D. Seal or Sealing: Use of liquid or mastic sealant, with or without compatible tape overlay, or gasketing of flanged joints, to keep air leakage at duct joints, seams, and connections to an acceptable minimum.
- E. Duct Sealing, Air Leakage Criteria, and Air Leakage Tests: Ducts shall be sealed as per duct sealing requirements of SMACNA HVAC Air Duct Leakage Test Manual for duct pressure classes
- F. Duct Pressure Classification: SMACNA HVAC Duct Construction Standards, Metal and Flexible.
- G. Exposed Duct: Exposed to view in a finished room or exposed to weather.

1.03 SUBMITTALS

- A. Qualification Data: For an ASCS.
- B. Strategies and procedures plan.
- C. Cleanliness verification report.

1.04 QUALITY ASSURANCE

- A. ASCS Qualifications: A certified member of NADCA.
 - 1. Certification: Employ an ASCS certified by NADCA on a full-time basis.
 - 2. Supervisor Qualifications: Certified as an ASCS by NADCA.
- B. UL Compliance: Comply with UL 181 and UL 181A for fibrous-glass ducts.
- C. Cleaning Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to HVAC air-distribution system cleaning

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including, but not limited to, review of the cleaning strategies and procedures plan.

PART 2 - PRODUCTS

- 2.01 DUCT MATERIALS AND SEALANTS
 - A. General: Except for systems specified otherwise, construct ducts, casings, and accessories of galvanized sheet steel, ASTM A653, coating G90; or, aluminum sheet, ASTM B209, alloy 1100, 3003 or 5052.
 - B. Specified Corrosion Resistant Systems: Stainless steel sheet, ASTM A167, Class 302 or 304, Condition A (annealed) Finish No. 4 for exposed ducts and Finish No. 2B for concealed duct or ducts located in mechanical rooms.
 - C. Joint Sealing: Refer to SMACNA HVAC Duct Construction Standards.
 - Sealant: Elastomeric compound, gun or brush grade, maximum 25 flame spread, and 50 smoke developed (dry state) compounded specifically for sealing ductwork as recommended by the manufacturer. Generally, provide liquid sealant, with or without compatible tape, for low clearance slip joints and heavy, permanently elastic, mastic type where clearances are larger. Oil base caulking and glazing compounds are not acceptable because they do not retain elasticity and bond.
 - 2. Tape: Use only tape specifically designated by the sealant manufacturer and apply only over wet sealant. Pressure sensitive tape shall not be used on bare metal or on dry sealant.
 - 3. Gaskets in Flanged Joints: Soft neoprene.
 - D. Approved factory-made joints may be used.

2.02 DUCT LINER (Where REQUIRED)

- A. Duct liner is only permitted to be used for supply and return ducts. Duct liner is not permitted for outside air ducts.
- B. Rectangular Duct or Casing Liner: ASTM C1071, Type I (flexible), or Type II (board), 25 mm (one inch) minimum thickness, applied with mechanical fasteners and 100 percent coverage of adhesive in conformance with SMACNA, Duct Liner Application Standard.
- C. Round Liner: Factory fabricated double-walled with one inch-thick thru two inch-thick sound insulation liner. Construction shall comply with flame and smoke rating required by NFPA 90A. Assemblies shall be complete with continuous sheet Mylar liner, 2 mil thickness, between the perforated liner and the insulation to prevent erosion of the insulation. Provide liner couplings/spacer for metal liner. At the end of insulated sections, provide insulation end fittings to reduce outer shell to liner size. Provide liner spacing/concentricity leaving airway unobstructed

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Examine HVAC air-distribution equipment, ducts, plenums, and system components to determine appropriate methods, tools, and equipment required for performance of the Work.
 - B. Perform "Project Evaluation and Recommendation" according to NADCA ACR 2021.

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- C. Prepare written report listing conditions detrimental to performance of the Work.
- D. Comply with provisions of Section 23 05 11, COMMON WORK RESULTS FOR HVAC, particularly regarding coordination with other trades and work in existing buildings.
- E. Fabricate and install ductwork and accessories in accordance with referenced SMACNA Standards
- F. Proceed with work only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare a written plan that includes strategies and step-by-step procedures. At a minimum, include the following:
 - 1. Supervisor contact information.
 - 2. Work schedule including location, times, and impact on occupied areas.
 - 3. Methods and materials planned for each HVAC component type.
 - 4. Required support from other trades.
 - 5. Equipment and material storage requirements.
 - 6. Exhaust equipment setup locations.
- B. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.
- C. Use the existing service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry and for inspection.
- D. Comply with NADCA ACR 2021, "Guidelines for Constructing Service Openings in HVAC Systems" Section.
- E. CLEANING
- F. Comply with NADCA ACR 2021.
- G. Remove visible surface contaminants and deposits from within the HVAC system.
- H. Systems and Components to Be Cleaned:
 - 1. Air devices for supply and return air.
 - 2. Air-terminal units.
 - 3. Ductwork:
 - a. Supply-air ducts, including turning vanes, to the air-handling unit.
 - b. Return-air ducts to the air-handling unit.
 - c. Exhaust-air ducts.

- I. Collect debris removed during cleaning. Ensure that debris is not dispersed outside the HVAC system during the cleaning process.
- J. Particulate Collection:
 - 1. For particulate collection equipment, include adequate filtration to contain debris removed. Locate equipment downwind and away from all air intakes and other points of entry into the building.
 - 2. HEPA filtration with 99.97 percent collection efficiency for particles sized 0.3 micrometer or larger shall be used where the particulate collection equipment is exhausting inside the building,
- K. Control odors and mist vapors during the cleaning and restoration process.
- L. Mark the position of manual volume dampers and air-directional mechanical devices inside the system prior to cleaning. Restore them to their marked position on completion of cleaning.
- M. System components shall be cleaned so that all HVAC system components are visibly clean. On completion, all components must be returned to those settings recorded just prior to cleaning operations.
- N. Clean all air-distribution devices, registers, grilles, and diffusers.
- O. Clean visible surface contamination deposits according to NADCA ACR 2021 and the following:
 - 1. Clean air-handling units, airstream surfaces, components, condensate collectors, and drains.
 - 2. Ensure that a suitable operative drainage system is in place prior to beginning wash-down procedures.
 - 3. Clean evaporator coils, reheat coils, and other airstream components.
- P. Duct Systems:
 - 1. Create service openings in the HVAC system as necessary to accommodate cleaning.
 - 2. Mechanically clean duct systems specified to remove all visible contaminants so that the systems can pass the HVAC System Cleanliness Tests (see NADCA ACR 2021).
- Q. Debris removed from the HVAC system shall be disposed of according to applicable Federal, state, and local requirements.
- R. Mechanical Cleaning Methodology:
 - Source-Removal Cleaning Methods: The HVAC system shall be cleaned using sourceremoval mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.
 - a. Use continuously operating vacuum-collection devices to keep each section being

cleaned under negative pressure.

- b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials such as duct and plenum liners.
- 2. Cleaning Mineral-Fiber Insulation Components:
 - a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR 2021.
 - b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests (see NADCA ACR 2021).
 - c. Fibrous materials that become wet shall be discarded and replaced.
- S. All existing ductwork served by fans and all AHU (all areas served by the AHU units) shall be Inspected and cleaned. Ducts are in service for a long-extended period with heavy buildup of dirt & deterioration of internal fiber glass liner from light to moderate conditions. This scope shall include thoroughly cleaning the fiberglass duct liner using brushes and vacuums, repair and replace any small rips or tears encountered and then fully encapsulate it with design polymerics dp-2510. The coating shall completely seal the fiberglass and help prevent the release of loose fiberglass fibers into air flow. Any extensive damaged or loose liners shall be replaced with new. This shall be field verified and confirmed.
- T. Some of the ductwork may be wrapped with insulation on the exterior, all ducts shall be cleaned by thoroughly brushing and vacuuming all interior surfaces. This shall be done using HEPA filtered collection vacuums. This method of cleaning shall ensure that all dust and dirt is removed, the HEPA filtered vacuums shall prevent any of the contaminants in the systems from being blown into the building spaces during cleaning process.
- U. Access points shall be cut into the rigid metal ducts as necessary to completely access the interior for cleaning.
- V. All access holes made in metal ducts shall be sealed with galvanized sheet metal panels of the same gauge as the ducts. Panels shall be installed using duct sealer and self-tapping screws placed a maximum of four inches apart around the entire perimeter. The panel shall overlap the access opening by at least one inch on all edges. Caulking shall be neat and continuous around the perimeter. All surfaces to be caulked shall be clean of any dirt, rust, etc., that would affect sealing.
- W. Access panels installed in lined metal duct shall have reflectix insulation attached with adhesive and/or pins. All raw edges shall be sealed to prevent fiber liberation.
- X. All interior dampers and turning vanes shall be thoroughly cleaned with a stiff-bristled brush and vacuuming. All manual dampers shall have their setting marked before cleaning by HVAC contractor and shall be reset to original setting after cleaning. Any broken/damaged dampers shall be replaced with new.
- Y. All work shall be supervised by a foreman having thorough knowledge and experience in cleaning air conditioning systems. The work shall be performed by experienced and qualified personnel in accordance with standards and guidelines as set by the national air duct cleaners association (NADCA) and CAL/OSHA.

- Z. Labor and materials: contractor shall furnish all labor, materials, supplies, tools, equipment, supervision, transportation and any other services or items necessary to accomplish the work
- AA. Existing services: the existing heating, ventilating and air conditioning systems shall be maintained to all occupied areas during the normal working week, this shall be coordinated with HVAC contractor & College.
- BB. Cleaning of premises: contractor shall keep the job site clean of all surplus materials and debris and shall dispose of all debris and leave area broom clean at the end of each work shift. Work shall be done at hours convenient to the district (day & night shift/afterhours/weekends/holidays) so as not to interfere with existing operation.
- CC. As necessary, furnishings and equipment shall be protected with plastic tarps where work is being performed.
- DD. Upon completion of cleaning, every interior surface shall be cleaned to a point where it is visibly free of accumulated debris and dust. Provide certification of duct cleaning, duct sealing and leakage tests. Submit a post-project report outlining scope of work, and which will include photographic documentation of the work that was performed.
- EE. The work while in progress will be subject to inspections by a representative of the College to confirm and ensure that the work is being done according to specifications and requirements.
- FF. Any mechanical problems discovered during cleaning shall be reported in writing to College representative.
- GG.Antimicrobial Agents, Coatings, and Sanitizers:
 - 1. Apply antimicrobial agents, coatings, and sanitizers if active fungal growth is reasonably suspected or where unacceptable levels of fungal contamination have been verified. Apply antimicrobial agents and coatings according to manufacturer's written recommendations and EPA registration listing after the removal of surface deposits and debris.
 - 2. When used, antimicrobial treatments, coatings, and sanitizers shall be applied after the system is rendered clean.
 - 3. Apply antimicrobial agents, coatings, and sanitizers directly onto surfaces of interior ductwork. Fogging is prohibited.
 - 4. Sanitizing agent products shall be registered by the EPA as specifically intended for use in HVAC systems and ductwork.

3.03 CLEANLINESS VERIFICATION

- A. Verify cleanliness according to NADCA ACR 2021, "Verification of HVAC System Cleanliness" Section.
- B. Verify HVAC system cleanliness after mechanical cleaning and before applying any treatment or introducing any treatment-related substance to the HVAC system, including biocidal agents, coatings, and sanitizers.
- C. Perform visual inspection for cleanliness. If no contaminants are evident through visual inspection, the HVAC system shall be considered clean. If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-

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cleaned and subjected to re-inspection for cleanliness.

- D. Prepare a written cleanliness verification report. At a minimum, include the following:
 - 1. Written documentation of the success of the cleaning.
 - 2. Site inspection reports, initialed by supervisor, including notation on areas of inspection, as verified through visual inspection.
 - 3. Surface comparison test results if required.
 - 4. Gravimetric analysis (nonporous surfaces only).
 - 5. System areas found to be damaged.
- E. Photographic Documentation: Provide photos of cleaned ducts.

3.04 RESTORATION

- A. Restore and repair HVAC air-distribution equipment, ducts, plenums, and components according to NADCA ACR 2021, "Restoration and Repair of Mechanical Systems" Section.
- B. Restore service openings capable of future reopening.
- C. Replace fibrous-glass materials that cannot be restored by cleaning or resurfacing.
- D. Replace damaged insulation with new to match existing.
- E. Ensure that closures do not hinder or alter airflow.
- F. New closure materials, including insulation, shall match opened materials and shall have removable closure panels fitted with gaskets and fasteners.

3.05 DUCT LEAKAGE TESTS AND REPAIR

- A. Ductwork leakage testing shall be performed by the Testing and Balancing (TAB) Contractor directly contracted by the General Contractor.
- B. Ductwork leakage testing shall be performed for the entire air distribution system (including all supply, return, exhaust, and relief ductwork), section by section, including fans, coils, and filter sections. Based upon satisfactory initial duct leakage test results, the scope of the testing may be reduced by the Campus on ductwork constructed to the static pressure of 500 Pa (2" WG) duct pressure classification. In no case shall the leakage testing of ductwork constructed above the static pressure of 500 Pa (2" WG) duct pressure of 500 Pa (2" WG) duct pressure of 500 Pa (2" WG) duct pressure classification or ductwork located in shafts or other inaccessible areas be eliminated.
- C. Test procedure, apparatus and report shall conform to SMACNA Leakage Test manual. The maximum leakage rate allowed is 4 percent of the design air flow rate.
- D. All ductwork shall be leak tested first before enclosed in a shaft or covered in other inaccessible areas.
- E. All tests shall be performed in the presence of the Campus authorized representative and the Test and Balance contractor. The Test and Balance agency shall measure and record duct

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leakage and report to the Campus and identify leakage source with excessive leakage.

- F. If any portion of the duct system tested fails to meet the permissible leakage level, the Contractor shall rectify sealing of ductwork to bring it into compliance and shall retest it until acceptable leakage is demonstrated to the IOR.
- G. All tests and necessary repairs shall be completed prior to insulation or concealment of ductwork.
- H. Make sure all openings used for testing flow and temperatures by TAB Contractor are sealed properly.

END OF SECTION

SECTION 23 33 46 FLEXIBLE DUCTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Flexible ducts, insulated.
 - 2. Flexible duct connectors.

1.02 ACTION SUBMITTALS

- A. Product data.
- B. Product Data Submittals: For each type of product.
- C. Shop Drawings: For flexible ducts.
 - 1. Include plans showing locations, mounting details, and attachment details.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

- 2.01 ASSEMBLY DESCRIPTION
 - A. Comply with NFPA 90A and NFPA 90B.
 - B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials must be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
 - C. Comply with the Air Duct Council's (formerly, Air Diffusion Council) "ADC Flexible Air Duct Test Code FD 72-R1" and "Flexible Duct Performance & Installation Standards."
 - D. Comply with ASTM E96/E96M.

2.02 FLEXIBLE DUCTS, INSULATED

- A. Standard: Product is to be UL 181 listed and bearing the UL label.
- B. Flexible Ducts, Insulated Class 1, Two-Ply Vinyl Film Supported by Helically Wound, Spring-Steel Wire; Fibrous-Glass Insulation:
- C. Flexible Ducts, Insulated Class 1, Multiple Layers of Aluminum Laminate Supported by Heli

cally Wound, Spring-Steel Wire; Fibrous-Glass Insulation:

PART 3 - EXECUTION

- 3.01 INSTALLATION OF FLEXIBLE DUCTS
 - A. Install flexible ducts in accordance with applicable details in the following publications:
 - 1. ADC's "Flexible Duct Performance & Installation Standards" for flexible ducts.
 - 2. NAIMA AH116.
 - 3. SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for metal ducts.
 - 4. SMACNA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
 - B. Install in indoor applications only. Do not install flexible duct in locations where it will be exposed to UV lighting.
 - C. Installation:
 - 1. Install ducts fully extended.
 - 2. Do not bend ducts across sharp corners.
 - 3. Bends of flexible ducting must not exceed a minimum of one-duct diameter.
 - 4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
 - 5. Install flexible ducts in a direct line, without sags, twists, or turns.
 - 6. Install in accordance with ADC instructions.
 - D. Supporting Flexible Ducts:
 - 1. Support flexible duct at manufacturer's recommended intervals, but at no greater distance than 4 ft. (1.2 m). Provide sufficient support so that maximum centerline sag is 1/2 in. per ft. (42 mm per meter) between supports. A connection to rigid duct or equipment may be considered a support joint.
 - 2. Install extra supports at bends placed approximately one-duct diameter from center line of the bend.
 - Ducts may rest on ceiling joists or truss supports. Spacing between supports must not exceed the maximum spacing in accordance with manufacturer's written installation instructions.
 - 4. Vertically installed ducts must be stabilized by support straps at a maximum of 72 inches (1800 mm) o.c.

END OF SECTION

SECTION 23 37 13.13 AIR DIFFUSERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Round ceiling diffusers.
- B. Related Requirements:
 - 1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
 - 2. Section 23 37 13.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.
- 1.02 ACTION SUBMITTALS
 - A. Product Data: For each type of product.

PART 2 - PRODUCTS

- 2.01 ROUND CONE DIFFUSERS
 - A. Devices shall be specifically designed for air volume flows.
 - B. Material: Steel
 - C. Finish: Baked enamel, white
 - D. Face Style: Four cone.
 - E. Mounting: Duct connection.
 - F. Pattern: Fully adjustable

2.02 DESCRIPTION

- A. Furnish and install TITUS model MCD round cone diffusers of sizes and mounting types designated by the plans and air distribution schedule.
- B. Construction:
- C. Diffusers shall be heavy-gauge steel construction, and shall consist of four seamless, onepiece, spun cones that incorporate a round inlet collar of sufficient length for connecting rigid or flexible duct.
- D. The diffuser shall integrate with all duct sizes shown on the plans.
- E. TITUS model MCD diffusers allow adjustment of the inner cones by turning the small center cone to achieve full horizontal to full vertical air pattern control.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install diffusers level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION
SECTION 23 37 13.23 REGISTERS AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fixed face heavy duty gym grille
- B. Related Requirements:
 - 1. Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
 - 2. Section 23 37 13.13 "Air Diffusers" for various types of air diffusers.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

- 2.01 GRILLES
 - A. Description:
 - 1. Furnish and install TITUS model PAR steel heavy duty gym grilles of sizes and mounting types designated by the plans.
 - B. Construction:
 - 1. The grille blades and border shall be steel construction.
 - 2. The 14 gauge steel border shall have smooth contours to reduce the possibility of injury to occupants when installed in a gymnasium.
 - C. Grilles shall be fixed louver type, and shall have:
 - 1. Forty-five (45) degree deflection, 3/4 inch on center blade spacing.
 - 2. The grille blade orientation shall be Front blades parallel to the long dimension.
 - 3. The grille shall be suitable for surface mounting with 1-1/4 inch flat border.
 - 4. The grille shall be supplied with a coated steel opposed blade damper. The damper shall be operable from the grille face.
 - D. Finish: Baked enamel, white

PART 3 - EXECUTION

- 3.01 INSTALLATION
 - A. Install registers and grilles level and plumb.
 - B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate

units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 26 00 10 ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

Electrical General Requirements specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements. Work includes but is not necessarily limited to the following:

- A. Definitions, guarantees, submittals, clean-up, "As-Builts" and all other applicable requirements of Division 0 and Division 1 apply to the work of this section.
- B. Examine all other sections for work related to those sections which are required to be provided as work under this Division & Sections.
- C. Coordinate all work in this Division with related trades.
- D. Furnish and install the following:
 - 1. Incidental items not indicated on the drawings nor mentioned in the Specifications that belong to the work described, or are required to provide complete operable systems, as though called out here in every detail.
 - 2. All construction power and lighting and all power for testing of equipment and systems through final acceptance tests.
 - 3. All equipment and facilities required to provide temporary and permanent services.
 - 4. Electrical distribution systems, including, electrical service, feeders, pull boxes, panel boards, branch circuit wiring, and circuit control and disconnect devices.
 - 5. All electrical work for the mechanical systems, except as referred to be furnished or installed as part of other sections/divisions of the specifications.
 - 6. All distribution material for and connection of the mechanical equipment, as required by the specific equipment furnished so that a complete and operable system results.
 - 7. Conduits, outlets and cabinets or terminal boards. Work related to the mechanical trade as listed below shall be included in this Division of the work. Refer to control drawings and mechanical drawings for exact requirements of work in this scope. Furnish and install the following:
 - a. All conduits, outlets, line voltage wiring, and control devices required for the specified operation of the equipment.
 - 8. Furnishing and installation of all hangers, anchors, sleeves, chases and supports, for all electrical materials and equipment.
 - 9. Connect all motors and electrical line voltage control equipment.
 - 10. Cleaning, patching, repairing, and painting.

1.02 APPLICABLE PUBLICATIONS AND STANDARDS

The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American National Standards Institute, Inc. (ANSI) Publications
- B. State of California Administrative Codes

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- C. National Electrical Manufacturers Association (NEMA) Publication
- D. National Fire Protection Association (NFPA) Publications
- E. Underwriters Laboratories, Inc. (UL) Publications.
- F. All current codes and regulations enforced by Division of State Architects. (DSA)

REFERENCES 1.03

A. All work and materials shall conform to all applicable Federal, State and local codes and regulations governing the installation.

LIST OF CALIFORNIA CODE OF REGULATIONS (C.C.R.)

APPLICABLE CODES AS OF JANUARY 1, 2023

- 1. Title 24 C.C.R., Part 1 2022 California Building Standards Administrative Code.
- 2. Title 24 C.C.R., Part 2 2022 California Building Code (CBC) (2018 International Building Code of The International Code Council, With California Amendments)
- 3. Title 24 C.C.R., Part 3 2022 California Electrical Code (CEC) (2017 National Electrical Code of The National Fire Protection Association, NFPA)
- 4. Title 24 C.C.R., Part 4 2022 California Mechanical Code (CMC) (2018 Uniform Mechanical Code of The International Association of Plumbing and Mechanical officials, IAPMO)
- 5. Title 24 C.C.R., Part 5 2022 California Plumbing Code (CPC) (2018 Uniform Plumbing Code of The International Association of Plumbing and Mechanical officials, IAPMO)
- 6. Title 24 C.C.R., Part 6 2022 California Energy Code
- 7. Title 24 C.C.R., Part 7 (No Longer Published in Title 24. See Title 8, CCR)
- 8. Title 24 C.C.R., Part 8 2022 California Historical Building Code
 9. Title 24 C.C.R., Part 9 2022 California Fire Code (CFC)
- (2018 International Fire Code of The International Code Council)
- 10. Title 24 C.C.R., Part 10 2022 California Existing Building Code (2018 International Existing Building Code of The International Code Council, With Amendments)
- 11. Title 24 C.C.R., Part 11 2022 California Green Building Standards Code (CALGREEN Code)
- 12. Title 24 C.C.R., Part 12 2022 California Referenced Standards Code
- 13. Title 19 C.C.R., Public Safety, State Fire Marshal Regulations.

PARTIAL LIST OF APPLICABLE STANDARDS

2022 CALIFORNIA BUILDING CODE (FOR SFM) REFERENCED STANDARDS CHAPTER 35

- 1. NFPA 12 Carbon Dioxide Extinguishing Systems
- 2. NFPA 13 Installation of Sprinkler Systems
- 3. NFPA 14 The Installation of Standpipe and Hose Systems
- 4. NFPA 17 Dry Chemical Extinguishing Systems
- 5. NFPA 17A Wet Chemical Extinguishing Systems
- 6. NFPA 70 National Electrical Code
- 7. NFPA 72. National Fire Alarm Code:

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- 8. NFPA 90A, Installation of Air Conditioning and Ventilating Systems
- 9. NFPA 101, Life Safety Code Safety to Life from Fire in Buildings and Structures
- 10. NFPA 750 Water Mist Fire Protection Systems
- 11. NFPA 2001 clean Agent fire Extinguishing Systems
- 12. UL 300 Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment
- 13. UL 464 Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories
- 14. UL 521 Heat Detectors for Fire Protective Signaling Systems
- 15. UL 1971 Signaling Devices for The Hearing Impaired
- 1.01 WORK SEQUENCE
 - A. Install work in phases to accommodate District's occupancy requirements. During the construction period, coordinate Architectural, electrical and mechanical schedule and operations with District's and other trades. Refer to Division 1 General Requirements.

1.02 DEFINITIONS

- A. The words "work" or "electrical work" herein include products, labor, equipment, tools, appliances, transportation and all related items, directly or indirectly required to complete the specified and indicated electrical installation.
- B. The word "concealed" shall mean that the installation will not be visible when all permanent or removable elements of the construction are in place. The word "exposed" shall mean that the installation is visible when all permanent or removable elements of the construction are in place.
- C. The word "code" shall mean any and all regulations and requirements of regulatory agencies, public and private, having jurisdiction over the work involved.
- D. The word "product" used in Division 26 means all material, equipment, machinery, and/or appliances directly or indirectly required to complete the specified and/or indicated electrical work.
- E. The words "standard product" shall mean a manufactured product, illustrated and/or described in catalogs or brochures, which are in general distribution prior to the date of issue of construction documents for bidding. Products will generally be identified by means of a specific catalog number and manufacturer's name.
- F. The word "provide shall mean furnish and install and where applicable shall also mean connect, complete installation and test.
- G. The words "powered equipment", as used in Division 26, shall mean a complex product converting and electrical energy source to:
 - 1. Heat energy.
 - 2. Mechanical power.
- H. Refer to Division 1, General Requirements, for additional definitions of words and phrases used to describe Division 26, Electrical Work.

1.03 DISTRICT FURNISHED PRODUCTS & INSTALLATION

Refer to drawings for items to designated as "OFOI" (Owner Furnished Owner Installed) and "OFCI" (Owner Furnished and Contractor Installed). Unless noted otherwise, all other items shall be provided (furnished and installed) by the Contractor for a complete and operational installation. Contractor to field Coordinate with District Project Manager.

- A. All items required for a complete and operational installation shall be furnished and installed by the Contractor.
- B. Contractor shall provide seismic bracing for all electrical & mechanical equipment(s).

1.04 DISCREPANCIES

- A. Where a conflict in requirements occurs between the specifications and drawings, or in the specifications or on the drawings, and a resolution is not obtained from the District/Architect before the bidding date, the more expensive alternate will become the contractual requirements.
- B. Omissions from the drawings or specifications or the miss-description of details of work which are manifestly necessary to carry out the intent of the drawings and specifications, or which are customarily performed, shall not relieve the Contractor from performing such omitted or miss-described details of the work but they shall be performed as if fully and correctly set forth and described in the drawings and specifications.
- C. The Contractor shall check all contract drawings furnished to him immediately upon their receipt and shall promptly notify the Architect/District of any discrepancies. Figures marked on drawings shall in general be followed in preference to scale measurements. Large scale drawings shall in general govern small scale drawings. The Contractor shall compare all drawings and verify the figures before laying out the work and will be responsible for any errors which might have been avoided thereby.

1.05 CHANGES

A. The Contractor shall be responsible to make and obtain approval for all necessary adjustments in circuiting as required to accommodate the relocations of equipment and/or devices which are affected by any approved authorized changes. All changes shall be clearly indicated on the "As-Built" drawings. A copy of the progress "As-Built" drawings shall be kept at job site for review by Inspector of Record/Architect/District.

1.06 SUBMITTALS

A. Submit shop drawings, manufacturer's data certificates for equipment, materials and finish, and pertinent details for each system where specified in each individual section, and obtain approval before procurement, fabrication, or delivery of the items to the job site. Partial submittals are not acceptable and will be returned without review. Include the manufacturer's name, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference, applicable technical society publication references, and other information necessary to establish contract compliance of each item the Contractor proposes to furnish. Photographs of existing installations and data submitted in lieu of catalog data are not acceptable and will be returned without approval. Contractor shall be responsible for reviewing and certifying submittals as conforming to the drawings and specifications prior to submittal and shall verify conformance of equipment as delivered with final shop submittals, specifications and plans. Contractor shall report to

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Engineer any deviations prior to initiation of construction. Contractor is responsible for promptly reporting to District any news of late equipment delivery which is likely or certain to delay installation.

- B. Submit under provisions of Division 1.
- C. Proposed Products List: Include Products specified in Division 26, 27 & 28 & Appendix "A"
- D. Submit shop drawings and product data grouped and referenced by the technical Section numbers.
- E. The Contractor shall be responsible for all equipment ordered and/or installed prior to receipt of shop drawings returned from the Architect bearing the Architect/Engineer's stamp of "Reviewed". All corrections or modifications to the equipment as noted on the shop drawings shall be performed and equipment removed from the job site at the request of the Architect/Project Manager without additional compensation.
- F. Shop Drawings: Drawings shall be a minimum of 8.1/2 inches by 11 inches in size with a minimum scale of 1/8-inch per foot, except as specified otherwise. Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, duct work, and other items that must be shown to assure a coordinated installation. In wiring diagrams, identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices. If equipment is disapproved, revise drawings to show acceptable equipment and resubmit.
- G. Manufacturer's Data: For each manufactured item, provide current manufacturer's descriptive literature of cataloged products, equipment drawings, diagrams, performance and characteristic curves if applicable, and catalog cuts.
- H. Standard Compliance: When materials or equipment provided by the Contractor must conform to the standards of organizations such as American National Standards Institute (ANSI) or Underwriters' Laboratories (UL), submit proof of such conformance to the Engineer for approval. If an organization uses a label or listing to indicate compliance with a particular standard, the label or listing will be acceptable evidence, unless otherwise specified. In lieu of the label or listing, submit a certificate from an independent testing organization, which is competent to perform acceptance testing and is approved by the District. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard.
- I. Certified Test Reports: Before delivery of materials and equipment, certified copies of all test reports specified in individual sections shall be submitted for approval.
- J. Certificates of Compliance or Conformance: Submit manufacturer's certifications as required on products, materials, finish, and equipment indicated in the technical sections. Certifications shall be documents prepared specifically for this contract. Pre-printed certifications and copies of previously submitted documents will not be acceptable. The manufacturer's certifications shall name the appropriate products, equipment, or materials and the publication specified as controlling the quality of that item. Certification shall not contain statements to imply that the item does not meet requirements specified, such as "as good as"; or "achieve the same end use and results as materials formulated in accordance with the referenced publications"; or "equal or exceed the service and performance of the specified material." Certificates shall simply state that the item conforms to the requirements specified. Certificates shall be printed on the manufacturer's letterhead and

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shall be signed by the manufacturer's official authorized to sign certificates of compliance or conformance.

1.07 REGULATORY REQUIREMENTS

- A. Electrical: Conform to NFPA 70, ANSI C2, and CAC Title 24, NFPA 101 and all other state and local codes.
- B. The requirements of authorities shall be the minimum acceptable requirements for the work, and nothing described in these Specifications or indicated on the drawings shall be construed to permit work not conforming to the most stringent of the applicable codes and regulations. When drawings or specifications call for materials or construction of better quality of larger size than required by codes, laws, rules and regulations, the drawings and specifications shall take precedence.
- C. Equipment not complying with applicable codes shall be removed and replaced with approved equipment at Contractor's expense. UL listing labels, where applicable, shall be installed prior to shipment from factory.

1.08 PRODUCT ALTERNATES OR SUBSTITUTIONS

A. Where a manufacturer's product is specified, the intent is to establish definite quality, construction, and performance characteristics. The manufacturer's latest published catalog data for the product shall become part of this specification as though stated herein to the extent that such data establishes quality desired, testing procedures, safety features, life expectancy, performance characteristics and, in the case of finish material, the general appearance. Substitute products, where permitted, will be required to equal or exceed these various requirements as established by the specified product manufacturer's literature.

1.09 GUARANTEE

- A. Except as may be specified under other sections in the Specifications, guarantee all equipment furnished under the Specifications for a period of Three year (District Standard) from date of acceptance against defective workmanship and material and improper installation. Upon notification of failure, correct deficiency immediately and without cost to the District.
- B. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the District, or their service agency as directed. Furnish manufacturer's warranties in accordance with District General Conditions of this Specification.

1.10 PROJECT/SITE CONDITIONS

- A. Install work in locations shown on drawings, unless prevented by project conditions.
- B. Prepare drawings showing proposed rearrangement of work to meet project conditions, including changes to work specified in other Sections. Obtain permission of District before proceeding.

1.11 OPERATION AND MAINTENANCE MANUAL

Submit as required for systems and equipment indicated in the technical sections. Furnish six copies, bound in hardback binders or an approved equivalent. Furnish one complete manual

prior to performance of systems or equipment tests and furnish the remaining manuals prior to contract completion. Inscribe the following identification on the cover; the words "OPERATION AND MAINTENANCE MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment. Include a table of contents and assemble the manual to conform to the table of contents, with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in. The manual shall include:

- A. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the system or equipment.
- B. A control sequence describing startup, operation, and shutdown.
- C. Description of the function of each principal item of equipment.
- D. Installation and maintenance instructions.
- E. Safety precautions.
- F. Diagrams and illustrations.
- G. Testing methods and test equipment required.
- H. Performance data.
- I. Parts list. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
- J. Appendix: List qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications.

1.12 POSTED OPERATING INSTRUCTIONS

Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions as directed. Attach or post operating instructions adjacent to each principal system and equipment including startup, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each system or equipment.

Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.13 INSTRUCTION TO DISTRICT PERSONNEL

Where indicated in the technical sections, furnish the services of competent instructors to give full instruction to District personnel in the adjustment, operation, and maintenance of systems and equipment, including pertinent safety requirements as required. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well

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as practical operation and maintenance work. Coordinate schedule of instructional class with District during the first regular work week after the equipment or system has been accepted and turned over to District for regular operation.

1.14 CATALOGED PRODUCTS/SERVICE AVAILABILITY

Materials and equipment shall be current products by manufacturers regularly engaged in the production of such products. Products shall have been in satisfactory commercial or industrial use for 3 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The 3 - year period shall be satisfactorily completed by a product for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 3 - year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, is furnished. The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.15 MANUFACTURER'S RECOMMENDATIONS

Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

1.16 DELIVERY AND STORAGE

Handle, store, and protect equipment and materials in accordance with the manufacturer's recommendations and with the requirements of NFPA 70B P, Appendix I, titled "Equipment Storage and Maintenance During Construction." Replace damaged or defective items with new items.

1.17 ELECTRICAL REQUIREMENTS

Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Power wiring and conduit shall conform to the requirements of Section 26 00 50 " Basic Electrical Materials and Methods."

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 Coordinate and comply with inspections, including any independent testing required to verify standard compliance, and deliver certificates for same to District. All work shall conform to the requirements of NFPA 70, Title 24, California Code of Regulations (CCR).

3.02 WORK RESPONSIBILITIES

A. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgement must be exercised in executing the work to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference with

Electrical General Requirements

structural conditions. The contractor is responsible for the correct placing of his work and the proper location and connection of his work in relation to the work of other trades. Advise appropriate trade as to locations of access panels.

- B. Locations shown on architectural ceiling plan or on wall elevations shall take precedence over electrical plan locations but where a major conflict is evident, notify the Engineer for instructions.
- C. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes shall be made without extra cost, providing the change is ordered before the conduit runs, etc. and work directly connected to same is installed and no extra materials are required.
- D. Where equipment is furnished by others, verify dimensions and the correct locations of this equipment before proceeding with the roughing-in of connections.
- E. Lighting fixtures in mechanical spaces are shown in their approximate locations only. Do not install light outlets or fixtures until mechanical piping and duct work is installed; then lights shall be installed in locations best suited for equipment arrangement or as directed by the Engineer.
- F. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with any work, carefully check and verify all dimensions, sizes, etc. with the shop drawings to see that the equipment will fit into the spaces provided without violation of applicable codes.
- G. Should any changes to the work indicated on the drawings or described in the specifications be necessary to comply with the above requirements, notify the Engineer immediately and cease work on all parts of the contract which are affected until approval for any required modifications to the construction has been obtained from the Engineer.
- H. Be responsible for any cooperative work which must be altered due to lack of proper supervision or failure to make proper provisions in time. Such changes shall be under direction of the Engineer and shall be made to his satisfaction.
- I. Perform all work with competent and skilled personnel.
- J. All work, including aesthetic as well as electrical and mechanical aspects of the work, shall be of the highest quality consistent with the best practices of the trade.
- K. Replace or repair, without additional compensation, and any work which, in the opinion of the Engineer, does not comply with these requirements.

3.03 PAINTING OF EQUIPMENT

- A. Factory Applied: Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA ICS 6 corrosion-resistance test, except equipment specified to meet requirements of ANSI C37.20 shall have a finish as specified in ANSI C37.20.
- B. Field Applied: Paint electrical equipment as required to touch up, to match finish on other equipment in adjacent spaces or to meet safety criteria.

C. When not already covered under the painting section of the specifications, all electrical work exposed to view shall be painted in accordance with the painting section of the specifications to match surroundings. Work to be painted shall include conduit, hangars, outlet boxes, pull boxes, surface raceway and similar items.

END OF SECTION

SECTION 26 00 50 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

- 1.01 SECTION INCLUDES
 - A. Conduit
 - B. Fittings and Conduit Bodies
 - C. Surface Raceways
 - D. 600 Volt Wires
 - E. Boxes
 - F. Wiring Devices
 - G. Cabinets and Enclosures

1.02 RELATED SECTIONS

- A. Section 26 00 10 Electrical General Requirements, applies to this section, with the additions and modifications specified herein.
- B. Section 26 05 26 & 27 05 26 Grounding and Bonding.
- 1.03 Section 26 05 53 Electrical Identification.
- 1.04 APPLICABLE PUBLICATIONS

The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American National Standards Institute, Inc. (ANSI) Publications
 - 1. C80.1-95 Rigid Steel Conduit, Zinc Coated
 - 2. C80.3-95 Electrical Metallic Tubing, Zinc Coated
 - 3. C80.5-95 Specification for Rigid Aluminum Conduit
 - 4. FB 1-97 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies
 - 5. OS 1-84 Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
 - 6. OS 2-86 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- B. National Electrical Manufacturers Association (NEMA) Publications:
 - 1. ABI-93 Molded Case Circuit Breakers
 - 2. ICS6-93 Industrial Controls and Systems Enclosures
 - 3. KS 1-96 Enclosed Switches
 - 4. TC 2-90 Electrical Plastic Tubing (EPT) and Conduit (EPC-40) and (EPC-80)
 - 5. WD 1-83 General Requirements for Wiring Devices
 - 6. WD 6-88 Wiring Device Dimensional Requirements
- C. National Fire Protection Association (NFPA) Publication:

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- 1. 70–2017 National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (U.L.) Publications:
 - 1. 1-93 Standard for Flexible Metal Conduit
 - 2. 6-93 Rigid Metallic Conduit
 - 3. 50-95 Cabinet and Boxes
 - 4. 83-91 Thermoplastic Insulated Wires
 - 5. 198E-88 Class R Fuses
 - 6. 360-96 Liquid-tight Flexible Steel Conduit
 - 7. 486A-91 Wire Connectors and Soldering Lugs, for use with Copper Conductors
 - 8. 498-96 Attachment Plugs and Receptacles
 - 9. 508-93 Industrial Control Equipment
 - 10. 510-94 Insulating Tape
 - 11. 514A-91 Metallic Outlet Boxes
 - 12. 514B-89 Fittings for Conduit and Outlet Box
 - 13. 0651-95 Schedule for 40 & 80 Rigid PVC Conduit
 - 14. 797-93 Electrical Metallic Tubing
 - 15. 1242-96 Standard for Intermediate Metal Conduit
- E. State of California Administrative Codes:
 - 1. Title 24, Part 2, Chapter 2-53, 2008 Energy Conservation Standards

1.05 SUBMITTALS

- A. Submit under provisions of Section 16010 and Division -1.
- B. Product Data: Provide for:
 - 1. Conduit (all types)
 - 2. 600 Volt Wires
 - 3. Receptacles (all types)
 - Switches (all types)
 Surface Raceways

 - 6. Cabinets and Enclosures
 - 7. Safety Switches.
- C. Test Reports: Provide for:
 - 1. Insulation resistance tests of low voltage conductors.
 - 2. Operational tests.

1.06 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately record actual routing of conduits larger than 1 inch.
- C. Accurately record actual locations and mounting heights of outlet, pull and junction boxes.
- D. Accurately record actual location of each new receptacle.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 and with all state adopted amendments, except where requirements herein are more stringent.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or a testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.08 QUALITY ASSURANCE

In each standard referenced to herein, consider the advisory provisions to be mandatory, as though the word "shall" have been substituted for "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or other words of similar meaning, to mean District.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site under provisions of Section 16010.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.10 PROJECT CONDITIONS

- A. The drawings are diagrammatic and shall not be scaled for exact locations: Field conditions and non-interference with other utilities and trades, shall determine exact locations.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

Materials and equipment shall conform to the respective specifications and standards and to the specifications herein. Electrical ratings shall be as indicated. Except where specifically indicated otherwise, provide only new materials having all legally required approvals and/or labels. Items of a similar nature shall be of the same type and manufacturer.

2.02 CONDUIT

- A. Rigid Steel Conduit (Zinc-coated): ANSI C80.1, UL 6, hot-dip galvanized, threaded type.
- B. Intermediate Metal Conduit: UL 1242, zinc coated steel only.
- C. Electrical Metallic Tubing: UL 797, ANSI C80.3.
- D. Rigid Plastic Conduit: NEMA TC-2, UL 651, PVC Schedule 40, Carlon or approved equal.
- E. Flexible Metal Conduit: UL 1.
- F. Liquid tight Flexible Metallic Conduit: UL 360, Interlocked steel construction with a polyurethane jacket, Electri-Flex Liquatite® type CEA or approved equal.

2.03 FITTINGS

A. Fittings for Rigid Metallic Conduit and Intermediate Metallic Conduit: UL 514B, threaded

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type.

- B. Fittings for EMT: Compression type. Split/set screw couplings unacceptable.
- C. Fittings for Flexible Metal Conduit: ANSI/NEMA FB 1.
- D. Expansion/Deflection Fittings: Provide fitting capable of a straight-line expansion movement of 2" in either direction and a movement of 3/4" from the normal in all other directions, OZ Gedney Type AX DX. Provide complete with grounding and bonding jumpers.

2.04 CONDUCTORS

Conductors shall bear the date of manufacture imprinted on the insulation with other identification. Wire and cable manufactured more than 6 months before delivery to the job site shall not be used.

- A. 600 Volt Wires and Cables: UL 83. Conductors shall be stranded copper. Insulation shall be type THHN/THWN unless otherwise noted.
- B. Minimum size for branch circuits shall be No. 12 AWG, THHN/THWN copper stranded/solid unless otherwise noted.

2.05 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2-inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
- B. Cast Boxes: NEMA FB 1, Type FD, cast ferroalloy. Provide gasketed cover and threaded hubs by box manufacturer.
- 2.06 RECEPTACLES: UL 498 and NEMA WD 1
 - A. Receptacles shall be NEMA 5-20R Decora Style with white color and stain less steel cover plates unless otherwise indicated on the drawings. Acceptable manufacturers: Hubbell, Pass & Seymour, Leviton or approved equal.
 - B. Weatherproof Receptacles: For flush mounted weatherproof convenience outlets, provide duplex receptacles as listed above with gasketed stainless steel cover plate and gasketed cap over each receptacle opening, Sierra WP series. Where surface mounted, use cast box with gasketed cast aluminum plate having duplex lift covers, Hubbell No. 5206. Receptacles shall be UL listed for use in "wet locations."
 - C. All receptacles located in mechanical rooms, electrical rooms, and on exterior of building shall be GFCI type. In addition to this requirement, provide GFCI type receptacles where indicated on the drawings.

2.07 SWITCHES: NEMA WD 1

A. General Purpose wall switches shall be heavy-duty commercial grade 20A, 277V AC, general use Decora style switch with stainless steel cover plates. Provide single pole, 2-pole, 3-way, 4-way, momentary contact, weatherproof, lock or other type switches indicated. Acceptable manufacturers: Hubbell, Pass & Seymour, Leviton or approved equal.

B. AC Manual HP Rated Motor Starting Switches: UL 508. Acceptable manufacturers: Hubbell, Pass & Seymour, Leviton or approved equal.

2.08 DEVICE PLATES

- A. Provide UL listed, one-piece stainless steel cover device plates for all wiring devices, for telephone/computer data outlets and for outlet boxes used as junction or pull boxes. For metal outlets and fittings, plates shall be of stainless steel. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."
- B. Provide 3/16" high block letters, black enamel filled machine engraving for new device plates under any of the following conditions listed below. Use designations indicated or select words to best describe purpose of each device.
 - 1. All receptacle device plates.
 - 2. Plates containing more than three switch devices.
 - 3. Plates for switches controlling loads, where such loads are not visible from the switch location.
 - 4. Selector switches.
 - 5. Manual motor starting switches.
 - 6. Special outlets where indicated.
 - 7. Control switches.
- 2.09 CABINETS: UL 50.
 - A. Cabinets for same type of use shall be the product of a single manufacturer.
 - B. Construct of cold-rolled drawing quality steel, with metal gages and construction methods conforming to National Electrical Code requirements, and Underwriters Laboratories' standards. Provide 12-gauge G-90 grade galvanized steel minimum, unless otherwise noted.
 - C. Finish doors, trims, and back boxes for surface-mounted cabinets in finished areas by applying a rust-resistant treatment, prime coat, and a final coat of manufacturer's standard enamel or lacquer finish. Galvanize all other sheet metal components of cabinets including back boxes for flush cabinets, excepting non-ferrous metal parts, or steel parts provided with cadmium plating or equivalent protective plating.
 - D. Equip doors with concealed or semi-concealed hinges and with flush or semi-flush spring catch type flush cylinder locks. Key cabinet doors of similar use alike and provide two keys with each lock.
 - E. Equip cabinets for use with telephone, alarm or signal systems with a 0.5" thick plywood backboard. Equip cabinets with terminal strips where so specified. Equip cabinets with nameplates.
 - F. Surface cabinets shall be furnished without knockouts. Punch or drill required openings during installation. Equip flush back boxes with manufacturer's standard pattern of knockouts.
 - G. Equip cabinet doors exceeding 40" in height with vertical bolt three-point locking mechanisms.
 - H. Acceptable manufacturers: Products from (or approved equal) to the following manufacturers are acceptable.

- 1. Cabinets for general use: Hoffman Engineering Co. or Approved equal.
- 2. Cabinets for systems and/or products, use cabinets furnished by manufacturer with system or product. Where system or product cabinets do not comply with these Specifications, submit cabinet shop drawings, indicating deviations, and obtain approval for their use.

2.10 JUNCTION BOXES AND PULL BOXES: UL 50

- A. Provide pull and junction boxes of Code gauge steel sized as indicated or required. Provide 16-gauge steel minimum, unless otherwise noted. Indoor enclosures shall conform to NEMA ICS 6 for the type 1, unless otherwise noted.
- B. Size junction and pull boxes to not less than minimum Code requirements. Increase size above Code requirements where necessary to provide space for pulling, racking or splicing enclosed conductors, or where specified or indicated dimensions exceed Code requirements.
- C. Fabricate sheet metal junction and pull boxes of galvanized, Code gage, sheet steel. Include angle iron framing where required for rigidity. Boxes shall not deflect or deform visibly when covers are removed after conduit and conductors are installed, and any deflection occurring shall not prevent the easy installation and removal of cover attachment screws.
- D. Do not use single covers for junction and pull boxes having cover length or width dimension exceeding three feet unless so specified, indicated, or approved. Sectionalize covers that exceed three feet in either dimension into two or more sections.
- E. For interior junction and pull boxes located in concrete floors, and 24" square or smaller, use cast iron boxes with integral cast tapped conduit hubs, and having recessed cover flush in the box trim placing all elements of the face of the box flush in the plane of the surrounding floor. Equip boxes with watertight covers where so indicated.
- F. Interior ceiling mounted pull boxers shall be a minimum 24" x 24" x 6" opening downward into room area and construction to receive the minimum number of conduits plus 50 percent.
- G. Equip surface sheet metal junction and pull boxes with covers aligning with the sides of the boxes and equip flush boxes with covers extending 3/4" all around the perimeter of the back box. Provide sufficient cover attachment screws to ensure that box covers will contact the surface of the box for the entire perimeter of the enclosure. Use 316 stainless steel fasteners to attach covers to boxes.
- H. Use brass screws to attach junction and pull box covers to interior floor boxes or to boxes located where moisture may be present.
- I. Acceptable manufacturers:
 - 1. Sheet steel junction and pull boxes: Hoffman Engineering Co. or Approved equal.
- 2.11 WIRE CONNECTORS AND TERMINALS: For use with copper conductors. UL 486A.
- 2.12 INSULATING TAPES: UL 510.

NAMEPLATES: Provide as specified in Section 26 05 53, "Electrical Identification." LIGHTING: Provide all required hardware to install fixtures and specified fixtures.

PART 3 - EXECUTION

3.01 INSTALLATION: Electrical installation shall conform to requirements of NFPA 70, state and local codes, and to requirements specified herein.

3.02 LOCATIONS

- A. The drawings indicate diagrammatically the desired locations and arrangements of the components of the electrical work. Follow the drawings as closely as possible but use judgment and coordinate with other trades to secure the best possible installation in the available space and under the developed conditions.
- B. Before installing any equipment, conduit, or locating any outlet, examine the complete set of documents, including shop drawings and specifications, and verify all dimensions and space requirements. Make such minor adjustments as may be necessary to fit the building structure and accommodate the work of other trades. Install all electrical work to preserve legal headroom, access, workspace, clearances and to keep openings and passage ways clear. Arrange for additional space if required for the servicing, maintenance, and replacement of the electrical equipment.
- C. Control devices shall not be mounted more than 6'-6" above the floor.
- D. Prior to installation, the District reserves the right to relocate any outlet or device within six feet of the location indicated on the plans and at no additional cost to the District.
- E. No additional compensation will be allowed for omissions, inadequate space, misunderstandings or rejected work caused by neglect of these requirements.

3.03 CONDUIT

- A. Rigid steel conduit may be used in all locations. Rigid steel conduit shall not be installed below grade in direct contact with earth; it shall be encased in 3" concrete envelope or painted with two coats of black asphalt paint.
- B. Intermediate metal conduit (IMC) may be used in lieu of rigid steel conduit where permitted by Code.
- C. Aluminum Conduit: Use not permitted.
- D. Electrical metallic tubing (EMT) may be installed in indoor dry locations only; it shall not be installed lower than four feet above the finished floor. Restrictions applicable to EMT:
 - 1. Do not install below grade.
 - 2. Do not encase in concrete.
 - 3. Do not use in areas subject to severe physical damage (including, but not limited to, mechanical equipment rooms and electrical equipment rooms).
 - 4. Do not use in hazardous areas.
 - 5. Do not use outdoors.
- E. Use liquid tight flexible metal conduit where flexible conduit is exposed to weather, oil, or moisture. Provide green ground conductor in all flexible conduit.
- F. Install conduit in accordance with NECA "Standard of Installation." The electrical drawings are diagrammatic and do not show all offsets, bends, fittings, junction boxes, pull boxes and expansion fittings required to meet field conditions. Determine actual material and hardware

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requirements and verify all dimensions by field inspection.

- G. Arrange supports to prevent misalignment during wiring installation.
- H. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- I. Group related conduits; support using conduit rack. Construct rack using steel channel provide space on each for 25 percent additional conduits.
- J. Arrange conduit to maintain headroom and present neat appearance.
- K. Route exposed conduit parallel and perpendicular to walls.
- L. Maintain adequate clearance between conduit and piping.
- M. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees.
- N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- O. Bring conduit to shoulder of fittings; fasten securely.
- P. Provide pull fittings in all overhead conduit runs exceeding 200 feet of straight conduit or having more than the equivalent of three 90-degree bends. Each 90-degree bend shall be considered the equivalent of 50 feet of straight run. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size.
- Q. Where conduit passes from one type of construction to another, or where there is a possibility of dissimilar movements, an expansion/deflection device or a suitable loop of seal tight flexible conduit shall be installed. Looped seal tight flexible conduit shall consist of 18" minimum length of looped conduit with a junction box at one or both ends, wherever conduit crosses building seismic joints.
- R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- S. Provide 1/8" diameter polyethylene pull line in each new empty conduit.
- T. Conduit which penetrates fire walls, fire partitions, or floors shall be metallic on both sides of fire walls, fire partitions, or floors for minimum distance of 6 inches. Restore fire rating integrity at conduit penetration. All holes created to extend electrical systems through fire rated floors and walls shall be sealed by the electrical contractor with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures beginning at 250°F. It shall be UL Classified and have I.C.B.O., B.O.C.A.I. and S.B.C.C.I. (NRB 243) approved ratings to three hours per ASTM E-814 (UL 1479).
- U. Acceptable Manufacturers: 3M, Carborundum, Hevi-Duty/Nelson, or approved equal.
- V. Where conductors of No. 4 AWG or larger are to be installed in a conduit, or where any conductors are to be deflected more than 30 degrees when leaving a conduit, terminate the conduit with an insulating bushing.
- W. Ground and bond conduit under provisions of Section 16170.

3.04 600 VOLT CONDUCTORS

A. Splices:

- 1. Splices in conductors #8 AWG and smaller shall be made with "Scotchlok" insulated connectors or equal of proper size for conductors being spliced.
- 2. Splices in conductors #6 AWG and larger shall be made with pressure type solder less connectors. The splice area shall be taped to provide equal or greater insulation than the original. Tape run-back over the original insulation shall extend 3 to 5 overall diameters of the insulated wire.
- B. Conductors and terminal lugs shall be used for terminating stranded conductors #6 AWG and larger and shall be T&B, Iscor, or approved equal solder less connectors.
- C. Wire in panels, cabinets, pull boxes and wiring gutters shall be neatly grouped, strapped together with T&B Model Tyrap cable strap or laced with #12 stranded lacing twine and fanned out to the terminals.
- D. Neutral conductor shall be continuous in outlet boxes and shall not be broken by addition or removal of devices.
- E. Wiring methods in return air plenum spaces shall comply with NEC 300-22.

3.05 FITTINGS

- A. Use threaded fittings for rigid metal conduit and compression fittings for tubing.
- B. Use cement-on fittings for plastic conduit and tapered drive-on fittings for fiber conduit.
- C. Fittings for flexible conduit shall be of the threadless hinged clamp type. Do not use fittings threaded internally into the flexible conduit ends.
- D. Use fittings made of the same material as the raceway except:
 - 1. Malleable iron and steel are interchangeable.
 - 2. Die cast fittings may be used for flexible steel conduit and for factory manufactured offsets.
 - 3. Use aluminum fittings only with aluminum conduit.
 - 4. Use plastic insulated bushings for conduit sizes larger than 1".
 - 5. Use insulated throat connectors for electrical metallic tubing.

3.06 CABINETS

- A. Set cabinets at heights indicated or specified. In the absence of such information, set cabinets at not to exceed 6'-6" from finish floor to top of cabinet.
- B. Align tops of cabinets in sight of each other at a uniform height.
- C. Install cabinets and other enclosure products in plumb with the building construction. Install flush enclosures so that the trim will rest against the surrounding surface material around the entire perimeter of the enclosure.
- D. Do not locate cabinets (or other electrical enclosures) where room doors will touch enclosure face when room door is opened 180°. Locate cabinets (and other enclosures) so that enclosure door can be opened through a minimum 180° arc, except that the arc may be

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reduced to 130° for enclosures mounted to wireways. Do not install surface mounted cabinets in finished areas, unless so indicated. Where conflicting data is indicated, verify mounting requirements prior to ordering cabinets.

3.07 WIRING DEVICES

- A. Use products of a single manufacturer for each type of wiring device. Different manufacturers may be used for different type devices, if the requirements of the specification are fulfilled.
- B. Use the products of a single manufacturer for all device plates. Obtain prior approval for any variations from this requirement except that plate variations are allowed for the following devices:
 - 1. Where the selected plate manufacturer does not manufacture a suitable finish plate.
 - 2. Where the raceway system enclosure employs a non-standard finish plate.
 - 3. Where non-standard plates are specified or indicated.
- C. Where pilot lights are indicated, use incandescent lamp and jewel type lens mounted in the same outlet as the switch, with common finish plate. Pilot lights shall be "on" when controlled load is "on".
- D. Substitute key operations for toggle where locking switches are indicated. Provide not less than two keys for each such switch, except not more than ten keys of the same pattern for the total project. Use only keys that are compatible with key system established for site.
- E. Position receptacles so that the ground contact in grounding type receptacles is on bottom of parallel prongs.
- F. Install adjacent devices of the same type and with the same mounting height in a common outlet box.
- G. Prior to installation of switch outlets, examine architectural plans and verify locations. Place switches in the wall at the latch side of the door.
- H. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with specialty building equipment requiring very exact electrical rough-in.

3.08 BOXES, OUTLETS AND SUPPORTS:

Provide boxes in wiring or raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, when installed exposed up to 7 feet above interior floors, when installed under raised floor or when installed in hazardous areas. Boxes in other areas shall be sheet steel. Each box shall have volume required by NFPA 70 for number of conductors enclosed in the box. Provide gaskets for cast-metal boxes installed in wet locations.

3.09 JUNCTION AND PULL BOXES

- A. Wherever possible use outlet boxes for junction and pull boxes.
- B. Locate interior junction and pull boxes in machine rooms, equipment rooms, storage rooms,

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electrical rooms and similar utility spaces unless otherwise indicated or approved. Where junction or pull boxes must be used in finished areas, use flush boxes only equipped with prime finished sheet metal plates. Fasten plates to boxes with countersunk flat head screws. Provide plates with 3/4" trim all around.

- C. Do not use sectionalized boxes except where indicated. Do not mix feeder and branch circuit conductors in a common pull or junction box.
- D. Where several feeders pass through common pull box, tag feeders to indicate circuit number and panel designation.

3.10 OPENINGS, CHASES AND SLEEVES

- A. Provide openings, chases, cutting, patching, sleeves and other products, necessary to permit the electrical raceways and cables to pass through the structure.
- B. Establish locations for openings, chases and sleeves sufficiently in advance of construction to avoid cutting and patching. Perform any required cutting and patching for electrical work and obtain approval for cutting from Architect prior to work being done.
- C. Repair damages to finished work and surfaces caused by cutting, to the satisfaction of District.
- D. Install sleeves wherever raceways of any type pass through walls or floors above grade, except that sleeves are not required for drywall construction or laid up masonry construction used for interior partitions and not fire rated.
- E. Use pipe or sheet steel sleeves for interior dry locations.
- F. Install sleeves with both ends flush with wall surfaces and with upper ends 3" above floor surfaces. Install bottom end of floor sleeves flush with slabs if not concealed by ceiling system. Use steel pipe sleeves through floors.
- G. Core drill existing concrete walls or slabs to pass new runs of conduit or tubing. Seal core drilled openings as described for sleeves.

3.11 MOUNTING HEIGHTS:

Mount disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor or platform. When installing switch next to existing switch, match mounting height of existing switch.

3.12 FIELD TESTS:

As an exception to requirements that may be stated elsewhere in the contract, the District shall be given minimum 5 working days' notice prior to each test. The Contractor shall provide all test equipment and personnel and submit written copies of all test results.

A. Distribution Conductors, 600 Volt Class: Test all conductors #10 AWG and larger to verify that no short circuits or accidental grounds exist. Tests shall be made using an instrument which applies a voltage of approximately 500 volts and providing a direct reading of resistance in ohms. Insulation resistance, corrected to 60°F, shall not be less than the following values: 250-750 kcmil 50 megohms 4-4/0 AWG 50 megohms 10-6 AWG 100 megohms Record resistance readings, temperature and weather conditions on the test form.

B. Operational Tests: Demonstrate the operation of each switch, relay and other item of electrical control with the system fully energized and operating. Each shall be demonstrated three times. Any faulty or defective Contractor furnished materials and workmanship found during the tests shall be replaced or corrected by the Contractor at no additional cost to the District.

END OF SECTION

SECTION 26 00 60 ELECTRICAL DEMOLITION

PART 1 - GENERAL

- 1.01 SECTION INCLUDES
 - A. Electrical demolition.
- 1.02 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
 - A. Environmental Protection Agency (EPA) Regulations:
 - 1. 40 CFR 261 Regulations Identifying Hazardous Waste
 - 2. 40 CFR 262 Regulations for Hazardous Waste Generators
 - 3. CFR 263 Regulations for Hazardous Waste Transporters
 - 4. 40 CFR 264 Regulations for Owners and Operators of Permitted Hazardous Waste Facilities
 - B. State of California Administrative Codes:
 - 1. Title 22, Division 4, Chapter 30 Minimum Standards for Management of Hazardous and Extremely Hazardous Wastes
 - C. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Regulation:
 - 1. 29 CFR 1910.94 Subpart G, Occupational Health and Environmental Control
 - D. Department of Transportation (DOT):
 - 1. 49 CFR 178 Regulations for Shipping Container Specifications

1.03 SUBMITTALS:

- A. Disposal Permit for Hazardous Waste: Submit a copy of the applicable EPA and state permits or licenses for transportation, treatment, storage, and disposal of hazardous waste by permitted facilities.
- B. Insurance: Provide evidence of reliable insurance coverage and assets to fully indemnify against long-term liabilities and/or catastrophic occurrences. Upon contract award, original Certificates of Insurance must be submitted to the District, indicating all required coverage's and endorsements as requested and required by District.

PART 2 - PRODUCTS

- 2.01 MATERIALS AND EQUIPMENT
 - A. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to Engineer before disturbing existing installation.
- D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate electrical outages with District.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until building modules are abandoned by the District and turned over to the Contractor for construction or new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from District at least 14 days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of this Section and as indicated on the drawings.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply unless otherwise indicated.
- D. Remove exposed abandoned conduit. Cut conduit flush with walls and floors, and patch surfaces.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- F. Disconnect and remove abandoned distribution equipment.
- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove, relocate or provide brackets, hangers, and other accessories as required.

- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

Extend existing installations using materials and methods as specified in Section 26 00 50 "Basic Electrical Materials and Methods."

K. Maintain electrical continuity of existing electrical systems which may extend to outside of the renovation areas.

3.04 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment which remain or are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

- 1.01 SUMMARY
 - A. Section Includes:
 - 1. Copper building wire rated 600 V or less.
 - 2. Fire-alarm wire and cable.
 - 3. Connectors, splices, and terminations rated 600 V and less.
 - B. Related Requirements:
 - 1. All Sections of Division 26, 27 & 28.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

- 2.01 COPPER BUILDING WIRE
 - A. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cerro Wire LLC.
 - 2. General Cable; Prysmian Group North America.
 - 3. Southwire Company, LLC.
 - B. Standards:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
 - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
 - C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8/ ASTM B496 for stranded conductors.
 - D. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.

- 2. Type THW and Type THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
- 3. Type XHHW-2: Comply with UL 44.

2.02 FIRE-ALARM WIRE AND CABLE

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Allied Wire & Cable Inc.
 - 2. Superior Essex Inc.; subsidiary of LS Corp.
 - 3. West Penn Wire.
 - 4. South Wire
 - 5. Belden
 - A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
 - B. Signaling Line Circuits: Twisted, shielded pair, not less than No. 18 AWG or size as recommended by system manufacturer.
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
 - C. Non-Power-Limited Circuits: Solid-copper conductors with 600 V rated, 75 deg C, colorcoded insulation, and complying with requirements in UL 2196 for a two-hour rating.
 - 1. Low-Voltage Circuits: No. 14 AWG, minimum, in pathway.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

2.03 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper.
 - 2. Type: One /Two hole with standard barrels.
 - 3. Termination: Compression/Crimp.

PART 3 - EXECUTION

- 3.01 CONDUCTOR MATERIAL APPLICATIONS
 - A. Feeders:
 - 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
 - 2. Copper for feeders. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- B. Branch Circuits:
 - 1. Copper, Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.
- 3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
 - A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
 - B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
 - C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
 - D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.
 - E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
 - F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

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

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are made only at terminal strips, (FATC), or at device terminals. T Tapping is not allowed.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

D. Comply with requirements in Section 2200 FM 200 Systems.

3.05 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.
- 3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS
 - A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 3.07 FIRESTOPPING
 - A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to UL requirements.

END OF SECTION

SECTION 26 05 26 ELECTRICAL GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Grounding and bonding conductors.
 - 2. Grounding and bonding clamps.
 - 3. Grounding and bonding bushings.
 - 4. Grounding and bonding hubs.
 - 5. Grounding and bonding connectors.
 - 6. Grounding (earthing) electrodes.
 - 7. Grounding electrode enclosures.

1.02 RELATED SECTIONS

- A. Division 26 & 27 Requirements applies to this section, with the additions and modifications specified herein.
- 1.03 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - 1. Product Listing: Include copy of unexpired approval letter, on letterhead of qualified electrical testing agency, certifying product's compliance with specified listing criteria.
 - B. Shop Drawings: Prepare and submit the following:
 - 1. Plans showing dimensioned locations of grounding features described in "Field Quality Control for Grounding and Bonding" Article, including the following:
 - a. Grounding electrode access enclosures.
 - b. Grounding electrodes.
 - c. Grounding arrangements and connections for separately derived systems.
 - C. Field quality-control reports.
 - a. In each standard referenced to herein, consider the advisory provisions to be mandatory, as though the word "shall" have been substituted for "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or other words of similar meaning, to mean Owner.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. In addition to items specified in Section 260010 "Supplemental Requirements for Electrical," include the following:
 - a. Plans showing locations of grounding features described in "Field Quality Control for Grounding and Bonding" Article, including the following:
 - 1) Grounding electrode access enclosures.
 - 2) Grounding electrodes.

- 3) Grounding arrangements and connections for separately derived systems.
- Instructions for periodic testing and inspection of grounding features at test wells, grounding connections for separately derived systems based on NETA MTS and NFPA 70B.
 - 1) Tests must determine if ground-resistance or impedance values remain within specified maximums, and instructions must recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

1.05 QUALIFICATIONS

- A. Electrical Power Testing (EPT) Technician III: Possessing active NICET EPT Level III certification. Able to manage switching procedures, conduct tests of complex equipment, analyze test and equipment data, plan a job, and lead a team. Has experience performing NFPA 70B, IEEE, and NETA electrical tests.
- B. Electrical Power Testing and Inspecting Agency: Entities possessing active credentials from a qualified electrical testing laboratory recognized by authorities having jurisdiction.
 - 1. On-site electrical testing supervisors must possess active NICET EPT Technician III certification.

1.06 SERVICE CONDITIONS FOR ELECTRICAL EQUIPMENT

- A. Electrical and ICT Equipment Grounding (Earthing): Do not exceed 5 Ω resistance to ground (earth).
 - a. if 5 Ω specified resistance to ground (earth) is not attained after complying with prescriptive requirements in Article 250 of NFPA 70, provide additional ground rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.

PART 2 - PRODUCTS

- 2.01 PERFORMANCE REQUIREMENTS
 - A. Regulatory Requirements: Products or components listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2.02 GROUNDING AND BONDING CONDUCTORS

- A. Equipment Grounding Conductor:
 - Standard Features: 600 V, THHN/THWN-2 or THWN-2, copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. ASTM Bare Copper Grounding and Bonding Conductor:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ERICO; brand of nVent Electrical plc.

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- b. Harger Lightning & Grounding; business of Harger, Inc.
- 2. Standard Features: Complying with one or more of the following:
 - a. Soft or Annealed Copper Wire: ASTM B3.
 - b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
 - c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
 - d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.03 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

2.04 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

2.05 GROUNDING (EARTHING) ELECTRODES

A. Standard Features: Copper-clad/Stainless steel; 5/8 inch by 8 ft.

2.06 GROUNDING ELECTRODE ENCLOSURES

- A. Description: Enclosures designed to protect grounding electrodes from damage while providing access for inspection and testing of the grounding system.
- B. Grounding Electrode Access Well Enclosure <Insert drawing designation>:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ERICO; brand of nVent Electrical plc.
 - b. Harger Lightning & Grounding; business of Harger, Inc.
 - c. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.
 - 2. Standard Features: Per manufacturer specifications.
 - a. Well Material: Concrete.
 - b. Cover Material: Steel.
 - c. Cover Strength: Sidewalk or turf use.

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.
 - B. Inspect test results of grounding system measured at point of electrical service equipment connection.

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- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.02 SELECTION OF GROUNDING AND BONDING PRODUCTS

- A. Grounding and Bonding Conductors:
 - 1. Provide solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
 - 2. Underground Grounding Conductors: Install bare copper conductor, [sizes as indicated on the drawings).
- B. Grounding and Bonding Connectors:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.03 INSTALLATION OF GROUNDING AND BONDING

- A. Comply with manufacturer's published instructions.
- B. Reference Standards:
 - 1. Electrical Construction: ICC IBC, ICC IFC, NFPA 1, NFPA 70, and NECA NEIS 1.
 - 2. Electrical Maintenance: NFPA 70B.
 - 3. Electrical Safety: NFPA 70E.
 - 4. Grounding and Bonding: NECA NEIS 331 and Article 250 of NFPA 70.
 - 5. Communications Work: BICSI N1.
 - 6. Work in ITE Rooms: NFPA 75.
 - 7. Work in Health Care Facilities: NFPA 99 and Article 517 of NFPA 70.
 - 8. Emergency and Standby Power Work: NFPA 110, NFPA 111, and NECA NEIS 416.
 - 9. Work in Confined Spaces: NFPA 350.
 - 10. Work in Basements and Other Developed Subterranean Spaces: NFPA 520.
 - 11. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
 - 12. Consult Architect for resolution of conflicting requirements.
- C. Special Techniques:
 - 1. Grounding and Bonding Conductors:
 - a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
 - 2. Grounding and Bonding Connectors: Make connections so the possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

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- a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
- b. Make connections with clean, bare metal at points of contact.
- c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
- d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
- e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
 - 2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.
- 3. Electrodes:
 - a. Ground Rods: Drive rods until the tops are 2 inch below finished floor or final grade unless otherwise indicated.
 - 1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2) Use exothermic welds for below-grade connections.
 - b. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and must be at least 12 inch deep, with cover.
 - 1) Install at least one test well for each service unless otherwise indicated. Install a ground rod electrically closest to the service entrance. Set top of test well flush with finished grade or floor.
 - c. Grounding Handholes: Install driven ground rod through handhole floor, close to wall, and set rod depth so 4 inch will extend above finished floor. If necessary, install ground rod before manhole is placed and provide indicated size bare, tinned-copper conductor from ground rod into handhole through waterproof sleeve in handhole wall. Protect ground rods passing through concrete floor with double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch above to 6 inch below concrete. Seal floor opening with waterproof, nonshrink grout.
- 4. Equipment Grounding and Bonding:
 - a. Install insulated equipment grounding conductors with feeders and branch circuits.
 - b. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1) Feeders and branch circuits.
 - 2) Receptacle circuits.
 - 3) Single-phase motor and appliance branch circuits.
 - 4) Three-phase motor and appliance branch circuits.
 - 5) Flexible raceway runs.
 - 6) Armored and metal-clad cable runs.

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- c. Metallic Fences: Comply with requirements of IEEE C2.
 - 1) Grounding Conductor: Bare tinned copper, not less than 8 AWG wire size.
 - 2) Gates: Must be bonded to grounding conductor with flexible bonding jumper.
 - 3) Barbed Wire: Strands must be bonded to grounding conductor.
- 5. Fence Grounding:
 - a. Grounding Method: At each grounding location, drive the grounding rod vertically until the top is 6 inch below finished grade. Connect rod to fence with 6 AWG conductor. Connect the conductor to each fence component at grounding location.
 - 1) Gates and Other Fence Openings: Ground fence on each side of opening.
 - i) Bond metal gates to gate posts by connecting bonding jumper between gate post and gate frame.
 - ii) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use 2 AWG wire and bury it at least 18 inch below finished grade.
- D. Protection: After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.04 FIELD QUALITY CONTROL FOR GROUNDING AND BONDING

- A. Administrant for Electrical Power Tests and Inspections:
 - 1. Contractor shall engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
 - 2. Engage qualified electrical testing and inspecting agency to administer and perform tests and inspections.
 - 3. Contractor shall Administer and perform tests and inspections in the Prescence of Project DSA I.O.R.
- B. Acceptance Testing Preparation:
- C. Field tests and inspections must be witnessed by DSA Project I.O.R.
- D. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
 - Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal at ground test wells and at individual ground rods. Make tests at ground rods before conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method in accordance with IEEE Std 81.
 - c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify

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Architect promptly and include recommendations to reduce ground resistance.

- 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to record of tests and observations. Include number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- E. Nonconforming Work:
 - 1. Grounding system will be considered defective if it does not pass tests and inspections.
 - 2. Remove and replace defective components and retest.
- F. Collect, assemble, and submit test and inspection reports.
 - 1. Report measured ground resistances that exceed the following values:
 - a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ω .
 - b. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 Ω .

END OF SECTION

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Type EMT FJMX.
 - 2. Type IMC raceways.
 - 3. Type LFMC raceways.
 - 4. Type PVC raceways and fittings.
 - 5. Fittings for conduit, tubing, and cable.
 - 6. Threaded metal joint compound.
 - 7. Solvent cements.
 - 8. Surface metal raceways and fittings.
 - 9. Wireways and auxiliary gutters.
 - 10. Metallic outlet boxes, device boxes, rings, and covers.
 - 11. Termination boxes.
 - 12. Cabinets, cutout boxes, junction boxes, and pull boxes.
 - 13. Cover plates for device boxes.
 - 14. Hoods for outlet boxes.

1.02 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Wireways and auxiliary gutters.
 - 2. Cabinets and cutout boxes.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details. Show that floor boxes are located to avoid interferences and are structurally allowable. Indicate floor thickness at location where boxes are embedded in concrete floors and underfloor clearances where boxes are installed in raised floors.

PART 2 - PRODUCTS

- A. TYPE EMT-S RACEWAYS AND ELBOWS
- B. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 797 and UL Category Control Number FJMX.
- C. Steel Electrical Metal Tubing (EMT-S) and Elbows:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - c. Western Tube; Zekelman Industries.
 - d. Wheatland Tube; Zekelman Industries.

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- 2. Material: Steel.
 - a. Exterior Coating: Zinc/Alternate corrosion-resistant coating.
 - b. Interior Coating: Zinc with organic top coating/Zinc/Organic coating.
 - c. Minimum Trade Size: trade size 3/4).
 - d. Colors: Manufactured to comply with UL 797, ANSI C80.3, NEMA RN2, NEC/CEC Article 250 -118
 - e. Black- Dark Colored Areas (3/4" 2" sizes)
 - f. Orange Fiber Optic systems (3/4" 2" sizes)
 - g. Green Critical (Hospital/healthcare use (3/4" 2" sizes)
 - h. Purple Security Systems/ Specialty Wiring Systems (3/4" 2" sizes)
 - i. Red Emergency Circuits/Fire Alarm systems (3/4" 4" sizes)
 - j. Yellow Caution areas/Specialty Equipment (3/4" 2" sizes)
 - k. Blue Low Voltage wiring/data communication/video/Network Security. (3/4" 2" sizes)
 - I. White Light Colored areas (3/4" 2" sizes)
 - m. Low friction ID Coating (E -Z Pull).

2.02 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 6 and UL Category Control Number DYIX.
- B. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit; Atkore International.
 - b. Calconduit; Atkore International.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. Killark; Hubbell Incorporated, Construction and Energy.
 - e. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - f. Western Tube; Zekelman Industries.
 - g. Wheatland Tube; Zekelman Industries.
 - 2. Exterior Coating: Zinc.
 - a. Exterior Coating: Zinc/Alternate corrosion-resistant coating.
 - b. Interior Coating: Zinc with organic top coating/Zinc/Organic coating.
 - c. Minimum Trade Size: trade size 3/4.
- C. PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Bluesteel Services LLC.
 - c. Calbond; Atkore International.
 - d. KorKap; Robroy Industries.
 - e. Perma-Cote; Robroy Industries.
 - f. Plasti-Bond; Robroy Industries.

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- 2. Options:
 - a. Exterior Coating: PVC complying with NEMA RN 1 and marked ETL Verified PVC-001.
 - b. Exterior Coating: Zinc/Alternate corrosion-resistant coating.
 - c. Interior Coating: Zinc with organic top coating/Zinc/Organic coating.
 - d. Minimum Trade Size: trade size 3/4.
 - e. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - f. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.03 TYPE FMC-S AND TYPE FMC-A RACEWAYS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1 and UL Category Control Number DXUZ.
- B. Steel Flexible Metal Conduit (FMC-S):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Electri-Flex Company.
 - 2. Material: Steel.
 - 3. Options:
 - a. Minimum Trade Size: trade size 3/4.

2.04 TYPE IMC RACEWAYS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1242 and UL Category Control Number DYBY.
- B. Steel Electrical Intermediate Metal Conduit (IMC):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Allied Tube & Conduit; Atkore International.
 - c. Calconduit; Atkore International.
 - d. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
 - e. Western Tube; Zekelman Industries.
 - f. Wheatland Tube; Zekelman Industries.
 - 2. Options:
 - a. Exterior Coating: Zinc/Alternative corrosion-resistant coating.
 - b. Interior Coating: Zinc with organic top coating/Zinc/Organic coating.
 - c. Minimum Trade Size: trade size 3/4.

2.05 TYPE LFMC RACEWAYS

A. Performance Criteria:

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- 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
- 2. General Characteristics: UL 360 and UL Category Control Number DXHR.
- B. Steel Liquid-tight Flexible Metal Conduit (LFMC-S):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Anaconda Sealtite; Anamet Electrical, Inc.
 - c. Electri-Flex Company.
 - d. International Metal Hose Co.
 - 2. Material: Steel.
 - a. Minimum Trade Size: trade size 3/4.
- C. Stainless Steel Liquid-tight Flexible Metal Conduit (LFMC-SS):
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Electri-Flex Company.
 - 2. Material: Stainless steel.
 - 3. Options:
 - a. Minimum Trade Size: trade size 3/4.
- 2.06 FITTINGS FOR CONDUIT, TUBING, AND CABLE
 - A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - B. Fittings for Type ERMC, Type IMC, Raceways:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Konkore Fittings; Atkore International.
 - e. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - g. Southwire Company.
 - 2. General Characteristics: UL 514B and UL Category Control Number DWTT.
 - 3. Options:
 - a. Material: Steel/Die cast.
 - b. Coupling Method: Compression coupling/Raintight compression coupling with distinctive color gland nut. Setscrew couplings & fittings not permitted.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
 - C. Fittings for Type EMT Raceways with compression fittings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the

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following:

- a. ABB, Electrification Products Division.
- b. Allied Tube & Conduit; Atkore International.
- c. Calconduit; Atkore International.
- d. Crouse-Hinds; Eaton, Electrical Sector.
- e. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
- f. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
- g. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
- h. Southwire Company.
- 2. General Characteristics: UL 514B and UL Category Control Number FKAV.
- 3. Options:
 - a. Material: Steel/Die cast.
 - b. Coupling Method: Compression coupling/Raintight compression coupling with distinctive color gland nut. Setscrew couplings & fittings not permitted.
 - c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
 - d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.
- D. Fittings for Type FMC Raceways:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Fittings Corp. (AMFICO).
 - b. Liquid Tight Connector Co.
 - c. Southwire Company.
 - 2. General Characteristics: UL 514B and UL Category Control Number ILNR.
- E. Fittings for Type LFMC Raceways:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Liquid Tight Connector Co.
 - 2. General Characteristics: UL 514B and UL Category Control Number DXAS.
- 2.07 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT
 - A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 2419 and UL Category Control Number FOIZ.
 - B. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. ABB, Electrification Products Division.

2.08 WIREWAYS AND AUXILIARY GUTTERS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

- 2. General Characteristics: UL 870 and UL Category Control Number ZOYX.
- B. Metal Wireways and Auxiliary Gutters:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Hoffman; nVent.
 - d. MonoSystems, Inc.
 - e. Wiegmann; Hubbell Incorporated, Commercial and Industrial.
 - 2. Additional Characteristics:
 - a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
 - b. Finish: Manufacturer's standard enamel finish.
 - 3. Options:
 - a. Degree of Protection: Type 1/Type 3R/Type 4/Type 12 as applicable due to environment where located unless otherwise indicated.
 - b. Wireway Covers: Screw-cover type/Flanged-and-gasketed type unless otherwise indicated.

2.09 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 514A and UL Category Control Number QCIT.
- B. Metallic Outlet Boxes:
 - 1. Description: Box having pry out openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - e. Killark; Hubbell Incorporated, Construction and Energy.
 - f. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - g. Pass & Seymour; Legrand North America, LLC.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - 3. Options:
 - a. Material: Sheet steel/Cast metal.
 - b. Sheet Metal Depth: as required per NFPA 70, Table 314.16(A) for permitted conductor quantities.
 - c. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lbs.

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- d. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lbs.
- C. Metallic Conduit Bodies:
 - 1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Crouse-Hinds; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Killark; Hubbell Incorporated, Construction and Energy.
 - e. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Pass & Seymour; Legrand North America, LLC.
 - g. Plasti-Bond; Robroy Industries.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
- D. Metallic Device Boxes:
 - 1. Description: Box with provisions for mounting wiring device directly to box.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Arlington Industries, Inc.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - e. Hubbell Premise Wiring; Hubbell Incorporated, Commercial, and Industrial.
 - f. Killark; Hubbell Incorporated, Construction and Energy.
 - g. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - h. Plasti-Bond; Robroy Industries.
 - i. Raco Taymac Bell; Hubbell Incorporated, Commercial, and Industrial.
 - j. Wiring Device-Kellems; Hubbell Incorporated, Commercial, and Industrial.
 - 3. Options:
 - a. Material: Sheet steel/Cast metal depth as required per NFPA 70, Table 314.16(A) for permitted conductor quantities for each size box.
 - b. Cast-Metal Depth: minimum 2.4 inch.

2.10 TERMINATION BOXES

- A. Description: Enclosure for termination base consisting of lengths of bus bars, terminal strips, or terminal blocks with provision for wire connectors to accommodate incoming or outgoing conductors or both.
- B. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics: UL 1773 and UL Category Control Number XCKT.
- C. Termination Boxes and Termination Bases for Installation online Side of Service Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. ABB, Electrification Products Division.
- b. B-line; Eaton, Electrical Sector.
- c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
- d. Hoffman; nVent.
- e. Metron; Hubbell Incorporated, Commercial and Industrial.
- f. Milbank Manufacturing Co.
- 2. Additional Characteristics: Listed and labeled for installation online side of service equipment.
- D. Termination Boxes and Termination Bases for Installation on Load Side of Service Equipment:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Erickson Electrical Equipment Company.
 - e. Hoffman; nVent.
 - f. Metron; Hubbell Incorporated, Commercial and Industrial.
 - g. Milbank Manufacturing Co.
 - 2. Additional Characteristics: Listed and labeled for installation on load side of service equipment.
- 2.11 CABINETS, CUTOUT BOXES, JUNCTION BOXES, AND PULL BOXES
 - A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Non-Environmental Characteristics: UL 50.
 - b. Environmental Characteristics: UL 50E.
 - B. Indoor Sheet Metal Cabinets:
 - 1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. FSR Inc.
 - e. Hoffman; nVent.
 - f. Killark; Hubbell Incorporated, Construction and Energy.
 - g. Milbank Manufacturing Co.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - i. Robroy Enclosures; Robroy Industries.
 - 3. Additional Characteristics: UL Category Control Number CYIV.
 - 4. Options:
 - a. Degree of Protection: Type 1/Type 3R/Type 4/Type 12 as applicable due to environment where located unless otherwise indicated.

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- b. Indoor Sheet Metal Cutout Boxes:
- 5. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
- 6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. FSR Inc.
 - e. Hoffman; nVent.
 - f. Killark; Hubbell Incorporated, Construction and Energy.
 - g. Milbank Manufacturing Co.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - i. Robroy Enclosures; Robroy Industries.
- 7. Additional Characteristics: UL Category Control Number CYIV.
- 8. Options:
 - a. Type 1/Type 3R/Type 4/Type 12 as applicable due to environment where located unless otherwise indicated.
- C. Indoor Sheet Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. FSR Inc.
 - d. Hoffman; nVent.
 - e. Hubbell Industrial Controls; Hubbell Incorporated, Commercial and Industrial.
 - f. Milbank Manufacturing Co.
 - g. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - 3. Additional Characteristics: UL Category Control Number BGUZ.
 - 4. Options:
 - a. Degree of Protection: Type 1/Type 3R/Type 4/Type 12 as applicable due to environment where located unless otherwise indicated.
 - b. Indoor Cast-Metal Junction and Pull Boxes:
 - 5. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 6. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; Eaton, Electrical Sector.
 - b. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - 7. Additional Characteristics: UL Category Control Number BGUZ.
 - 8. Options:
 - a. Degree of Protection: Type 1/Type 3R/Type 4/Type 12 as applicable due to environment where located unless otherwise indicated.

- D. Outdoor Sheet Metal Cabinets:
 - 1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. Erickson Electrical Equipment Company.
 - e. FSR Inc.
 - f. Hoffman; nVent.
 - g. Killark; Hubbell Incorporated, Construction and Energy.
 - h. Milbank Manufacturing Co.
 - i. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - j. Robroy Enclosures; Robroy Industries.
 - 3. Additional Characteristics: UL Category Control Number CYIV.
 - a. Options:
 - b. Degree of Protection: Type 3R/Type 4X as applicable due to environment where located unless otherwise indicated.

c.

- E. Outdoor Sheet Metal Cutout Boxes:
 - 1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. B-line; Eaton, Electrical Sector.
 - c. Crouse-Hinds; Eaton, Electrical Sector.
 - d. Erickson Electrical Equipment Company.
 - e. FSR Inc.
 - f. Hoffman; nVent.
 - g. Killark; Hubbell Incorporated, Construction and Energy.
 - h. Milbank Manufacturing Co.
 - i. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - j. Robroy Enclosures; Robroy Industries.
 - 3. Additional Characteristics: UL Category Control Number CYIV.
 - a. Options:
 - b. Degree of Protection: Type 3R /Type 4X as applicable due to environment where located unless otherwise indicated.
- F. Outdoor Sheet Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. B-line; Eaton, Electrical Sector.
 - b. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. FSR Inc.

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- d. Hoffman; nVent.
- e. Hubbell Industrial Controls; Hubbell Incorporated, Commercial and Industrial.
- f. Milbank Manufacturing Co.
- g. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
- h. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
- 3. Additional Characteristics: UL Category Control Number BGUZ.
 - a. Options:
 - b. Degree of Protection: Type 3R /Type 4X as applicable due to environment where located unless otherwise indicated.
- G. Outdoor Cast-Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crouse-Hinds; Eaton, Electrical Sector.
 - b. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - 3. Additional Characteristics: UL Category Control Number BGUZ.
 - 4. Options:
 - a. Degree of Protection: Type 3R /Type 4X as applicable due to environment where located unless otherwise indicated.

2.12 COVER PLATES FOR DEVICES BOXES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - b. Wall plate-Securing Screws: Metal with head color to match wall plate finish.
- B. Metallic Cover Plates for Device Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - c. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
 - d. Leviton Manufacturing Co., Inc.
 - e. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
 - f. Pass & Seymour; Legrand North America, LLC.
 - g. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - 2. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - b. Wall plate Material: Type 302/304 non-magnetic stainless steel with brushed finish.

2.13 HOODS FOR OUTLET BOXES

- A. Performance Criteria:
 - 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
 - 2. General Characteristics:
 - a. Reference Standards:
 - 1) UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Receptacle, hood, cover plate, gaskets, and seals comply with UL 498 Supplement SA when mated with box or enclosure complying with UL 514A, UL 514C, or UL 50E.
 - 3. Mounts to box using fasteners different from wiring device.
- B. Retractable or Re-attachable Hoods for Outlet Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - 2. Options:
 - a. Provides Gray, weatherproof, "while-in-use" cover.
- C. Extra-Duty, While-in-Use Hoods for Outlet Boxes:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - c. EGS; Emerson Electric Co., Automation Solutions, Appleton Group.
 - d. Leviton Manufacturing Co., Inc.
 - e. Raco Taymac Bell; Hubbell Incorporated, Commercial and Industrial.
 - 2. Additional Characteristics: Marked "Extra-Duty" in accordance with UL 514D.
 - 3. Options:
 - a. Provides gray, weatherproof, "while-in-use" cover.
 - b. Manufacturer may combine nonmetallic device box with hood as extra-duty rated assembly.

PART 3 - EXECUTION

- 3.01 SELECTION OF RACEWAYS
 - A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.
 - B. Outdoors:
 - 1. Exposed and Subject to Severe Physical Damage: IMC.
 - 2. Exposed and Subject to Physical Damage: IMC.
 - 3. Exposed and Not Subject to Physical Damage: IMC.

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- 4. Concealed Aboveground: IMC
- 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
- C. Indoors:
 - 1. Hazardous Classified Locations: IMC.
 - 2. Exposed and Subject to Severe Physical Damage: IMC. Subject to severe physical damage includes the following locations:
 - a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 - 3. Exposed and Subject to Physical Damage: IMC. Subject to physical damage includes the following locations:
 - a. Locations less than 2.5 m above finished floor.
 - b. Stub-ups to above suspended ceilings.
 - 4. Exposed and Not Subject to Physical Damage: EMT.
 - 5. Concealed in Ceilings and Interior Walls and Partitions: EMT
 - 6. Damp or Wet Locations: IMC.
 - 7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC/FMC.
- D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines (No Set Screw Z Fittings).
 - 1. IMC: Provide threaded type fittings unless otherwise indicated.

3.02 SELECTION OF BOXES AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
 - 1. Outdoors:
 - a. Type 3R/Type 4 unless otherwise indicated.
 - b. Locations Exposed to Hosed own: Type 4X.
 - c. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
 - 2. Indoors:
 - a. Type 1 unless otherwise indicated.
 - b. Damp or Dusty Locations: Type 4.
 - c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
 - d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
 - e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.
 - f. Locations Exposed to Hose down: Type 4X.
 - g. Locations Exposed to Corrosive Agents: Type 4X.
 - h. Locations Exposed to Spraying Oil or Coolants: Type 13.
- C. Exposed Boxes Installed Less Than 8 ft. Above Floor:

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- 1. Provide cast-metal boxes. Boxes with knockouts or unprotected openings are prohibited.
- 2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.03 INSTALLATION OF RACEWAYS

- A. Installation Standards:
 - 1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
 - 2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
 - 3. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
 - 4. Comply with NECA NEIS 101 for installation of steel raceways.
 - 5. Comply with NECA NEIS 102 for installation of aluminum raceways.
 - 6. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
 - 7. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 - Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to trade size 1-1/4 and insulated throat metal bushings on trade size 1-1/2 and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
 - 9. Raceway Terminations at Locations Subject to Moisture or Vibration:
 - a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG. Install insulated throat metal grounding bushings on service conduits.
- B. General Requirements for Installation of Raceways:
 - 1. Complete raceway installation before starting conductor installation.
 - 2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
 - 3. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch of changes in direction.
 - 4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
 - 5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
 - 6. Support conduit within 12 inch of enclosures to which attached.
 - 7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
 - 8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.

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- d. Conduit extending into pressurized duct and equipment.
- e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
- f. Where otherwise required by NFPA 70.
- 9. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
- 10. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
- 11. Keep raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- 12. Cut conduit perpendicular to the length. For conduits trade size 2 and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
- 13. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lbs tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- C. Requirements for Installation of Specific Raceway Types:
 - 1. Types EMT-A, ERMC-A, and FMC-A:
 - 2. Types ERMC and IMC:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
 - 3. Types FMC and LFMC:
 - a. Comply with NEMA RV 3. Provide a maximum of 72 inch of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 4. Type PVC:
 - a. Do not install Type PVC conduit where ambient temperature exceeds 122 deg F (Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
 - b. Comply with manufacturer's written instructions for solvent welding and fittings.
- D. Stub-ups to Above Recessed Ceilings:
 - 1. Provide EMT, IMC for raceways.
 - 2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- E. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
 - ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 - 2. EMT: Provide compression/steel/cast-metal fittings. Comply with NEMA FB 2.10.
 - 3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
- F. Expansion-Joint Fittings:

- Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground IMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
- 2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F temperature change.
- Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
- 4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
- 5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- G. Raceways Penetrating Rooms or Walls with Acoustical Requirements:
 - 1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.04 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.
- B. Install surface raceway with a minimum 2-inch radius control at bend points.
- C. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.05 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
- D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

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- E. Locate boxes so that cover or plate will not span different building finishes.
- F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- I. Set metal floor boxes level and flush with finished floor surface.
- J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - 2. Provide gaskets for wall plates and covers.

3.06 FIRESTOPPING

A. Install UL Listed firestopping materials at penetrations of fire-rated floor and wall assemblies.

3.07 PROTECTION

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

3.08 CLEANING

A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floormounted enclosures before installing wall plates, covers, and hoods.

END OF SECTION

SECTION 26 05 44

ELECTRICAL AND LOW VOLTAGE SLEEVES AND SLEEVE SEALS GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This section includes labor, materials, and equipment necessary to complete the installation required for the items specified under this section, including but not limited to Sleeves And Sleeve Seals For Electric and Low voltage Cabling.

1.03 SUBMITTALS

- A. Product Data: Provide manufacturer's standard catalog data for specified products demonstrating compliance with referenced standards and listing numbers of systems in which each product is to be used.
- B. Submit schedule of all expected opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
- C. Certificates: Product Certificate of Compliance from the manufacturer certifying material compliance with applicable code and specified performance characteristics.
- D. Installation Instructions: Submit manufacturer's printed installation instructions.

1.04 QUALITY ASSURANCE

- A. Products/Systems: Provide sleeves & sleeve seals systems that comply with the following requirements:
 - 1. Firestopping products bear the classification marking of qualified testing and inspection agency.
- B. Installer Qualifications: Experience in performing work of this section who is qualified by the firestopping manufacturer as having been provided the necessary training to install firestop products in accordance with specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - 1. Manufacturer's original, unopened, undamaged containers, identification labels intact identifying product and manufacturer, date of manufacture; lot number; shelf life, if applicable; qualified testing and inspection agency's classification marking; and mixing instruction for multi-component products.
 - 2. Handle and store products according to manufacturer's recommendations published in technical materials. Leave products wrapped or otherwise protected and under clean and dry storage conditions until required for installation.
- B. Storage and Protection:
 - 1. Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.06 PROJECT CONDITIONS

A. Do not install products when ambient or substrate temperatures are outside limitations recommended by the manufacturer.

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- B. Do not install products when substrates are wet due to rain, frost, condensation, or other causes.
- C. Do not use materials that contain flammable solvents.
- D. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- E. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- F. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings

PART 2 - PRODUCTS

- 2.01 PERFORMANCE REQUIREMENTS
 - A. References:
 - 1. ANSI/TIA-EIA-569-D "Telecommunications Pathways and Spaces"
 - 2. ASTM E90, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements".
 - 3. ASTM E814, "Fire Tests of Through Penetration Firestops".
 - 4. ASTM E1725, "Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components".
 - 5. CAN/ULC S115, "Standard Method of Fire Tests of Firestops Systems."
 - 6. UL 1479, "Fire Tests of Through Penetration Firestops".
 - 7. National Fire Protection Association (NFPA) NFPA 101: Life Safety Code.
 - 8. National Fire Protection Association (NFPA) NFPA 70: National Electrical Code.
 - 9. Underwriters Laboratories Inc. (UL) Fire Resistance Directory
 - B. Fire rated cable pathway devices shall be used in fire-rated construction for ALL low-voltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints. Such devices shall:
 - 1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.
 - 2. Be tested for the surrounding construction and cable types involved.
 - 3. Have UL Systems permitting cable loads from; "Zero to 100% Visual Fill." This requirement eliminates the need for fill-ratio calculations to be made by cable technicians to ensure cable load is within maximum allowed by UL System.
 - 4. Be "Maintenance-Free", having a corresponding Evaluation Services Report from a Nationally Recognized Third-Party Laboratory. Maintenance-Free is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
 - a. Opening or closing of doors.
 - b. Spinning rings to open or close fabric liner.
 - c. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
 - d. Evaluation Services Report (ESR) from an accredited Nationally Recognized Thirdparty Laboratory certifying compliance with this definition of "Maintenance-Free" and all relevant codes and standards.
 - 5. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
 - 6. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
 - 7. Affix adhesive wall label immediately adjacent to devices to communicate with future cable technicians, authorities having jurisdiction and others the manufacturer of the device and

the corresponding UL System number installed.

- C. Non-rated cable pathway devices shall be used in non-fire-rated construction for all lowvoltage, video, data and voice cabling, optical fiber raceways and certain high-voltage cabling where frequent cable moves, adds and changes may occur. Pathways required for high voltage cabling will be detailed on the prints. Such devices shall:
 - 1. Limit the movement of smoke and sound of wall and or floor penetrated.
 - 2. Restore the STC Rating of the penetrated assembly.
 - 3. Provide L Ratings of greater than 1 CFM when empty and greater than 2.5 CFM at all other loading up to 100 percent.
 - 4. Accommodate cable loads from; "Zero to 100% Visual Fill."
 - 5. Not have inner fabric liner that tightens around and compresses cables tightly together encouraging potential cable damage or interference.
 - 6. Be "Maintenance-Free", maintenance-free is defined as; No action required by cabling technician to open and/or close pathway for cable moves, adds or changes, such as, but not limited to:
 - a. Opening or closing of doors.
 - b. Spinning rings to open or close fabric liner.
 - c. Removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
 - d. Furnish letter from manufacturer certifying compliance with this definition of "Zero-Maintenance".
 - 7. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
 - 8. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
 - 9. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.
- D. As an alternative to using a fire-rated or non-rated cable pathway device for a single or tow low voltage cables (up to an aggregate cross-sectional area of 0.52 in. (O.D.) penetrating one or two-hour, gypsum board/stud wall assemblies or non-rated assemblies, either as a through-penetration or as a membrane-penetration, a fire-rated cable grommet may be substituted. The product shall consist of a molded, two-piece, plenum-rated grommet having a foam fire and smoke sealing membrane that conforms to the outside diameter of the individual cable. The grommet product shall be capable of locking into place to secure the cable penetration within the wall assembly. The grommet shall be UL Classified and tested to the requirements of ASTM E814 (UL 1479) and CAN/ULC S115.
- E. Where non-mechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction. Provide letter from manufacturer certifying compliance with this section.
- F. Cable pathway shall replace conduit sleeves in walls and floors, and the following.
 - 1. When installed individually in floors, devices shall pass through core-drilled or preformed opening utilizing tested floor plates.
 - 2. When multiple units are ganged in floors, devices shall be anchored by means of a tested grid.
 - 3. When installed individually in walls, devices shall pass through core drilled opening utilizing tested wall plates or integrated flanges.
 - 4. When multiple units are ganged in walls, devices shall be anchored by means of a tested adjustable gang bracket.

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G. Cable tray shall terminate at each barrier and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier.

2.02 MANUFACTURERS

- A. Design Intent Manufacturer: Specified Technologies Inc., 210 Evans Way, Somerville, NJ 08876. Tel: (800) 992-1180, Fax: (908) 526-9623, Email: <u>techserv@stifirestop.com</u>, Website: <u>www.stifirestop.com</u>.
- B. Substitutions: Or Approved equal.
- C. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.03 MATERIALS

- A. General: Use only products that have been tested for specific fire resistance rated construction conditions or acoustical and smoke related requirements conforming to construction assembly type, penetrating item type, annular space requirements, and rating involved for each separate instance.
- B. Firestop Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) SpecSeal Series SSS Sealant.
 - 2. Specified Technologies Inc. (STI) SpecSeal Series LCI Sealant.
- C. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) SpecSeal Series SSP Putty.
- D. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame-retardant poly bag, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) SpecSeal Series SSB Pillows.
- E. Fire-Rated Cable Grommet: Molded, two-piece grommet with an integral fire and smoke sealing foam membrane for sealing individual cable penetrations through framed wall assemblies. Grommet snaps together around cable and locks tightly into the wall.
 - 1. Specified Technologies Inc. (STI) EZ-Firestop Grommets.
- F. Fire-Rated Cable Pathways: Device modules comprised of steel pathway with self-adjusting intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) EZ-PATH Fire Rated & Non-Fire rated Pathway.
- G. Smoke and Acoustical Pathways: Device module comprised of a nonmetallic pathway with integral self-adjusting smoke and sound sealing system for cable penetrations through non-fire-resistance rated wall or floor assemblies, the following products are acceptable:
 - 1. Specified Technologies Inc. (STI) EZ-PATH Smoke & Acoustical Pathway.
- H. Protective Wrap: Endothermic Wrap incorporating foil scrim evaluated for protection of cable pathways, liquid fuel lines, as well as in through-penetration and membrane-penetration firestopping. Testing incorporates protection of Electrical Metallic Tubing (EMT), Rigid Metallic Conduit (RMC), Cable Trays, single and/or multi containment liquid fuel lines. Wrap to have a maximum weight of no greater than 1.4 lbs./ft² and allow for the use of steel tie wire when installed around piping, conduits, and/or cable trays. The following products are acceptable:
 - 1. Specified Technologies, Inc. (STI) E-Wrap[™] Endothermic Wrap

PART 3 - EXECUTION

- 3.01 EXAMINATION
 - A. Before beginning installation, verify that substrate conditions previously installed under other sections are acceptable for installation of firestopping in accordance with manufacturer's installation instructions and technical information.
 - B. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants, and any other substances that may inhibit optimum adhesion.
 - C. Provide masking and temporary covering to protect adjacent surfaces.
 - D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified in the published design.
- B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of products.
- 3.03 FIELD QUALITY CONTROL
 - A. Keep areas of work accessible until inspection by authorities having jurisdiction.
 - B. Where deficiencies are found, repair firestopping products so they comply with requirements.

3.04 ADJUSTING AND CLEANING

- A. Remove equipment, materials, and debris, leaving area in undamaged, clean condition.
- B. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

3.05 SCHEDULES

Penetrant Type	Concrete Floor	Concrete Wall	Gypsum Board Wall
Blank Opening	C-AJ-0100, C-AJ-	C-AJ-0100, C-AJ-	W-L-0020, W-L-0034
	AJ-0116	AJ-0116	
Metal Conduits	C-AJ-1080, C-AJ-	C-AJ-1080, W-J-1098,	W-L-1049, W-L-1222,
	1240, C-AJ-1353	W-J-1100	W-L-1168
Plastic	C-AJ-2140, C-AJ-	C-AJ-2038, C-AJ-	W-L-2059, W-L-2074,
Conduits/	2292, F-A-2186, F-A-	2108, C-AJ-2578, C-	W-L-2093, W-L-2241
Raceways	2210, F-A-2225	AJ-2586, W-J-2018,	
-		W-J-2076	
Cables	C-AJ-3214, C-AJ-	C-AJ-3214, C-AJ-	W-L-3219, W-L-3248,
	3231, F-A-3015, F-A-	3231, W-J-3098, W-J-	W-L-3287, W-L-3356,
	3021, F-A-3054	3099, W-J-3124, W-J-	W-L-3377, W-L-3378,
		3150, W-J-3180	W-L-3379, W-L-3390
Cable Trays	C-AJ-3317, C-AJ-	C-AJ-8181, W-J-4021,	W-L-3218, W-L-3271,
	8181, C-AJ-4029, F-	W-J-4022, W-J-4033,	W-L-3286, W-L-3306,
	A-3015, F-A-3037	W-J-3098, W-J-3145,	W-L-4008, W-L-4029,
		W-J-3158	W-L-4043, W-L-8073

3.06 DOCUMENTATION

- A. Place system stickers on each side of wall penetrations.
- B. Place a reproduction (photo copy) of the UL System description in a document protector and mount it to the wall next to the wall penetration.
 - 1. Highlight the section of the system description that list the allowed cable types.

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END OF SECTION

SECTION 26 05 48 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Restraints rigid type.
 - 3. Restraints cable type.
 - 4. Restraint accessories.
 - 5. Post-Installed concrete anchors.
 - 6. Concrete inserts.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load capacity for each seismic -restraint device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic restraint component used.
 - 3. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by ICC-ES product listing, UL product listing and FM Approvals.
 - 4. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated Design Submittal for Each Seismic-Restraint Device: Signed and sealed by qualified structural professional engineer.
 - 1. For each seismic-restraint device, including **restraint rigid and cable type, restraint accessory and concrete anchor and insert** that is required by this Section or is indicated on Drawings, submit the following:
 - a. Seismic Restraints: Select seismic restraints complying with performance requirements, design criteria, and analysis data.

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- b. Post-Installed Concrete Anchors and Inserts: Include calculations showing anticipated seismic loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
- 1.03 INFORMATIONAL SUBMITTALS
 - A. Field quality-control reports.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Seismic -Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: ICC-ES product listing, UL product listing and FM Approvals.
- B. Consequential Damage: Provide additional seismic restraints for suspended electrical components or anchorage of floor-, roof-, or wall-mounted components so that failure of a non-essential or essential component will not cause failure of any other essential building component.
- C. Component Supports:
 - 1. Load ratings, features, and applications of reinforcement components must be based on testing standards of a nationally recognized testing agency.

2.02 RESTRAINTS - RIGID TYPE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. California Dynamics Corporation.
 - 2. Cooper B-line; brand of Eaton, Electrical Sector.
 - 3. Hilti, Inc.
 - 4. Unistrut; Atkore International.
 - 5. Vibration Mountings & Controls, Inc.
 - B. Description: Shop- or field-fabricated bracing assembly made of ANSI/AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.03 RESTRAINTS - CABLE TYPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- 1. CADDY; brand of nVent Electrical plc.
- 2. Cooper B-line; brand of Eaton, Electrical Sector.
- 3. Vibration Mountings & Controls, Inc.
- B. Seismic Restraint Cables: ASTM A1023/A1023M galvanized or ASTM A603 galvanizedsteel or ASTM A492 stainless steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket, or mechanical (Flemish eye) loop.
- C. Restraint cable assembly and cable fittings must comply with ASCE/SEI 19. Cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.04 RESTRAINT ACCESSORIES

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CADDY; brand of nVent Electrical plc.
 - 2. Cooper B-line; brand of Eaton, Electrical Sector.
 - 3. Hilti, Inc.
 - 4. Mason Industries, Inc.
 - 5. Unistrut; Atkore International.
 - B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections/Reinforcing steel angle clamped] to hanger rod. Non-metallic stiffeners are unacceptable.
 - C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to **rigid channel bracings and restraint cables**.
 - D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
 - E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
 - F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.05 POST-INSTALLED CONCRETE ANCHORS

- A. Mechanical Anchor Bolts:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- 2. Cooper B-line; brand of Eaton, Electrical Sector.
- 3. Hilti, Inc.
- 4. Mason Industries, Inc.
- 5. Powers Fasteners.
- 6. Simpson Strong-Tie Co., Inc.
- 7. Unistrut; Atkore International.
- 8. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.
- B. Provide post-installed concrete anchors that have been prequalified for use in seismic and wind-load applications.
 - 1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
 - 2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.
- C. Expansion-type anchor bolts are not permitted for equipment in excess of 10 hp that is not vibration isolated.
 - 1. Undercut expansion anchors are permitted.

2.06 CONCRETE INSERTS

- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-line; brand of Eaton, Electrical Sector.
 - 2. Hilti, Inc.
 - 3. Mason Industries, Inc.
 - 4. Simpson Strong-Tie Co., Inc.
 - 5. Unistrut; Atkore International.
 - B. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC446 testing.
 - C. Comply with MSS SP-58.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and equipment to receive seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by **an evaluation service member of ICC-ES**.
- B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry static and seismic loads within specified loading limits.

3.03 INSTALLATION OF SEISMIC-RESTRAINTDEVICES

- A. Provide seismic restraint devices for systems and equipment, where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
 - 1. Install equipment and devices to withstand the effects of earthquake motions.
- B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified.
- C. Installation of seismic restraints must not cause any stresses, misalignment, or change of position of equipment or conduits.
- D. Equipment Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES that provides required submittals for component.
- E. Raceway, Cable, Wireway, Cable Tray, and Busway Support and Hanger Restraints:
 - 1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 2. Install seismic-restraint and wind-load-restraint] devices using methods approved by an evaluation service member of ICC-ES an agency acceptable to authorities having juris

diction] that provides required submittals for component.

- 3. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
- 4. Install seismic-restraint devices using methods approved by **an evaluation service member of ICC-ES** providing required submittals for component.
- F. Install cables so they do not bend across edges of adjacent equipment or building structure.
- G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Post-Installed Concrete Anchors:
 - Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Mechanical-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors must be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Set anchors to manufacturer's recommended torque using a torque wrench.
 - 5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.05 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Perform tests and inspections with the assistance of a factory-authorized service representative or self-performed by qualified contractor in presence of IOR.
 - 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 3. Schedule test with IOR, before connecting anchorage device to restrained component

Vibration and Seismic Controls

(unless pos connection testing has been approved), and with at least seven days' advance notice.

- 4. Test to 90 percent of rated proof load of device.
- B. Nonconforming Work:
 - 1. Seismic controls will be considered defective if they do not pass tests and inspections.
 - 2. Remove and replace malfunctioning units and retest as specified above.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 26 05 53 ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and labels.
- B. Wire and cable markers.
- C. Conduit markers.

1.02 APPLICABLE PUBLICATIONS:

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

- A. American National Standards Institute, Inc. (ANSI) Publications:
 - 1. Latest Edition of National Electrical Safety Code with 2022 California Electrical Code (CEC) amendments.
 - 2. Z35.1-72 Accident Prevention Signs
- B. State of California Administrative Code:
 - 1. Title 8, Industrial Relations
- C. National Fire Protection Association (NFPA) Publication:
 - 1. 70-2017 National Electrical Code (NEC)

1.03 SUBMITTALS

- A. Submit under provisions of Division 1 & 26/27/28.
- B. Product Data: Provide data for nameplates, labels, conduit and wire markers.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

PART 2 - PRODUCTS

2.01 NAMEPLATES

- A. Provide laminated plastic nameplates for all electrical equipment and devices including, but not limited to, the following:
 - 1. Enclosures for panel boards, distribution boards, HVAC equipment's disconnects and control, panels, pull boxes, cabinets, and motors.
 - 2. Enclosures for all separately enclosed devices including but not limited to disconnect switches, circuit breakers, contactors, time switches, control stations and relays.
 - 3. Wall switches not within sight of outlet controlled.
 - 4. Special systems such as but not limited to telephone, warning and signal systems.

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Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator, and pull box.

- 5. Devices mounted within and part of an equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
- 6. Receptacles and lighting switches: Panelboard I.D. and circuit number.
- B. Nameplate designations shall clearly state:
 - 1. Manufacturer's nameplate including equipment design rating of current, voltage, KVA, HP, bus bracing rating, or as applicable.
 - 2. Equipment nameplate designating system usage and purpose, system nominal voltage, equipment rating for KVA, amperes, HP and RPM as applicable.
 - 3. Contactors: Voltage, continuous current, horsepower or interrupting current, and whether "mechanically-held" or "electrically-held".
 - 4. Motors: Rated voltage, full load amperes, frequency, phases, speed, horsepower, code letter rating, time rating, type of winding, class and temperature.
 - 5. Controllers: Voltage, current, horsepower, and trip setting of motor running overcurrent protection.
 - 6. Receptacles and lighting switches (wiring devices): Panel designation and circuit number.
- C. Nameplates shall be melamine plastic, 0.125-inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering into the black core. Minimum size of nameplates shall be 1 Inch by 2.5 inches. Lettering shall be normal block style unless otherwise noted.
- D. Letter Size:
 - 1. Use 0.25-inch letters for identifying individual equipment and loads.
 - 2. Use 0.50 inch for identifying grouped equipment and loads.

2.02 WIRE MARKERS

- A. Description: Tape or tubing type wire markers, 3M Scotch Code or approved equal.
- B. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
 - 2. Control Circuits: Control wire number indicated on schematic or interconnection diagrams on shop drawings.
- 2.03 UNDERGROUND WARNING TAPE: Provide per the requirements of Section 16050, "Basic Materials and Methods".
- 2.04 ENGRAVED DEVICE PLATES: Provide per the requirements of Section 16050, "Basic Materials and Methods".

PART 3 - EXECUTION

- 3.01 PREPARATION
 - A. Degrease and clean surfaces to receive nameplates and labels.
 - B. Coordinate installation of nameplates, markers and warning signs with the sequence of painting.

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3.02 NAMEPLATES

- A. Provide laminated plastic nameplates for all electrical equipment and devices including, but not limited to, the following:
 - 1. Enclosures for panel boards, distribution boards, HVAC equipment and controls, pull and junction boxes, cabinets and electronic circuit monitors.
 - 2. Enclosures for all separately enclosed devices including but not limited to disconnect switches, circuit breakers, contactors, time switches, control stations and relays.
 - 3. Special systems such as but not limited to telephone, warning and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator, and pull box.
 - 4. Devices mounted within and part of an equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
- B. Mounting: Provide number, location, and letter designation of nameplates as indicated. Install nameplate parallel to equipment lines. Fasten nameplates to enclosures with a minimum of two sheet-metal screws or two rivets. Fasten nameplates to device plates with suitable adhesive. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- 3.03 WIRE MARKERS: Provide markers for each conductor at panelboard gutters, pull boxes, junction boxes, outlet boxes, and each load connection.

END OF SECTION

SECTION 26 06 30 ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

- 1.01 SECTION INCLUDES: Acceptance testing requirements for electrical power systems.
- 1.02 APPLICABLE CODES AND PUBLICATIONS: The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. Use latest applicable codes adopted and enforced by Authorities Having Jurisdiction (AHJ).

APPLICABLE PUBLICATIONS: The following publications form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American National Standards Institute, Inc. (ANSI) Publication:
 - 1. C2-93 National Electrical Safety Code
 - 2. C37.16-88 Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors -Preferred Ratings, Related Requirements and Application Recommendations
- B. International Electrical Testing Association Inc. (NETA) Publication:
 - 1. ATS-1999 Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- C. Institute of Electrical and Electronic Engineers (IEEE) Publications:
 - 1. 141-86 Recommended Practice for Electric Power Distribution for Industrial Plants
 - 2. 242-86 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
 - 3. 399-90 Recommended Practice for Industrial and Commercial Power System Analysis
 - 4. 446-87 Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications
- D. National Fire Protection Association (NFPA) Publication:
 - 1. 70-2017 National Electrical Code (NEC) with latest 2022 California Electrical Code (CEC) amendments.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1 & Division 26,27 & 28.
- B. Qualifications: Provide for:
 - 1. Designated project safety representative.
 - 2. Certified Engineering Technician(s) to be assigned to the project.
- C. Acceptance Test Procedures: Provide for:
 - 1. Distribution Panel Boards.
 - 2. Low voltage circuit breakers (>100A)
 - 3. Grounding systems.
 - 4. Conductors and Cables.
 - 5. All controls provided for 1all specialized systems including but not limited to Theatrical Lighting system and digital screens, rigging hoist & controls etc., as indicated on contract

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documents.

- D. Certified Test Reports: The final report shall be signed and shall include the following information: Summary of the project, description of the equipment tested, visual inspection report, description of the tests, test results, conclusions and recommendations, appendix including appropriate test forms, and identification of the test equipment used. Provide bound copies for:
 - 1. Distribution Panel Boards.
 - 2. Low voltage circuit breakers (>100A)
 - 3. Grounding systems
 - 4. Conductors and Cables.
 - 5. Controls of all specialized system noted above.

1.04 QUALIFICATIONS

- A. The contractor shall engage the services of a qualified testing personnel to provide final inspection, testing, calibration, and adjusting on the electrical distribution system as defined in this Section. The testing personnel shall have been engaged in full practice for a minimum of five years. The organization shall be corporately independent of the supplier, producer, manufacturer.
- B. The testing organization/personnel shall have a calibration program with accuracy traceable every six months, and in an unbroken chain, to the National Institute of Standards and Technology (N.I.S.T.).
- C. The testing personnel shall have a designated safety representative on the project. The safety standards shall include OSHA and NFPA 70E.
- D. Testing and inspection (engaged by the contractor) shall be performed by an Engineering Technician, certified by a National organization, with a minimum 5 years' experience inspecting, testing, and calibrating electrical distribution equipment, systems and devices. Information on the qualifications of the Certified Engineering Technician shall be submitted to the Engineer for approval prior to the start of work.
- E. The qualifications of the testing personnel shall be submitted to the Engineer/District for approval minimum 30 days prior to the start of testing.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

- 3.01 ALL INSPECTIONS SHALL BE PERFORMED in accordance with applicable codes and standards including NEC, CEC, ANSI, IEEE, NEMA and OSHA.
 - A. The testing personnel shall provide all materials, equipment, labor and technical supervision to perform the inspections and tests.

3.02 INSPECTION

A. A visual inspection of the installed equipment shall be performed by the independent testing organization to verify that the distribution equipment installed and to be tested is the equipment denoted on the approved shop drawings. The inspection shall check the

equipment designations, device characteristics, special installation requirements, applicable codes, and standards.

B. After completion of the visual inspection, a report shall be developed stating any discrepancies that may have been found.

3.03 TESTING, CALIBRATION AND ADJUSTMENT

- A. The testing organization shall perform tests on each item of distribution equipment identified in accordance with the latest edition of the International Electrical Testing Association's (NETA) Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems.
- B. Field acceptance testing shall be accomplished on each item of electrical distribution equipment installed or connected as part of this contract. This shall include:
 - 1. Distribution Panel Boards.
 - 2. Low voltage circuit breakers
 - 3. Grounding systems
 - 4. Conductors and Cables.
 - 5. Controls of all specialized system noted above item 1.03D.
- C. Systems shall be energized or otherwise placed in service only after completion of all required tests and an evaluation of the test results has been completed.
- 3.04 CORRECTION OF DEFICIENCIES: Any deficiencies found shall be rectified, and work affected by such deficiencies shall be completely re-tested at the Contractor's expense. Final acceptance of the electrical power system is contingent upon satisfactory completion of the acceptance and system function tests.

END OF SECTION

SECTION 26 24 16 PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panel boards.

1.02 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

1.03 REFERENCES

The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications.

- A. NEMA PB 1 Panelboards
- B. NEMA PB 1.1 Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- C. NEMA AB 1 Molded Case Circuit Breakers
- D. NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
- E. UL 50 Enclosures for Electrical Equipment
- F. UL 67 Panelboards
- G. UL 98 Enclosed and Dead-front Switches
- H. UL 489 Molded-Case Circuit Breakers and Circuit Breaker Enclosures
- I. CSA Standard C22.2 No. 29-M1989 Panelboards and Enclosed Panelboards
- J. CSA Standard C22.2 No. 5-M91 Molded Case Circuit Breakers
- K. Federal Specification W-P-115C Type I Class 1
- L. Federal Specification W-C-375B/Gen Circuit Breakers, Molded Case, Branch Circuit And Service.
- M. NFPA 70 National Electrical Code (NEC)
- N. ASTM American Society of Testing Materials
- O. IBC International Building Code Seismic compliance requirements
- P. NFPA 5000 NFPA Building Code Seismic compliance requirements
- Q. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures Seismic compliance requirements
- R. ICC ES AC156 International Code Council Evaluation Services Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems – seismic testing protocol.
- S. Manufacturer's Instruction Bulletin and installation Manual

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of panel board.
- B. Shop Drawings: For each panel board and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.

- 3. Detail bus configuration, current, and voltage ratings.
- 4. Short-circuit current rating of panel boards and overcurrent protective devices.
- 5. Include evidence of NRTL listing for series rating of installed devices.
- 6. Include evidence of NRTL listing for SPD as installed in panel board.
- 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- 8. Include wiring diagrams for power, signal, and control wiring.
- 9. Key interlock scheme drawing and sequence of operations.
- 10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panel boards.

1.05 INFORMATIONAL SUBMITTALS

- A. Panel board schedules for installation in panel boards.
- 1.06 CLOSEOUT SUBMITTALS
 - A. Operation and maintenance data.

1.07 FIELD CONDITIONS

- A. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures not exceeding 104° F ...
 - 2. Altitude not exceeding 3300 feet.

1.08 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panel boards that fail in materials or workmanship within specified warranty period.
 - 1. Manufacturer shall warrant specified equipment to be free from defects in materials and workmanship for Thirty-Six (36) months of service after Notice of Completion.

PART 2 - PRODUCTS

2.01 PANELBOARDS COMMON REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.
- D. Enclosures: Flush and Surface mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Height: 84 inches maximum with operating device height of 6'7" maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall

have no exposed hardware.

- 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
- E. Incoming Mains Location: Convertible between top and bottom.
- F. Phase, Neutral, and Ground Buses Hard-drawn copper, 98 percent conductivity.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panel board.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panel board.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Sub feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- H. NRTL Label: Panel boards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panel boards shall have meter enclosures, wiring, connections, and other provisions for digital metering. Coordinate with utility company for exact requirements.
- I. Future Devices: Panel boards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- J. Panel board Short-Circuit Current Rating: Series and Fully rated to interrupt symmetrical shortcircuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panel boards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- B. Surge Suppression: Factory installed as an integral part of indicated panel boards, complying with UL 1449 SPD Type 1/Type 2 as indicated on the drawings.

2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Square D: by Schneider Electric. NF & NQOD Type:
 - a. Interior
 - 1) Shall be type NQ or NQOD panelboard rated for 240 Vac/48 Vdc maximum. Continuous main current ratings, as indicated on associated schedules on drawings,

not to exceed 600 amperes maximum.

- 2) Minimum short circuit current rating: As indicated on the drawings and obtained from shirt circuit & coordination studies in rms symmetrical amperes at 240 Vac.
- 3) Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and CEC Articles 230-F and -G.
- 4) All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
- 5) A solidly bonded copper equipment ground bar shall be provided.
- 6) Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length.
- 7) Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting spaces.
- 8) Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.
- 9) Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 100A interiors shall be horizontally/vertically] mounted. Main circuit breakers over 100A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.
- 10) Interior phase bus shall be pre-drilled to accommodate field installable options (NQ only), i.e., Sub-Feed Lugs, Sub-Feed Breakers, Thru-Feed Lugs.
- 2. Main Circuit Breaker:
 - a. Shall be Square D type circuit breakers.
 - b. Main circuit breakers shall have an over center, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
 - c. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
 - d. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.
 - e. Circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.
 - f. Lugs shall be CSA and UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Lug body shall be bolted in place; snap-in designs are not acceptable.
 - g. The circuit breakers shall be CSA and UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm

Switch, Mechanical Lug Kits, and Compression Lug Kits.

- 3. Branch Circuit Breakers
 - a. Shall be Square D type circuit breakers. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the associated schedules on drawings.
 - b. Molded case branch circuit breakers shall have bolt-on type bus connectors.
 - c. Circuit breakers shall have an over center toggle mechanism which will provide quickmake, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
 - d. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red VISI-TRIP® indicator appearing in the clear window of the circuit breaker housing.
 - e. The exposed faceplates of all branch circuit breakers shall be flush with one another.
 - f. Lugs shall be UL Listed to accept solid or stranded [copper and aluminum conductors] [copper conductors only. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16. Branch circuit breakers rated 30 amperes and below shall be UL Listed to accept 60° C rated wire.
 - g. Breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.
- 4. Enclosures
 - a. Type 1 Boxes
 - 1) Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvannealed steel is not acceptable.
 - Boxes shall have removable end walls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
 - 3) Box width shall be 20" wide maximum.
 - b. Type 1 Fronts
 - 1) Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
 - 2) Fronts shall be hinged 1-piece with door. Mounting shall be flush/surface as indicated on associated schedules and drawings.
 - 3) Panelboards shall have MONO-FLAT fronts with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs.
 - 4) Front shall have cylindrical tumbler type lock with catch and spring-loaded stainlesssteel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.

2.04 IDENTIFICATION

- A. Panel board Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panel board door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC

rating.

C. Circuit Directory: Directory card inside panel board door, mounted in metal frame with transparent protective cover.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1.
- B. Install panel boards and accessories according to NECA 407/NEMA PB 1.1.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- E. Mount panel board cabinet plumb and rigid without distortion of box.
- F. Mount recessed panel boards with fronts uniformly flush with wall finish and mating with back box.
- G. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- H. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- I. Install filler plates in unused spaces.
- J. Stub four 1-inch empty conduits from panel board into accessible ceiling space or space designated to be ceiling space in the future. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.02 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements per standard codes.
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panel board door.
- C. Panel board Nameplates: Label each panel board with a nameplate complying with requirements for identification.
- D. Device Nameplates: Label each branch circuit device in power panel boards with a nameplate complying with requirements for identification.
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panel board bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panel boards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panel boards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1 General

1.1 Summary

- 1.1.1. This section outlines the baseline standards for all low voltage communications systems cabling and conduit. The specific requirements found in related sections supersede requirements listed in this section. Standards that have been established by the industry and supplemented by the district are listed in this section to assure proper and consistent installation of all systems.
- 1.1.2. During the course of installation, contractors may discover components and installations that do not meet current District standards. Contractors will install new systems separate from these non-standard installations or retrofit the existing installation to bring into compliance with current District standards. Expanding on a non-compliant, legacy system will be deemed non-compliant to the contracted work and must corrected.

1.2 Qualifications

- 1.2.1. The contractor shall hold a valid State of California C-7 or C-10 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications, shall have been in business of furnishing and installing communication systems of this type for at least two years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.
- 1.2.2. The contractor shall be a factory authorized installer for the brand of equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall maintain a spare set of all major parts for the system at all times.

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1.3 Related Sections

- A. Section 27 00 00 PUSD Communications
- B. Section 27 05 26 PUSD Grounding and Bonding for Communications Systems
- C. Section 27 05 28 PUSD Pathways for Communications Systems
- D. Section 27 05 43 PUSD Underground Ducts and Raceways for Communications Systems
- E. Section 27 11 00 PUSD Communications Equipment Room Fittings
- F. Section 27 13 00 PUSD Communications Backbone Cabling
- G. Section 27 13 13 PUSD Communications Copper Backbone Cabling
- H. Section 27 13 23 PUSD Communications Optical Fiber Backbone Cabling
- I. Section 27 15 00 PUSD Communications Horizontal Cabling
- J. Section 27 15 01.15 PUSD Access Control Communications Conductors and Cables
- K. Section 27 15 01.17 PUSD Intrusion Detection Communications Conductors and Cables
- L. Section 27 15 13 PUSD Communications Copper Horizontal Cabling
- M. Section 27 15 43 PUSD Communications Faceplates and Connectors
- N. Section 27 16 19 PUSD Communications Patch Cords, Station Cords, and Cross Connect Wire
- O. Section 27 20 00 PUSD Data Communications
- P. Section 27 21 00 PUSD Data Communications Network Equipment
- Q. Section 27 21 29 PUSD Data Communications Network Equipment
- R. Section 27 21 33 PUSD Data Communications Wireless Access Points
- S. Section 27 30 00 PUSD Voice Communications
- T. Section 27 40 00 PUSD Audio-Video Communications
- U. Section 27 51 00 PUSD Distributed Audio-Video Communications Systems
- V. Section 27 51 13 PUSD Networked Paging System
- W. Section 28 10 00 PUSD Access Control System
- X. Section 28 20 00 PUSD Video Surveillance System
- Y. Section 28 30 00 PUSD Security Detection, Alarm, and Monitoring
- Z. Section 28 50 00 PUSD Specialized Systems

1.4 Applicable Standards

- 1.4.1. The equipment shall be U.L. listed labeled, and approved for the application shown in the contract documents.
- 1.4.2. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:
 - A. The contract documents
 - B. All related sections and divisions pertaining to the type of work being performed
 - C. ANSI/TIA 568 Commercial Building Telecommunications Standards (current edition, including all applicable revisions, addendums and errata)
 - D. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces (current edition, including all applicable revisions, addendums and errata)
 - E. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – all applicable revisions and addendums

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- F. CEC (current edition, including all applicable revisions, addendums and errata)
- G. CFC (current edition, including all applicable revisions, addendums and errata)
- H. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- I. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials
- J. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
- K. ASTM E1966 Standard Test Method for Fire-Resistive Joint Systems
- L. UL 263 Fire Tests of Building Construction and Materials
- M. UL 723 Tests for Surface Burning Characteristics of Building Materials
- N. UL 1479 Fire Tests of Through-Penetration Firestops
- O. UL 2079 Tests for Fire Resistance of Building Joint Systems
- P. UL Fire Resistance Directory

1.5 Definitions and acronyms

- A. CEC: California Electrical Code
- B. CFC: California Fire Code
- C. EMT: Electrical Metallic Tubing
- D. Firestopping (through-penetration protection system): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.
- E. FMC: Flexible Metal Conduit
- F. IDF: Intermediate Distribution Frame
- G. IMC: Intermediate Metal Conduit
- H. LAN: Local Area Network
- I. LFMC: Liquidtight Flexible Metal Conduit
- J. MDF: Main Distribution Frame
- K. NEC: National Electrical Code
- L. PVC: Polyvinyl Chloride plastic
- M. WAN: Wide Area Network

2 Products

2.1 Product Standards

- 2.1.1. All materials shall conform to the current applicable industry standards including but not limited to:
 - 2.1.1.1 NEMA (National Electrical Manufacturers' Association)
 - 2.1.1.2 ANSI (American National Standards Institute)
 - 2.1.1.3 ASTM (American Society for Testing and Materials)

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- 2.1.1.4 ICEA (Insulated Cable Engineers Association)
- 2.1.1.5 IEEE (Institute of Electrical and Electronic Engineers)
- 2.1.1.6 National Electrical Safety Code
- 2.1.1.7 Telecommunications Industry Association (TIA)
- 2.1.1.8 Electronic Industries Alliance (EIA)
- 2.1.2. Underwriters Laboratories Listing (UL)
 - 2.1.2.1 All Material shall be Underwriters Laboratories Listed unless otherwise specified
- 2.1.3. Product Condition
 - 2.1.3.1 All products must be new, unless otherwise specified
- 2.1.4. Product substitutions shall be managed according to the following guidelines:
 - 2.1.4.1 Where specified only by reference standards, select any product meeting standards by any manufacturer.
 - 2.1.4.2 Where specified by naming several products or manufacturers, select any product and manufacturer named that meets the specified requirements.
 - 2.1.4.3 Submit requests for substitutions within 10 days of contract award
 - 2.1.4.4 Acceptance of substitutions is at the discretion of the Districts ITS department's project manager. The District reserves the right to determine suitability of the substitute product and reject any and all materials submitted for substitution
 - 2.1.4.5 All substitute products and materials must be approved for substitution by the District in writing prior to installation.
 - 2.1.4.6 Products rejected or otherwise judged unsatisfactory by the District will not be authorized for use in completing the Work. Any unapproved products discovered as part of the installation will be removed and replaced with District-specified and approved products at the Contractor's expense.

3 Execution

- A. Each Contractor shall be knowledgeable of work to be performed by other trades and take necessary steps to integrate and coordinate their work with other trades.
- B. The Contractor shall be responsible for furnishing all materials on the drawings or as specified herein for a complete system.
- C. All telecommunications infrastructure shall be installed in an aesthetically pleasing and functional fashion.

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- D. All outages affecting users, including wireless access points, shall be submitted to the Districts ITS Department's project manager for approval two weeks before starting any work that will affect user connectivity.
- E. All work by the contractor must comply with the manufacturer's product recommended installation instructions and warranty requirements.

End of Section

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1 General

1.1 Related Sections

Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

1.2 Related Documents

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

1.3 Qualifications

The Installing Electronic Systems Contractor shall hold a valid State of California C-7 or C-10 license for all low voltage installations and a State of California C-10 License for any related high-voltage applications, shall have been in business of furnishing and installing communication systems of this type for at least ten years, and capable of being bonded to assure the District of performance and satisfactory service during the guarantee period.

The Installing Electronic Systems Contractor shall be a factory authorized distributor and warrantee station for the brand of equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall maintain a spare set of all major parts for the system at all times.

1.4 Definitions

- 1.4.1 BCT: Bonding conductor for telecommunications.
- 1.4.2 BDF: Building Distribution Frame
- 1.4.3 BICSI: Building Industry Consulting Service International.
- 1.4.4 CEC: California Electrical Code (CCR Title 24, Part 3) based on the National Electrical Code.
- 1.4.5 EMT: Electrical metallic tubing.
- 1.4.6 IDF: Intermediate Distribution Frame
- 1.4.7 MDF: Main Distribution Frame
- 1.4.8 LAN: Local area network.

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- 1.4.9 RCDD: Registered Communications Distribution Designer.
- 1.4.10 TGB: Telecommunications grounding busbar.
- 1.4.11 TMGB: Telecommunications main grounding busbar.

1.5 Applicable Standards

- 1.5.1 The equipment shall be U.L. listed labeled, and approved for the application shown in the contract documents.
- 1.5.2 The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:
 - 1.5.2.1 The Contract Documents.
 - 1.5.2.2 ANSI/TIA 568 Commercial Building Telecommunications Standards (Current Editions, including all applicable revisions, addendums and errata's.)
 - 1.5.2.3 ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces (Current Edition, including all applicable revisions, addendums and errata's.)
 - 1.5.2.4 ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – All applicable revisions and addendums.
 - 1.5.2.5 J-STD-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications (Current Edition, including all applicable revisions, addendums and errata's.)
 - 1.5.2.6 Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) (Current Edition, including all applicable revisions, addendums and errata's.)
 - 1.5.2.7 CEC (Current Edition, including all applicable revisions, addendums and errata's.)

1.6 Action Submittals

1.6.1 Product data for each type of product used.

- 1.6.1.1 Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.
- 1.6.1.2 Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
- 1.6.1.3 System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by District.
- 1.6.1.4 Cabling Administration Drawings.

1.7 Informational Submittals

- 1.7.1 As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following: BCT, TMGB, TGBs, and routing of their bonding conductors.
- 1.7.2 Qualification Data: For Installer.
- 1.7.3 Qualification Data: For testing agency and testing agency's field supervisor.
- 1.7.4 Field quality-control reports.
- 1.7.5 Closeout Submittals
 - 1.7.5.1 Result of the bonding-resistance test at each TMGB/TGB and its nearest grounding electrode.

1.8 Quality Assurance

Products, services, and materials provided by the Contractor shall be new and of high quality and free of faults and defects.

Provide products, services, and materials as specified in this document. Substitution of products, services, or materials must receive approval in writing from the Districts ITS – Systems Administration Department.

Contractor shall warranty all work executed and materials furnished shall be free from defects of material and workmanship for a period of two (2) years from acceptance date of Contract Completion. Immediately upon receipt of written notice from the District, Contractor shall repair or replace at no expense to the District: Any defective material or work which may be discovered before final acceptance or work, or within warranty period; any material or work damaged thereby; and adjacent material or work which may be displaced in repair or replacement.

Examination of or failure to examine work by the District shall not relieve Contractor from these obligations.

If Contractor fails to repair or replace material or work indicated above within 7 days of receiving written notice, the District, with its own personnel or by Contract, may proceed with repair or replacement and assess cost against Contractor, if Contractor does not respond accordingly.

Persons skilled in trade shall install system in accordance with best trade practice. Further, in accordance with all applicable building codes. Contractor and all contractors' employees terminating cable to wiring terminating devices shall be certified by the manufacturer of the wiring device. Copies of certificates shall be provided to the District Representative prior to the start of work.

2 **Products**

2.1 System Components

2.1.1 Comply with J-STD-607-B.

2.2 Conductors

- 2.2.1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - Harger Lightning and Grounding.
 - Panduit Corp.
 - Tyco Electronics Corp.
 - Comply with UL 486A-486B.
- 2.2.2 Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
 - 2.2.2.1 Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
 - 2.2.2.2 Cable Tray Equipment Grounding Wire shall be No. 6 AWG and not longer than 12 inches (300 mm). The jumper shall be a wire and shall have a crimped grounding lug with two holes and long barrel for two crimps. Attach with grounding screw or connector provided by cable tray manufacturer.
- 2.2.3 Bare Copper Conductors:

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2.2.3.1 Solid Conductors: ASTM B 3.

2.2.3.2 Stranded Conductors: ASTM B 8.

2.2.3.3 Tinned Conductors: ASTM B 33.

2.3 Connectors

Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.

Retain "Manufacturers" Paragraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

- 2.3.1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - Burndy; Part of Hubbell Electrical Systems.
 - Chatsworth Products, Inc.
 - Harger Lightning and Grounding.
 - Panduit Corp.
 - Tyco Electronics Corp.
- 2.3.2 Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467. Electroplated tinned copper, C and H shaped.
- 2.3.3 Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.
- 2.3.4 Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch (15.8or 25.4-mm) centers for a two-bolt connection to the busbar.
- 2.3.5 Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 Grounding Busbars

- 2.4.1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - Chatsworth Products, Inc.
 - Harger Lightning and Grounding.
 - Panduit Corp.

- 2.4.2 TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, length as indicated on Drawings. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-B.
 - 2.4.2.1 Predrilling shall be with holes for use with lugs specified in this Section.
 - 2.4.2.2 Mounting Hardware: Stand-off brackets that provide a 4-inch (100-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
 - 2.4.2.3 Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- 2.4.3 TGB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, length as indicated on Drawings. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-B.
 - 2.4.3.1 Predrilling shall be with holes for use with lugs specified in this Section.
 - 2.4.3.2 Mounting Hardware: Stand-off brackets that provide at least a 2-inch (50-mm) clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.)
 - 2.4.3.3 Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- 2.4.4 Rack and Cabinet Grounding Busbars: Rectangular bars of hard-drawn solid copper, accepting conductors ranging from No. 14 to No. 2/0 AWG, NRTL listed as complying with UL 467, and complying with J-STD-607-B.
 - 2.4.4.1 Predrilling shall be with holes for use with lugs specified in this Section.
 - 2.4.4.2 Cabinet-Mounted Busbar: Terminal block, with stainless-steel or copper-plated hardware for attachment to the cabinet.
 - 2.4.4.3 Rack-Mounted Horizontal Busbar: Designed for mounting in 19-inch (483-mm) equipment racks. Include a copper splice bar for transitioning to an adjoining rack, and stainless-steel or copper-plated hardware for attachment to the rack.

2.5 Labeling

- 2.5.1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - Brother International Corporation.
 - HellermannTyton.
 - Panduit Corp.

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- 2.5.2 Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- 2.5.3 Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.6 Labeling

- 2.6.1 Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - Brother International Corporation.
 - HellermannTyton.
 - Panduit Corp.
- 2.6.2 Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- 2.6.3 Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 Application

- 2.7.1 Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- 2.7.2 Conductor Terminations and Connections: Equipment Grounding Conductor Terminations: Bolted connectors.
- 2.7.3 Conductor Support: Secure grounding and bonding conductors at intervals of not less than 36 inches (900 mm).
- 2.7.4 Grounding and Bonding Conductors:

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- 2.7.4.1 Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
- 2.7.4.2 Install without splices.
- 2.7.4.3 Support at not more than 36-inch (900-mm) intervals.
- 2.7.4.4 Conductors shall not be installed in EMT unless otherwise indicated.

2.8 Connections

Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.

Stacking of conductors under a single bolt is not permitted when connecting to busbars.

- 2.8.1 Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
 - Use crimping tool and the die specific to the connector.
 - Pretwist the conductor.
 - Apply an antioxidant compound to all bolted and compression connections.
 - Primary Protector: Bond to the TMGB with insulated bonding conductor.
- 2.8.2 Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Install top-mounted rack grounding busbar unless the enclosure and rack are manufactured with the busbar. Bond the equipment grounding busbar to the TGB No. 6 AWG bonding conductors.
- 2.8.3 Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
- 2.8.4 Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

2.9 Identification

- 2.9.1 Labels shall be preprinted or computer-printed type.
- 2.9.2 Label each telecommunications conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

2.10 Firestop Systems

- 2.10.1 A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.
- 2.10.2 All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.
- 2.10.3 Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE, licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the District's Technical Representative prior to installing the firestop system.
- 2.10.4 All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

2.11 Field Quality Control

- 2.11.1 Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- 2.11.2 Perform tests and inspections.
- 2.11.3 Tests and Inspections:

- 2.11.3.1 Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- 2.11.3.2 Test the bonding connections of the system using an AC earth groundresistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
- 2.11.3.3 Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
- 2.11.3.4 Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
- 2.11.3.5 With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB. Maximum acceptable ac current level is 1 A.
- 2.11.4 Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify District's ITS Systems Administration department promptly and include recommendations to reduce ground resistance.
- 2.11.5 Grounding system will be considered defective if it does not pass tests and inspections.
- 2.11.6 Prepare test and inspection reports.

2.12 Cleaning And Protection

The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

2.13 Warranty

- 2.13.1 The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the District.
- 2.13.2 The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the District after the end of the guarantee period.

- 2.13.3 A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.
- 2.13.4 Special Warranty: The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. All warranty repairs shall be done within fourteen days from being notified in writing by the District. This warranty shall be provided at no additional cost to the District.

END SECTION

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1 General

1.1 Summary

- A. This section outlines the baseline standards for all low voltage communications systems pathways and raceways. The specific requirements found in related sections supersede requirements listed in this section.
- B. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

2 Typical Components

The following list of components is current as of revision date of this specification. Part Numbers may be changed by the manufacturer at any time. Please use manufacture's substituted parts for the appropriate replacement part as needed or coordinate with the District to assure the correct parts used. All new installation shall employ the following specification regardless of currently employed systems unless authorized by the District in writing.

2.1 Back Boxes

All Backboxes must be of the appropriate size to support the quantity of cables needed while maintaining the bend radius on all cables.

- 2.1.1. Flush Mount:
 - 2.1.1.1 Standard deep metal back box with 3/4" and 1" knockouts.
- 2.1.2. Indoor Surface Mount:
 - 2.1.2.1 Single Gang: Wiremold Part No. 2348*
 - 2.1.2.2 Double Gang: Wiremold Part No. 2348S/51
- 2.1.3. Outdoor:
 - 2.1.3.1 Standard weatherproof deep metal back box with 3/4" and 1" knockouts.
 - 2.1.3.2 Must be listed for wet locations

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2.2 Metallic Raceway System

Part Numbers are for ivory colored components but may be substituted with color to match décor. If additions to existing raceways and boxes are installed, they should of the same color. If wall color is something other than an available color, raceway will be painted to match the wall directly behind the raceway.

- 2.2.1. Wiremold 500 Series
 - 2.2.1.1 Two-piece surface-mount raceway Part No. V500
 - 2.2.1.2 Bushing Part No. 502
 - 2.2.1.3 Connection Cover Part No. V506
 - 2.2.1.4 Coupling Part No. 5701
 - 2.2.1.5 Supporting Clip Part No. V5703
 - 2.2.1.6 Flat Elbow Part No. V511
 - 2.2.1.7 Internal Elbow Part No. V517
 - 2.2.1.8 External Elbow Part No. V518
- 2.2.2. Wiremold 700 Series
 - 2.2.2.1 Two-piece surface-mount raceway Part No. V700
 - 2.2.2.2 Bushing Part No. 702
 - 2.2.2.3 Connection Cover Part No. V706
 - 2.2.2.4 Coupling Part No. 5701
 - 2.2.2.5 Supporting Clip Part No. V5703
 - 2.2.2.6 Flat Elbow –Part No. V711
 - 2.2.2.7 Internal Elbow Part No. V717
 - 2.2.2.8 External Elbow Part No. V718
- 2.2.3. Wiremold 2000 Series
 - 2.2.3.1 Two-piece surface-mount raceway –Part No. WM2300BAC
 - 2.2.3.2 Entrance end fit –Part No. WM2310A

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2.2.4. Wiremold 500 / 700 Series

- 2.2.4.1 Singe-Gang Shallow Switch and Receptacle Box Fitting V5748S
- 2.2.4.2 Two-Gang Shallow Switch and Receptacle Box Fitting V5747-2
- 2.2.4.3 Single-Gang Flush Type Extension Adapter Fitting V5751
- 2.2.4.4 Two-Gang Flush Type Extension Adapter Fitting V5751-2
- 2.2.4.5 Blank Extension Box Part No. V5760

2.3 Non-Metallic Raceway System

Part Numbers are for white colored components but may be substituted with color to match décor. The District generally employs ivory colored component. If additions to existing raceways and boxes are installed, they should of the same color.

- 2.3.1. Wiremold 3200 Series
 - 2.3.1.1 Two-piece surface-mount raceway –Part No. WM2300BAC
 - 2.3.1.2 Entrance end fit –Part No. WM2310A
 - 2.3.1.3 Raceway clip cover –Part No. WM 2306
 - 2.3.1.4 Flat Elbow –Part No. WM2311
 - 2.3.1.5 Internal Elbow Part No. WM 2317
 - 2.3.1.6 External Elbow Part No. WM 2318
 - 2.3.1.7 T-connector cover Part No. WM 1315

2.4 J-Hooks

- 2.4.1.1 B-Line 2inch Cable Hook with Clip, Part No BL-BCH32-W2
- 2.4.1.2 B-Line 2inch Cable Hook with L-Bracket, Part No. BL-BCH21-RB

2.5 Conduit

Electrical Conduits in compliance with NEMA specifications.

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3 Installation

3.1 General Installation

- 3.1.1. All exposed conduits, raceways and boxes shall be painted to match the area directly behind the conduit, raceway or box unless otherwise noted.
- 3.1.2. Non-metallic systems, such as Wiremold 2300 series should be colored to match décor, if not possible they should be white or ivory.
- 3.1.3. All exposed conduits, raceways and boxes shall be mounted in an aesthetically pleasing fashion concealing the conduit or pathway wherever possible.
- 3.1.4. Unless otherwise noted horizontal conduit and raceway over 3' from the floor will be mounted within 6" of the celling following the lines of the celling.
- 3.1.5. Unless otherwise noted use of zip ties for any low voltage cabling is forbidden. For bundling and wire management velcro must be used.
- 3.1.6. Cables must be property supported and follow an approved pathway.

3.2 Supporting Devices

- 3.2.1. Provide ICC-ES Code Compliant corrosion resistant anchors & fasteners in compliance with ACI, ASTM and CBC as applicable to installed locations. Submit appropriate anchors and fasteners as manufactured by Hilti/DeWalt/Redhead or approved equal with ICC- ES approval.
- 3.2.2. Install conduit and raceway support and spacing in accordance with CEC.
- 3.2.3. Install multiple conduit runs on common hangers.

3.3 Sleeves

- 3.3.1. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- 3.3.2. Extend sleeves through floors 2 inches above finished floor level. Caulk joint between sleeves and floor.
- 3.3.3. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- 3.3.4. Seal both sides of sleeve with firestopping compound.

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3.4 Conduit & Raceway

- 3.4.1. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- 3.4.2. Install raceways accordance with CEC & CFC guidelines.
- 3.4.3. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- 3.4.4. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- 3.4.5. Conduit & Raceway Types & Guidelines:
 - 3.4.5.1 Cut raceways square using saw or pipe cutter; de-burr cut ends.
 - 3.4.5.2 Bring conduit to shoulder of fittings; fasten securely.
 - 3.4.5.3 Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
 - 3.4.5.4 Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.
 - 3.4.5.5 Close ends and unused openings in wireway.
 - 3.4.5.6 All Conduits will be capped with a plastic bushing to avoid cable damage
 - 3.4.5.7 Use of split Y conduit fittings or other conduit intercept methods is expressly forbidden. When joining multiple conduits together a pull box or vault is required.
 - 3.4.5.8 Use of pull elbows are expressly forbidden.
 - 3.4.5.9 Flexible Metallic & Flexible Nonmetallic:
 - a) Not permitted except where required for systemic or vibration requirements.
 - b) Use must be approved in writing by the Districts ITS department.
 - 3.4.5.10 EMT:
 - a) Permitted to be installed indoors above celling and intra-wall.
 - b) Permitted to be installed outdoors when installed above 10 feet in height and weatherproof fittings are used.
 - c) Not permitted in any location where the conduit is subject to severe physical damage.

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3.4.5.11 Ridged:

- a) Permitted to be installed anywhere that EMT is allowed as well as outdoors in areas under 10 feet in height.
- Permitted in locations where conduit may be subject to severe physical damage; however, precautions should be taken to minimize the chance of severe physical damage.

3.4.5.12 Rigid Nonmetallic:

- a) Conduit will be a minimum of Schedule 40, unless otherwise specified.
- b) Permitted only for underground installation, unless otherwise specified.
- c) Join conduit using cement as recommended by manufacturer. Wipe conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

3.4.5.13 Non-Metallic Raceway System:

- a) Permitted to be used indoors only when running cables within the walls is not feasible.
- b) Use must be approved by the Districts ITS department project manager.

3.4.6. Conduit Size:

- 3.4.6.1 Conduit sizing shall be a minimum of ³/₄ inch conduit.
- 3.4.6.2 Conduit installed between the IDF and MDF shall be a 2-inch conduit minimum.
- 3.4.6.3 Conduit size shall be determined by the number of cables required and the conduit fill ratio, unless otherwise specified.
- 3.4.6.4 For conduits feeding a multiple-outlet surface raceway, a minimum of one 1¹/₂" conduit shall be supplied for every 18' of raceway.
- 3.4.7. Raceway Fill Ratio:

Raceways will not be filled above 60%. The exact number of cables through each conduit will vary by the size of the conduit, distance of the run, number of bends and Outside Diameter (OD) of the cable.

- 3.4.7.1 Max fill ratio straight raceways shorter than 6ft: 60%
- 3.4.7.2 Max fill ratio raceways less than 100ft: 40%

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- 3.4.7.3 Max fill ratio raceways over 100ft: 28%
- 3.4.7.4 Continuous raceways with more than 180° worth of bends are not allowed.
- 3.4.7.5 If a raceways reaches the maximum fill rate, a tag will be attached to the raceways inside the pull box indicating that the raceways is full.
- 3.4.8. Pathway Routing
 - 3.4.8.1 Install no more than equivalent of two 90° bends between boxes. Install factory elbows for bends in metal conduit larger than 2-inch size.
 - 3.4.8.2 Route exposed raceway parallel and perpendicular to walls.
 - 3.4.8.3 Route raceway installed above accessible ceilings parallel and perpendicular to walls.
 - 3.4.8.4 Route conduit under slab from point-to-point.
 - 3.4.8.5 Maintain clearance between raceway and piping for maintenance purposes.
 - 3.4.8.6 Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
 - 3.4.8.7 Underground conduct shall be installed per section 27 05 43
- 3.4.9. Mounting and Attachment
 - 3.4.9.1 Arrange raceway supports to prevent misalignment during wiring installation.
 - 3.4.9.2 Group related raceway; support using conduit rack. Construct rack using steel channel and provide space on each for 25 percent additional raceways.
 - 3.4.9.3 Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
 - 3.4.9.4 Do not attach raceway to ceiling support wires or other piping systems.
 - 3.4.9.5 Construct wireway supports from steel channel.
 - 3.4.9.6 Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- 3.5 Boxes
- 3.5.1.1 Install wall mounted boxes at elevations to accommodate mounting heights. If drawings are provided install as indicated on Drawings.

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- 3.5.1.2 Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- 3.5.1.3 Orient boxes to accommodate wiring devices.
- 3.5.1.4 In Accessible Ceiling Areas: Install outlet and junction boxes no more than 18 inches from ceiling access panel or from removable recessed luminaire.
- 3.5.1.5 Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- 3.5.1.6 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- 3.5.1.7 Install stamped steel bridges to fasten flush mounting outlet box between studs.
- 3.5.1.8 Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- 3.5.1.9 Install adjustable steel channel fasteners for hung ceiling outlet box.
- 3.5.1.10 Do not fasten boxes to ceiling support wires or other piping systems.
- 3.5.1.11 Support boxes independently of conduit.
- 3.5.1.12 Install gang box where more than one device is mounted together. Do not use sectional box.
- 3.5.1.13 Install gang box with plaster ring for single device outlets.

3.6 J-Hooks

- 3.6.1.1 The portions of cables installed without raceways or cable tray supports shall be installed with "J-hook" cable supports.
- 3.6.1.2 The "J-hooks" shall provide a wide flat cable support base (0.5"W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support.
- 3.6.1.3 The individual "J-hook" will be appropriately attached to the building structure through methods such as "beam clamp", "hanger rod", clevis hanger styles.
- 3.6.1.4 Install "J-hooks" not more than 48 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to "J-hooks" with hook and loop

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straps. "J-hooks" supported cables, bundle cables together with hook and loop straps.

- 3.6.1.5 "Bridle rings" shall not be used to support cables.
- 3.6.1.6 Cables shall not rest directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.
- 3.6.1.7 Cables shall be loosely bundled in groups not greater than 40 cables.

3.7 Pull String

- 3.7.1. When using an existing pull-string to run cables through conduit, a new pull-string will be installed to replace the one being used.
- 3.7.2. For conduits 1-1/2 inches and larger the pull-string is to be of the polyester tape variety ("mule tape") rated up to 1200lb
- 3.7.3. For conduits smaller than 1-1/2 inches the pull string is to be nylon pull-string such as Greenlee Poly Line 430 rated up to 210lb.

3.8 Firestopping

- 3.8.1. Install firestopping per the CEC and CFC requirements
- 3.8.2. Install material at perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- 3.8.3. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- 3.8.4. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- 3.8.5. Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

END SECTION

SECTION 27 05 43

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1 General

1.1 Summary

- A. This section outlines the baseline standards for all underground ducts and pathways for low voltage communications systems. The specific requirements found in related sections supersede requirements listed in this section.
- B. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

1.2 Job Conditions

- 1.2.1. Environmental Requirements: Provide dewatering and drainage as required in accordance with Los Angeles County requirements and all requirements of the State Water Quality Resources, and as required accomplishing this work. Discharge only clean water and only at approved locations. Provide berms at tops of excavations and embankments and protect the excavation slope with plastic during rainy weather. Divert all water away from excavations and slopes.
 - 1.2.1.1 Contractor shall be responsible for protection and maintenance of all "work areas" during inclement weather, shall maintain existing site drainage in all "non-work areas", and shall not create conditions which would cause any existing portions of site or improvements to be damaged by inclement weather.
 - 1.2.1.2 Flooded Excavations: Should excavations become flooded with standing water, Contractor shall immediately begin pumping to remove such standing water. Failure to protect excavations or to promptly remove such standing water, which results in saturation of subsoils shall require Contractor to remove such saturated soils and replace the soil by properly compacted fill as directed by District Soils Engineer at NO additional cost to District.
 - 1.2.1.3 Erosion Control Plans: Contractor shall implement Erosion Control Plan, prepared by others, for the site and be responsible for implementing and maintaining all erosion control mediation devices. Contractor shall further be responsible for maintaining, updating and implementing the Erosion Control Plans in accordance with local jurisdictions and their requirements. Contractor shall modify the Erosion Control Plans, provide additional devices,

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and implement changes as required or necessitated as work progresses at NO additional cost to District. Contractor shall send one copy of the plan to School District.

- 1.2.1.4 Storm Water Regulations: Contractor shall coordinate work and comply with all requirements of Federal Clean Water Act "NPDES Program" (National Pollutant Discharge Elimination System) which is administered through State of California "2009 General Permit for Storm Water Discharge Associated with Construction Activity". Contact: State Water Resources Control Board, Sacramento, CA, 916-657-1146.
- 1.2.2. Existing Conditions:
 - 1.2.2.1 Grading work and equipment shall be confined to work area; remainder of site is not included in work area(s):
 - 1.2.2.2 CAUTION! Take special care to not damage, modify or move existing utilities, permanent field equipment, drainage systems, landscape sprinkler lines, retaining walls, curbs, walks, trees, AC paving, turf, or any other items except as required in the Contract. Any damage to any existing items to remain, such as landscape sprinklers, utilities, drain lines, trees, AC paving, turf, or any other items shall be repaired or replaced according to requirements of appropriate Spec. Section and the District at NO cost to District.
 - 1.2.2.3 Contractor is hereby advised that existing underground utility locations are typically not shown. Some existing utilities or other items may be very shallow and Contractor is warned that extreme caution is advised in all demolition and earthwork operations.
 - 1.2.2.4 All damage and associated repairs to existing underground utilities and improvements are the sole responsibility of Contractor.

2 Typical Components

The following list of components is current as of revision date of this specification. Part numbers may be changed by the manufacturer at any time. Please use manufacture's substituted parts for the appropriate replacement part as needed or coordinate with the District to assure the correct parts used. All new installation shall employ the following specification regardless of currently employed systems unless authorized by the District in writing.

2.1 Conduit

- 2.1.1. PVC Conduit must be schedule 40 or greater be manufactured to comply with NEMA, NEC and UL specifications.
- 2.1.2. Galvanized ridged steel conduit wrapped in 10 Mil PVC pipe wrap for stub-ups.
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3 Installation

3.1 General Installation

- 3.1.1. The district expressly forbids direct burial of data and voice cables. All cables running underground must be run through appropriate vaults and conduits.
- 3.1.2. Pathway should be designed so as to remain outside of the drip line of existing trees.

3.2 Excavation

- 3.2.1. Contractor must comply with California Government Code 4216 and is responsible for calling Dig Alert whenever excavating.
- 3.2.2. Where crossing of concrete or asphalt is required, saw cut and remove surface material prior to excavating. Remove concrete in complete sections from control joint to control joint regardless of the width of the excavation. Restore concrete and asphalt surfaces following excavation to match existing depth, strength, color, and type of material.

3.3 Bracing & Shoring

- 3.3.1. Contractor is solely responsible for the stability of all slopes and excavations, decreasing the inclinations as required, and all bracing, shoring and other protective measures as required at NO additional cost to District.
- 3.3.2. Contractor shall be solely responsible for design, construction, and maintenance of any and all bracing and shoring to safely support all loads.
- 3.3.3. If steep or vertical-sided excavations are necessary, Contractor shall shore sidewalls in accordance with Cal/OSHA Excavation Standards, good construction practices, and all applicable safety ordinances and codes to provide trench/soil stability during construction and shall submit shoring system design to District's Soils Engineer for review and approval. For steep or vertical-sided excavations whose depth exceeds 4 feet, shoring and bracing is mandatory.

3.4 Fill

- 3.4.1. Base:
 - 3.4.1.1 Scarify and moisture-condition the subgrade bed to receive fill prior to placing materials.
 - 3.4.1.2 Moisture-condition base material to within three (3) percent of optimum moisture content and place in loose, horizontal layers.
 - 3.4.1.3 Level the subgrade bed using sand for trenches and gravel for MH/HH as necessary to form an even base.

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- 3.4.2. Bedding: Do not exceed 4" depth of bedding lifts/layers before compacting
- 3.4.3. Backfill: Do not exceed 6" depth of backfill lifts/layers before compacting.
- 3.4.4. Compaction: Compact using a vibratory plate or roller or other mechanical device. Compaction through jetting and/or pounding is not acceptable.
 - 3.4.4.1 Bedding: Compact material to a dense state equaling at least 95% of the maximum dry density per ASTM D1557.
 - 3.4.4.2 Backfill: Compact material up to two (2) feet below the finished grade with a minimum relative compaction of 90% of the maximum dry density per ASTM D1557. Compact material from two (2) feet below the finished grade up to the finished grade with a minimum relative compaction of 95% of the maximum dry density per ASTM D1557.

3.5 Repair / Replace

- 3.5.1. Surfaces removed or damaged during installation of underground ducts and raceway will be repaired / replaced with new material matching the specs of what was removed.
- 3.5.2. Where concrete is to be replaced steel dowels will be installed every 18" to tie the new slab to the existing slab.

3.6 Underground Conduits

- 3.6.1. Provide bushing on all conduit terminations.
- 3.6.2. All bends shall be factory made and be 10 times the diameter of the conduit.
- 3.6.3. Splice conduits with fittings approved by the conduit manufacturer for the specified applications.
- 3.6.4. PVC conduits shall be minimum of schedule 40 constructions, including if concrete encased.
- 3.6.5. Use galvanized rigid steel conduit for stub-ups. Couple steel conduits to the ducts with adapters designed for the purpose.
- 3.6.6. Galvanized ridged steel conduit will be continuously wrapped with 10Mil PVC pipe wrap for the entire underground section and extend a minimum of 12" above finished grade.
- 3.6.7. All conduits entering the building must be sloped to drain into the maintenance hole/hand hole and not into the building. This slope must be at least 1% at all points.
- 3.6.8. Conduits should enter the Maintenance Hole (MH) at the lower level of the vault and reserve the upper layers for expansion.

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- 3.6.9. As a minimum, 4 2" conduits shall be installed to each building. This will provide for one conduit for copper, one for fiber optic cabling and two for spares.
- 3.6.10. Electrical conduits shall be spaced no less than 12 inches from voice and data conduits, with either one sack slurry or sand fill. The top of the conduit shall be a minimum of 24 inches below grade.
- 3.6.11. Mark trenches with an Underground Warning Tape approximately 18 inches below grade. Tape must be 6" wide, orange in color and denote buried fiber optic cable.
- 3.6.12. Multiple voice/data conduits should be separated from each other using a spacing device such as Carlon spacers or equivalent
- 3.6.13. No conduit from maintenance hole/hand hole to the building entrance facility shall have more than two 90 degree bends or any combination of bends/sweeps totaling more than 180 degrees.
- 3.6.14. Conduits traversing parking lots or driveways must be concrete encased.

3.7 Underground Pull Boxes, Vaults & Handholds

- 3.7.1. Must be traffic rated and marked "Communications" on the lid
- 3.7.2. Will be installed according to the manufactures specifications
- 3.7.3. Will be installed for every 100 feet of continuous conduit.
- 3.7.4. Will be installed when the run exceeds 180° worth of bends.
- 3.7.5. For each cable pull where a cable direction change is required.
- 3.7.6. All conduits will be capped or sealed to prevent dirt or debris from entering the conduit.

3.8 Tracer Wire

- 3.8.1. Tracer wire is to be installed in trench for every new conduit run
 - 3.8.1.1 Pull Box, Vault & Handholds: tracer wire will terminate within each Pull Box, Vault & Handhold near the top and consist of a 1' loop.
 - 3.8.1.2 Above Ground: When pathway transitions to above ground tracer wire will be installed in conduit parallel to the pathway and will terminate in the same enclosure as the pathway with a 1' loop.
- 3.8.2. Tracer wire shall be orange in color and a minimum of 12 AWG with HDPE or LLDP sheath.
- 3.8.3. Use of THHN and THWN electrical wire is prohibited.

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3.9 Pull String

- 3.9.1. When using an existing pull-string to run cables through conduit, a new pull-string will be installed to replace the one being used.
- 3.9.2. For conduits 1-1/2 inches and larger the pull-string is to be of the polyester tape variety ("mule tape") rated up to 1200lb
- 3.9.3. For conduits smaller than 1-1/2 inches the pull string is to be nylon pull-string such Greenlee Poly Line 430 rated up to 210lb.

Sealing

3.9.4. Any empty conduit or innerduct that enters the building must be properly sealed in order to prevent rodents, water or noxious fumes from entering the building. These can be sealed with either expanding foam or Jackmoon plugs

END SECTION

PUSD - Communications Equipment Room Fittings

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

PUSD - Communications Backbone Cabling

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

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- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

PUSD - Communications Copper Backbone Cabling

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1. General

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for additional information covered by this section.

1 Backbone Copper Category Cable

The building backbone consists of the cable and the supporting infrastructure within a building or cluster of buildings that connects the Telecommunications Spaces (MDF/BDF/IDF').

1.1 Copper Category Cable Specifications

Cables shall meet the following requirements:

- 1. UL 444 and 1666, ANSI/TIA-568, FCC Part 68, Category 5e, listed as CMR, CMP, Indoor/Outdoor, or OSP. Cable must be rated for the environment it is installed in.
- 2. Riser or plenum rated multi-pair copper cables shall be installed between the MDF and IDF as required per section 2.2.
- The cable is labeled on both ends clearly identifying the opposite end of the cable based on a cable number assigned by the District ITS Representative. The cable pair count shall also be included in the label.
- 4. The minimum bend radius during installation is 10 times the outside diameter of the cable and 8 times the outside diameter after installation. Minimum bend radius shall be maintained during and after the installation phase.
- Cable will include a minimum of a 10' service loop on each side prior to terminations at the MDF/BDF/IDF locations. The District ITS Representative shall approve the location of this service loop prior to cable installation and termination.
- 6. The Cable is terminated on a Siemon 66M150 blocks with 89B standouts or equivalent.

1.2 Copper Backbone Category Cable Sizing

- 1. The size of the backbone cable is a function of the number of voice ports supported by the IDF.
- 2. The minimum number of copper cable pairs required for each voice port = 2 pairs.

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- 3. Cables shall be sized to the next larger, standard pair size (i.e. 25, 50, 100, etc.).
- 4. In the event of a conflict between the spec and the drawings the larger pair count will be used.

1.3 Outside Plant UTP Copper Category Cable

- 1. All outside plant cable shall be OSP or Indoor/Outdoor rated.
 - a. Any cable that will traverse any outdoor or underground conduit but will also have section traveling continuously for more than 50ft before termination must employ indoor/outdoor rated cable instead of OSP.
 - b. Any cables traversing very long lengths and/or has any sections "free runs" (not going through conduit, vaults or junction boxes or otherwise exposed to the elements) must employ OSP.
- 2. OSP Copper cable shall have a loop left in each Manhole/pull box.

PUSD - Communications Optical Fiber Backbone Cabling

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

PUSD - Communications Copper Horizontal Cabling

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

SECTION 27 15 01.15 PUSD – Access Control Communications Conductors and Cables

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THE CONTRACTOR SHALL FOLLOW THESE SPECIFICATIONS FOR ALL PRODUCTS AND INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH THE DISTRICT'S ITS DEPARTMENT PROJECT MANAGER PRIOR TO THE START OF ANY RELATED WORK.

1 General

1.1 Summary

This section outlines the baseline standards for all access control systems cabling. The requirements found in this section supersede requirements listed in other sections. All Ethernet network cable required for the intrusion detection systems shall have a jacket color of orange and follow the specifications outlined in Section 27 20 00.

Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

1.2 Submittals

Contractor to supply map of the site outlining the path that the cables were ran, the location of any cable splices, and the location of any pathway used that has less than 25% remaining capacity based on the fill ratios documented in Section 27 05 28.

2 Typical Components

2.1 Typical Cable Types

- 2.1.1. Composite Access Control Wire, 16 conductor (#22-3pr, #18-4c, #18-6c) (Preferred)
- 2.1.2. Composite Access Control Wire, 16 conductor (#18-3pr, #16-4c, #18-6c)
- 2.1.3. 18 gauge AWG, 2 conductor ("18/2")
- 2.1.4. 18 gauge AWG, 4 conductor ("18/4")
- 2.1.5. 18 gauge AWG, 6 conductor ("18/6")
- 2.1.6. 18 gauge AWG, 8 conductor ("18/8")
- 2.1.7. 22 gauge AWG, 2 conductor ("22/2")
- 2.1.8. 22 gauge AWG, 4 conductor ("22/4")
- 2.1.9. 22 gauge AWG, 5 conductor ("22/5")

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2.2 Typical Cable Jacket Ratings

- 2.2.1. Plenum
- 2.2.2. Indoor/Outdoor

2.3 Cable Splice

2.3.1. Dolphin 1-Port Moisture Resistant, Run Tap Insulation Displacement Connector

3 Installation

3.1 Cable Installation

- 3.1.1. Cable Requirements
 - 3.1.1.1 Cables shall be UL listed, complying with California Electrical Code and ETL verified to meet or exceed specified requirements and be rated for the space that they occupy.
 - 3.1.1.2 It is the responsibility of the contractor to utilize the appropriately rated cable. Unless otherwise noted all cable will be plenum rated. All cables that traverse any outdoor or underground conduit shall be either OSP or indoor/outdoor rated. If a cable that outdoor or underground conduit also traverses a plenum air space, then the cable must be Plenum OSP or plenum indoor/outdoor rated.
 - 3.1.1.3 All cable conductors must be copper; copper-clad aluminum is not allowed
 - 3.1.1.4 Unless otherwise noted use of zip ties for any low voltage cabling is forbidden. For bundling and wire management velcro must be used.
 - 3.1.1.5 Cables between access control components shall have a jacket color of white or grey, unless the cable type is OSP in which case black is acceptable.
 - 3.1.1.6 With the exception of cables for transfer hinges, all cable runs shall be home run, cable splices are not allowed for new installs.
 - 3.1.1.7 If shielded cable is utilized, then all shielding must be bonded together and connected to ground at the reader controller.

3.1.2. Installation

3.1.2.1 Cables shall be installed through pathways defined in Section 27 05 28 and Section 27 05 43

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- 3.1.2.2 Cables pulled through all conduits and raceways must use Dynablue cable pulling lubricant. Lubricant shall be continuously applied to all cables. The cable manufacturer must specifically approve all lubricants. **The district expressly prohibits yellow 77 and other wax based lubricants**.
- 3.1.2.3 All exposed cable must be in conduit/raceway. Conduits/raceways are optional above 8' in a limited access room (e.g., Electrical or Mechanical rooms)
- 3.1.2.4 Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware.
- 3.1.2.5 The maximum sag allowed when pulling through J-hooks is six inches.
- 3.1.2.6 Care shall be taken to ensure that cables are not resting directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.
- 3.1.2.7 Cables shall be bundled in groups of not greater than 40 cables.
- 3.1.2.8 Cables shall be installed so that they do not obscure any valves, fire alarm conduit, boxes, or other control devices.
- 3.1.2.9 Any cable damaged during installation shall be replaced by the contractor prior to final acceptance at no cost to the District.

3.2 Service Loops

- 3.2.1. For each cable provide 10 feet of service loop at both ends of the cable, unless otherwise noted.
 - 3.2.1.1 End devices such as readers, strikes, transfer hinges, and switches must have a minimum of 18" of service slack at the device side. Example: The cable from a reader interface to a strike needs a 10' service loop at the reader interface and 18" of service slack at the strike.
- 3.2.2. Loop will have a minimum diameter of 18 inches.
- 3.2.3. Loops will be mounted either to a backboard or supported using J-Hooks. If J-Hooks are used they must be mounted according to Section 27 05 28.
- 3.2.4. Access Control Panel and Reader Interface
 - 3.2.4.1 When access control panel and reader interface is located in a limited access area, such as a data room or electrical room, the loop will be mounted on the backboard adjacent to or above the access control panel.
 - 3.2.4.2 When access control panel and reader interface is located in a public space, such as a classroom or office, the loop will be mounted above the celling.

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3.3 Cable Splice

- 3.3.1. With the exception of cables for transfer hinges, cable splices are only permitted to extend or repair an existing cable. All new runs must be home run from the access control panel or reader interface to the device.
- 3.3.2. Strip wire before applying the moisture resistant connector
- 3.3.3. Each side of the splice will have a two-foot service loop. Loops will be group together with hook and loop straps.
- 3.3.4. Cable splices are not permitted for Ethernet cables.

3.4 Cable Termination

- 3.4.1. When connecting to devices that have connectors already on the cable, the corresponding pigtail connector shall be used. Modifying the device cable to remove the connector is not allowed.
- 3.4.2. When terminating cable on device that has a terminal block then the cable shall be stripped so that the cable makes a solid mechanical bond and so that no exposed wire is visible.

4 Cable Labeling

4.1 Cables

- 4.1.1. All label printing will be machine generated using indelible ink ribbons or cartridges on self-laminating labels.
- 4.1.2. Label shall be wrapped completely around the cable and back onto itself so that it cannot be removed easily.
- 4.1.3. Cables shall be labeled on both sides within one foot of termination point.

4.1.4.	Cable Labeling Standard:			
	a) Access Control Panel to Reader Interface:	A-P		
		Exa		
	b) Reader Interface to Device:	A-D		
		Exo		

A-P[PanelID]-[RoomIdentifier] *Example: A-P01-B205* A-DeviceType *Example: A-Reader*

4.2 Cable Splice

4.2.1. Except for the purpose of repairs of existing cable or for connecting end devices (transfer hinges, readers, door position switches, etc.) splices shall not be allowed.
Cables spliced for the purposes of repair shall be identified on both ends with a band of blue electrical tape or blue shrink wrap.

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4.2.2. When a splice is utilized for a repair both cables must be labeled in accordance with section 4.1 within one foot of the splice.

END SECTION

PUSD – Intrusion Detection Communications Conductors and Cables

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1 General

1.1 Summary

This section outlines the baseline standards for all intrusion detection systems cabling. The requirements found in this section supersede requirements listed in other sections. All Ethernet network cable required for the intrusion detection systems shall have a jacket color of orange and follow the specifications outlined in Section 27 20 00.

Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

1.2 Submittals

Contractor to supply map of the site outlining the path that the cables were ran, the location of any cable splices, and the location of any pathway used that has less than 25% remaining capacity based on the fill ratios documented in Section 27 05 28.

2 Typical Components

Cables shall be UL listed, complying with California Electrical Code and ETL verified to meet or exceed specified requirements. All cables will be rated for the space that they are installed and must be copper conductors; copper-clad aluminum is not allowed. Cables installed in underground conduit will be OSP loose tube gel filled with rated jacket.

2.1 Typical Cable Types

- 2.1.1. 22 gauge AWG, 4 conductor ("22/4") unshielded cable using standard alarm colors Black, Red, White, and Light Green
- 2.1.2. 20 gauge AWG, 12 conductor ("20/12") unshielded cable using standard alarm colors Black, Red, White, Light Green, Orange, Light Blue, Brown, Yellow, Violet, Gray, Pink, and Tan

2.2 Punch Block

2.2.1. Siemon 66M150 blocks with 89B standouts

2.3 Bridge Clips

2.3.1. Semon SMBC-2-3 - Red

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2.3.2. Semon SMBC-2-2 - White

2.4 Cable Splice

2.4.1. Dolphin 1-Port Moisture Resistant, Run Tap Insulation Displacement Connector

3 Installation

3.1 Cable Installation

- 3.1.1. Cable Requirements
 - 3.1.1.1 Cables shall be U. L. listed, complying with California Electrical Code and ETL verified to meet or exceed specified requirements and be rated for the space that they occupy.
 - 3.1.1.2 It is the responsibility of the contractor to utilize the appropriately rated cable. All cables that traverse any outdoor or underground conduit shall be either OSP or indoor/outdoor rated. All cables running through a plenum air space must be plenum rated.
 - 3.1.1.3 Cables between alarm components shall have a jacket color of white or grey, unless the cable type is OSP in which case black is acceptable.
 - 3.1.1.4 All cable runs shall be home run, cable splices are not allowed for new installs.
- 3.1.2. Installation
 - 3.1.2.1 Cables shall be installed through pathways defined in Section 27 05 28
 - 3.1.2.2 Cables pulled through all conduits and raceways must use Dynablue cable pulling lubricant. Lubricant shall be continuously applied to all cables. The cable manufacturer must specifically approve all lubricants. **The district expressly prohibits yellow 77**.
 - 3.1.2.3 Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware.
 - 3.1.2.4 The maximum sag allowed when pulling through J-hooks is six inches.
 - 3.1.2.5 Care shall be taken to ensure that cables are not resting directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.
 - 3.1.2.6 Cables shall be bundled in groups of not greater than 40 cables.

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- 3.1.2.7 Cables shall be installed so that they do not obscure any valves, fire alarm conduit, boxes, or other control devices.
- 3.1.2.8 Any cable damaged during installation shall be replaced by the contractor prior to final acceptance at no cost to the District.
- 3.1.2.9 If shielded cable is utilized, then all of the shielded wires must be bonded together all the way back to the alarm panel enclosure where it will be bounded to ground.

3.2 Service Loops

- 3.2.1. For each cable provide 10 feet of service loop at both ends of the cable, unless otherwise noted.
- 3.2.2. Loop will have a minimum diameter of 18 inches.
- 3.2.3. Loops will be mounted either to a backboard or supported using J-Hooks. If J-Hooks are used they must be mounted according to Section 27 05 28.
- 3.2.4. Alarm Panel and Consolidation Point
 - 3.2.4.1 When alarm panel or consolidation point is located in a limited access area, such as a data room or electrical room, the loop will be mounted on the backboard adjacent to or above the alarm panel or consolidation point.
 - 3.2.4.2 When alarm panel or consolidation point is located in a public space, such as a classroom or office, the loop will be mounted above the celling.

3.3 Cable Splice

- 3.3.1. Cable splices are only permitted to extend or repair an existing cable. All new runs must be home run from the panel or consolidation point to the sensor.
- 3.3.2. Strip wire before applying the moisture resistant connector
- 3.3.3. Each side of the splice will have a two-foot service loop. Loops will be group together with hook and loop straps.
- 3.3.4. Cable splices are not permitted for Ethernet cables.

3.4 Cable Termination

3.4.1. When connecting to devices that have connectors already on the cable, the corresponding pigtail connector shall be used. Modifying the device cable to remove the connector is not allowed.

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3.4.2. When terminating cable on device that has a terminal block then the cable shall be stripped so that the cable makes a solid mechanical bond and so that no exposed wire is visible.

4 Cable Labeling

4.1 Cables

- 4.1.1. All label printing will be machine generated using indelible ink ribbons or cartridges on self-laminating labels.
- 4.1.2. Label shall be wrapped completely around the cable and back onto itself so that it cannot be removed easily.
- 4.1.3. Cables shall be labeled on both sides within one foot of termination point.

4.1.4.	Cable Labeling Standard:			
	a)	Sensor to Alarm Panel:	I-P[PanelID]-[RoomIdentifier]	
			Example: I-P01-B205	
	b)	Sensor to Consolidation Point:	I-C[ConsolidationPointIID]-[RoomIdentifier]	
			Example: I-C03-B205	
	c)	Alarm Panel to Consolidation Point:	I-P[PaneIID]- C[ConsolidationPointIID]	
			Example: I-P01-C03	

4.2 Cable Splice

- 4.2.1. Cables that have been spliced shall be identified on both ends with a band of red electrical tape or red shrink wrap.
- 4.2.2. At the point of splice both wires must be labeled as outlined in 4.1.

PUSD - Communications Copper Horizontal Cabling

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

PUSD - Communications Faceplates and Connectors

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

SECTION 27 16 19 PUSD - Communications Patch Cords, Station Cords, and Cross Connect Wire

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK.

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS DEPARTMENT PERSONNEL PRIOR TO START OF WORK

1. General

1.1 Summary

This chapter describes the requirements for voice and data cabling for Pomona Unified School District and is divided into sections for ease of reference.

Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

Any discrepancies between this document, the drawings, and the physical site must be brought to the attention of the District. This includes any part or method specified that is not optimal for the application listed. Installation of approved parts in a sub-optimal usage will be considered to not meet these specifications.

In order to establish quality and standards of performance of equipment, the district requires that contractors use Leviton System Components or equivalent. All mechanical, electrical and general information set forth on the respective data sheets for each specified item shall be considered as part of these specifications and binding herein. Any proposed equal item offered shall be substantiated fully to prove equality. A list of at least six jobs of the identical equipment that has been in service for at least three years must be submitted with telephone numbers and addresses.

All of the Electronic Systems Equipment shall be furnished and installed by an Authorized Manufacturer Distributor of the equipment that is also an Authorized Installer. The Contractor shall furnish a letter or certification from the manufacturer of all major equipment, which certifies that the Installing Communication Contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacture that they will have a service representative assigned to this area for the life of the equipment.

All data cabling, including wire, fiber, terminators, and patch cables, shall include a lifetime warranty backed by the manufacturer. Please see specific required components at:

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https://www.leviton.com/en/support/product-support/networking/network-solutionswarranties

As the component requirements for Leviton's Limited Lifetime Product and Performance Warranty may occasionally change, the components listed at this URL supersedes those listed on this specification. It is the responsibility of the contractor to satisfy this requirement based on Leviton's requirements. The District should be contacted to resolve any discrepancies.

The entire system shall be installed by a single contractor. If subcontractors are used, they will perform work as an agent of the primary contractor and such work will be the responsibility of and warranted by the primary contractor. Upon notification by the District of a failure, the Contractor shall repair or replace components that no longer fall within the specifications set by the manufacturer. All data wiring shall be certified as required by the manufacturer to comply with the warranty. The certification documentation shall be presented to the District upon completion of the certification.

Unless otherwise stated and approved by the District in writing, all components required to create a complete connection to the district network must be submitted and provided by the contractor. This may include miscellaneous items such as switching/routing equipment, adapters, cables, media converters, hardware, etc. that may not have been included in the district specification. This may also include hardware that may need to be added to existing equipment. If any components were left out of the process during proposal or submittal that would cause the connection to be incomplete, the contractor must provide such components at no cost to the district. Any discrepancies must be reported to the District prior to the start of work. A complete connection outlets in all classrooms.

The district has adopted Cisco and Aerohive technology as the standard for all wired and wireless network equipment installation. All equipment and components are to be in new condition, purchased from an authorized retailer. While the District will entertain proposed solutions from other manufacturers, it is the vendor's responsibility and obligation to provide documentation and other evidence that a non-District standard product is functionally equivalent or better, this information must be provided at the time of the Bid Opening in order for the possible equivalent products to be considered during Bid evaluations. Without such documentation, the District cannot accept the argument on functional equivalency or better based upon on cost alone. In addition, any proposed solution must be fully compatible and interoperable with the District's existing network and VoIP infrastructure without sacrificing any extensible features. Refurbished or alternative equipment may only be used with prior written consent letter from the District. The Districts decision is final on such matters.

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The model of the equipment listed in this specification is a baseline list of equipment that is updated to reflect the latest known generation of equipment. The District will make every attempt at keeping this list up-to-date. If the listed items become outdated or unavailable, the contractor is responsible for informing the District or substituting with the current generation or replacement equipment as needed to accomplish the installation without sacrificing compatibility or features. Replacement must be a direct replacement model or upgrade as approved and recommended by District standard manufacturers as detailed on the device EoL notification.

The District currently employs wireless infrastructure using Aerohive wireless access points as well as Cisco. Any new installation should employ Aerohive access points unless authorized in writing by the district.

The specification is primarily for communication (low-voltage) components but may refer to electrical (high-voltage) specifications. This is not intended to be authoritative on this subject. If there is a separate electrical specification for this job, it will take precedence over any statements concerning electrical systems in this specification.

2. Quality Assurance Standards

2.1 Industry Standards

This specification refers to various authoritative industry standards. This district will make every attempt to be compliant to all of these standards. In the event that any statements in this specification contradict these standards, the contractor must bring it to the attention of the district to determine the course of action. The list of standards includes, but is not limited to:

ISO

ANSI/EIA/TIA especially 568-A/B/C (with 568C taken precedence), 569, and 607 ITU-T especially G.651 and G.652 CSA/CEC NEC/NFPA NEMA AWG IEEE NFPA

2.1.1 Seismic Standard

Manufacturer Seismic Qualification Certification: Submit certification that distribution racks and their components will withstand seismic forces defined in Division 16 Section "Seismic Controls for Electrical Work." Include the following:

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Basis for Certification: Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based. Indicate whether withstand certification is based on actual test of assembled components or on calculation. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity of each rack-mounted component and of each assembled rack type, and locate and describe mounting and anchorage provisions. Provide a detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

2.1.2 Fiber Optic and Copper Data System:

Leviton Systems

Corning Fiber Optics

The current district standard employs Leviton System components (including Leviton qualified third-party components) or proven equivalents.

2.2 District

2.2.1 Installer Qualifications

The system installer must have, on staff, a registered communication distribution designer certified by Building Industry Consulting Service International.

In order to establish quality and standards of performance of equipment, contractors will use Leviton systems components or equivalent in specification and quality to maintain the warranty of all installed channels. All mechanical, electrical and general information set forth on the respective data sheets for each specified item shall be considered as part of these specifications and binding herein. Any proposed equal item offered should be substantiated fully to prove equality. A list of at least six jobs of the identical equipment that has been in service for at least three years must be submitted with contact telephone numbers and addresses. The District reserves the right to require a complete sample of any proposed equal item and may, if necessary, request a sample tested by an independent testing laboratory to prove equality. The decision of the District regarding equality of proposed equal items will be final.

If a substitution item is given final acceptance by the District, the contractor shall pay all costs (including travel, lodging, meals, computers, etc.) required to provide factory certification, equal to that of a Factory Authorized Distributor of the substituted item, for at least two (2) selected District representatives. This training shall occur at the primary

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factory of the substituted item in question and shall allow the selected District representatives to provide any and all Factory / Manufacturer approved repairs, services, software upgrades, etc., without affecting any available or applicable Manufacturer Warranties.

All of the Electronic Systems Equipment shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the installing Communication Contractor has obtained the equipment through an Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacture that they will have a service representative assigned to this area for the life of the equipment. Contractor must employ at least one certified (CCNA, CCNP, etc.) to install and configure the LAN equipment as coordinated with District IT department. Contractor must also employ Aerohive certified installers if working with Aerohive access points.

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

2.3 Planning and Coordination

Before work commences, the installing contractor shall meet jointly with district representatives and, if necessary, the telecommunications and LAN equipment suppliers to exchange information and agree on the deployment and installation schedule and procedures. The locations and orientation of distribution frames, cross-connects, and patch panels in equipment rooms and wiring closets shall also be decided to minimize the impact on other services sharing the space.

Any electronic equipment purchased as part of the job with a cost of more than \$500 must be sent to the district warehouse for asset recording and inventory before being installed at the final location. No exceptions.

Work done at school sites must be scheduled in advance. Contractors are to inform the ITS department of the scope of work, the area that will be worked in, and the time and date of work. ITS will get authorization from the school administration before the work is scheduled. If contractor attempts to begin work without getting authorization, the school site will be instructed to ask the contractor to leave.

The district will attempt to communicate any safety concerns such as other pending work to the facilities, areas with asbestos, lead or other hazards. If the contractor has such

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concerns, the district must be notified immediately before the start of work. The District Maintenance and Operations Department shall advise on any needed provisions.

3 Typical Components

The following list of components is current as of revision date of this specification. Part Numbers may be changed by the manufacturer at any time. Please substitute the appropriate replacement part as needed or coordinate with the District to assure the correct parts used. All new installation shall employ the following specification regardless of currently employed systems unless authorized by the District in writing.

Cables shall be U.L. listed, complying with California Electrical Code and ETL verified to meet or exceed specified requirements. All fiber and copper cables will be rated for the space that they are installed. Cables installed in underground conduit will be OSP loose tube gel filled with rated jacket, etc.

3.0.1 OSP vs indoor/outdoor rated copper and fiber optic cables – Per current EIA/TIA standards, any copper or fiber cable that will traverse any outdoor or underground conduit but will also have section traveling continuously for more than 50ft before termination must employ indoor/outdoor rated cable instead of OSP. Any cables traversing very long lengths and/or has any sections "free runs" (not going through conduit, vaults or junction boxes or otherwise exposed to the elements) must employ OSP. If both condition exist for Fiber cables, a fusion splice will need to be used to transition from one to the other. If this condition exists for copper cables, a new IDF location must be recommended.

3.1 Fiber Optic System

All new fiber installs shall be single mode cable following the specifications outlined in section 3.1.2. Multimode cable is only allowed for repairing existing fiber or with written approval of the ITS department's project manager.

3.1.1 Multi-Mode Cable

Fiber optic cable (50/125micron – OM3 and OM4) graded index multi-mode, minimum 24 conductor, optical glass fibers for use with, but not limited to, ETHERNET, TOKEN RING and FDDI communication systems; potential dual operation at 850nm and 1300nm wave length. Corning or equal. Unless stated otherwise, for new multimode installations OM4 cable is specified and shall have an aqua colored jacket for interior-rated cables with black allowable for OSP and underground cable.

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Fibers will terminate on Leviton HDX 12-fiber shuttered splice module SPLCH-12AQ. Use of the Leviton HDX to SDX Adapter Bracket will be required if mounting in an SDX enclosure and there is not already an adapter bracket with an open slot available. For fiber counts exciding 12 fibers, multiple fiber splice modules must be utilized and located next to each other. When splitting between multiple modules fibers must be bundled and protected so that all fibers in a module move together and cannot get snagged when the module or tray is moved.

Fiber strands shall meet the following minimum specifications:

3.1.1.1 OM3

WAVE LENGTH	MIN. BANDWIDTH	MAX. ATTEN.
850nm	2000MHz per km	2.5dB per km
1300nm	1500MHz per km	1.0dB per km
3.1.1.2 OM4		
WAVE LENGTH	MIN. BANDWIDTH	MAX. ATTEN.
850nm	4700MHz per km	2.5dB per km
1300nm	3500MHz per km	1.0dB per km

3.1.2 Single-Mode Cable

Fiber optic cable optical fibers (9/125micron) graded index single-mode, minimum 12conductor, and optical glass fiber, potential dual operation at 1300nm and 1550nm wave length. Unless stated otherwise, for new single mode installations G.652.D cable is specified and shall have a yellow colored jacket for interior-rated cables with black allowable for OSP and underground cable. For runs utilizing existing pathways with tight bends G.657.B3 fiber shall be used.

Fibers will terminate on a Leviton HDX 12-fiber shuttered splice module SPLCH-12BL. Use of the Leviton HDX to SDX Adapter Bracket will be required if mounting in an SDX enclosure and there is not already an adapter bracket with an open slot available. For fiber counts exciding 12 fibers, multiple fiber splice modules must be utilized and located next to each other. When splitting between multiple modules fibers must be bundled and protected so that all fibers in a module move together and cannot get snagged when the module or tray is moved.

Fiber strands shall meet the following minimum specifications:

3.1.2.1 OS1

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WAVE LENGTH	MIN. BANDWIDTH	MAX. ATTEN.
1310nm	N/A	1.00dB per km
1550nm	N/A	1.00dB per km
2 OS2		
WAVE LENGTH	MIN. BANDWIDTH	MAX. ATTEN.

3.1.2.2

WAVE LENGTH	MIN. BANDWIDTH	MAX. ATTEN.
1310nm	N/A	0.40dB per km
1550nm	N/A	0.40dB per km

3.1.3 Fiber Distribution Box

New fiber termination panels in the MDF/BDF shall employ Leviton Opt-x Uhdx Distribution Enclosure With Sliding Tray, capable of handling a minimum of 24 Leviton HDX 12-Fiber Splice modules.

New IDF fiber termination panels shall be Leviton Opt-X 1000i SDX 1RU Distribution and Splice Enclosure, empty, with sliding tray. Use of the Leviton HDX to SDX Adapter Bracket will be required if there is not already an adapter bracket with an open slot available.

3.1.4 Fiber Optic Patch Cable

Current system employ ST-LC Fiber Patch Cable in various lengths

New systems will employ LC to LC Fiber Patch Cables in various lengths

Previous systems employ Dual ST to ST Fiber Patch Cable SC to SC Fiber Patch Cable SC to LC Patch Cable

3.2 **Copper Cable System – Data**

3.2.1 Horizontal Cable

*For the purpose of color code identification, PUSD considers any color within the Purple color range to be synonymous with Purple. These include violet, magenta, lavender, lilac, indigo and others that fall with this range.

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Cables shall be U. L. listed, complying with California Electrical Code and ETL verified to meet or exceed specified requirements.

All non fiber cables will be copper wire, aluminum or copper clad aluminum is not allowed.

Interior

Category 6 cables shall be 22 to 23 AWG wire (4 pair), individually insulated and color coded, with an overall non-conductivity and appropriately rated purple or blue jacket, as manufactured Berk-Tek, etc. meeting EIA/TIA TSB36. Unless otherwise designated, all data cables are to be category 6, rated to 550MHz.

23AWG 4Pair TP BC Solid CAT6 Indoor/Outdoor Black Jacket as Manufactured by Berk-Tek for runs between buildings using underground and/or outdoor conduit and vaults. Must be installed inside grounded metal conduit and pullboxes.

*For cables running through plenum, even short distances, plenum rated cables must be employed regardless of what currently exists

23AWG 4Pair TP BC Solid CAT6 Outside Plant Flooded Black Jacket as manufactured by Berk-Tek for Outside Plant use only; not UL listed; not fire retardant; no more than 50ft in-building length.

3.2.2 Outlet Termination

See section 4.6.1.1 to determine the correct color jack to use.

Leviton EXTREME Cat 6 QUICKPORT Jack, Purple	(61110-RP6)
Leviton EXTREME Cat 6 QUICKPORT Jack, Orange	(61110-RO)
Leviton EXTREME Cat 6 QUICKPORT Jack, Red	(61110-RR6)
Leviton EXTREME Cat 6 QUICKPORT Jack, Green	(61110-RV6)

3.2.3 Patch Panel

- Standard Density:
 - o Flat QUICKPORT[™] Patch Panel with Vertical Numbering, 48-Port, 2RU, Black. Cable management bar included. (49255-48N)
- High Density:

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Leviton QuickPort High-Density 1RU 48-Port Patch Panel with Vertical Numbering (49255-v48)

3.2.4 Patch Cable

The modular patch cord shall meet or exceed the requirements for Category 6 described in TIA/EIA-568-B.2-1The cords shall meet TIA/EIA-568-B.2-1. All plastics used in construction of the connector bodies shall be fire-retardant with a UL flammability rating of 94V-0.

Category 6 Rated 4-Pair stranded UTP purple (violet) patch cord with boot.

Category 6 Rated 4-pair stranded UTP green cross-over patch cord with boot

Cable lengths of 3, 7, 10 and 15ft lengths are supported by the district.

- 3.2.5 Copper Cable System Voice
- 3.2.5.1 Cable

The district has adopted using Category 6 cables and termination jacks in place of Category 3 components for all new voice installation. This will enable support for both standard analog and VOIP equipment.

Category 6 Voice Cable shall be four pair 24 AWG beige in color from Data/Voice jack location to MDF or IDF. Please see cable specification in section "Copper Cable System –Data".

Voice tie cables between IDF terminals and MDF terminals shall be not less than 25 pair category 3 24 AWG per 20 classrooms.

3.2.5.2 Punch block

Siemon 66M150 blocks with 89B standouts

3.2.5.3 Patch Panel (for VOIP Equipment) See Data – Copper section

3.2.5.4 Termination

Leviton 61110-RW6 (White – Cat6 Voice) modular RJ45 jack insert wall jack, Allen tel 219-4.

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3.2.5.5 Phones

ITT/Cortelco 255444-MBA-20H Ash wall telephone (Cisco IP Phones – Model No.)

3.3 Installation Hardware

3.3.1 Modular Outlet Faceplate

Single Gang 1-port face plate – Leviton Part No. 41080-1WP* Single Gang 2-port face plate – Leviton Part No. 41080-2WP* Single Gang 4 port face plate – Leviton Part No. 41080-4WP* Single Gang 6 port face plate – Leviton Part No. 41080-6WP* Port blanks – Leviton Part No. 41084BWB* 2-port Telecom type (biscuit) surface mount housing Leviton Part No. 41089-2WP* Stainless steel Wallphone wallplate, Leviton Part No. 4108W-1SP Blank Wallplate, Leviton Part No. WP-PB IV

It is preferred to have all cables run through wall conduits without using surface mount raceways. When needed, the raceway systems below may be employed.

3.3.2 Outlet Box

Single Gang Surface Mount backbox – Wiremold Part No. 2348* Double Gang Surface Mount backbox – Wiremold Part No. 2348S/51

3.3.3 Surface Mount Raceway

Wiremold 3200 Series Two-piece surface-mount raceway –Part No. WM2300BAC Entrance end fit –Part No. WM2310A Raceway clip cover –Part No. WM 2306 Flat Elbow –Part No. WM2311 Internal Elbow – Part No. WM 2317 External Elbow – Part No. WM 2318 T-connector cover – Part No. WM 1315

*Part Numbers are for white colored components but may be substituted with color to match décor. The District generally employs ivory colored component. If additions to existing raceways and boxes are installed, they should of the same color.

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3.3.4 Cable Support

B-Line 2inch Cable Hook with Clip, Part No BL-BCH32-W2 B-Line 2inch Cable Hook with L-Bracket, Part No. BL-BCH21-RB CPI Cable Runway Series runway sections (ladders), radii, bends junctions supports hardware, various part no.

3.3.5 Conduits

Electrical Conduits as Manufactured by Allied Electrical or equivalent in compliance to NEMA, IBEW, NECA and Division 16 Section "Raceways and Boxes."

3.3.5.1 PVC (Plastic)

Schedule 40 Conduit Schedule 40 90,45 Degree Bend Compression Coupler Set Screw Coupling Connector

3.3.5.2 EMT (Galvanized Steel, Thin Wall)

Seal-Tight Conduit Seal-Tight Connectors Plastic Bushing Sleeve Kit Lock Nut Locking Ring Outdoor Box (Various Sizes) Outdoor Pull Box (Various Sizes)

3.3.5.3 Rigid (Coated or Galvanized Steel or Aluminum)

IMC Type Conduit Couplers Nipples Unistrut Strap

3.3.6 Racks and Cabinets

3.3.6.1 MDF & Server Racks

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APC NetShelter SX 42U 750mm Wide x 1070mm Deep Networking Enclosure with Sides Black, APC Part No. AR3140

3.3.6.2 IDF Racks

• Two post rack for IDF rooms

19" W Universal Rack System CPI (46353-505)

• Wall mount IDF cabinet

Cabinet height is determined by the number of patch panels being installed or unless otherwise specified in writing by the ITS department project manager.

1 Patch Panel	CUBE-iT Wall-Mount Cabinet 24" ((11840-724)
2 Patch Panels	CUBE-iT Wall-Mount Cabinet 36" (11840-736)
3-4 Patch Panels	CUBE-iT Wall-Mount Cabinet 48" ((11840-748)

Wall mount IDF cabinets to include Low-Decibel Dual-Fan and Filter Kit for CUBE-iT Wall-Mount Cabinet (40975-001)

Please see spec chart at www.chatsworth.com and configure as needed

Modification of the IDF cabinet is not allowed without written approval from the manufacture. Any modifications to the cabinet that jeopardize the structural integrity of the cabinet will result in the replacement of the cabinet at the contractor's expense.

3.3.6.3 Wire Management

2U 3"x3" front, 2"x4" rear horizontal wire manager w/ hinges, Hellerman Tyton Part No. WMB2

1U 1.5"x3" front, 1.5"x4" rear horizontal manager; HellermanTyton Part No. WMBP2

Vertical Cabling Ring (Cabinet Enclosures), Chatsworth Product Inc. (CPI) Part Numbers: 12465-xxx

Enhanced Cable Management for Cabinet Enclosures, CPI Part No. 13170-700

Front to Back management Tray for Enhance Cable Management, CPI 13168-701 Combination Cabling Section (CCS) Vertical Cable Management (Rack System), CPI Part No. 30165-703

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Single Sided Wide Vertical Cabling Section (VCS) Vertical Cable Management (Rack System), CPI Part No. 11374-103

Velcro 3/4X15 Cable Ties – Black

All cable routing and management systems must be fully compliant with CAT6 specifications in bend radii and cable pack density

3.3.7 Grounding Bus

Grounding Components that meet with California Electrical Code, BICSI and ANSI/EIA/TIA standards are required –Chatsworth Products Inc. or equivalent. Parts vary by application.

3.3.8 Backboard

³/₄" thick fire-treated, void-free plywood panel painted with a fire-resistant paint. Size varies by application

3.3.9 Labeling

Brother P-Touch Industrial Strength Series Label Tape (High Heat Tolerance) Cable Wrap-around Labels (8mm), Leviton Part No. 59260-W

3.4 Switching and Routing Equipment

3.4.1 Core Switch Equipment (or equal)

4500-E series switches with supervisor 8-E, 7-E, or 7-LE and dual 2800W power supplies 6500-E series switches with supervisor T2 or 6T and dual 3000W power supplies

3.4.2 Edge Switch Equipment (or equal)

Cisco WS-C3650-48PQ-S	48 Port PoE+ Switches with 10GbE SFP+ Uplinks
Cisco WS-C3650-24PD-S	24 Port PoE+ Switches with 10GbE SFP+ Uplinks
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Switches should be stacked using the StackWise-160 stacking cables when available and SX, LX, or SFP interconnect cables when stacking with non-Cisco 3650 series switches

3.4.3 Wireless Network Equipment (or equal)

Aerohive AH-AP230	802.11a/g/n/ac AP, FCC (3x3)
Aerohive AH-AP1130***	802.11a/g/n/ac AP, FCC (2x2:2) (Outdoor)

**Power injectors are not allowed for new installations. A proper PoE switch must be employed to power new access points unless authorize in writing by the District.

***Alternate type of external antenna may be specified according to the coverage needed.

3.4.4 Routers (or equal)

Cisco ASR-9001 Cisco 2921

4 Installation

4.1 General

Standards have been established by the industry and supplemented by the district in this section to assure proper and consistent installation of all system.

During the course of installation, contractors will discover many components and installations that do not meet current District standards since many were installed before District and/or industry standards existed. It is expected that contractors will install new systems separate from these non-standard installations or otherwise elect to retrofit the existing installation to bring into compliance with current District standards. Piggybacking on a non-compliant legacy system will be deemed non-compliant to the contracted work and must corrected.

4.2 Network Design

PUSD employs a star typography for the site's Local Area Network. This means that there is a Main Distribution Frame (MDF) in a logical and central location which connects to the rest of the campus; this is also the typical location for Telephone Voice Systems, WAN connections and other campus-wide systems. From the MDF, a continuous Fiber Optic connection is made to Intermediate Distribution Frames to service

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each wing or area of the site. Each wing should be serviced by one or more IDFs. Classrooms separated by less than 10 ft would be considered part of the same wing. Wings may be serviced by multiple IDFs if needed.

Typical classrooms have 8 connections per classrooms. The location of the data outlet will be ADA, NEC and CSA compliant. The bottom the receptacle box will be installed 18 inchs from the floor. Data outlets will be installed no more than 6 ft from existing or concurrently installed power outlets. If a requested location does not fit these requirements, the contractor will notify the district before installation for instruction.

Design proposal will be submitted in the form of a digital map drawing (CAD) with clear markings of data outlets, MDF/IDF, pertinent pathways and junction boxes and any relevant information. The final design must be approved by the district in writing before installation.

4.3 Data Centers and Distribution Frames (MDF and IDF)

4.3.1 Standards

4.3.1.1 MDF

The MDF will be installed in a dedicated room with enough enclosed space to provide room for a minimum of three 42U 4 post racks and a minimum of one wall covered with at least three 4x8 sheets of fire rated backboard. Racks are required to have a minimum of 4' of clearance in front, back, and at the end of the row. Backboard must have a minimum of 4' of clearance in front of it. Room will be equipped appropriate environmental systems to maintain proper operating conditions.

Racks will be allocated as follows:

- One rack for cores switch, core network equipment, fiber enclosures.
- One rack for site servers.
- One or more racks for copper patch panels and edge switches.

4.3.1.1.1 MDF Power

MDF will be equipped with a minimum of a 100A 208V three phase dedicated electrical panel. Panel must be sized to accommodate all equipment located in the room plus have a minimum of four extra breaker spaces for future devices.

Each rack will have two dedicatee 30A 208V circuits with L6-30 receptacles and one dedicated 20A 120V circuit with two 5-20 double duplex receptacles. Unless otherwise noted core switch and site server racks will each have a dedicated 30A 208V UPS

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plugged into one of the L6-30 receptacles and a 30A 208V PDU plugged into the other L6-30 receptacle. Racks for edge switches will have two 30A 208V PDUs plugged into the L6-30 receptacles.

Backboard will have a minimum of two dedicated 20A 120V circuits each with a 5-20 double duplex receptacles. Receptacles shall be mounted at the top of the backboard with one double duplex receptacle will be 3' in from the left edge of the backboard and one double duplex receptacle will be 3' in from the right edge of the backboard.

4.3.1.2 IDF

IDFs for new facilities will be installed in a dedicated closet or shared electrical closet. IDF will have a minimum of one 7' tall 2-post rack with a cable management. Each rack will be have one dedicated 30A 208V circuit with a L6-30 receptacle and one dedicated 20A 120V circuit with two 5-20 duplex receptacles.

IDFs installed at existing facilities may be installed in closets or classrooms where. IDFs installed in classrooms will employ lockable enclosures and have one dedicated 20A 120V circuit with two 5-20 duplex receptacles installed on the back wall of the cabinet. The locking cylinders (front and rear) will keyed to the district standard (CH761).

All IDF locations must have environmental systems are available to maintain proper operating conditions for equipment.

Any data centers supporting more Ethernet channels than can be installed on a single Rack shall have multiple racks and be contained in a dedicated closet with enough space to provide at least 3ft of clearance to the front, side and rear. Racks may be installed side by side, with vertical wire management in between, as long as there is the standard clearance to the sides of the outer racks.

4.3.1.1 Environmental

All data centers will be supported with the proper HVAC system to sustain an ambient temperature of 65 to 80 degrees Fahrenheit and humidity of between 10% and 85% to avoid condensation and ESD. Any Rack or Cabinets installed in a classroom or other non-dedicated area must have an evaluation performed to assure proper cooling for such equipment with existing cooling systems. If existing systems is inadequate, contractors must recommend additions, upgrade or recommend against installation of equipment. Installation of equipment in environmentally inadequate space will be considered to not conform to the district specification.

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Addition of equipment to classrooms must not increase noise levels by more than 20 dB (SPL) over previous noise levels. Noise reduction must not be remedied at the expense of cooling factors.

Proper sized Cabinet Enclosure or Rack will be installed to support a minimum of 8 connections per classroom to all classrooms that will be supported by the IDF regardless of how many connections are installed at that time. In addition, every classrooms would require two connection for a wireless access point (WAP).

2' Cabinets may support a maximum of 96 total Ethernet channels, including up to two 48-port switch

3' Cabinets and Racks may support a maximum of 144 total Ethernet channels, including up to three 48-port switches

4' Cabinets and Racks may support a maximum of 192 total Ethernet channels, including up to four 48-port switches

7' Cabinets and Racks may support a maximum of 384 total Ethernet channels, including up to seven 48-port switches

Example: A Wing of 6 classrooms may have up to 60 connections including 3 wireless connections. Even if only 3 connections are installed in each classroom, a 3ft cabinet would be installed.

4.3.2 Installation

Floor mount racks and cabinets shall be securely attached to the concrete floor as specified by the manufacture or using 3/8" hardware, whichever is greater. Racks shall be installed with a minimum clearance of three feet behind the rack three feet on either side, and three feet in front. A cable ladder will be installed to secure the top of the rack using the appropriate hardware and attached to at least one wall. A backboard will be installed on the wall behind the rack for mounting cable service loops, telco blocks and other wall mounted equipment. Vertical wire management shall be supplied to each side of all open racks. All Racks shall be floor mounted and installed in secure spaces such as communications closet.

Only Cabinet enclosures will be use in classrooms. 2ft - 4ft Cabinets will be installed against a treated backboard using bolts with anchors. 2-inch clearance from the ceiling will be provided and a minimum of 3ft of clearance side-to-side, but no more than 6ft from the adjacent wall. Enclosures will have sleeve conduits installed on entrance holes before running cable through. Ceiling tiles may only be cut as needed to allow sleeve conduits through. Ceiling tiles excessively cut or broken will be replaced at the cost of the contractor.

4.3.2.1 Component Installation

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Patch Panel, Fiber Optic Distribution box and Switch equipment must be installed from top to bottom, starting with the first patch panel position and first switch position. Mounting of the fiber patch panel shall be below the copper patch panels. The first patch panel will always be installed in the first U position. Fiber Distribution box position always remains the same for each sized rack or cabinet. This is typically at, from the top, U-space#5(2ft cabinet), U#8(3ft), U#10(4ft), or U#16(7ft). The first switch would be installed at the next U position below the Fiber Optic Enclosure U#6(2ft), U#9(3ft). U#11(4ft), and U#21(7ft). All unused locations in the fiber termination panels shall be filled with blank panels.

Please see Rack Space Diagram for specific placement of equipment and component. Rack Space Diagram



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All equipment and components must follow the U-space designation indicated on the rack or cabinet. No mounting in-between U-Spaces unless specifically authorized by the district.

If the combination of equipment, components, cables, etc. weights more than the cabinet is rated for, the district must be informed before work is done. Any screws that are stripped at either thread or driver slot must be removed, disposed of and replace immediately.

The inter-bay manager shall have integral routing and slack storage loops supporting a 1.5" minimum bend radius. Horizontal cable management shall be providing in each rack. One combination front and rear horizontal wire management shall be provided for each fiber termination box, for each 48 ports of RJ45 panels, and each 48 ports of switches. For Cat 6 cables, the district-approved cable fill rate for 2U wire management is no more than 48 cables, with no more than 19 inch of each cable residing inside the wire management. 1U wire management fill rate is 24 cables.

All patch cord must follow this path in connecting patch panel to switching equipment:

• Connection to patch panel

t

- Routed through appropriate slot on the adjacent horizontal wire management
- Exit the wire management on the corresponding side (port 1-12 left, port 13-24 right, port 26-38 left, 39-48 right)
- Routed through vertical wire manager (if present)
- Enter wire management for switching equipment (if present)
- Routed through the appropriate slot
- Patched to the correspond switch port

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- Any deviation from this would indicate a missing component, patch cord of improper length, or cabinet of improper size.
- Patch cord employed shall be long enough to connect the patch panel port to switching equipment without causing bends or kinks against Cat 6 system specifications. The Patch cord must also be short enough to avoid unnecessary slack or over-stuffing of wire managers (no more than 19 inches of any single patch cable inside the wire manager).

4.3.2.2 Patch panel to switch connection scheme

Each patch panel will be designated and labeled with a letter, starting with A. The corresponding switch will also be labeled with that same letter.

Starting with the first fully populated patch panel, each port will be connected to a corresponding port on the switch designated for that patch panel. In the event that two 24-port patch panels are connected to a 48-port switch, the second patch panel would start at port 25.

Once all fully populated patch panels are connected to switches, the remaining patch panels (those that are not fully populated with horizontal cable) will be consolidated onto the remaining switch(es).

All cables shall be organized with Velcro cable ties to ensure a neat and manageable system. Only Velcro may be used for entire run. Plastic "Zip Ties" are expressly forbidden.

4.3.3 Grounding and Bonding

IDF and MDF racks/cabinets must be grounded and bonded following the California Electrical Code grounding requirements for Telecommunications Systems. A telecommunications ground bus bar shall be provided whenever there is more than one rack/cabinet in an IDF and/or MDF. The telecommunications ground bus bar shall attach to the grounding electrode system, the ground bus, the rack and hardware to create a common electrical potential system. If the data contractor is the prime contractor, or no electrical contractor is working concurrently in association with this project, then the data contractor shall be responsible for grounding and bonding the IDF and/or MDF.

4.4 Cable Routing and Pathways

4.4.1 Standards

Exterior and hidden conduits are typically EMT (above ceiling and intra-wall), PVC (underground), or rigid (outdoor).

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Conduits will not be filled above 60%. The exact number of cables through each conduit will vary by the size of the conduit, distance of the run, number of 90 degree bends and Outside Diameter (OD) of the cable.

For sleeves and straight conduits shorter than 50ft - 60%For straight conduits shorter than 100ft - 40%For conduit runs over 100ft or with two 90° bends - 28%

Continuous conduits with more than two 90 ° bends are not allowed.

Example: A 1¹/₂ inch sleeve conduit may have no more than 29 CAT6 cables having an OD of .232 inch. A 2 inch conduit may have up to 48 cables.

4.4.2 Installation

4.4.2.1 Conduits and Ducts

Cable raceways shall not be filled greater than the with California Electrical Code maximum fill for the particular raceway type. Conduit sizing shall be a minimum of $\frac{3}{4}$ " inch conduit for each outlet with no more than two outlets fed by one $1\frac{1}{2}$ " homerun. If two outlets are fed by one homerun, the conduit shall be $1\frac{1}{2}$ " to the IDF or MDF and $\frac{3}{4}$ " to the end box. For conduits feeding a multiple-outlet surface raceway, one $1\frac{1}{2}$ " conduit shall be supplied for every 18' of raceway. These specifications shall take precedence over conduit routing shown on the plans that deviate from this method. The data contractor shall bring any discrepancies to the attention of the owner.

Cables being pulled through walls and between building will be pulled through a sleeve conduit (galvanized EMT nipple) of the appropriate length secured with lock nut and washer and capped with a plastic bushing to avoid cable damage. In accordance with NFPA codes, firestop compound will be use to seal each conduit leading from one room or area of building to another. Combination of different firestop compounds is expressly forbidden.

When using an existing pull-string to run cables through conduit, a new pull-string will be installed to replace the one being used. For conduits 1-1/2 inches and larger the pull-string is to be of the polyester tape variety ("mule tape") rated up to 1200lb. For conduits smaller than 1-1/2 inches the pull string is to be nylon pull-string such Greenlee Poly Line 430 rated up to 210lb.

Where cables are "pulled through" or pulled from a "center of run pull" without splices or terminations, lead out the cables at manholes, pull boxes and conduits taking care to feed them in again by hand for the next run.

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Splicing of cables or conductors is not permitted except as approved by the District ITS department.

Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

Dynablue cable pulling lubricant shall be continuously applied to all cables. The cable manufacturer must specifically approve all lubricants. The district expressly prohibits yellow 77.

The use of flex conduits is forbidden with low voltage systems.

4.4.2.2 Pull Boxes and Vaults

The district expressly forbids direct burial of data and voice cables. All cables running underground must be run through appropriate vaults and conduits.

A junction box will be installed for every 100ft of continuous conduit. A junction box will be installed when the number of 90° bends exceeds two. For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multisegmented sheaves, etc. shall be used to insure proper cable pulling tensions and side wall pressures. Cables shall not be pulled directly around a short right-angle bend. Any device or surface in which the cable comes in contact with when under pull-in tension shall have a minimum radius 50% greater than the final specified minimum installed cable bend radius. For conduits 1-1/2 inches and larger a pull-string is to be of the polyester tape variety ("mule tape") rated up to 1200lb will be installed between each junction box and secured at each junction box for each conduit connecting them unless a conduit has met or exceeded the conduit fill rate. For conduits smaller than 1-1/2 inches the pull string is to be nylon pull-string such Greenlee Poly Line 430 rated up to 210lb will be installed between each junction box and secured at each junction box for each conduit connecting them unless a conduit has met or exceeded the conduit fill rate. If a conduit reaches the maximum fill rate, a tag will attached to the conduit inside the pull box indicating that the conduit is full. Pull strings must start/end at each pull box. The same string must not be run continuously through more than two pull boxes. Pull boxes installed on the side of buildings will be Galvanized EMT painted gray and secured with by screws. Any stripped screws must be replaced immediately.

Concrete vaults or manholes will be installed connected with minimum 2 inch PVC conduits. Vaults will be covered with Iron grated cover secured with 3/8 inch bolts.

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Cables pulled through vaults will have a 360° loop around the edge of the vault while not exceeding bending radius for the type of cable. The bottom of the vault shall be filled with a minimum of 2 inches of gravel. No more than two 90° bends in conduits between vaults and pull boxes including vertical bends leading to pull boxes installed on the side buildings.

In the event that a cable must change direction within a pull box or manhole, a minimum 360° loop of the cable shall be created to maintain the bend radius.

4.4.2.3 Plenum/Ceiling

When not installed in conduit, (per the plans and electrical specifications requirements), all horizontal cables shall be supported at a maximum of four-foot intervals. Cables shall not be attached to walls, ceiling grid or lighting support wires directly. At no point shall cable(s) rest on acoustic ceiling grids or panels, nor shall they be attached to ceiling grind wires. Horizontal distribution cables shall be loosely bundled in groups not greater than 40 cables. Bundles shall be supported by cable tray, conduit, trapezes, or multiple support straps and hooks. Any hanger used shall be rated and tested for hanging category 6 cables. Where light support style wires for drop cable legs are required, and installed by the data contractor specifically for this use, the contractor shall install multi-function clips to support the cabling hangers. Cables must be supported every 4 ft using support hooks (such as J-hooks or D brackets) with a lateral thickness of no less than 1/2 inch. Jhooks or brackets attached to grind wire may support no more than 40 cables at each grind wire regardless the number of hooks attached to each grind wire. When a coil of cable is attached to grind wires each time a cable passes through the J-hook counts as one wire. If additional cables support is needed, J-hooks must be attached to staggered grind wires. If grind wire placement is not sufficient for having hooks every 4ft as well as supporting no more than 40 cables each, alternative support cable or bracket must be installed. Thin support wires may not be used to directly support cables. Nylon "Zipties" may not be used to bundle or support cables directly but may be used to reinforce broad hooks and loops (Velcro) strips. Cables laying on or supported by ceiling tiles or draped over ducts is expressly forbidden, regardless of existing cable routing.

4.4.2.4 Walls

It is preferred that the each outlet is feed by conduit inside the wall to an internal device box instead of surface mount raceways.

Internal conduit will be a minimum of 1 inch in diameter. Top entrance conduit entering each wall may have a bend radius of no more than 10".

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When running cables within walls is not feasible, a non-metallic raceway system, such as Wiremold 2300 series, may be used.

4.4.2.5 Raceways and Device Boxes

No data/voice outlet will be installed over 6 ft from an electrical outlet. Conduits run in parallel to any electrical conduits will be no less than 6 inches from this conduit. Perpendicular runs (jumps) are exempt from this.

When installed on painted surfaces, adhesive backs of the raceways will NOT be used. Instead, Raceway backs will be secured every 18 inches using the appropriate screws for the surface that the raceway will be installed on. When installed on a smooth, unpainted surface, adhesive backs may be used with or without screws depending on the surface material. Raceways will be colored white or ivory or to match décor.

4.5 Fiber Optic Cabling

4.5.1 Standards

Unless otherwise indicated in writing, all fiber cabling shall be a "home run" to the MDF, meaning there is no coupling or cross connection at any junctions between the IDF and the MDF. Cables will be rated for the space in which it is installed. E.g., fiber cables installed in underground conduit will be OSP loose tube gel filled with rated jacket. For Fiber runs from 100 to 500 meters, multi-mode cable shall be used to create a 10Gbps backbone between IDFs. OM3 fiber optic cable (50micron core) may be used with prior district approval up to 300 meters; OM4 fiber optic cable (50micron) may used up to 400 meters. While OM3 cables remain an option for shorter runs, all new installation will generally use OM4 cables even at these shorter ranges.

For backbones specifically created to support 40Gbit bandwidth between IDFs, OM4 cables shall be used up to 150 meters.

Beyond 400 meters, a single-mode fiber optical cable (9/125micron) shall be employed up to 60 kilometers.

4.5.2 Installation

Provide fiber optic cable routed between buildings as needed and terminate on a wall mount or rack enclosure. Leave at least 10' of slack cable at each end. Slack shall be

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organized in a loop no less than 18" in diameter and secured against the backboard or back of the cabinet.

Fiber cables may share conduit space with low voltage data and telecommunications cabling as long as the total fill rate of this conduit is not exceeded. Running fiber cables through conduits with high voltage power, fire alarm and bell systems is not permitted. Pulling eyes on optical fibers and copper conductor shall not be used. Provide a full 360° loop of cable around manhole and pull box interiors for all fiber optic cabling.

All fibers in a multi-fiber cable shall be fully operational within the performance characteristics specified prior to and after the cable is installed. The use of spare fibers in the cable to compensate for defective fibers is not permitted. Defective cables shall be removed and replaced with fully functional cables at no additional cost to the contract.

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4.5.3 Termination

For all installations, all fiber will be terminated on both ends using Leviton SDX 24-Fiber Splice modules with LC connectors. Provide dust cover caps for each unused connector.

For upgrades to existing Fibers, all strands in the cable must be terminated and installed in the proper order in the fiber termination panel.







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All unused locations in the fiber termination panels shall be filled with blank panels.

4.5.4 Labeling

The index card of each fiber termination panel must be completed. This card will list the source (or destination) of the cable plus a unique number, starting from 1, will be assigned for each strand

(typically, blue = 1, orange = 2, etc.). Typical examples are:

(at MDF)	(at IDF 4)
IDF4-1	MDF1
IDF4-2	MDF2

i.e. Fiber optic cables shall be labeled at both ends of each cable and at each pull box as follows: Y1/Y2

Y1= the source closet ID of the cable.

Y2= the destination closet ID of the cable.

Example:

0/1 would be a cable run from the MDF to IDF $\#\ 1$

4.5.5 Testing

Cables may be used for, but not limited to, Ethernet, SONET, video, or Fibre Channel and must be capable of carrying this data.

Each individual optical fiber and copper wire conductor in all terminated and unterminated cables provided in the contract shall be tested after installation, splicing and termination is completed.

Fiber - All fiber terminations shall be visually inspected with a minimum 200x microscope to ensure that no surface imperfections exist after final polishing. In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source as well as an OTDR. Cable length and splice attenuation shall be verified using an OTDR.

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Attenuation - Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction using an LED light source and power meter. Horizontal distribution multimode optical fiber attenuation shall be measured at either 850 nanometers (nm) or 1300 nm. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference, two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link Performance Testing. Refer to section 2.01B for maximum attenuation values.

4.6 Category 6 Data System

4.6.1 Standard

4.6.1.1 Ethernet Jacks

Purple*	Denote client connected Cat6 ports.
Orange	Denote non connected Cat6 ports such as access points, CCTV cameras
	and other non-client related devices.
Red	Denote fire alarm ports
Green	Denote AV connected ports

Previous/existing (obsolete) Standards

- Blue Ethernet Jacks denote Cat5E ports.
- Orange Ethernet Jacks denote Cat5 ports.
- White Ethernet Jacks denote Voice jacks.

4.6.1.2 Patch Cords

Purple*	Indicate a client device with a Cat6 rating.
Orange	Indicate a non-client device.
Red	Indicate fire alarm systems.
Green	Indicate crossover cables

Previous/existing (obsolete) standards

- Yellow patch cords indicate Cat5E rating.
- Blue or Black cords indicate Cat5 rating.

No patch cord longer than 15ft shall be employed anywhere along the datalink from computer desktop to switching equipment port unless explicitly authorized by the district in writing.

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*For the purpose of color code identification, PUSD considers any color within the Purple color range to be synonymous with Purple. These include violet, magenta, lavender, lilac, indigo and others that fall with this range.

4.6.1.3 Horizontal cable

Category 6 system horizontal cables shall have purple or blue jackets with the exception of indoor/outdoor and OSP cables which will have a black jacket. Unless otherwise specified, the District only authorizes Category 6 rated components for all future installation. Other listed district standards are for reference only.

The minimum bend radius for all cables and the maximum pulling tension shall not exceed manufacturer's recommendations or rated specification of such cables.

Data termination locations will be ADA, NEC and CSA compliant with bottom of outlet boxes measuring 18 high from the floor.

4.6.2 Installation

Provide copper cables from each data system jack indicated on the drawings to the appropriate voice or data IDF or MDF patch panel.

Provide 12 inches of cable slack (service loop) at outlets either behind faceplate or at the top of the wall, above the visible ceiling.

Copper wire cables connecting to equipment racks shall be installed with not less than 10 feet (3 meters) each of slack at the IDF location. The slack cable shall be coiled and mounted on the backboard or rear panel of the cabinet. Alternatively, if there is not enough space inside the cabinet, such as 2 or 3ft cabinets, the coil can be located above the ceiling as long as proper support is installed. Coils will employ Velcro for bundling. No nylon zip ties may be used for support or bundling throughout the length of the cable.

For each cable pull where a cable direction change is required, flexible feed-in tubes, pullout devices, multi-segmented sheaves, etc. shall be used to insure proper cable pulling tensions and sidewall pressures. Cables shall not be pulled directly around a short right angle bend. Any device or surface the cable comes in contact with when under pullin tension shall have a minimum radius 50% greater than the final specified minimum installed cable bending radius.

Consolidation points are expressly prohibited unless approved by the district ITS department.

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4.6.3 IDF

Each cable must be routed through wire management and approach the termination point perpendicular to the patch panel. There should be at least 4 inch of cable from wire management exit to termination.

Routing of cables, bundling, support and termination of CAT6 cables must follow ANSI/TIA-568B.2-1 specification, such as:

- Separation of individual twisted pair is to be no more than .5" from termination point.
- Cable jacket may be striped back no more than ³/₄ inches from termination point.
- cable bundles are to remain loose. No tight (cigarette packs) bundles are allowed.

Whenever possible (if enough slack is available), cables terminated on to older patch panels should be re-terminated on new patch panels along with newer cables (i.e. Cat5 cables re-terminated on a Cat 6 patch panel) if the patch panel is not full. New cables may not be terminated on older patch panels (i.e. Cat6 cable terminated on Cat5e patch panel).

Example:

An IDF has a Cat5e patch panel with 5 Cat5e cables terminated. 14 new Cat6 cables will be installed along with a new Cat6 24 port patch panel. The Cat5e cables should be disconnected from the Cat5e patch panel. The Cat6 patch panel would be installed in its place with the Cat5e cables terminated in position 1-5 and relabeled as needed (at the patch and the outlet port) and the new Cat6 cables installed in position 6-19.

If the combination of old and new cables adds up to more than available ports on the new patch panel, all cables on any incomplete patch panel shall be re-terminated on a new CAT6 patch panel. New CAT6 cables shall be installed at the tail end of the new panel plus any additional panels needed.

It is also possible to terminate a CAT5e cable onto a **blue** CAT5e rated keystone and installed on modular patch panel plates such as Leviton 69270-D48. This will allow for mixes rated cables on the same panel.

Orange CAT6 keystones will be installed on modular patch panels for all non-client ports (devices such as AP's, CCTV cameras, etc) These ports should be grouped together at the end of the patch panel.

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A 14 foot Category 6 patch cord will be provided for each station outlet port and one variable length Category 6 (depending on what is required to properly patch over all ports from Patch panel to switching equipment; cable length must be long enough for connection with compromising cable bend radii but short enough as to not produce unnecessary slack) patch cord for each position terminated in the MDF and IDF. Patch cords shall be violet for Category 6 wiring. Crossover cables (568A to 568B) shall be green.

Each Cable shall be labeled with over-the-wire labels within 6 inches from termination on each end following the same labeling scheme as the outlet faceplate.

4.6.4 Category 6 Voice System

For all future installations, cables installed for use with analog voice system will be Category 6 cables to allow for easy transition to digital or VOIP systems.

All Category 6 voice cables shall be run along the same path and conduit as data cables. Cat 6 Voice cables installed for analog systems shall also be included in the same service loop as data cables but will exit and be terminated on a 66M150 blocks with 89B standouts.

Only the blue and white cable will be terminated to the 66M150 block for individual cables. All pairs shall be terminated on one side of the 66 block(s) for a tie cable.

4.6.5 Termination

All cable pairs shall be terminated at the outlet. Outlet labeling shall be same as outlined above at all IDF and MDF locations for telco connections.

Data outlet shall be cabled with four 4 pair, category 6, 23 AWG copper cables, terminating on RJ45 jack equipped with 110 type terminations and on the MDF/IDF data category 6 patch panels in compliance with TIA 568B wiring standards, using 110 type hardware as shown in the drawings.

Separation of individual twisted pairs is to be no more than .5" from termination point.

3.3ft. (1 meter) slack will be left above the ceiling at the termination point. An additional 1ft. (.3 meter) behind the outlet (in the device box) should also be left if possible without cause excessive kinks to the cable.

4.6.6 Labeling

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4.6.6.1 Horizontal Cable

Cables shall be identified by a self-adhesive label as detailed below. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate. Outlet labeling shall be applied to the faceplate, below (or adjacent to) the outlet. All labeling shall be approved by the owner's representative before any labeling begins. Any labeling installed before the complete project labeling scheme has been approved by the owner may need to be replaced at contractor's expense.

4.6.6.2 Outlet Port

All cables, outlets, and terminations shall be labeled and designated in accordance with following standards.

X1-X2

X1= The MDF or IDF ID number. The MDF is ID 0.X2= The termination point on the patch panel.

Examples:

0-1 would indicate a cable run to the MDF and terminated on position 1 of the patch panel.

4-32 would indicate a cable run to IDF # 4 and terminated on position 32 of the patch panel (i.e., the 8th port on the second patch panel).

When a data jacks and voice jacks terminated on the same outlet, data jacks will precede voice jacks from left to right, top to bottom.

Example: D= Data, V	V = Voice	
D D	D D	D V
VV	D D	V V
	DV	

Data outlets specifically for wireless access points will be terminated on a telco style two port surface mount biscuit at the edge of the ceiling adjacent to the wall or as need to supply data to the access point. The biscuit must use standard 110-type data outlets.

Data outlet as well as the corresponding patch panel port for wireless access points will be label as follows:

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X1-W-X2 = (IDF#)-W-(termination point on the patch panel)

"W" denotes a channel specifically for wireless network

All voice tie cables between IDFs and MDFs shall be labeled at both ends as follows:

T1-T2

T1= The source closet name or ID of the cable.

T2= The destination closet name or ID of the cable.

Example: 0-1 would be a cable run from the MDF to IDF # 1.

Cabinets and Racks

All IDF locations shall be labeled with a self-adhesive label mounted in the lower-right corner of the outside Plexiglas door of the wall-mounted cabinet, or on the top center of a floor-mounted cabinet or rack, as follows.

IDF-X

X= the IDF ID number. All IDF's must have a unique number starting from 1. ID 0 is reserved for the MDF.

All identification labels will be mechanically printed. Hand written labels will not be accepted.

4.6.7 Testing and Certification

All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

Copper - Each cable shall be tested for continuity on all pairs and/or conductors. Twistedpair voice cables shall be tested for continuity, pair reversals, shorts, and opens using a "green light" type test set. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All category 6 cables shall be tested to ensure standard performance compliance to 550MHz. All tests shall be

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saved in electronic format for the owner's use. These data cables shall be tested using a (Class II) cable analyzer.

Continuity - Each pair of each installed cable shall be tested using a "green light" test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance. In addition, the three cables adjacent to the failed cable, in both directions, must also be re-tested to assure that correction measure have not change the performance of near-by cables.

Length - Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA/EIA-568-A Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable. For Category 6 cabling, the total length of horizontal cabling shall not exceed 90m (295 ft.). Testing shall be for the data link, and not channel.

Performance Verification - High speed unshielded twisted pair (UTP) data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the standards tests, including: Near End Cross-Talk (NEXT); Attenuation; Attenuation to Cross-Talk Ratio (ACR); Equal-Level Far-End Crosstalk (ELFEXT); Power Sum NEXT, ACR, and ELFEXT (PSNEXT, PSACR, PSELFEXT), and Insertion and Return Loss (IL, RL).

Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

4.6.8 Voice Termination Locations

The MDF and all IDFs are to be installed directly on the backboard. If the MDF or IDF is not in a dedicated communications closet, the terminal blocks shall be enclosed in a communications box appropriate for the space in which it is installed.

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4.7 Electronics and Instruments

Switching and routing equipment must be fully configured and rack-installed. Equipment will be installed in specific U-Space locations detailed in diagram in Figures 4.3.2.1 Configuration typically includes adding the switch to the VTP domain, assigning an IP address, configuring SNMP, telnet passwords, and other management options, powering up and testing the equipment, connecting all patch cables, and placing the cables into the wire management ("dressing" the rack). Each switch will be label with the Management VLAN's IP address. The first two switches of each switch stack in an IDF must be connected by Fiber directly to the Fiber Distribution Box going back to the MDF using a GBIC or SFP module and fiber patch cable. Each additional switch will have a stacking cable connected to each of the first two switches. Up to three additional switches may be added – a total of 5 switches per "stack". The 6th switch would require an additional "stack" and will again be connected directly to the MDF via Fiber. Whenever there is more than one "stack", stacks should be evenly divided in numbers of switches. Switches connected via StackWise cables are limited to nine unit stacks.

All configuration and network designs for switches, access points, routers, and other equipment will be done under the supervision of the District's Systems Administrator or his designee. This includes IP addressing, HSRP, EIGRP, OSPF, and other protocol configuration.

All patch cables must be installed one-to-one. That is, every jack on the patch panel will be connected to the corresponding position on the switch. For example, ports 1-24 will connect to ports 1-24 on the first switch, ports 25-48 would connect on ports 1-24 of the second switch, etc., with port 1 connecting to port 1, port 2 to port 2, etc.

Provide two appropriate fiber patch cables for every switch or switch cluster to be installed. Typically, this is two patch cables for every fraction of 24 wires run to an IDF. Additionally, provide stacking cables as needed for IDF stacks of switches. Provide, configure, and install Cisco switches and routers, as indicated by the District Systems Administrator or on the plans, to permit connectivity on every new data cable. IP addresses and other information is available from the District ITS department.

4.7.1 Wireless Access Point Implementation Procedure for Contractors

4.7.1.1 Planning

Plan with CAD drawing of the deployment area and installation location will be provided by the district.

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This proposal drawing will include the coverage area PUSD and contractor will work to create a deployment list that includes:

PUSD

• Locations (Room Number)

Contractor

- Serial No.
- Mac Address
- Uplink Switch IP and Port No.

4.7.1.2 Labeling

Each access point shall be labeled in large print with the MAC address.

4.7.1.3 AP Configuration:

- Contractor will provide the completed spreadsheet with the Serial and MAC of each AP and the location each will be installed.
- Access points with dual uplinks must be cabled and patched over as sequential odd/even numbered ports on both the patch panel and the switch so that the odd numbered port is always providing the POE to the AP. (Example: On a Cisco switch the AP should be patched over to ports 3&4 whereas port 3 provides the POE power.)
- Access points with dual uplinks must patched over so that both ports for the AP reside on the same ASIC on the switch.
- PUSD will enter this info into Hive Manager.
- PUSD will create/configure the correct VLANs if not already done.
- Contractor will also configure the correct VLAN settings on the uplink port of the network switch as needed. This configuration will also be provided by PUSD. Typical configuration (this may vary depending on the specific switch model/ios version and other factors (such as the use of Power Injectors and future security features):

interface FastEthernet0/x description AP <AP Hostname> ip arp inspection trust switchport trunk encapsulation dot1q switchport trunk native vlan 3 switchport mode trunk

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- Contractor will install the AP to Manufacturer's and PUSD specs and power on the AP. The APs should download the needed configuration from Hive Manager and configure as necessary.
- Contractor will connect to

Signal Testing and Adjustments

Contractor - Signal test will be done from the extremities (corners of the opposite room or other areas that may be more affected by obstruction or interference) of the coverage area of each AP. Using the weakest measurements:

Measure the RSSI in dBm Measure the Noise Level Determine the SNR level (if your utility doesn't already provide this) Measure the RSSI of the nearest Access if within range.

RSSI must be above -69dBm SNR must be no lower than 20dB, preferably higher than 25dB range. All AP should be adjusted so that the RSSI of the current AP is at least 15dB higher than the nearest AP. This process may involve adjustment to existing Access Points.

Provide the Disrtict with a report on co-channel interference/overlap.

5 Post installation

5.1 Clean-up

- Except for necessary modifications directly related to the scope of work, all facilities must be returned to their original condition before work started.
- Any incidental repair work needed directly related to the work will be carried out at the cost of the contractor unless agreed to in writing before work is performed.
- Any previous installation marked for demolition as agreed by the contractor and the district must be completed including any patch work and repair to the facility.
- All new wall outlets must be cleaned of smudges and dust.
- All Cabinets and Data Closets must be free of debris such as cut wires, metal shavings, and extra parts.

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- Unless otherwise stated, all related unused parts, such as dust-covers, caps, cables, connectors, blanks, and manuals must be returned to the district.
- All keys that are borrowed for access to the facilities must be returned. If keys are lost, the district has the right to change locks for the affected area at the expense of the contractor.
- Missing items from facilities after jobs will be investigated
- Contractors must assure that all doors are properly closed and locked before leaving.
- Any damages caused by the installation will be repaired at the contractor's expense unless the owner is made aware of the likely damage before work and has agreed in writing to waive the contractor from responsibility.

5.2 Inspection

- A preliminary report with all the relevant test results will be presented to the district.
- At the owner's discretion, the documentation will be used to spot check all test results and quality of installation. Please see Testing and Certification section for each respective Data System (Sections 4.5.5 and 4.6.7).
- A punch-list will be created if any problems are found.
- Only after all items have been resolved will Owner sign off on job.

5.3 Deliverables

- At the close of the Job, the contractor will provide a package with the following items before Owner will sign off on a job:
- Letter of completion
- All relevant test results on electronic file (no print-outs necessary). If the results are in a proprietary format, software capable of reading this format must also be included.
- As-Built Drawing detailing all MDF/IDF designation, all port types/locations and designation using district approved symbols and legend. As-Built must contain only communication systems and show all data/voice locations numeric designation, IDF location and designation, and all relevant pathway information including installed junctions and pullboxes. As-Built drawings will be provided in color print as well as

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in an editable electronic file (.dwg). Such files and all intellectual rights to them will become the property of Pomona USD.

- 14ft patch cords for each station outlet.
- Unused parts accepted and paid for by the District.
- Removed equipment, returned to the ITS department.
- Pertinent Equipment Manuals
- Contractor and Component Manufacturer's contact information
- Documentation of Warranty
- Pull Sheet of all parts used as applicable (a Sales Order would suffice if accurate)
- All electronic files will be submitted on CD/DVD

Wireless LAN Deliverables

Deployment spreadsheet that will include:

- AP Installation Location
- AP Hostname
- Serial No.
- MAC address
- Channel/Band Assignment
- Radio Power setting (dBm)
- Uplink Switch IP
- Uplink port No.
- Signal Test Results
 - o RSSI
 - o SNA
 - o RSSI of the nearest AP

Relevant As-builts in DWG format using the original vectors (not raster overlay)

SECTION 27 21 00

PUSD - Data Communications Network Equipment

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK.

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

SECTION 27 21 29

PUSD - Data Communications Switches and Hubs

Version 2022.08.25

CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

SECTION 27 21 33

PUSD – Data Communications Wireless Access Points

Version 2022.08.25

CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK.

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

SECTION 27 30 00 PUSD - Voice Communications

Version 2022.08.25

CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK.

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

SECTION 27 40 00

PUSD - Audio-Video Communications

Version 2022.08.25

CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK.

1. General

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Specification in this section is in the process of being updated. Please refer to Section 27 20 00 for the information covered in this section.

1.1 Section 27 15 00 Overrides

This section list

1.1.1 Horizontal Copper Cable

- A. Point to point horizontal cable that will not part of an Ethernet link, such as HDBase-T, will be green in color.
- B. All other speculations for horizontal cable listed in Section 27 15 13 and related sections apply.

1.1.2 Horizontal Copper Cable Termination

- A. All network jacks for AV Systems will be green in color on both the station side of the link and on the patch panel
- B. Termination of horizontal cable directly on an RJ45 modular plug is forbidden.
- C. All other specifications for horizontal cable termination listed in Section 27 15 13 and related sections apply.

1.1.3 Patch Cables

- A. All patch cables for Audio-Video Communications systems and equipment will be green in color.
- B. All other specifications for horizontal cable termination listed in Section 27 16 19 and related sections apply.

SECTION 27 51 00

PUSD - Distributed Audio-Video Communications Systems

Version 2022.08.25

CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

- A. Specification in this section is in the process of being updated. Please refer to Section 27 51 13 for the information covered in this section.
- B. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

SECTION 27 51 13

Network Paging Systems

Version 2022.08.25

CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1. General

1.1 Introduction

The district has adopted the Atlas IED GlobalCom system for IP based paging solutions. Any solution provided must be compatible and integrate with this existing system and act as one seamless system or replace the existing system in its entirety district wide. It is the intent of this system to be centrally managed for the purposes of schedule management and support the creation of a district wide "all call" paging zone.

1.2 General Requirements

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Any discrepancies between this document, the drawings, and the physical site or any part or method specified that is not optimal for the application listed must be brought to the attention of the District's Systems Administration department. Installation of approved parts in a suboptimal usage will be considered to not meet these specifications.
- C. All of the electronic systems equipment shall be furnished and installed by the authorized manufacturer's distributor or installer of the equipment and shall include evidence of this authorization in their proposal.
- D. The entire access control system shall be installed by a single contractor. If subcontractors are used, they will perform work as an agent of the primary contractor and such work will be the responsibility of and warranted by the primary contractor. Upon notification by the District of a failure, the Contractor shall repair or replace components that no longer fall within the specifications set by the manufacturer.

1.3 Substitutions

Parts and software may be substituted with equivalent products providing that the vendor can show that the product is equivalent. If a substitution item is given final acceptance by the Systems Administration department, the contractor shall pay all costs (including travel, lodging, meals, computers, etc.) required to provide factory certification, equal to that of a factory authorized distributor of the substituted item, for at least two selected District representatives. This training

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will be provided by the manufacture of the substituted item in question and shall allow the selected District representatives to provide any and all factory/manufacturer approved repairs, services, software upgrades, etc., without affecting any available or applicable manufacturer warranties.

2 Quality Assurance Standards

2.1 Requirements of Regulatory Agencies

- A. Furnish security equipment to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed. Standards include, but are not limited to:
 - a. UL6500 Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General Use
 - b. UL1480 Standard for Safety Speakers for Fire Alarm, Emergency, and Commercial and Professional Use
 - c. ASTM E 1374-02 Standard Guide for Open Office Acoustics and Applicable ASTM Standards
 - d. ASTM E 1573-02 Standard Test Method for Evaluating Masking Sound in Open Office Using a Weighted and One-Third Octave Band Sound Pressure Levels
 - e. ASTM E 1130-02e1 Standard Test Method for Objective Measurement of Speech Privacy in Open Offices Using Articulation Index
- B. Furnish security equipment to comply with the requirements of American National Standards for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People (ICC/ANSI A117.1), the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.

2.2 Contractor qualifications

- A. Trained, authorized, and certified to install the specified products.
- B. Has a minimum of five years of system design, engineering supervision, and installation experience in the access control industry.
- C. Will maintain a fully staffed local office within 60 miles of the work site. The service center will be staffed by factory-trained technicians.
- D. The contractor must maintain an inventory of spare parts and other items critical to system operation and as necessary to meet the emergency service requirements for warranty service, within the local service center.
- E. Must have engineering and project management capability consistent with the requirements of this project. The contractor shall provide a project manager who is actively involved in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the

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operation and maintenance manuals, training programs, documentation and system testing, maintenance of Drawings and the coordination of all subcontract labor. The District reserves the right to approve the contractor's Project Manager.

F. Must abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

2.3 Pre-Installation Conference

Prior to work commencing, a conference between the contractor and the Systems Administration department shall take place to review materials and procedures and to coordinate related work. The locations and orientation of distribution frames, cross-connects, and patch panels in equipment rooms and wiring closets shall also be decided to minimize the impact on other services sharing the space.

Work done at school sites must be scheduled in advance. Contractors are to inform the ITS department of the scope of work, the area that will be worked in, and the time and date of work. ITS will get authorization from the school administration before the work is scheduled. If contractor attempts to begin work without getting authorization, the school site will be instructed to ask the contractor to leave.

The district will attempt to communicate any safety concerns such as other pending work to the facilities, areas with asbestos, lead or other hazards. If the contractor has such concerns, the district must be notified immediately before the start of work. The District Maintenance and Operations Department shall advise on any needed provisions.

2.4 Warranty

- A. All components shall be supplied with a minimum five-year warranty against defects in materials and workmanship, commencing upon approval of the notice of completion of the project.
- B. During the system warranty period, system updates are to be made available to District at no charge.

3 System Requirements

3.1 General Requirements

- 1. The intent of this specification is to provide a hybrid IP and 70v classroom bell and paging system. Classrooms speakers must IP based and have the ability to control each and every speaker individually. Outside and common areas must be grouped together in a logical manor and homerun back to the MDF.
 - a. Speakers located in classrooms must have the ability to be controlled individually
 - b. Speakers located in common areas and outside must be grouped together in a logical manor

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- 2. The entire classroom bell and paging system shall be controllable from a windows based computer.
- 3. The basic system configuration shall provide dual channel paging for alternating networked speakers.
- 4. The system shall provide accommodation for the integration of existing, or future, 70.7 volt amplifiers and speaker arrays for use in the creation of hybrid systems having traditional 70.7 volt zones as well as IP addressable speaker zones under the same software control.

3.2 Announcement Control System

The Announcement Control System must provide the following:

- 1. Minimum of 1 FXS port to connect to the FXO port on the districts phone system with the ability to accept DTFM tone codes for PA zone selection.
- 2. Minimum of 4 Dante Channels
- 3. Scheduler to run announcements / bells at specific times based on multiple complex schedules.
- 4. The system shall provide a timer function allowing network audio levels to be automatically controlled according to a calendar-based user defined schedule.
- 5. The system shall provide automatic daylight saving time adjustments.
- 6. The system shall provide a transition process that automatically increases the masking volume over a period of time according to a programmed schedule.
- 7. The system shall allow for up to four independent timer zones per programmable timer.
- 8. The system shall allow independent timer multiple schedules for each day of the week.
- 9. The system shall allow configurable levels of volume adjustment and attenuation.
- 10. Ability to set permission to restrict access to capabilities & speaker groups.
 - a. Example: Ability to restrict access so principal is able to log into system to manage bell schedules and announcements but not change speaker configurations.
- 11. Ability to interface with the IP and Analog speakers identified in sections 3.3 and 3.4
- 12. Ability to digitally adjust volume for individual IP speakers in 0.5 dBA increments over a range of 35 dBA to 85 dBA @ 1m from the Announcement Control System.
- 13. The system shall be capable of ensuring that the expected network devices are present and communicating properly and identify network devices that are not communicating properly.
- 14. The network control software shall be capable of monitoring and displaying the current settings for all network devices and speakers.
- 15. The system shall be capable of generating detailed reports of all system settings down to the level of individual network devices and speakers.
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16. Speaker controllers shall be capable of equalization, level adjustment and network audio channel selection for every channel.

3.3 IP Speakers

3.3.1 Specifications

All IP Speakers shall we wall mounted Atlas IED IP-SDM or equivalent with the following specifications:

- 1. LCD display configured as a clock with the ability to display other text content
- 2. Clock functionality set and synchronized through NTP
- 3. Powered over IEEE 802.11af (POE)
- 4. Native integration with Globalcom and InformaCast software

3.3.2 Installation

- 1. IP Speakers shall be surface mounted to the wall using the appropriate wall mount enclosure.
- 2. Network cabling for IP Speakers will conform with District communications specification 27 20 00
- 3. Horizontal network cable shall be terminated on a biscuit mounted within the enclosure.
- 4. All horizontal network able, key stone jacks (both IDF and device side), and patch cables shall be orange.

3.4 Analog Speakers

Analog speakers will be connected back to the IP paging system through an ATLAS/IED IP-ZCM1RMK IP to Analog gateway or equivalent and will be a traditional 70.7 Volt system. IP to Analog gateway to be located in the MDF. An Amplifier such as the ATLAS/IEDPA1001G or equivalent must be used when total power requirements exceed 15.

3.4.1 Specifications

Analog speakers will be 15W @ 70.7V and be rated for the environment they are installed in.

3.4.2 Installation

- 1. Each individual speaker shall be a continuous home run cable from the speaker to a euro style consolidation block located in the IDF serving the area. With each speaker receiving its own space on the block.
- 2. Cables must be ran using an approved pathway as outlined in section 27 05 28 of the Districts Communications System Spec.

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- 3. Speakers shall use a minimum of 18/2 AWG shielded coper cable. Heavier gauge wire may be required due to distance or other design considerations; however, it is the contractor's responsibility to identify when wire should be sized larger.
- 4. A minimum of an 18/8 shielded copper tie cable will be installed between the IDF and the MDF terminating on euro style consolidation blocks in each location. Heavier gauge wire may be required due to distance or other design considerations; however, it is the contractor's responsibility to identify when wire should be sized larger.
- 5. Individual speakers shall be combined and cross connected on the consolidation block with no more than 8 speakers per pair of wires on the tie cable.
- 6. Shielding for all PA cables shall be bonded together at each IDF and bonded to ground at the MDF. To avoid ground loops shielding must be bonded to ground only at the MDF.
- 7. All cables must be permanently labeled using a machine generated label between 6" and 18" from the end of the cable. Label must clearly identify the opposite end of the cable.

3.4.2.1 Interior speakers

Interior speakers shall be flush mounted to using the appropriate mounting bracket unless otherwise specified.

3.4.2.2 Exterior speakers

Exterior speakers shall be wall mounted a minimum of 15' above the ground and located no less than 8' horizontally from any item that would serve as a climbing surface for vandals, such as vertical conduits and pipes.

4 Testing and Acceptance

4.1 Contractor On-Site Testing

Contractor shall functionally test and certify each component in the system after installation to verify proper operation and confirm that the wiring and installation conforms to District's Networked Paging Systems Specification or manufacture's best practices, whichever is stricter.

4.2 District Test and Inspection

Once the Contractor has finished the On-Site Testing, the District Systems Administration department will walk the site with the Contractor and functionally test and inspect select components in the system after installation to verify proper operation, confirm that the wiring and installation conforms to District's Networked Paging Systems Specification or manufacture's best practices (whichever is stricter), and generate a punch list, if necessary.

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4.3 Final Test and Inspection

Once the contractor has finished correcting all of the issues identified on the punch list, the District Systems Administration department will walk the site with the Contractor and perform a final test and inspection of the system.

4.4 Operational Demonstration

At the request of the District, contractor will provide an Operational Demonstration to demonstrate any new features and functionality.

4.5 Acceptance Requirements

- A. Receipt of final documentation.
- B. Successful Final Test and Inspection.
- C. Successful Operational Demonstration Test.
- D. Successful training and demonstration, including operation of systems using the manuals.

5 Post Installation

5.1 Clean-up

- A. Except for necessary modifications directly related to the scope of work, all facilities must be returned to their original condition before work started.
- B. Any incidental repair work needed directly related to the work will be carried out at the cost of the contractor unless agreed to in writing before work is performed.
- C. Any previous installation marked for demolition as agreed by the contractor and the district must be completed including any patch work and repair to the facility.
- D. All new wall outlets must be cleaned of smudges and dust.
- E. All Cabinets and Data Closets must be free of debris such as cut wires, metal shavings, and extra parts.
- F. Unless otherwise stated, all related unused parts, such as dust-covers, caps, cables, connectors, blanks, and manuals must be returned to the Systems Administration department.
- G. All keys that are borrowed for access to the facilities must be returned. If keys are lost, the district has the right to change locks for the affected area at the expense of the contractor.
- H. Missing items from facilities after jobs will be investigated
- I. Contractors must assure that all doors are properly closed and locked before leaving.
- J. Any damages caused by the installation will be repaired at the contractor's expense unless the District is made aware of the likely damage before work and has agreed in writing to waive the contractor from responsibility.

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5.2 Deliverables

5.2.1 Software & Software Licenses

Any and all software and software licenses that were installed/used as part of this project

5.2.2 Parts and Hardware

5.2.2.1 Keys

All of the keys for all hardware with a lock.

5.2.2.2 Unused Parts and Hardware

All unused parts and hardware including any parts and hardware that was removed and not reused during the course of the project need to be returned to the Systems Administration department.

5.2.2.3 Failed Parts and Hardware

Unless otherwise specified all failed parts and hardware not covered under warranty need to be returned to the Systems Administration department.

5.2.3 Documentation

5.2.3.1 Access Control Panels

- A. Site and Room where panel is located
- B. IP Address Assigned to the Panel
- C. Name of panel in the Access Control System

5.2.3.2 Readers/Reader Interface

- A. Site, Room, Location where reader interface is installed
- B. Channel that the reader interface is installed on
- C. ID that the reader interface is configured for
- D. Name of the Area that the Reader is a member of
- E. Name of the Reader in the Access Control System

5.2.3.3 Areas

A. List of all newly created area in the Access Control System

5.2.3.4 Manuals

One set of manuals and install guides for each type hardware and equipment installed.

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CONTRACTOR MUST FOLLOW THESE SPECIFICATIONS FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PROJECT MANAGER PRIOR TO START OF WORK

1. General

1.1 Introduction

The district has adopted Vanderbilt SMS Enterprise as its access control system. Any products provided must be compatible and integrate with this existing system and act as one seamless system or replace the existing system in its entirety district wide. It is the intent of this system to be centrally managed for controlling user access district wide and to be capable of automation for account creation and management.

1.2 General Requirements

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Any discrepancies between this document, the drawings, and the physical site or any part or method specified that is not optimal for the application listed must be brought to the attention of the District's Systems Administration department. Installation of approved parts in a suboptimal usage will be considered to not meet these specifications.
- C. All of the electronic systems equipment shall be furnished and installed by the authorized manufacturer's distributor or installer of the equipment and shall include evidence of this authorization in their proposal.
- D. The entire access control system shall be installed by a single contractor. If subcontractors are used, they will perform work as an agent of the primary contractor and such work will be the responsibility of and warranted by the primary contractor. Upon notification by the District of a failure, the Contractor shall repair or replace components that no longer fall within the specifications set by the manufacturer.
- E. System must be installed according to manufacture requirements to be backed by the Manufactures warranty. At a minimum the installation must be supervised and inspected by an installer with a valid Vanderbilt installer certification for SMS Enterprise issued within the last 5 years.

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1.3 Substitutions

Parts and software may be substituted with equivalent products providing that the vendor can show that the product is equivalent. If a substitution item is given final acceptance by the Systems Administration department, the contractor shall pay all costs (including travel, lodging, meals, computers, etc.) required to provide factory certification, equal to that of a factory authorized distributor of the substituted item, for at least two selected District representatives. This training will be provided by the manufacture of the substituted item in question and shall allow the selected District representatives to provide any and all factory/manufacturer approved repairs, services, software upgrades, etc., without affecting any available or applicable manufacturer warranties.

2 Quality Assurance Standards

2.1 Requirements of Regulatory Agencies

- A. Furnish security equipment to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed. Standards include, but are not limited to:
 - a. NEC/NFPA
 - b. TIA 568-C
 - c. TIA 569
 - d. TIA 607
- B. Furnish security equipment to comply with the requirements of American National Standards for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People (ICC/ANSI A117.1), the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.

2.2 Contractor qualifications

- A. Trained, authorized, and certified to install the specified products. Contractor must possess a current and valid Installer Certification. Certification must be issued within the last 2 years or have an expiration date printed on the certification that shows that it is valid for the duration of the project.
- B. Has a minimum of five years of system design, engineering supervision, and installation experience in the access control industry.
- C. Will maintain a fully staffed local office within 60 miles of the work site. The service center will be staffed by factory-trained technicians.
- D. The contractor must maintain an inventory of spare parts and other items critical to system operation and as necessary to meet the emergency service requirements for warranty service, within the local service center.

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- E. Must have engineering and project management capability consistent with the requirements of this project. The contractor shall provide a project manager who is actively involved in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the operation and maintenance manuals, training programs, documentation and system testing, maintenance of Drawings and the coordination of all subcontract labor. The District reserves the right to approve the contractor's Project Manager.
- F. Must abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

2.3 Pre-Installation Conference

Prior to work commencing, a conference between the contractor and the Systems Administration department shall take place to review materials and procedures and to coordinate related work. The locations and orientation of distribution frames, cross-connects, and patch panels in equipment rooms and wiring closets shall also be decided to minimize the impact on other services sharing the space.

Work done at school sites must be scheduled in advance. Contractors are to inform the ITS department of the scope of work, the area that will be worked in, and the time and date of work. ITS will get authorization from the school administration before the work is scheduled. If contractor attempts to begin work without getting authorization, the school site will be instructed to ask the contractor to leave.

The district will attempt to communicate any safety concerns such as other pending work to the facilities, areas with asbestos, lead or other hazards. If the contractor has such concerns, the district must be notified immediately before the start of work. The District Maintenance and Operations Department shall advise on any needed provisions.

2.4 Warranty

- A. The entire system shall be provided with a one-year factory warranty against defects in materials and workmanship, commencing upon approval of the notice of completion of the project.
- B. During the system warranty period, system updates are to be made available to District at no charge.

3 Typical Components

The following list of components is current as of revision date of this specification. Part numbers may be changed by the manufacturer at any time. Please substitute the appropriate replacement part as needed or coordinate with the District to assure the correct parts used.

3.1 Cabling

Cabling must follow standards outlined in 27 15 01.15

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3.2 Access Control Enclosure

- A. Altronix Trove2M2 + RSB1
 - a. Unless otherwise specified this is the enclosure used for all new access control installs.
 - b. Supports equipment required for 1-16 access control locks.
 - c. Install (1) 3/4" conduit for power and (2) 2" conduits for low voltage wiring & data3

3.3 Reader Controller

- B. VMRC-2S3NB Dual Reader Controller capable of supporting 30 additional devices
 - a. Unless otherwise specified this is the reader controller used for all projects
- C. VMRC-1S3NB PoE capable Single Reader Controller supporting 8 additional devices
 - a. Only approved in limited circumstances and use must be approved in writing by PUSD Systems Administration
- D. VRCNX-A Vanderbilt SMS Reader Controller with NEMA 1 enclosure with lock
 - a. Only used to replace existing controllers with VRINX's attached

3.4 Power Supply

- A. eFlow104NB Altronix power supply charger board only
 - 120VAC Input
 - 24VDC, 10A output
- B. AL1024ULXPD16 Altronix power supply/charger with lock
 - Only approved in limited circumstances and use must be approved in writing by PUSD Systems Administration
 - 120VAC Input
 - 24VDC, 10A output with 16 fuse protected outputs
 - Two 12VDC / 12Ah batteries per power supply wired in series to provide 24VDC

3.5 Power Distribution

- A. ACM8 Altronix Access Power Controller board only
 - 8 3.5A Fuse Protected Relay Outputs
 - Used in Trove enclosure to power the strikes and controlled by the VMRC-1, VMRC-2, VRI-1, and VRI-2 boards.
- B. PDS16 Altronix Access Power Controller board only
 - Stacked with the VR6 to distribute 12VDC power
 - 16 3A Fuse Protected Outputs
 - Used in Trove enclosure to power the VMRC-1, VMRC-2, VRI-1, and VRI-2 boards.
- C. VR6 Voltage Regulator board only
 - 24VDC input into 12VDC output
 - Stacked with the PDS16

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3.6 Reader Interface

All reader interfaces not located within the Trove enclosures must have a lock.

- A. VRI-2S3NB Vanderbilt SMS Dual Reader Interface
 - a. Unless otherwise specified this is the reader interface used for all new projects
- *B.* Special Readers Only approved in limited circumstances and use must be approved in writing by PUSD Systems Administration
 - a. VRINX Vanderbilt SMS Single Reader Interface
 - b. VRI-1S3 Vanderbilt SMS Single Reader Interface

3.7 Reader

Note: Readers are 12V only. If using with a VRI-1 or VRI-1S3 a 24VDC to 12VDC adapter will be required.

- A. IRXPO–2S–BLE iRox Pro + U.S. Single Gang multiCLASS SE Wall Reader with BLE a. Unless otherwise specified this is the reader interface used for all new projects
- B. IRXPO-3S-BLE iRox Pro + U.S. Double Gang multiCLASS SE Wall Reader with BLE
 a. Used for vehicle reader pedestals
- C. IRXPO–1S–BLE iRox Pro + Narrow multiCLASS SE Wall Reader with BLE
 - a. Only approved in limited circumstances and use must be approved in writing by PUSD Systems Administration

3.8 Door Unlock Switches

Door Unlock switches shall be a red single pole toggle switch mounted in a single or multi gang box with an engraved cover identifying the switches as Door Unlock Switches and the corresponding door(s) that the switch opens. Contact Districts ITS Systems Administration for the exact wording of the labels.

3.9 Door Position Switch

GE/Interlogix 1076D-N White DPDT Steel Door Contact with 1/2" Gap allowance

3.10 Request to Exit Sensor

BOSH DS160i High Performance Request-to-Exit Sensor

3.11 Door Hardware

The contractor shall be responsible for compliance with Section 08 71 00, Door Hardware. That section may provide certain items of door hardware for use of the system including power transfer hinges, door position switches, request-to-exit switches, and electric latch retraction panic hardware. The Contractor shall be responsible for all low voltage installation required to integrate the devices furnished by section 08 71 00 into the access control system. Any discrepancies between 08 71 00 and 28 10 00 shall be brought to the attention, in writing, of the Districts ITS Systems Administration department project manager for resolution.

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Contractor shall use factory pigtails when terminating connections to avoid voiding product warranties. OEM connectors shall not be removed without approval in writing from the Districts ITS Systems Administration department project manager.

3.11.1 Rim Strike

- 9600-630* HES Electric Service Mount Rim Strike (Fail Secure)
- * Install strike with addition of HES 2005M3 Smart Pac III

3.11.2 Mortise Strike

- 8500* HES Mortise Electric Strike
- * Install strike with addition of HES 2005M3 Smart Pac III

3.11.3 Cylindrical Strike

HES 8000C* HES 8000C No Cut Electric Cylindrical Strike

* Install strike with addition of HES 2005M3 Smart Pac III

3.11.4 Electrified Removable Mullion

Command Access V-KRM-EL Electric Power Transfer modification of the Sargent/Yale keyed removable mullion system

3.11.5 Electrified Panic

Contact the District Lock Shop for specifics on the make/model of Electrified Panic to use.

a. Only approved in limited circumstances and use must be approved in writing by PUSD Systems Administration

3.11.6 Electrified Transfer Hinge

Electrified transfer hinges must be split so that the section containing the wires can be removed without removing the door.

a. Only approved in limited circumstances and use must be approved in writing by PUSD Systems Administration

Contact the District Lock Shop for specifics on the make/model of transfer hinges to use.

4 Hardware Installation

The contractor shall furnish and install all hardware, devices, and components to meet the performance and functional requirements described in these contract documents. Include all items required,

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whether or not individually specified, to ensure a completely operational integrated Security Management System. The contractor must complete all database entry, and provide the District with assistance on cardholder entry, as well as all system programming. No additional costs shall be allowed to make the system operational or to meet specifications.

4.1 Low Voltage/Communication Cabling

- A. Cabling to be installed per section 27 15 01.15
- B. Conduit/Raceway to be installed per section 27 05 28
- C. Whenever possible all cables should run through the wall or above the celling without using surface mount raceways.
- D. When service mounted raceway is required then a metallic raceway system will be utilized.
- E. Door Cords and Transfer Hinges
 - a. Transfer hinges must be used wherever electrified door hardware is used and must be able to power the lock as well as provide signal for the request to exit switch.
 - b. Door cords are not permitted unless explicitly approved in writing by the Systems Administration department.

4.2 Access Control Enclosure

- A. Enclosure must be installed so that the door to the cabinet can be opened a minimum of 120 degrees and have at least 3' of clearance in front. Enclosure must not interfere with the opening of any other surrounding equipment.
- B. Enclosure will be installed adjacent the closest IDF unless otherwise directed to by the District's Systems Administration department.
- C. Every enclosure must have (1) 3/4" conduit for 120v power and (2) 2" conduits for data / low voltage. Unless otherwise approved all conduits must exit the top of the enclosure. See section 5.1 Access Control Enclosure Layout for conduit layout.
- D. Enclosure must have the Altronix RSB1 installed and mounted in the upper left corner of the enclosure. All splices to the RSB1 must be done utilizing push-in lever style wire connector rated for the wire sizes being used, such as the Wago 221-2401. Twist on wire nuts are not allowed within the Access Control Enclosure.
- E. Input power must be hardwired on a dedicated 120V circuit. Load permitting, sharing the circuit used for the IDF and/or Alarm Panel is acceptable unless otherwise specified.
- F. Exposed conduits and raceways for must be EMT or Ridged. For 120v power, Armored Cable, Metal Clad Cable and Flexible Metal Conduit Power are only approved for use above T-bar celling. Conduits and raceways must be secured per California Electrical Code requirements and painted to match wall directly behind them.

4.3 Reader Controller

A. Unless otherwise specified, Reader Controller must be installed in the access control enclosure. See section 5.1 Access Control Enclosure Layout for board layout.

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- B. Every Reader Controller must have one Ethernet network port in the enclosure (typically installed in a biscuit) going back to the nearest IDF and terminated on the patch panel. Ethernet install must comply with 27 20 00. All Ethernet cables and jacks must be orange.
- C. Panel must be connected to the District's network and have a reserved IP address on the network provided by the Systems Administration department.
- D. For Reader Controller without a data backplane such as the VMRC-1 or VMRC-2 and where the reader interfaces are not in the same enclosure a data backplane must be established using either euro style barrier strips or terminal blocks. Terminal strips with exposed metal parts such as the Eaton TB100-28 are forbidden. See section 5.1 for installation diagram.
- E. The onboard relays may only be utilized for triggering non powered loads. For electrified door hardware, relays on the reader interface to be used to trigger the contacts on the Altronix ACM8

 Altronix Access Power Controller.

4.4 Power Supply

Power supplies are used to power the Reader Controller, Reader Interfaces, Associated Lock Hardware, and any accessories, as needed.

- A. Unless otherwise specified Power Supply must be installed in the access control enclosure. See section 5.1 Access Control Enclosure Layout for board layout.
- B. Input power for the power supply will be provided by the RSB1 in the Access Control Enclosure. All splices to the RSB1 must be done utilizing push-in lever style wire connector rated for the wire sizes being used, such as the Wago 221-2401. Twist on wire nuts are not allowed within the Access Control Enclosure.
- C. 24VDC output from power supply will be connected to the

4.5 Power Distribution

4.5.1 ACM8 – 24DC Power

- ACM8 to be powered directly from the 24VDC output of the power supply
- Strikes will be wired to the ACM8 based on their Reader Address ID. For readers 1-8 the reader address ID matches that of the output ID. For readers 9-16 the formula reader address 8 will be utilized to determine the output ID. (Example: Reader Address 1 Output 1 on the ADM8)

4.5.2 PDS16 + VR6 – 12VDC Power

- VRI6 to be powered directly from the 24VDC output of the power supply
- VRI6 output to be set at 12VDC
- VRI6 and PDS16 to be stacked together per manufactures direction so that PDS16 outputs 12VDC
- 12VDC output to power the Reader Controller, and Reader Interfaces

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4.6 Reader Interface

- A. Unless otherwise specified the reader interface will be installed in the same Access Control Enclosure as the Reader Controller.
- B. Reader Interface must be installed on the secure side of the door unless approved in writing by the Districts Systems Administration Department.
- C. Reader Interface for outdoor locations such as gates must be installed with the Reader Controller; outdoor enclosures for the Reader Interface are not permitted unless approved in writing by the Districts Systems Administration Department.
- D. Reader Interface must be located within 500 wire-feet from the Reader Controller.
- E. For installs where the reader interface is not located within the Access Control Enclosure:
 - a. Reader Interface must be installed so that the door to the cabinets can be opened completely and have at least 3' of clearance in front and 1' of clearance on at least one side. Reader Interface must not interfere with the opening of any other surrounding equipment.
 - b. Reader Interface must be mounted above the T-bar celling. If there is no T-bar celling then must be mounted a minimum of 8' above the ground.

4.6.1 Installation

- Wiring from Reader Interface to the Reader Controller and Power Supply must be at least 18/4 unshielded cable (18/6 preferred) or greater gauge and must be one continuous run back to the Access Control Enclosure. Heavier gauge wire may be required to reduce voltage drop or higher current needs. It is up to the contractor to identify situations that require heavier gauge wire.
 - Red and Black wires are used for power and must be landed on a dedicated port on the power distribution board.
 - White and Green wires are used for communication and terminate on the Reader Controller.
- The onboard relays may only be utilized for triggering non powered loads. For electrified door hardware, relays on the reader interface to be used to trigger the contacts on the Altronix ACM8 Altronix Access Power Controller.

4.7 Reader

- Reader will be mounted to the door jamb on the same side as the strike unless otherwise specified. For readers on doors not utilizing a strike the location of the reader will be specified during the initial job walk by the District Systems Administration department.
- Wiring from the Reader Interface to the Reader must be one continuous run of at least 18/6 unshielded cable or greater gauge. Unused wires should be neatly wrapped around cable for future use.

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• Reader will be mounted so that the wires entering the conduit or door jamb are protected from damage.

4.8 Request to Exit Devices (REX)

Unless otherwise specified every access control door will have a REX device. Request to Exit Devices must be used in conjunction with Door Position switches and wired to the Reader Interface using at least 22/4 unshielded cable or greater gauge. If the opening has two doors, both doors must have REX switches.

The REX switch should be incorporated into the exit hardware so that it is triggered automatically when the door is opened from the inside. The exception to this would be for doors where electrified strikes are used, in this case a REX motion detector is acceptable. In both situations, the REX must be wired so that it only disables contact reporting and does not unlock the door.

4.9 Door Position Switch

Unless otherwise specified every access control door will have a door position switch. Door Position Switches must be used in conjunction with Request to Exit Devices and wired to the Reader Interface using at least 22/4 unshielded cable or greater gauge. If the opening has two doors, both doors must have door position switches. Door Position Switches should be installed on the top of the door or frame opposite the hinge. All four conductors must be connected from the door contact to the wire. The White/Green pair of wires will be used for the door position sensor and the red black will be left long, neatly coiled, for use with the intrusion system.

4.10 Door Unlock Switches

Door Unlock switches will be used whenever a door is needed to be left unlocked. Switch shall be mounted in a single or multi gang box with an engraved cover identifying the switches as Door Unlock Switches and the corresponding door(s) that the switch opens. Switch wire must be ran to the dry contacts on either the reader interface or an IO board such as the VI-16INS3 with a minimum of 22/4 unshielded cable.

4.11 Door Hardware

Door hardware power to be supplied / triggered via the ACM8 - Altronix Access Power Controller.

4.11.1 Single Door Opening

Electrified strikes must be used on all single door openings that are access controlled. It is the responsibility of the contractor to work with the District's Lock Shop to determine the correct type of electrified strike required. Electrified strikes will be used in conjunction with the HES Smart PAC III.

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4.11.2 Double Door Opening With Removable Mullion

Double doors will utilizes an electric strike in conjunction with an electrified removable mullion. The electrified removable mullion must allow for the complete removal of the mullion without the needing to disconnect the power wires for the strike. It is the responsibility of the contractor to work with the District's Lock Shop to determine the correct type of electrified strike required Electrified strikes will be used in conjunction with the HES Smart PAC III.

4.11.3 Wired Locks with Integrated Reader Controller

Wired locks with integrated Reader Controllers not permitted unless explicitly approved in writing by the Districts Systems Administration department.

4.11.4 Wireless Locks

Wireless locks are not permitted unless explicitly approved in writing by the Systems Administration department.

4.12 Motorized Gates

Motorized gates must be connected to the access control system through a Reader Interface regardless of whether a reader will be installed. Gate will be wired to the Reader Interface as follows:

- A. Relay 1 is wired to the gate opener contact as normally open
- B. Relay 2 is wired to the exit loop contact as normally closed

4.13 Rollup Doors

Access controlled rollup doors will be wired to the Reader Interface as follows:

A. Relay 1 is wired to the opener contact as normally open.

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5 Diagrams

5.1 Access Control Enclosure Layout



TROVE2M2 DOOR LAYOUT TROVE2M2 ENCLOSURE LAYOUT

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5.2 Sample System Wiring – Legacy Installs



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5.3 Sample Access Control / ADA Opener Integration



6 Programming

Contractor is responsible for programming all newly-installed hardware and making sure that all devices and panels follow the established naming convention.

6.1 Naming Conventions

- A. Reader Controller: <Site> <IDF Number> (e.g., Cortez IDF 1 or Cortez MDF)
- B. Readers: <Site> <Room> <Door> (e.g., Cortez Classroom A101, Cortez Classroom A101 North)
- C. Areas: <Site> <Room> (e.g., Cortez Classroom A101)

6.2 Reader Controller Configuration

New Reader Controllers will be configured with the IP address provided by the Systems Administration Department and added into SMS Enterprise.

6.3 Area Configurations

Areas in SMS Enterprise should match those of the physical area that the lock is providing access to. If more than one door is access controlled for the same physical area, all doors must be added to the same Area in SMS Enterprise unless otherwise specified.

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6.4 Reader Configuration

The District has two predefined reader templates defined that should be used in most instances. If these templates are not used then locks must be configured with the settings outlined below unless otherwise specified. Every reader needs to be added to the appropriate Area in SMS Enterprise. The "Special Access Privilege" request type is only used for toggle doors.

6.4.1 Predefined Reader Templates

- A. School Crashbar Doors (Default)
- B. School Toggle Lock (Only used if specified)

6.4.2 Valid Access

All readers will be configured for a valid access request and will have the following settings unless otherwise specified:

- A. Disable contact reporting for 30 seconds
- B. Disable contact triggers for 30 seconds
- C. Energize relay that lock is attached to for 3 seconds
- D. Activate green LED for 3 seconds

6.4.3 Invalid Access

All readers will be configured for an invalid access request and will have the following settings unless otherwise specified:

A. Activate red LED for 1 second

6.4.4 Toggle (Special Access Privilege)

This is a special case and will only be used if specified; it is not set up by default. If specified, the reader will be configured for a "valid access – special access privilege" request and will have the following settings:

6.4.4.1 Toggle On (Valid Access – Special Access Privilege)

- A. Disable contact reporting indefinitely (0 seconds)
- B. Disable contact triggers indefinitely (0 seconds)
- C. Energize relay that lock is attached to indefinitely (0 seconds)
- D. Activate green LED indefinitely (65535 seconds)
- E. Change reader type to Exit Only Reader

6.4.4.2 Toggle Off (Valid Exit – Special Access Privilege)

- A. Reset all contacts
- B. Reset relay
- C. Reset LED
- D. Change reader type to Normal Access Reader

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6.4.5 Toggle (Button/Switch)

This is a special case and will only be used if specified; it is not set up by default. If specified, the reader will be configured for a "valid access – special access privilege" request and will have the following settings:

6.4.5.1 Toggle On (Button Latched/Switch On)

- A. Disable reader reporting indefinitely (0 seconds)
- B. Energize relay that lock is attached to indefinitely (0 seconds)
- C. Activate green LED indefinitely (65535 seconds)

6.4.5.2 Toggle Off (Button Released/Switch Off)

- A. Reset reader reporting
- B. Reset relay
- C. Reset LED

7 Labeling

7.1 Wire Labeling

All wires must be labeled on both sides. Labels must be machine printed and permanently affixed to the cable within 4" of termination. Labels be self-laminating wrap style labels or printable heat shrink. Flag style labeling is prohibited. All labeling must follow the established naming convention shown below.

7.1.1 Wire Labeling Conventions

A. From Reader Controller to:

	a.	Reader:	<room>-RDR (e.g A101-RDR)</room>
	b.	Lock:	<room>-LCK (e.g. A101-LCK)</room>
	c.	DOD:	<room>-DOD (e.g. A101-DOD)</room>
	d.	REX:	<room>-REX (e.g. A101-REX)</room>
	e.	Button/Switch:	<room>-BTN (e.g. A101-BTN)</room>
В.	From end device (Reader, Lock, DOD, REX, Button, Switch, etc) to:		

- a. Reader Controller < Reader Controller Name> (e.g. IDF1)
- b. Other Location/Device <Location>-<Device> (e.g. A101-VRI1)

7.2 Enclosures

The following information will be clearly labeled on the inside of all enclosures:

- A. Any wiring diagram stickers supplied shall be installed on the inside of the enclosure.
- B. Reader Controller: IP Address of Reader Controller.
- C. Power Supply: Electrical panel and circuit that the Power Supply receives power from.
- D. Reader Interface: ID number assigned to the Reader Interface.

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7.3 Locks

When locks with integrated reader interfaces are used, the lock will be clearly labeled with the ID number assigned to the lock. Label will be located under the cover protecting the Reader Interface board.

8 Testing and Acceptance

8.1 Contractor On-Site Testing

Contractor shall functionally test and certify each component in the system after installation to verify proper operation and confirm that the wiring and installation conforms to District's Access Control Specifications or manufacture's best practices, whichever is stricter.

8.2 District Test and Inspection

Once the Contractor has finished the On-Site Testing, the District Systems Administration department will walk the site with the Contractor and functionally test and inspect select components in the system after installation to verify proper operation, confirm that the wiring and installation conforms to District's Access Control Specifications or manufacture's best practices (whichever is stricter), and generate a punch list, if necessary.

8.3 Final Test and Inspection

Once the contractor has finished correcting all of the issues identified on the punch list, the District Systems Administration department will walk the site with the Contractor and perform a final test and inspection of the system.

8.4 Operational Demonstration

At the request of the District, contractor will provide an Operational Demonstration to demonstrate any new features and functionality.

8.5 Acceptance Requirements

- A. Receipt of final documentation.
- B. Successful Final Test and Inspection.
- C. Successful Operational Demonstration Test.
- D. Successful training and demonstration, including operation of systems using the manuals.
- E. Purging of Contractor User privileges and return of all key card media.

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9 Post Installation

9.1 Clean-up

- A. Except for necessary modifications directly related to the scope of work, all facilities must be returned to their original condition before work started.
- B. Any incidental repair work needed directly related to the work will be carried out at the cost of the contractor unless agreed to in writing before work is performed.
- C. Any previous installation marked for demolition as agreed by the contractor and the district must be completed including any patch work and repair to the facility.
- D. All new wall outlets must be cleaned of smudges and dust.
- E. All Cabinets and Data Closets must be free of debris such as cut wires, metal shavings, and extra parts.
- F. Unless otherwise stated, all related unused parts, such as dust-covers, caps, cables, connectors, blanks, and manuals must be returned to the Systems Administration department.
- G. All keys that are borrowed for access to the facilities must be returned. If keys are lost, the district has the right to change locks for the affected area at the expense of the contractor.
- H. Missing items from facilities after jobs will be investigated
- I. Contractors must assure that all doors are properly closed and locked before leaving.
- J. Any damages caused by the installation will be repaired at the contractor's expense unless the District is made aware of the likely damage before work and has agreed in writing to waive the contractor from responsibility.

9.2 Deliverables

9.2.1 Software & Software Licenses

Any and all software and software licenses that were installed/used as part of this project

9.2.2 Parts and Hardware

9.2.2.1 Keys

All of the keys for all hardware with a lock, including power supplies, reader controllers, and reader interface panels.

9.2.2.2 Unused Parts and Hardware

All unused parts and hardware including any parts and hardware that was removed and not reused during the course of the project need to be returned to the Systems Administration department.

9.2.2.3 Failed Parts and Hardware

Unless otherwise specified all failed parts and hardware not covered under warranty need to be returned to the Systems Administration department.

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9.2.3 Documentation

9.2.3.1 Access Control Enclosure

- A. Site and Room where panel is located
- B. IP Address Assigned to the Reader Controller
- C. Name of panel in the Access Control System

9.2.3.2 Readers/Reader Interface

- A. Site, Room, Location where reader interface is installed
- B. Channel that the reader interface is installed on
- C. ID that the reader interface is configured for
- D. Name of the Area that the Reader is a member of
- E. Name of the Reader in the Access Control System

9.2.3.3 Areas

A. List of all newly created area in the Access Control System

9.2.3.4 Manuals

One set of manuals and install guides for each type hardware and equipment installed.

END SECTION

CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1 General

1.1 Introduction

The district has adopted Panasonic Video Insight as its video surveillance network video recorder (NVR) software; any solution provided must be compatible and integrate with this existing system and act as one seamless system or replace the existing system in its entirety district wide. It is the intent of this system to be centrally managed for controlling user access district wide and to be capable of automation for account creation and management.

1.2 General Requirements

- A. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.
- B. Any discrepancies between this document, the drawings, and the physical site or any part or method specified that is not optimal for the application listed must be brought to the attention of the District's Systems Administration department. Installation of approved parts in a suboptimal usage will be considered to not meet these specifications.
- C. Any deviations from the requirements listed in this specifications must be approved in writing by the District's Systems Administration department.
- D. Any changes to the design must be approved by the District Systems Administration staff
- E. All of the electronic systems equipment shall be furnished and installed by the authorized manufacturer's distributor or installer of the equipment and shall include evidence of this authorization in their proposal.
- F. The contractor shall include all the necessary parts and supplies needed for a fully functioning system in its scope.
- G. The entire video surveillance system shall be installed by a single contractor. If subcontractors are used, they will perform work as an agent of the primary contractor and such work will be the responsibility of and warranted by the primary contractor. Upon notification by the District of a failure, the Contractor shall repair or replace components that no longer fall within the specifications set by the manufacturer.

H. Unless otherwise noted, all materials and equipment shall be new, of the type, capacity, and quality specified, free from defect, and has a warranty for a minimum of 3 years.

1.3 Substitutions

Parts and software may be substituted with equivalent products providing that the vendor can show that the product is equivalent. If a substitution item is given final acceptance by the Systems Administration department, the contractor shall pay all costs (including travel, lodging, meals, computers, etc.) required to provide factory certification, equal to that of a factory authorized distributor of the substituted item, for at least two selected District representatives. This training will be provided by the manufacture of the substituted item in question and shall allow the selected District representatives to provide any and all factory/manufacturer approved repairs, services, software upgrades, etc., without affecting any available or applicable manufacturer warranties.

2 Quality Assurance Standards

2.1 Requirements of Regulatory Agencies

- A. Furnish security equipment to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed. Standards include, but are not limited to:
 - a. NEC/NFPA
 - b. TIA 568-C
 - c. TIA 569
 - d. TIA 607

2.2 Contractor qualifications

- A. Trained, authorized, and certified to install the specified products.
- B. Must have engineering and project management capability consistent with the requirements of this project. The contractor shall provide a project manager who is actively involved in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the operation and maintenance manuals, training programs, documentation and system testing, maintenance of Drawings and the coordination of all subcontract labor. The District reserves the right to approve the contractor's Project Manager.
- C. Must abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

2.3 Pre-Installation Conference

Prior to work commencing, a conference between the contractor and the Systems Administration department shall take place to review materials and procedures and to coordinate related work. The

locations and orientation of distribution frames, cross-connects, and patch panels in equipment rooms and wiring closets shall also be decided to minimize the impact on other services sharing the space.

Work done at school sites must be scheduled in advance. Contractors are to inform the ITS department of the scope of work, the area that will be worked in, and the time and date of work. ITS will get authorization from the school administration before the work is scheduled. If contractor attempts to begin work without getting authorization, the school site will be instructed to ask the contractor to leave.

The district will attempt to communicate any safety concerns such as other pending work to the facilities, areas with asbestos, lead or other hazards. If the contractor has such concerns, the district must be notified immediately before the start of work. The District Maintenance and Operations Department shall advise on any needed provisions.

2.4 Warranty

- A. All components shall be supplied with a minimum one-year warranty against defects in materials and workmanship, commencing upon approval of the notice of completion of the project.
- B. During the system warranty period, system updates are to be made available to District at no charge.

3 Typical Components

3.1 Cameras

Currently the District supports the following IP Cameras for new and replacement installs.

3.1.1 2 Megapixel Camera

a. Arecont 2356PMTIR-S cameras with 8–22mm varifocal lenses (2.1MP)

3.1.2 5 Megapixel Camera

a. Advidia B-51 cameras with 9-22mm varifocal lenses (5MP)

3.1.3 Doorbell Camera

a. Hanwha Techwin TID-600R 2MP Video Intercom Station

4 System Requirements

4.1 General

- A. The system will record on motion-only or full time depending on the need.
- B. The system will record at 7-14 fps per camera.
- C. The system will store recorded video for a minimum of fourteen (14) days before overwriting the earliest recorded images.

4.2 Recorder

If a recorder is needed for a project, design and specifications will be provided by the Districts Systems Administration Department.

4.3 Cameras

4.3.1 General

- A. All cameras must be non-proprietary, i.e., they may not be compatible only with software, Network Video Recorders (NVRs), panels, and ancillary devices of only one manufacturer.
- B. IP cameras must communicate directly with the NVR without the need of third party software or other intermediary products.
- C. Fixed Dome
- D. Wide Dynamic Range
- E. IR LED for night vision
- F. Remote zoom and focus
- G. Auto focus
- H. P-Iris control
- I. Day/night functionality with mechanical IR cut filter
- J. POE IEEE 802. 3af
- K. H.264 and MJPEG compression
- L. Outdoor Rated IP66 or better
- M. IK-10 Vandal-Resistant or better

4.3.2 2 Megapixel Camera

- A. Resolution 1920 x1080 @ 30FPS
- B. Minimum 10-20mm varifocal lens or better
 - a. Lens requirement is based on F1.6, 1/2.7" CMOS sensor

4.3.3 5 Megapixel Camera

- A. Resolution 2560 x1920 @ 14FPS
- B. Minimum 10-20mm varifocal lens or better
 - a. Lens requirement is based on F2.0 1/2.5" CMOS sensor

4.3.4 Intercom Camera

- A. Resolution 1920x1080 @ 14FPS
 - a. Field of View
 - 180° (Horizontal)
 - 114° (Vertical)

5 Installation

5.1 General

- A. Install must comply with all related sections listed in section 1.3
- B. All materials shall be of the same brand or manufacturer throughout for each class/model of material or equipment.
- C. The contractor will furnish and install dome cameras as needed.
- D. The contractor will furnish and install all server used as NVRs as needed.
- E. The contractor will furnish, install and configure all network switches as needed.
- F. The contractor will furnish and install appropriate dome camera mounting hardware as needed.
- G. The contractor will furnish and install media converters that will supply IEEE 802.3af power to the cameras as needed.

5.2 Locations

- A. Cameras will be installed at locations as directed by District Systems Administration staff.
- B. Cameras will be located so that the minimum pixel per foot (PPF) is 80 at the near end and 40 and the far end of the area of interest.
- C. Cameras are to be located in a manner to maximize the depth of field.

5.3 Camera Instillation

- A. The contractor will need to identify the ports available or needed on each switch and communicate with the District's Systems Administration staff to configure or add and configure the necessary switches.
- B. For every camera location two CAT6 fully functioning and terminated network jacks will be installed.
 - a. For cable lengths longer than 90 meters, the contractor shall use fiber optic cable and provide power for the contractor supplied media converters.
- C. The contractor will configure and adjust cameras to cover the area of interest and meet the pixels per foot requirement
- D. The contractor will test and confirm video connectivity.
- E. The contractor will take necessary precautions to ensure water does not enter the camera housing, camera, or structure.
- F. The contractor will take necessary precautions to ensure secure mounting of equipment.
- G. Flexible conduit is permitted only for segments under 12 inches.

5.4 Camera Mounting

A. Camera must be mounted so that it is a minimum of 10' off of the ground and no higher than 20' off the ground, unless otherwise specified.

- B. Camera must be mounted a minimum of 6' away from any object that may be used as a ladder to reach the camera, such as fencing, conduits, of piping.
- C. Vertical Surfaces
 - a. Cameras mounted to walls and other vertical surfaces will use the appropriate wall mount adaptor to ensure a camera is mounted horizontally. Vertical mounting is not permitted.
 - b. The wall mount adaptor will be secured to the wall using one of the methods listed below:
 - i. To an existing electrical box using the appropriate camera j-box adaptor.
 - ii. Through bolts installed in such a manor to prevent the camera from being ripped off the wall.
 - iii. Epoxy anchors for concrete or masonry walls where through bolts are not possible. Epoxy anchors must have a minimum of a 4" embedment depth.
 - iv. Concrete anchors or lag screws are approved only for interior installations.
- D. Pole Mounting
 - a. Cameras mounted to poles will utilize the appropriate pole mount adaptor to ensure a camera is mounted horizontally.
 - b. Poles installed for the sole purposes of camera mounting must be designed to withstand vandalism and not be easily bent.
- E. Horizontal Surfaces
 - a. Cameras mounted to horizontal surfaces must be flush mounted whenever possible and utilize the appropriate celling mount adaptor.
 - b. Cameras mounted in drop celling's must be additionally secured with a safety wire which allows the camera to fall no more than 3"
 - c. Cameras mounted under breezeways and less than 15' off the ground will be mounted to a round electrical box adapter plate to provide for a more secure mounting of the camera. Plate will be attached to the breezeway utilizing no less than (8) screws distributed throughout the plate. Screws should be between 1-1/2" and 2-1/2" in length and utilize the longest possible screw without going through to the other side.
- F. Intercom Camera
 - a. Camera will be securely mounted to resist vandalism from kicking, prying and hitting attacks. Screws should be between 1-1/2" and 2-1/2" in length and utilize the longest possible screw without going through to the other side.
 - b. Camera will be mounted so that the operable portion of the device is ADA compliant and between 46" and 48" above walkway.
 - c. Camera must be wired so that the relay triggers a contact on the Districts access control system and does not directly open the door.

6 Post Installation

6.1 Clean-up

- A. Except for necessary modifications directly related to the scope of work, all facilities must be returned to their original condition before work started.
- B. Any incidental repair work needed directly related to the work will be carried out at the cost of the contractor unless agreed to in writing before work is performed.
- C. Any previous installation marked for demolition as agreed by the contractor and the district must be completed including any patch work and repair to the facility.
- D. All new wall outlets must be cleaned of smudges and dust.
- E. All Cabinets and Data Closets must be free of debris such as cut wires, metal shavings, and extra parts.
- F. Unless otherwise stated, all related unused parts, such as dust-covers, caps, cables, connectors, blanks, and manuals must be returned to the Systems Administration department.
- G. All keys that are borrowed for access to the facilities must be returned. If keys are lost, the district has the right to change locks for the affected area at the expense of the contractor.
- H. Missing items from facilities after jobs will be investigated
- I. Contractors must assure that all doors are properly closed and locked before leaving.
- J. Any damages caused by the installation will be repaired at the contractor's expense unless the District is made aware of the likely damage before work and has agreed in writing to waive the contractor from responsibility.

6.2 Deliverables

6.2.1 Software & Software Licenses

- A. Any and all software and software licenses that were installed/used as part of this project
 - a. Contractor will furnish 1 perpetual video channel and/or server license for each camera installed (if needed).
 - b. Contractor will furnish 1 annually renewable one-year video channel and/or server license software support agreements for each camera installed.
 - c. Contractor will furnish 1 server license for each new server deployed
 - d. Contractor will furnish Microsoft Windows 2019 standard core license for each new server deployed appropriately licensed for the number of CPU cores the server has.

6.2.2 Parts and Hardware

6.2.2.1 Unused Parts and Hardware

All unused parts and hardware including any parts and hardware that was removed and not reused during the course of the project need to be returned to the Systems Administration department.

6.2.2.2 Failed Parts and Hardware

Unless otherwise specified all failed parts and hardware not covered under warranty need to be returned to the Systems Administration department.

6.2.3 Documentation

6.2.3.1 As-built Drawings

As-built drawings showing path used and switch port information required.

6.2.3.2 Manuals

One set of manuals and install guides for each type hardware and equipment installed.

END OF SECTION

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Intrusion Alarm System

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1. General

1.1 Introduction

The district has adopted the DMP Entre Access & Security Management System as its intrusion alarm system; any solution provided must be compatible and integrate with this existing system and act as one seamless system or replace the existing system district wide. It is the intent of this system to be centrally managed of arming/disarming the system as well as monitoring for trouble events and alarms.

1.2 General Requirements

- A. Any discrepancies between this document, the drawings, and the physical site or any part or method specified that is not optimal for the application listed must be brought to the attention of the District's Systems Administration department. Installation of approved parts in a sub-optimal usage will be considered to not meet these specifications.
- B. All of the electronic systems equipment shall be furnished and installed by the authorized manufacturer's distributor or installer of the equipment and shall include evidence of this authorization in their proposal.
- C. The entire alarm system shall be installed by a single contractor. If subcontractors are used, they will perform work as an agent of the primary contractor and such work will be the responsibility of and warranted by the primary contractor. Upon notification by the District of a failure, the Contractor shall repair or replace components that no longer fall within the specifications set by the manufacturer.
- D. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

1.3 Substitutions

Parts and software may be substituted with equivalent products providing that the vendor can show that the product is equivalent. If a substitution item is given final acceptance by the Systems Administration department, the contractor shall pay all costs (including travel, lodging, meals, computers, etc.) required to provide factory certification, equal to that of a factory authorized distributor of the substituted item, for at least two selected District representatives. This training will be provided by the manufacture of the substituted item in question and shall allow the selected District

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representatives to provide any and all factory/manufacturer approved repairs, services, software upgrades, etc., without affecting any available or applicable manufacturer warranties.

2 Quality Assurance Standards

2.1 Requirements of Regulatory Agencies

- A. Furnish security equipment to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed the requirements of the Specifications.
- B. Furnish security equipment to comply with the requirements of American National Standards for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People (ICC/ANSI A117.1), the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.

2.2 Contractor qualifications

- A. Trained, authorized, and certified to install the specified products.
- B. Has a minimum of five years of system design, engineering supervision, and installation experience in the alarm industry.
- C. Will maintain a fully staffed local office within 60 miles of the work site. The service center will be staffed by factory-trained technicians.
- D. The contractor must maintain an inventory of spare parts and other items critical to system operation and as necessary to meet the emergency service requirements for warranty service, within the local service center.
- E. Must have engineering and project management capability consistent with the requirements of this project. The contractor shall provide a project manager who is actively involved in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the operation and maintenance manuals, training programs, documentation and system testing, maintenance of Drawings and the coordination of all subcontract labor. The District reserves the right to approve the contractor's Project Manager.
- F. Must abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

2.3 Pre-Installation Conference

Prior to work commencing, a conference between the contractor and the Systems Administration department shall take place to review materials and procedures and to coordinate related work.

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2.4 Warranty

- A. All components shall be supplied with a minimum one-year warranty against defects in materials and workmanship, commencing upon approval of the notice of completion of the project.
- B. During the system warranty period, software and firmware updates are to be made available to District at no charge.

3 Typical Components

The following list of components is current as of revision date of this specification. Part numbers may be changed by the manufacturer at any time. Please substitute the appropriate replacement part as needed or coordinate with the District to assure the correct parts used.

3.1 Cabling

Cables shall be UL listed, complying with California Electrical Code and ETL verified to meet or exceed specified requirements. All cables will be rated for the space that they are installed and must be copper conductors; copper-clad aluminum is not allowed. Cables installed in underground conduit will be OSP loose tube gel filled with rated jacket. Cable gauges outlined below are the minimum gauge allowed. Cable must be properly sized to account for current and voltage drop requirements.

3.1.1 Typical Cable Types

- A. 22 gauge AWG, 4 conductor ("22/4") unshielded cable using standard alarm colors Black, Red, White, and Light Green
- B. 20 gauge AWG, 12 conductor ("20/12") unshielded cable using standard alarm colors Black, Red,
 White, Light Green, Orange, Light Blue, Brown, Yellow, Violet, Gray, Pink, and Tan.

3.2 Alarm Enclosure & Power Supply

A. 352P-G DMP Extra-large panel enclosure with 505-12 Power Supply

3.3 Power Distribution Board

A. PD16W Altronix – 16 Fused Outputs Power Distribution Module

3.4 Alarm Panel

A. XR150DMP Dialer & Network Panel no Enclosure (See 3.2 for Enclosure)B. XR550DMP Dialer & Network Panel no Enclosure (See 3.2 for Enclosure)

3.5 Zone Expander

- A. 714-16PCB DMP 16 Port Zone Expansion ModuleB. 714-18T DMP 4 Zone Loop Expander with Built in Terminal Strip
- 3.6 Key Pad
 - A. DMP-7060-I Keypad Ivory

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3.7 Motion Detector

- C. BSH-DS9370 Bosh DS9370, Ceiling Mount (360 motion)
- D. ISC-PDL1-WAC30G Bosh Detector anti-mask, 100ft (30m)
- E. ISC-CDL1-W15G Bosh Motion detector, 50ft (15m)

3.8 Door Contact

- A. 1078W/1076W GE Steel Door Contact
- B. ISN-C66 Overhead door contact, track mount
- C. ISN-CMET-200AR Bosch Armored Contact
- D. ISN-C60-W Bosch Slim Terminal Connection Contacts

4 Hardware Installation

The contractor shall furnish and install all hardware, devices, and components to meet the performance and functional requirements described in these contract documents. Include all items required, whether or not individually specified, to ensure a completely operational Integrated Alarm System. The contractor must complete all database entry and system programming. No additional costs shall be allowed to make the system operational or to meet specifications.

4.1 Low Voltage/Communication Cabling

- A. All cabling will be installed to the specifications outlined in the District's Communications Cabling Specification Division 270000 and related sections.
- B. All exposed cable must be in conduit. Conduits are optional above 10' in a limited-access room (e.g., Electrical or Mechanical rooms).
- C. All cables must have a minimum of a 5' service loop on the Alarm Panel side.
- D. All cables must have a minimum of a 10' service loop on the device side (e.g. Motion Detector, Door Contact, Keypad, etc.)
- E. Cable Termination
 - a. Where wires are to be spliced together, gel-filled bean-type connectors are to be used. Wirenuts are not acceptable.
 - b. When connecting to devices that have connectors already on the cable, the corresponding pigtail connector shall be used. Modifying the device cable to remove the connector is not allowed.

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4.2 Alarm Enclosure Layout


4.3 Alarm Enclosure Power Wiring



4.4 Alarm Expansion Panel Layout



4.5 Alarm Expansion Panel Power Wiring



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4.6 Alarm Enclosure & Power Supply

Power supplies are used to power the Alarm Panel, motion detectors and any accessories, as needed.

- A. Enclosure must be installed so that the door to the cabinets can be opened completely (90 degrees or more) and have at least 3' of clearance in front and 1' of clearance on at least one side. Enclosure must not interfere with the opening of any other surrounding equipment.
- B. Enclosure must be mounted so the top of the enclosure is less than 10' off the floor and the bottom of the enclosure is at least 1' above the floor.
- C. Enclosure must be mounted at least 4" below the ceiling.
- D. Painted backboards shall be installed for surface-mounted panels. If the backboard is attached to drywall, it must span at least two studs.
- E. Enclosure will be installed adjacent the closest IDF unless otherwise directed to by the District's Systems Administration department.
- F. Input power must be hardwired on a dedicated 120V circuit. Load permitting, sharing the circuit used for the IDF and/or Access Control panel is acceptable unless otherwise specified.
- G. Exposed conduits and raceways for input power must be EMT or Ridged. Armored Cable, Metal Clad Cable and Flexible Metal Conduit Power are only approved for use above T-bar celling. Conduits and raceways must be secured per California Electrical Code requirements and painted to match wall directly behind them.

4.7 Distribution Board

Power Distribution Board will be mounted inside the Alarm Enclosure to an adapter board; see sections 4.2 through 4.5 for mounting location and wiring directions. Mounting Power Distribution Board directly to the Alarm Enclosure & Power Supply is forbidden. Power Distribution Board will receive its power from the regulated 12VDC output of the Power Supply.

4.8 Alarm Panel

Alarm Panel will be mounted inside of the Alarm Enclosure & Power Supply. See section 4.2 for mounting location.

- A. Every Alarm Panel must have one Ethernet network port in the enclosure (typically installed in a biscuit) connected to the nearest IDF and terminated on the patch panel.
- B. Panel must be connected to the District's network and have a reserved IP address on the network as provided by the Systems Administration department.
- C. Alarm Panel battery terminals will be hooked up to the Power Distribution Board as outlined in section 4.3.
- D. Battery trouble on power supply must be wired to contact 10 with a 3.3K resistor

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4.9 Expansion Panel

16 Port Zone Expander Module will be mounted inside of the Alarm Enclosure & Power Supply. See section 4.4 for mounting location.

- A. Wiring from 16 Port Zone Expander Module to the Alarm Panel must be one continuous run back to the Alarm Enclosure & Power Supply with at least 22/4 unshielded cable. For runs over 500' a 18/4 unshielded cable will be used. Runs over 1000' are not permitted.
- B. Unless otherwise noted every Expansion Panel will be landed on a dedicated LX bus on the Alarm Panel.
- C. Battery trouble on power supply must be wired to the last contact on the last zone expander with a 1K resistor

4.10 Keypad

- A. Keypad should be mounted so that the center of the keypad is at 52 inches. Keypad must be mounted so that the top of the keypad is no higher than 58 inches and the bottom is no lower than 48 inches.
- B. Keypad will be mounted by the door of the nearest classroom or office unless otherwise specified.
- A. Wiring for Keypad should be run within the wall whenever possible. When not possible keypad will be mounted to a DMP 695 Conduit Backbox and a raceway will be installed to the point where the cable is no longer exposed.
- C. Wiring from Keypad to the Alarm Panel must be at least 22/4 unshielded cable.

4.11 Zone Expander

- A. Up to six Zone Expanders will be mounted inside the Alarm Enclosure & Power Supply on the side of the enclosure. See section 4.2 for mounting location.
- B. Zone Expander will be secured to the inside the Alarm Enclosure & Power Supply using Velcro with a VHB adhesive backing.
- C. If Zone Expander does not have screw terminals, then for every Zone Expander an eight-positon Eurostyle terminal strip will also be installed. The wires from the Zone Expander will be landed on the terminal strip in order of zone number.

4.12 Alarm Sensors

Alarm sensors include any device that is capable of triggering an alarm in the system. Devices include but are not limited to Motion Detectors, Door Contracts, Glass Break Detectors and Leak Detectors.

A. Wiring from Alarm Sensor to the Alarm Panel or Consolidation Point must be one continuous run with at least 22/4 unshielded cable or greater gauge. Heavier gauge wire may be required to reduce voltage drop or higher current needs. It is up to the contractor to identify situations that require heavier gauge wire.

- B. Every Alarm Sensor must be configured for its own zone unless otherwise directed by the District's Systems Administration department.
- C. Each zone will be terminated with a 1k end of line resistor (EOL) wired in parallel and located at the Alarm Sensor.
- D. Alarm Sensors must be landed on the Alarm Panel or Zone Expander in a logical and consistent manor.
- E. Devices requiring power such as Motion Detectors or Glass Break Detectors must be landed on a dedicated port on the Power Distribution Board that corresponds to their zone number.

4.12.1 Motion Detector

- A. Every room with exterior doors or windows must have a Motion Detector.
- B. Motion Detectors will be of the 360 degree celling mount type and mounted in the center of the room unless otherwise specified.

4.12.2 Door Contact

- A. Door Contracts may be used in lieu of Motion Detectors in rooms that do not have any windows such as custodial, storage, mechanical, or electrical rooms or as approved by the Systems Administration department.
- B. Door Contacts located in areas other than custodial, storage, mechanical, or electrical rooms must be armored cables running back to a J-box where the splice will be made. If cable is unable to be installed in the wall a raceway will be installed to the point where the cable is no longer exposed.

5 Programming

Contractor is responsible for programming all newly-installed hardware and making sure that all devices and panels follow the established naming convention.

5.1 Naming Conventions

- A. Areas: <Site> <Location> (e.g., Cortez Building A)
- B. Zones: <Site> <Room> (e.g., Cortez Classroom A101)
- C. Keypads: <Site> Keypad <Room> (e.g., Cortez Keypad Classroom A101)

5.2 Alarm Panel Configuration

- A. New Alarm Panels will be configured with the IP address provided by the Systems Administration Department and added into SMS Enterprise.
- B. Account Number provided by District's Systems Administration department.
- C. Programing includes setting up Areas, Zones, Remote Options, System Options, Devices, and programing codes.
 - Remote Options:

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- Remote Disarm = Enabled
- System Options:
 - Reset Swinger Bypass = Enabled
 - Swinger Bypass Trips = 0
 - Power Fail Delay = 0
 - GMT = 8
- Bell Options:
 - Cuttoff = 5
- D. New Zones will be added to the Alarm Panel and follow the Naming Conventions outlined in section 5.2.

5.3 Zone Configuration

- Output Action for Monitored Zones (Motions, Door Contacts, Etc)
 - DO (Disarm Open) = None
 - DS (Disarm Short) = Trouble
 - AO (Armed Open) = Alarm
 - AS (Alarm Short) = Alarm
- Output Action for Supervisory Contacts (Power Supply, Battery Zones, Etc)
 - DO (Disarm Open) = Trouble
 - DS (Disarm Short) = Trouble
 - AO (Armed Open) = Trouble
 - AS (Alarm Short) = Trouble

5.4 Entre Configuration

District's Systems Administration department will be responsible for adding all of the new Zones into Entre once the project has been completed, unless otherwise specified.

6 Labeling

6.1 Wires

- A. All wires must be clearly labeled with a typed laminated wraparound label to clearly identify the other end.
- B. Labels should be located approximately 6" from the end of the outer jacket of the wire.

6.2 Enclosures

The following information will be clearly labeled on the inside of all enclosures:

- A. Any wiring diagram stickers supplied shall be installed on the inside of the enclosure.
- B. Alarm Panel: IP Address of Alarm Panel.
- C. Power Supply: Electrical panel and circuit that the Power Supply receives power from.

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7 Testing and Acceptance

7.1 Contractor On-Site Testing

Contractor shall functionally test and certify each component in the system after installation to verify proper operation and confirm that the wiring and installation conforms to District's Alarm Specifications or manufacture's best practices, whichever is stricter.

7.2 District Test and Inspection

Once the Contractor has finished the On-Site Testing, the District Systems Administration department will walk the site with the Contractor and functionally test and inspect select components in the system after installation to verify proper operation, confirm that the wiring and installation conforms to District's Alarm Specifications or manufacture's best practices (whichever is stricter), and generate a punch list, if necessary.

7.3 Final Test and Inspection

Once the contractor has finished correcting all of the issues identified on the punch list, the District Systems Administration department will walk the site with the Contractor and perform a final test and inspection of the system.

7.4 Operational Demonstration

At the request of the District, contractor will provide an Operational Demonstration to demonstrate any new features and functionality.

7.5 Acceptance Requirements

- A. Receipt of final documentation.
- B. Successful Final Test and Inspection.
- C. Successful Operational Demonstration Test.
- D. Successful training and demonstration, including operation of systems using the manuals.
- E. Purging of Contractor User privileges and return of all key card media.

8 Post Installation

8.1 Clean-up

- A. Except for necessary modifications directly related to the scope of work, all facilities must be returned to their original condition before work started. Any damages caused by the installation will be repaired at the contractor's expense unless the District is made aware of the likely damage before work and has agreed in writing to waive the contractor from responsibility.
- B. Any incidental repair work needed directly related to the work will be carried out at the cost of the contractor unless agreed to in writing before work is performed.

- C. Any previous installation marked for demolition as agreed by the contractor and the district must be completed including any patch work and repair to the facility.
- D. All new wall outlets must be cleaned of smudges and dust.
- E. All Cabinets and Data Closets must be free of debris such as cut wires, metal shavings, and extra parts.
- F. Unless otherwise stated, all related unused parts, such as dust-covers, caps, cables, connectors, blanks, and manuals must be returned to the Systems Administration department.
- G. All keys that are borrowed for access to the facilities must be returned. If keys are lost, the district has the right to change locks for the affected area at the expense of the contractor.
- H. Contractors must assure that all doors are properly closed and locked before leaving.

8.2 Deliverables

8.2.1 Software & Software Licenses

Any and all software and software licenses that were installed/used as part of this project

8.2.2 Parts and Hardware

8.2.2.1 Keys

All of the keys for all hardware with a lock, including power supplies, alarm panels, and reader interface panels.

8.2.2.2 Unused Parts and Hardware

All unused parts and hardware including any parts and hardware that was removed and not reused during the course of the project must be returned to the Systems Administration department.

8.2.2.3 Failed Parts and Hardware

Unless otherwise specified all failed parts and hardware not covered under warranty must be returned to the Systems Administration department.

8.2.3 Documentation

8.2.3.1 Alarm Panels

A spreadsheet including the following:

- A. Site and Room where panel is located
- B. IP Address Assigned to the Panel

8.2.3.2 Zone Map

A site map outlining the following items for every zone:

- A. Location
- B. Zone Number

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C. Zone Name

8.2.3.3 Manuals

One set of manuals and install guides for each type hardware and equipment installed.

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CONTRACTOR TO FOLLOW THESE SEPECIFICATION FOR ALL PRODUCTS & INSTALLATION REQUIRED FOR THE PROJECT AND TO COORDINATE WITH DISTRICT'S ITS – SYSTEMS ADMINISTRATION PERSONNEL PRIOR TO START OF WORK

1. General

1.1 Introduction

The district utilizes many specialized systems this section is designed to detail requirements for specific systems not covered in other areas and to act as a catch all for special systems not specifically listed within this document.

1.2 General Requirements

- A. Any discrepancies between this document, the drawings, and the physical site or any part or method specified that is not optimal for the application listed must be brought to the attention of the District's Systems Administration department. Installation of approved parts in a sub-optimal usage will be considered to not meet these specifications.
- B. All of the electronic systems equipment shall be furnished and installed by the authorized manufacturer's distributor or installer of the equipment and shall include evidence of this authorization in their proposal.
- C. The entire system shall be installed by a single contractor. If subcontractors are used, they will perform work as an agent of the primary contractor and such work will be the responsibility of and warranted by the primary contractor. Upon notification by the District of a failure, the Contractor shall repair or replace components that no longer fall within the specifications set by the manufacturer.
- D. Contractor is responsible for complying with all Division 27, and Division 28 sections and requirements in their entirety. For list of all Division 27, and Division 28 sections see section 1.3 of 27 00 00. If section 27 00 00 was not provided contact Pomona Unified School Districts ITS Systems Administration Department to receive complete copy of the Division 27, and Division 28 sections.

1.3 Substitutions

Parts and software may be substituted with equivalent products providing that the vendor can show that the product is equivalent. If a substitution item is given final acceptance by the Systems Administration department, the contractor shall pay all costs (including travel, lodging, meals, computers, etc.) required to provide factory certification, equal to that of a factory authorized distributor of the substituted item, for at least two selected District representatives. This training will be provided by the manufacture of the substituted item in question and shall allow the selected District representatives to provide any and all factory/manufacturer approved repairs, services, software upgrades, etc., without affecting any available or applicable manufacturer warranties.

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2 Quality Assurance Standards

2.1 Requirements of Regulatory Agencies

- A. Furnish security equipment to comply with the requirements of laws, codes, ordinances, and regulations of the governmental authorities having jurisdiction where such requirements exceed. Standards include, but are not limited to:
 - a. NEC/NFPA
 - b. TIA 568-C
 - c. TIA 569
 - d. TIA 607
- B. Furnish security equipment to comply with the requirements of American National Standards for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People (ICC/ANSI A117.1), the governmental authority having jurisdiction and to comply with Americans with Disabilities Act.

2.2 Contractor qualifications

- A. Trained, authorized, and certified to install the specified products.
- B. Has a minimum of five years of system design, engineering supervision, and installation experience in the access control industry.
- C. Will maintain a fully staffed local office within 60 miles of the work site. The service center will be staffed by factory-trained technicians.
- D. The contractor must maintain an inventory of spare parts and other items critical to system operation and as necessary to meet the emergency service requirements for warranty service, within the local service center.
- E. Must have engineering and project management capability consistent with the requirements of this project. The contractor shall provide a project manager who is actively involved in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the operation and maintenance manuals, training programs, documentation and system testing, maintenance of Drawings and the coordination of all subcontract labor. The District reserves the right to approve the contractor's Project Manager.
- F. Must abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

2.3 Pre-Installation Conference

Prior to work commencing, a conference between the contractor and the Systems Administration department shall take place to review materials and procedures and to coordinate related work. The locations and orientation of distribution frames, cross-connects, and patch panels in equipment rooms and wiring closets shall also be decided to minimize the impact on other services sharing the space.

Work done at school sites must be scheduled in advance. Contractors are to inform the ITS department of the scope of work, the area that will be worked in, and the time and date of work. ITS will get authorization from the school administration before the work is scheduled. If contractor attempts to begin work without getting authorization, the school site will be instructed to ask the contractor to leave.

The district will attempt to communicate any safety concerns such as other pending work to the facilities, areas with asbestos, lead or other hazards. If the contractor has such concerns, the district must be notified immediately before the start of work. The District Maintenance and Operations Department shall advise on any needed provisions.

2.4 Warranty

- A. All components shall be supplied with a minimum one-year warranty against defects in materials and workmanship, commencing upon approval of the notice of completion of the project.
- B. During the system warranty period, system updates are to be made available to District at no charge.

3 Products

3.1 General

Unless otherwise approved in writing by the Districts Systems Administration Department all systems will conform the following minimum standards.

- A. Devices will be IP based and comply with established network standards
- B. Devices requiring less than 15.4 watts shall have the option to be powered via PoE
- C. Device shall utilize a standard RJ45 network connector and shall support auto negotiation of network speed and transfer mode.
- D. Device must support external time synchronization from an NTP (Network Time Protocol) server.
- E. Device must be covered by a minimum of a 1-year warranty
- F. Devices must be in compliance with California's law for IoT device cyber security, California Civil Code Section 1798.91.04.
- G. The specified unit shall be of manufacturer's official product line, designed for commercial and/or industrial 24/7/365 use.

3.2 Smoking, Vape Detectors & Noise Detectors

The District utilizes the Halo Smart Sensor 2C manufactured by IPVideo Corporation. Any substitution must be approved in writing by the Districts Systems Administration Department. All devices must meet or exceeded the following requirements:

- A. Sensor must be vandal resistant with an IK10 impact rating.
- B. All exposed screws must be anti-tamper TORX screws.

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- C. Must not rely on any form of cloud/hosted service.
- D. Must provide adjustable detection and measurement of:
 - 1. Particulates Size 1 μ m particulates μ g/m³
 - 2. Particulates Size 2.5 μm particulates μg/m³
 - 3. Particulates Size 10 μ m particulates μ g/m³
 - 4. Carbon Dioxide
 - 5. Total Volatile Organic Compounds
 - 6. Carbon Monoxide
 - 7. Ammonia
 - 8. Temperature/Humidity
 - 9. Sound Levels
 - 10. Tamper
 - 11. Vape
 - 12. Vape THC
 - 13. Spoken Keyword
 - 14. Gunshot
 - 15. Aggression
 - 16. Masking / Spray Paint
 - 17. Indoor Air Quality, AQI: Air Quality Index
- E. Event functionality
 - 1. The sensor shall be equipped with an integrated event functionality, which can be triggered by:
 - a) Sensor tampering
 - b) Manual Trigger/Virtual Inputs
 - c) Event threshold met
 - 2. Response to triggers shall include:
 - d) Relays Outputs
 - Wired Normally Open or Closed
 - Rated at 48VDC at 1 amp
 - e) Status Light
 - f) Speaker
 - Pre-Recorded Files
 - Programmable
 - g) Send notification, using API, HTTP, HTTPS, or Email
 - h) Identification in data logs

4 Installation

The contractor shall furnish and install all hardware, devices, and components to meet the performance and functional requirements described in these contract documents. Include all items required, whether or not individually specified, to ensure a completely operational integrated Security Management System. No additional costs shall be allowed to make the system operational or to meet specifications.

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4.1 General Cabling Requirements

A. All cabling will be installed to the specifications outlined in the District's Communications Cabling Specification Division 27 00 00 and related sections.

4.2 Smoking, Vape Detectors & Noise Detectors

- A. Sensor must be installed per the manufactures specifications and in such a manner that they will not be subject to damage/vandalism.
- B. Network Connection
 - Each sensor must be connected to an RJ45 Ethernet network jack located within 1' of the sensor. Network cabling must comply with PUSD Communications and Security Specification Section 27 20 00.
 - b. Terminating the horizontal network cable on an RJ-45 plug is expressly forbidden.
 - c. Network jack must be accessible through the cutout required for the sensor.
- C. Licensing
 - a. A CCTV Camera license must be provided for every sensor. Please refer to Section 28 20
 00 for the current camera system licensing requirements.

4.3 Other Specialized Systems

All systems not specifically covered by this specification must follow the standards outlined in the PUSD Communications and Security Specifications Division 27 00 00 & 28 00 00. Device installation and configuration requirements must be approved in writing by a PUSD ITS Supervisor prior to work starting.

5 Programming

5.1 General

- A. Contractor is responsible for programming all newly-installed hardware and making sure that all devices and panels follow the established naming convention.
- B. Network Connection
 - a. Each device must be connected to the District's network and have a reserved IP address on the network as provided by the Systems Administration department.
- C. All firmware found in products shall be the latest and most up to date provided by the manufacturer.
- D. All equipment requiring users to log on using a password shall be configured with individually unique password/passwords. No system/product default passwords shall be allowed.

5.2 Smoking, Vape Detectors & Noise Detectors

- A. Sensor must be programed as described by the project manager. Including:
 - a. Event thresholds
 - b. Event actions

6 Labeling

6.1 Wires

All wires must be clearly and permanently labeled on both ends identifying the other end. Labeling must follow standard for specific type of cable used as listed in their relevant sections. Labeling shall be done using printed wraparound label. Handwritten labels are not permitted. Cable

7 Testing and Acceptance

7.1 Contractor On-Site Testing

Contractor shall functionally test and certify each component in the system after installation to verify proper operation and confirm that the wiring and installation conforms to District's Specifications or manufacture's best practices, whichever is stricter.

7.2 District Test and Inspection

Once the Contractor has finished the On-Site Testing, the District Systems Administration department will walk the site with the Contractor and functionally test and inspect select components in the system after installation to verify proper operation, confirm that the wiring and installation conforms to District's Specifications or manufacture's best practices (whichever is stricter), and generate a punch list, if necessary.

7.3 Final Test and Inspection

Once the contractor has finished correcting all of the issues identified on the punch list, the District Systems Administration department will walk the site with the Contractor and perform a final test and inspection of the system.

7.4 Operational Demonstration

At the request of the District, contractor will provide an Operational Demonstration to demonstrate any new features and functionality.

7.5 Acceptance Requirements

- A. Receipt of final documentation.
- B. Successful Final Test and Inspection.
- C. Successful Operational Demonstration Test.

8 Post Installation

8.1 Clean-up

A. Except for necessary modifications directly related to the scope of work, all facilities must be returned to their original condition before work started.

- B. Any incidental repair work needed directly related to the work will be carried out at the cost of the contractor unless agreed to in writing before work is performed.
- C. Any previous installation marked for demolition as agreed by the contractor and the district must be completed including any patch work and repair to the facility.
- D. All new wall outlets must be cleaned.
- E. All Cabinets and Data Closets must be free of debris such as cut wires, metal shavings, extra part, etc.
- F. Unless otherwise stated, all related unused parts, such as dust-covers, caps, cables, connectors, blanks, and manuals must be returned to the Systems Administration department.
- G. All keys that are borrowed for access to the facilities must be returned. If keys are lost, the district has the right to change locks for the affected area at the expense of the contractor.
- H. Missing items from facilities after jobs will be investigated at the Districts discretion.
- I. Contractors must assure facility is secure before leaving.
- J. Any damages caused by the installation will be repaired at the contractor's expense unless the District is made aware of the likely damage before work and has agreed in writing to waive the contractor from responsibility.

8.2 Deliverables

8.2.1 Software & Software Licenses

Any and all software and software licenses that were installed/used as part of this project

8.2.2 Parts and Hardware

8.2.2.1 Unused Parts and Hardware

All unused parts and hardware including any parts and hardware that was removed and not reused during the course of the project need to be returned to the Systems Administration department.

8.2.2.2 Failed Parts and Hardware

Unless otherwise specified all failed parts and hardware not covered under warranty need to be returned to the Systems Administration department.

8.2.3 Documentation

8.2.3.1 Manuals

One set of manuals and install guides for each type hardware and equipment installed.

8.2.3.2 As-built Drawings

As-built drawings showing path used and switch port information required.